Delta Ohm develops and manufactures instruments for measuring temperature, humidity, pressure, air speed, light, acoustic and vibration, CO, CO_2 air quality, multifunction instruments, data loggers, WBGT microclimate, environmental analysis and water analysis.

These are safe, accurate and resistant instruments.
The **SIT CENTRE N°. 124 laboratory** of **Delta Ohm** is accredited in legal metrology for the following physical quantities:

- Temperature
- Humidity
- Pressure
- Air speed
- Photometry-radiometry
- Acoustic

It is now 30 years that **Delta Ohm** works with its instrument in the industrial, maintenance and assistant field, together with specialized Distributors. **Delta Ohm** production is spread over 60 countries.

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Delta Ohm srl - Via G. Marconi, 5 - 35030 Caselle di Selvazzano (Pd) - Italy - Tel. 0039 0498977150 r.a. - Fax 0039 049635596 - e-mail: deltaohm@tin.it

index of categories

Temperature page 5 to 44

Portable instruments with Pt100, thermocouple probes. Configurable transmitters for Pt100 and thermocouple sensors.
Calibrators, amplifiers/converters. Indicators/regulators.
• Accredited laboratory SIT Centre 124 in Temperature.

Humidity page 45 to 92

Portable instruments, temperature and humidity combined probes.
Humidity and temperature transmitters, HVAC, temperature, humidity and CO_2 transmitters, dataloggers, mini-dataloggers.
• Accredited laboratory SIT Centre 124 in Humidity.

Pressure page 93 to 120

Portable instruments, pressure probes.
Low and high pressure transmitters.
• Accredited laboratory SIT Centre 124 in Pressure.

Air speed page 121 to 156

Portable instruments, hot-wire probes, vane probes, Pitot tubes.
Air speed transmitters.
• Accredited laboratory SIT Centre 124 in Air speed.

Light page 157 to 192

Portable instruments, probes.
Photometric and radiometric transmitters.
• Accredited laboratory SIT Centre 124 in Photometry, Radiometry.

Acoustic - Vibrations page 193 to 224

Sound level meters, Calibrators.
Vibration meters, Accelerometers, Accessories.
• Accredited laboratory SIT Centre 124 in Acoustic.

Air Quality - CO - CO_2 page 225 to 240

Portable instruments for :CO_2, CO, RH, °C, Air speed.
Dataloggers CO_2 - CO - UR - °C, CO_2, CO_2 and Temperature transmitters.

Multifunction page 241 to 260

Multi input portable instruments, probes families.

Datalogger page 261 to 276

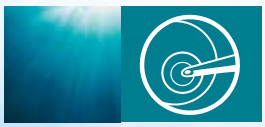
Datalogger for Pt100 probes with 8 inputs, for thermocouple probes with 8 to 16 inputs.
Mini-datalogger for temperature or temperature and humidity.
CO, CO_2, temperature and humidity datalogger.

Microclimate - WBGT page 277 to 296

Microclimate analysis in working environments, moderate hot or cold.

Environmental Analysis page 297 to 336

Temperature, Humidity, Barometers, Rain indicators, Rain Gauges, Ultrasonic Anemometers,
Pyranometers, Albedometers, Netradiometers, Pyrgeometers, Photometrers, Radiometers.



Water Analysis page 337 to 408

Portable and bench-top instruments fort pH, conductivity and dissolved oxygen, Electrodes and probes
pH and conductivity transmitters, Electrodes and probes, Turbidimeter.

ISOTHERM

Temperature

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  Portable instruments for Pt100 probes
- Probes with Pt100 sensor — pag. 9
- HD 2108.1, HD 2108.2, HD 2128.1, HD 2128.2, HD 2328.0 — pag. 14
  Portable instruments for Thermocouple probes
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- HD 778TR1, HD 978TR1, HD 978TR2, HD 778 T CAL — pag. 32
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- HD 978TR3, HD 978TR4, HD 978TR5, HD 978TR6 — pag. 34
  Configurable 4÷20mA or 0÷10Vdc signal amplifiers, converters
- HD 9022, DO 9404 — pag. 36
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The qualitative level of our instruments is the result of a continuous evolving of the product itself. This may bring to slight differences between what written in the following manual and the instrument you bought. We cannot completely exclude the presence of errors inside the manual, which we apologise for. Data, images and descriptions included in this manual cannot be enforced legally. We reserve the right to perform modifications and corrections at any time without notice.

HD 2107.1
HD 2107.2
HD 2127.1
HD 2127.2

HD2107.1, HD2107.2, HD2127.1 E HD2127.2
THERMOMETERS SENSORS: Pt100, Pt1000

L'HD2107.1 and l'HD2107.2 are portable instruments equipped with large LCD display fitted with one input. **HD2127.1 and HD2127.2** are instruments fitted with two inputs. They measure temperature by means of immersion, penetration, contact or air probes. Their sensor can be Pt100 with 3 or 4 wires, Pt1000 with 2 wires.

Probes are equipped with an automatic recognition module: factory calibration data are stored inside.

The instruments HD2107.2 and HD2127.2 are **data loggers**; they store up to 80.000 samples which can be transferred into a PC connected to the instrument through a multi-standard RS232C serial port and a USB 2.0. It is possible to configure the storage interval, the printing and the baud rate by the menu.
All models are equipped with RS232C serial port and are able to transfer the acquired measures, in real time, into a PC or a portable printer.
Functions Max, Min and Avg calculate maximum, minimum and average values.
Further functions are: REL relative measure, HOLD and automatic switching-off system, excludable.
Instruments have IP67 protection degree.

TECHNICAL SPECIFICATIONS OF THE INSTRUMENTS

Instrument	
Dimensions (Length x Width x Height)	185x90x40mm
Weight	470g (complete with batteries)
Materials	ABS, rubber
Display	2x4½ digits plus symbols Visible area: 52x42mm
Operating conditions	
Operating temperature	-5 … 50°C
Storage temperature	-25 … 65°C
Working relative humidity	0 … 90% RH, no condensation
Protection degree	**IP67**
Power supply	
Batteries	4 Batteries 1.5V type AA
Autonomy	200 hours with 1800mAh alkaline batteries
Current consumption with instrument off	20µA
Main	12Vdc / 1000mA Output main adapter
Unit of measurement	*°C - °F - °K*
Security of data stored	Unlimited, independent of battery charge conditions
Time	
Date and time	Schedule in real time
Accuracy	1min/month max drift
Measured values storage	
*model **HD2107.2***	
Type	2000 pages containing 40 samples each
Quantity	Total of 80000 samples
Storage interval	1s…3600s (1 hour)
*model **HD2127.2***	
Type	2000 pages containing 16 pairs of samples each
Quantity	Total of 32000 samples (channel A + channel B)
Storage interval	1s…3600s (1 hour)
Serial interface RS232C	
Type	RS232C electrically isolated
Baud rate	can be set from 1200 to 38400 baud
Data bit	8
Parity	None
Stop bit	1
Flow Control	Xon/Xoff
Serial cable length	Max 15m
Immediate print interval	1s … 3600s (1 hour)
*USB interface - model **HD2107.2, HD2127.2***	
Type	1.1 - 2.0 electrically isolated
Connections	
Input module for the probes	8-pole male DIN45326 connector
Serial interface and USB	8-pole MiniDin connector
Mains adapter	2-pole connector (positive at centre)
Measurement of temperature by Instrument	
Pt100 measurement range	-200…+650°C
Pt1000 measurement range	-200…+650°C
Resolution	**0.01°C in the range ±199.99°C** **0.1°C in the remaining range**
Instrument Accuracy	±0.01°C
Drift after 1 year	0.1°C/year

HD2107

HD2127

SWD10

HD2110CSNM

TECHNICAL DATA OF PROBES AND MODULES EQUIPPED WITH INSTRUMENT
Temperature probes Pt100 sensor with SICRAM module

Model	Type	Application field	Accuracy
TP472I	Immersion	-196°C…+500°C	±0.25°C (-196°C…+350°C) ±0.4°C (+350°C…+500°C)
TP472I.0	Immersion	-50°C…+400°C	±0.25°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP473P	Penetration	-50°C…+400°C	±0.25°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP473P.0	Penetration	-50°C…+400°C	±0.25°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP474C	Contact	-50°C…+400°C	±0.3°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP474C.0	Contact	-50°C…+400°C	±0.3°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP475A.0	Air	-50°C…+250°C	±0.3°C (-50°C…+250°C)
TP472I.5	Immersion	-50°C…+400°C	±0.3°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP472I.10	Immersion	-50°C…+400°C	±0.30°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP49A	Immersion	-70°C…+400°C	±0.25°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP49AC	Contact	-70°C…+400°C	±0.25°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP49AP	Penetration	-70°C…+400°C	±0.25°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP875	Globe-thermometer Ø150mm	-30°C…+120°C	±0.25°C
TP876	Globe-thermometer Ø 50mm	-30°C…+120°C	±0.25°C
TP87	Immersion	-50°C…+200°C	±0.25°C
TP878 TP878.1	For solar panels	+5°C…+80°C	±0.25°C
TP879	For compost	-20°C…+120°C	±0.25°C

Common features
Temperature drift @20°C 0.003%/°C

4 wires Pt100 and 2 wires Pt1000 Probes

Model	Type	Application field	Accuracy
TP47.100	4 wires Pt100	-50…+400°C	Class A
TP47.1000	2 wires Pt1000	-50…+400°C	Class A

Common features
Temperature drift @20°C
Pt100 0.003%/°C
Pt1000 0.005%/°C

PURCHASING CODES

HD2107.1: The kit consists of instrument HD2107.1, 4 per 1.5V alkaline Batteries, instruction manual, case and DeltaLog9 software. **Probes and cables have to be ordered separately.**
HD2107.2: The kit consists of instrument HD2107.2 **data logger**, 4 per 1.5V alkaline Batteries, instruction manual, case and DeltaLog9 software. **Probes and cables have to be ordered separately.**
HD2127.1: The kit consists of instrument HD2127.1, 4 per 1.5V alkaline Batteries, instruction manual, case and DeltaLog9 software. **Probes and cables have to be ordered separately.**
HD2127.2: The kit consists of instrument HD2127.2 **data logger**, 4 per 1.5V alkaline Batteries, instruction manual, case and DeltaLog9 software. **Probes and cables have to be ordered separately.**
HD2110CSNM: 8-pole connection cable MiniDin - Sub D 9-pole female for RS232C.
C.206: Cable for instruments of the series HD21…1 and .2 to connect directly to USB input of PC.
HD2101/USB: Connection cable USB 2.0 connector type A - 8-pole MiniDin.
DeltaLog9: Software for download and management of the data on a PC using Windows 98 to XP and Vista operating systems.
SWD10: Stabilized power supply at 230Vac/12Vdc-300mA-1000mA mains voltage.
HD40.1: Upon request, portable, serial input, 24 column thermal printer, 58mm paper width.

TP875

HD40.1

Probes equipped with SICRAM module

TP472I: Immersion probe, Pt100sensor. Stem Ø 3 mm, length 300 mm. Cable 2 meters long.
TP472I.0: Immersion probe, Pt100sensor. Stem Ø 3 mm, length 230 mm. Cable 2 meters long.
TP473P: Penetration probe, Pt100sensor. Stem Ø 4mm, length 150 mm. Cable 2 meters long.
TP473P.0: Penetration probe, Pt100sensor. Stem Ø 4mm, length 150 mm. Cable 2 meters long.
TP474C: Contact probe, Pt100sensor. Stem Ø 4mm, length 230mm, contact surface Ø 5mm. Cable 2 meters long.
TP474C.0: Contact probe, Pt100sensor. Stem Ø 4mm, length 230mm, contact surface Ø 5mm. Cable 2 meters long.
TP475A.0: Air probe, Pt100sensor. Stem Ø 4mm, length 230mm. Cable 2 meters long.
TP472I.5: Immersion probe, Pt100sensor. Stem Ø 6mm, length 500 mm. Cable 2 meters long.
TP472I.10: Immersion probe, Pt100sensor. Stem Ø 6mm, length 1,000mm. Cable 2 meters long.
TP49A: Immersion probe, Pt100sensor. Stem Ø 2.7mm, length 150mm. Cable 2 meters long. Aluminium handle.
TP49AC: Contact probe, Pt100sensor. Stem Ø 4 mm, length 150mm. Cable 2 meters long. Aluminium handle.
TP49AP: Penetration probe, Pt100sensor. Stem Ø 2.7mm, length 150mm. Cable 2 meters long. Aluminium handle.
TP875: Globe thermometer Ø 150 mm with handle. Cable 2 meters long.
TP876: Globe thermometer Ø 50 mm with handle. Cable 2 meters long.
TP87: Immersion probe, Pt100sensor. Stem Ø 3 mm, length 70 mm. Cable 2 meters long.
TP878: Contact probe for solar panels. Cable 2 meters long.
TP878.1: Contact probe for solar panels. Cable 5 meters long
TP879: Penetration probe for compost. Stem Ø 8 mm, length 1 meter. Cable 2 meters long.

Temperature probes without SICRAM module

TP47.100: Direct 4 wires Pt100 sensor immersion probe. Stem Ø 3 mm, length 230mm. 4 wires connection cable with connector, 2 meters long.
TP47.1000: Pt1000 sensor immersion probe. Stem Ø 3 mm, length 230mm. 2 wires connection cable with connector, 2 meters long.
TP47: Only connector for probe connection without SICRAM module: direct 3 and 4 wires Pt100, 2 wires Pt1000.

HD 2307.0

HD2307.0
THERMOMETER SENSORS: Pt100, Pt1000

L'HD2307.0 is a portable instrument equipped with large LCD display. It measures temperature by means of immersion, penetration, contact or air probes. Its sensor can be 3 or 4 wires Pt100, Pt1000. Probes are equipped with an automatic recognition module: factory calibration data are stored inside. The *Max*, *Min* and *Avg* function calculate the maximum, minimum or average values. Other functions include: the relative measurement REL, the HOLD function, and the automatic switching-off system, excludable. **The instrument has IP67 protection degree.**

TECHNICAL SPECIFICATIONS OF THE INSTRUMENTS

Instrument

Dimensions	
(Length x Width x Height)	140x88x38mm
Weight	160g (complete with Batteries)
Materials	ABS
Display	2x4½ digits plus symbols Visible area: 52x42mm

Operating conditions

Operating temperature	-5 … 50°C
Storage temperature	-25 … 65°C
Working relative humidity	0 … 90% RH, no condensation
Protection degree	**IP67**

Power supply

Batteries	3 Batteries 1.5V type AA
Autonomy	200 hours with 1800mAh alkaline batteries
Current consumption with instrument off	< 20µA

Unit of measurement	*°C - °F*

Connections

Module input for probes	DIN45326 8 poles male Connector

Measurement of temperature by Instrument

Pt100 measurement range	-200…+650°C
Pt1000 measurement range	-200…+650°C
Resolution	0.1°C
Accuracy	±0.05°C
Drift after 1 year	0.1°C/year

TECHNICAL SPECIFICATIONS OF PROBES AND MODULES EQUIPPED WITH INSTRUMENT
Temperature probes Pt100 sensor with SICRAM module

Model	Type	Application field	Accuracy
TP472I	Immersion	-196°C…+500°C	±0.25°C (-196°C…+350°C) ±0.4°C (+350°C…+500°C)
TP472I.0	Immersion	-50°C…+400°C	±0.25°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP473P	Penetration	-50°C…+400°C	±0.25°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP473P.0	Penetration	-50°C…+400°C	±0.25°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP474C	Contact	-50°C…+400°C	±0.3°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP474C.0	Contact	-50°C…+400°C	±0.3°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP475A.0	Air	-50°C…+250°C	±0.3°C (-50°C…+250°C)
TP472I.5	Immersion	-50°C…+400°C	±0.3°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP472I.10	Immersion	-50°C…+400°C	±0.30°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP49A	Immersion	-70°C…+400°C	±0.25°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP49AC	Contact	-70°C…+400°C	±0.25°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP49AP	Penetration	-70°C…+400°C	±0.25°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP875	Globe-thermometer Ø150mm	-30°C…+120°C	±0.25°C
TP876	Globe-thermometer Ø 50mm	-30°C…+120°C	±0.25°C
TP87	Immersion	-50°C…+200°C	±0.25°C
TP878 TP878.1	For solar panels	+5°C…+80°C	±0.25°C
TP879	For compost	-20°C…+120°C	±0.25°C

Common features

Temperature drift @20°C	0.003%/°C

4 wires Pt100 and 2 wires Pt1000 Probes

Model	Type	Application field	Accuracy
TP47.100	4 wires Pt100	-50…+400°C	Class A
TP47.1000	2 wires Pt1000	-50…+400°C	Class A

Common features

Temperature drift @20°C	
Pt100	0.003%/°C
Pt1000	0.005%/°C

PURCHASING CODES

HD2307.0: The kit consists of instrument HD2307.0, 3 per 1.5V alkaline Batteries, instruction manual and case. **Probes have to be ordered separately.**

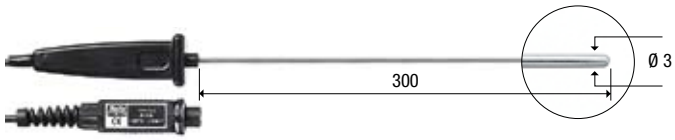
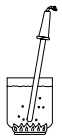
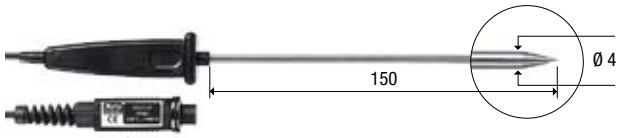
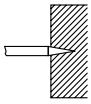
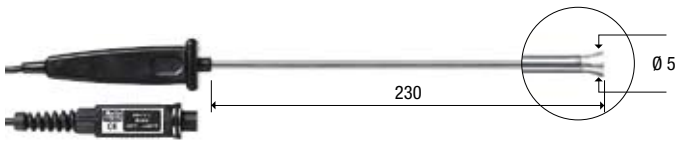
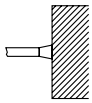
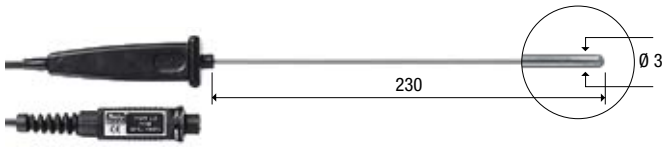
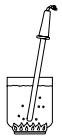
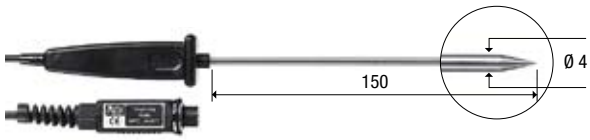
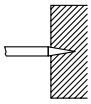
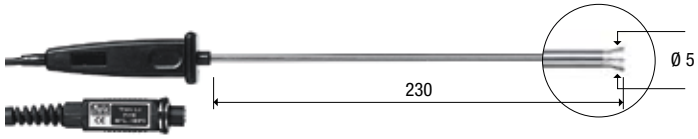
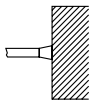
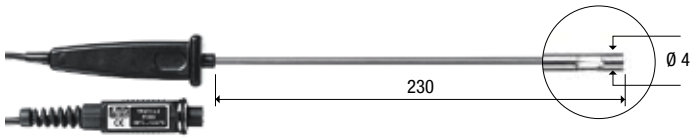
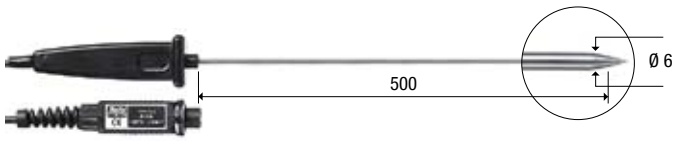
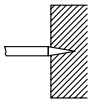
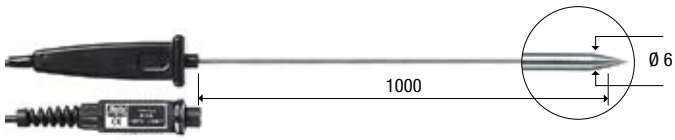
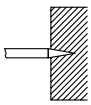
Probes equipped with SICRAM module

TP472I: Immersion probe, Pt100sensor. Stem Ø 3 mm, length 300 mm. Cable 2 meters long.
TP472I.0: Immersion probe, Pt100sensor. Stem Ø 3 mm, length 230 mm. Cable 2 meters long.
TP473P: Penetration probe, Pt100sensor. Stem Ø 4mm, length 150 mm. Cable 2 meters long.
TP473P.0: Penetration probe, Pt100sensor. Stem Ø 4mm, length 150 mm. Cable 2 meters long.
TP474C: Contact probe, Pt100sensor. Stem Ø 4mm, length 230mm, contact surface Ø 5mm. Cable 2 meters long.
TP474C.0: Contact probe, Pt100sensor. Stem Ø 4mm, length 230mm, contact surface Ø 5mm. Cable 2 meters long.
TP475A.0: Air probe, Pt100sensor. Stem Ø 4mm, length 230mm. Cable 2 meters long.
TP472I.5: Immersion probe, Pt100sensor. Stem Ø 6mm, length 500 mm. Cable 2 meters long.
TP472I.10: Immersion probe, Pt100sensor. Stem Ø 6mm, length 1,000mm. Cable 2 meters long.
TP49A: Immersion probe, Pt100sensor. Stem Ø 2.7mm, length 150mm. Cable 2 meters long. Aluminium handle.
TP49AC: Contact probe, Pt100sensor. Stem Ø 4 mm, length 150mm. Cable 2 meters long. Aluminium handle.
TP49AP: Penetration probe, Pt100sensor. Stem Ø 2.7mm, length 150mm. Cable 2 meters long. Aluminium handle.
TP875: Globe thermometer Ø 150 mm with handle. Cable 2 meters long.
TP876: Globe thermometer Ø 50 mm with handle. Cable 2 meters long.
TP87: Immersion probe, Pt100sensor. Stem Ø 3 mm, length 70 mm. Cable 2 meters long.
TP878: Contact probe for solar panels. Cable 2 meters long.
TP878.1: Contact probe for solar panels. Cable 5 meters long
TP879: Penetration probe for compost. Stem Ø 8 mm, length 1 meter. Cable 2 meters long.

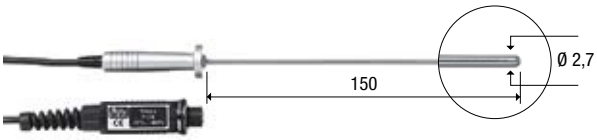
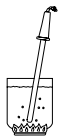
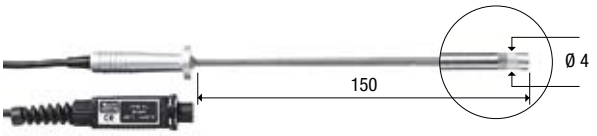
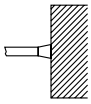
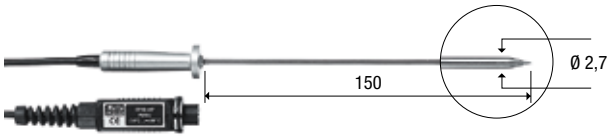
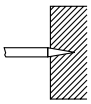
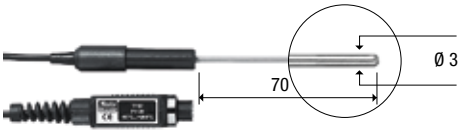
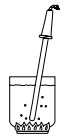
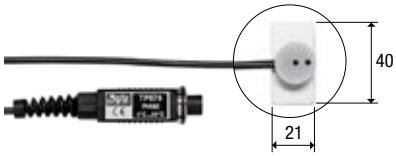
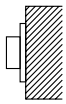
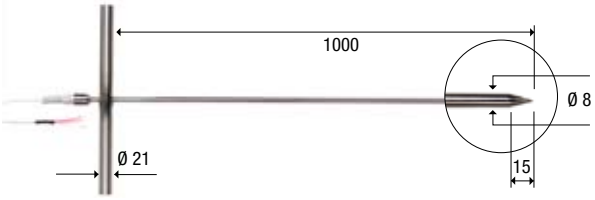
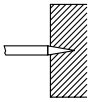
Temperature probes without SICRAM module

TP47.100: Direct 4 wires Pt100 sensor immersion probe. Stem Ø 3 mm, length 230mm. 4 wires connection cable with connector, 2 meters long.
TP47.1000: Pt1000 sensor immersion probe. Stem Ø 3 mm, length 230mm. 2 wires connection cable with connector, 2 meters long.
TP47: Only connector for probe connection: direct 3 and 4 wires Pt100, 2 wires Pt1000.

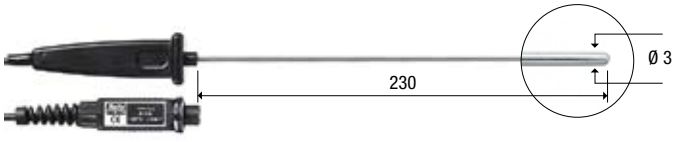
PT100 PROBES FOR PORTABLE INSTRUMENTS EQUIPPED WITH SICRAM MODULE

CODE	°C max	τ s	DIMENSIONS	USE
TP 472 I	-196 +500	3s		
TP 473 P	-50 +400	5s		
TP 474 C	-50 +400	5s		
TP 472 I.0	-50 +400	3s		
TP 473 P.0	-50 +400	5s		
TP 474 C.0	-50 +400	5s		
TP 475 A.0	-50 +250	12s		
TP 472 I.5	-50 +400	3s		
TP 472 I.10	-50 +400	3s		

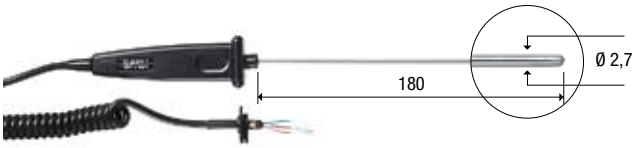
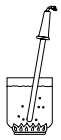
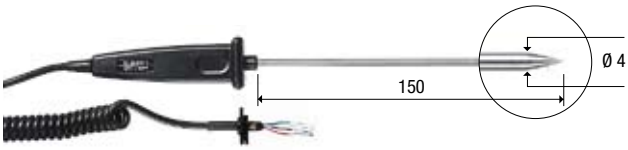
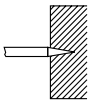
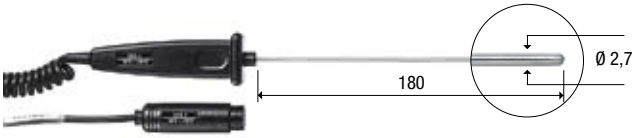
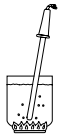
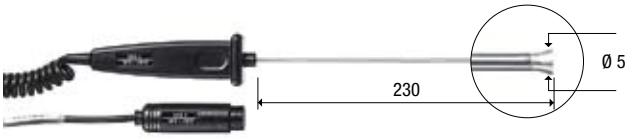
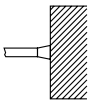
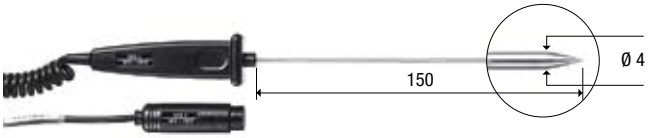
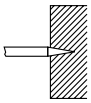
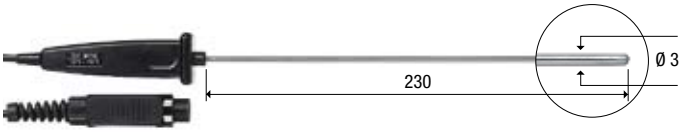
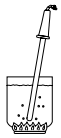
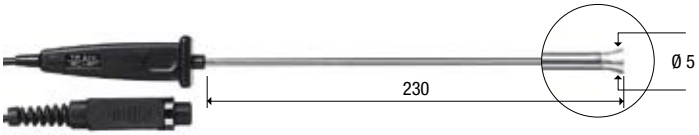
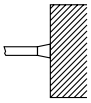
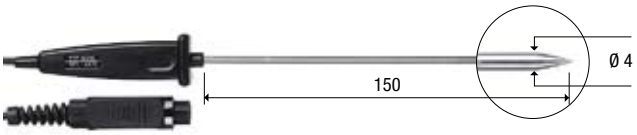
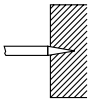
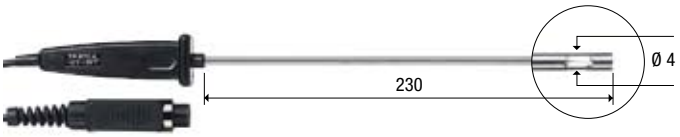
Pt100 PROBES FOR PORTABLE INSTRUMENTS EQUIPPED WITH SICRAM MODULE

CODE	°C max	τ s	DIMENSIONS	USE
TP 49 A	-70 +400	3,5s		
TP 49 AC	-70 +400	5,5s		
TP 49 AP	-70 +400	4s		
TP 87	-50 +200	3s		
TP 878	+5 +80	60s	Contact probe for solar panels. Cable L = 2m.		
TP 878.1	+5 +80	60s	Contact probe for solar panels. Cable L = 5m.		
TP879	-20 +120	60s	Penetration probe for compost. Cable L = 2m		
TP 875	-30 +120	15s	Globe-thermometer probe for measuring radiant heat ø150 mm. (ISO7243, ISO7726). 4 wires Pt100 Sensor cable L=2m. **Equipped with SICRAM module.**	
TP 876	-30 +120	15s	Globe-thermometer probe for measuring radiant heat ø50 mm. (ISO7243, ISO7726). 4 wires Pt100 Sensor cable L=2m. **Equipped with SICRAM module.**	

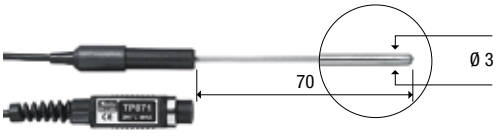
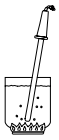
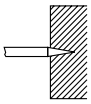
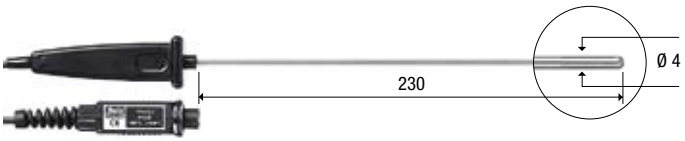
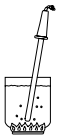
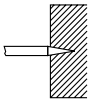
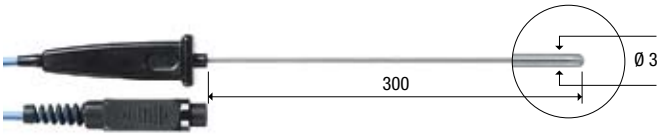
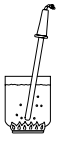
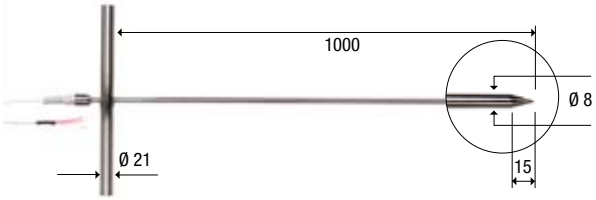
Pt100 / Pt1000 SENSOR PROBES WITH TP 47 MODULE

CODE	°C max	τ s	DIMENSIONS	USE
TP 47.100 (Pt100) **TP 47.1000 (Pt1000)**	-50 +400	3s		
TP 47	Only connector for connection of probes without SICRAM module: direct 3 and 4 wires Pt100, 2 wires Pt1000.			

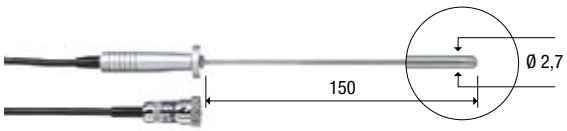
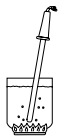
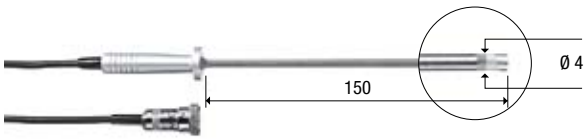
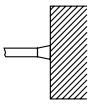
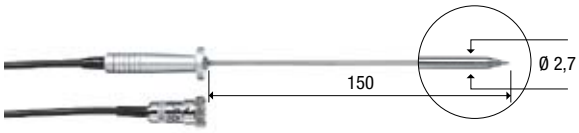
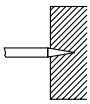
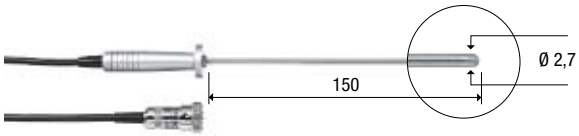
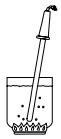
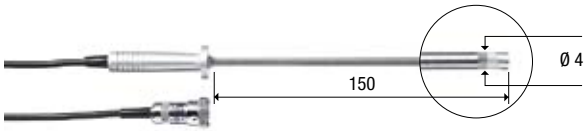
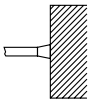
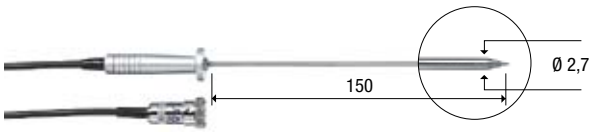
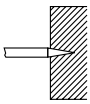
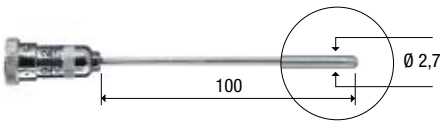
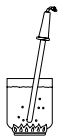
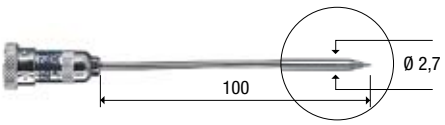
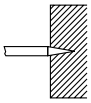
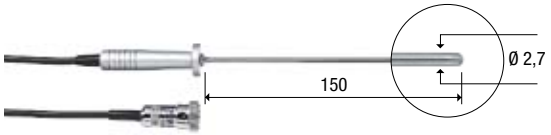
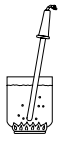
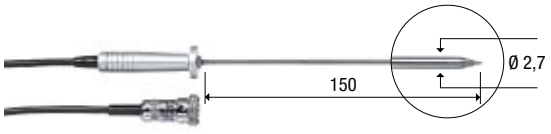
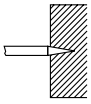
Pt100 SENSOR PROBES FOR OBSOLETE INSTRUMENTS

CODE	°C max	τ s	DIMENSIONS	USE
S 8601 P	-50 +200	3,5s		
S 8601 PP	-50 +200	5s		
STS 3	-50 +150	3,5s		
STS 3/C	-50 +150	5s		
STS 3/P	-50 +150	5s		
TP 870	-50 +400	3s		
TP 870 C	-50 +400	5s		
TP 870 P	-50 +400	5s		
TP 870 A	-50 +250	12s		

Pt100 SENSOR PROBES FOR OBSOLETE INSTRUMENTS

CODE	°C max	τ s	DIMENSIONS	USE
TP 871	-50 +200	3s		
TP 872/500	-50 +400	10s		
TP 872/1000				
TP 873	-50 +500	6s		
TP 874	-30 +200	3s		
TP 875.1	-30 +120	15s	Globe-thermometer probe for measuring radiant heat ø150 mm. (ISO7243, ISO7726). **4 wires** Pt100 sensor cable L=2m.	
TP 876.1	-30 +120	15s	Globe-thermometer probe for measuring radiant heat ø50 mm. (ISO7243, ISO7726). **4 wires** Pt100 sensor cable L=2m.	
TP 877	-200 +400	3s		
TP879.1	-20 +120	60s	Penetration probe for compost 4 wires cable L = 2 m	

Pt100 SENSOR PROBES FOR OBSOLETE INSTRUMENTS

CODE	°C max	τ s		DIMENSIONS	USE
TP 9 A	-70 +400	3,5s	**CLASS A**		
TP 9 AC	-70 +400	5,5s	**CLASS A**		
TP 9 AP	-70 +400	4s	**CLASS A**		
TP 93	-70 +400	3,5s	**CLASS 1/3 DIN**		
TP 93 C	-70 +400	5,5s	**CLASS 1/3 DIN**		
TP 93 P	-70 +400	4s	**CLASS 1/3 DIN**		
TP 932	-70 +200	3,5s	**CLASS 1/3 DIN**		
TP 932 P	-70 +200	4s	**CLASS 1/3 DIN**		
TP 95	-70 +400	3,5s	**CLASS 1/5 DIN**		
TP 95 P	-70 +400	4s	**CLASS 1/5 DIN**		

When temperature exceeds 400°C avoid violent impact and thermal shock, as the Pt100 sensor may got irreparably damaged.

HD 2108.1
HD 2108.2
HD 2128.1
HD 2128.2

	HD2108.1	HD2108.2	HD2128.1	HD2128.2
TC input:	1	1	2	2
Storage capacity	----	76000 samples	----	38000 couples of temperature
PC interface	RS232C	RS232C + USB2.0	RS232C	RS232C + USB2.0
Data logger	NO	YES	NO	YES
A-B function	NO	NO	YES	YES

HD 2108.1, HD 2108.2, HD 2128.1, HD2128.2
THERMOCOUPLE THERMOMETERS: K, J, T, N, R, S, B, E

The HD2108.1 and HD2108.2 **with one input** and the HD2128.1 and HD2128.2 **with two inputs** are portable instruments with a large LCD display. They measure the temperature using immersion, penetration air or contact probes. The sensor may be a thermocouple of type K, J, T, N, R, S, B or E.
Instruments HD2108.2 and HD2128.2 are **data logger**, they store up to 76.000 samples the first and 38.000 couples of values the second. These data can be transferred into a PC connected to the instrument through a multi-standard RS232C serial port and a USB 2.0. It is possible to configure the storage interval, the printing and the baud rate by the menu.
All models are equipped with RS232C serial port and are able to transfer the acquired measures, in real time, into a PC or a portable printer.
Functions Max, Min and Avg calculate maximum, minimum and average values.
Further functions are: REL relative measure, HOLD and automatic switching-off system, excludable. HD2128.1 and HD2128.2 calculate A-B difference of the temperatures acquired by the two input channels.
Instruments have IP67 protection degree.

TECHNICAL SPECIFICATIONS OF THE INSTRUMENTS

Instrument

Dimensions (Length x Width x Height)	185x90x40mm
Weight	470g (complete with Batteries)
Materials	ABS, rubber
Display	2x4½ digits plus symbols Visible area: 52x42mm

Operating conditions

Operating temperature	-5 … 50°C
Storage temperature	-25 … 65°C
Working relative humidity	0 … 90% RH, no condensation
Protection degree	**IP67**

Power supply

Batteries	4 Batteries 1.5V type AA
Autonomy	200 hours with 1800mAh alkaline batteries
Current consumption with instrument off	20µA
Main	12Vdc / 1000mA Output main adapter

Unit of measurement — *°C - °F - °K - mV - mV*C*

Security of data stored — Unlimited, independent of battery charge conditions
1min/month max drift

Time

Date and time	Schedule in real time
Accuracy	1min/month max drift

Measured values storage

Model ***HD2108.2***	2000 pages each one containing 38 samples, 76000 samples in total
Model ***HD2128.2***	2000 pages each one containing 19 samples, 38000 couples of samples
Storage interval	1s … 3600s (1 hour)

Serial interface RS232C

Type	RS232C electrically isolated
Baud rate	can be set from 1200 to 38400 baud
Data bit	8
Parity	None
Stop bit	1
Flow Control	Xon/Xoff
Serial cable length	Max 15m
Immediate print interval	1s … 3600s (1 hour)

*USB interface - model **HD2108.2** and **HD2128.2***

Type	1.1 - 2.0 electrically isolated

Connections

Probes input connector	2-pole female polarized standard miniature
Serial interface and USB	8-pole MiniDin connector
Mains adapter	2-pole connector (positive at centre)

HD2108

HD2128

SWD10

HD2110CSNM

Measurement of temperature by Instrument

TC measuring range: K	-200…+1370°C
TC measuring range: J	-100…+750°C
TC measuring range: T	-200…+400°C
TC measuring range: N	-200…+1300°C
TC measuring range: R	+200…+1480°C
TC measuring range: S	+200…+1480°C
TC measuring range: B	+200…+1800°C
TC measuring range: E	-200…+750°C

Resolution **0.05°C up to 199.95°C**
0.1°C from 200.0°C up to full scale

Instrument accuracy

Thermocouple K	±0.1°C up to 600°C
	±0.2°C over 600°C
Thermocouple J	±0.05°C up to 400°C
	±0.1°C over 400°C
Thermocouple T	±0.1°C
Thermocouple N	±0.1°C up to 600°C
	±0.2°C over 600°C
Thermocouple R	±0.25°C
Thermocouple S	±0.3°C
Thermocouple B	±0.35°C
Thermocouple E	±0.1°C up to 300°C
	±0.15°C over 300°C

Accuracy is referred to the instrument only; error due to the thermocouple or to the cold junction reference sensor is not included.

Temperature drift @20°C	0.02%/°C
Drift after 1 year	0.1°C/year

Thermocouple probes accuracy:
Tolerance of a type of thermocouple corresponds to the maximum acceptable shift from the e.m.f. of any thermocouple of that type, with reference junction at 0°C. The tolerance is expressed in degrees Celsius, preceded by the sign. The percentage tolerance is given by the ratio between the tolerance expressed in degrees Celsius and the measurement junction temperature, multiplied by one hundred.
The tolerances refer to the operating temperature expected for the thermocouple, in agreement with the thermo-elements' diameter.
Those thermocouples that comply with the limits for temperatures over 0°C, do not necessarily comply with the limits for ranges below 0°C.

Tolerance classes for thermocouples (reference junction at 0°C)

Type of thermocouple	Tolerance Class 1	Tolerance Class 2	Tolerance Class 3 (1)
Type T			
Temperature interval	from -40 to +125°C	from -40 to +133°C	from -67 to+40°C
Tolerance	± 0.5°C	± 1°C	± 1°C
Temperature interval	from 125 to 350°C	from 133 to 350°C	from -200 to -67°C
Tolerance	± 0.004 · Itr	± 0.0075 · Itr	± 0.015 · Itr
Type E			
Temperature interval	from -40 to +375°C	from -40 to +333°C	from -167 to +40°C
Tolerance	± 1.5°C	± 2.5°C	± 2.5°C
Temperature interval	from 375 to 800°C	from 333 to 900°C	from -200 to -167°C
Tolerance	± 0.004 · Itr	± 0.0075 · Itr	± 0.015 · Itr
Type J			
Temperature interval	from -40 to +375°C	from -40 to +333°C	-
Tolerance	± 1.5°C	± 2.5°C	-
Temperature interval	from 375 to 750°C	from 333 to 750°C	-
Tolerance	± 0.004 · Itr	± 0.0075 · Itr	-
Type K, type N			
Temperature interval	from -40 to +375°C	from 40 to +333°C	from -167 to +40°C
Tolerance	± 1.5°C	± 2.5°C	± 2.5°C
Temperature interval	from 375 to 1000°C	from 333 to 1200°C	from -200 to -167°C
Tolerance	± 0.004 · Itr	± 0.0075 · Itr	± 0.015 · Itr
Type R, type S			
Temperature interval	from 0 to +1100°C	from 0 to +600°C	-
Tolerance	± 1°C	± 1.5°C	-
Temperature interval	from 1100 to 1600°C	from 600 to 1600°C	-
Tolerance	± [1 + 0.003 (t-1 100)] °C	± 0.0025 · Itr	-
Type B			
Temperature interval	-	-	from +600 to +800C
Tolerance	-	-	+ 4°C
Temperature interval	-	from 600 to 1700 °C	from 800 to 1700°C
Tolerance	-	± 0.0025 · Itr	± 0.005 · Itr

(1) Materials for thermocouples are generally supplied so to comply with the factory tolerances specified in the table for temperatures over -40°C. However these materials can sometimes not comply with the factory tolerances for the low temperatures reported under Class 3, for thermocouples of T, E, K and N type, when thermocouples have to comply at the same time the limits of Class 3 and Class 1 and/or Class 2.

PURCHASING CODES

HD2108.1: The kit consists of **one input** instrument HD2108.1, 4 per 1.5V alkaline Batteries, instruction manual, case and DeltaLog9 software. **Probes and cables have to be ordered separately.**

HD2108.2: The kit consists of **one input** instrument HD2108.2**, data logger**, 4 per 1.5V alkaline Batteries, instruction manual, case and DeltaLog9 software. **Probes and cables have to be ordered separately.**

HD2128.1: The kit consists of **two inputs** instrument HD2128.1, 4 per 1.5V alkaline Batteries, instruction manual, case and DeltaLog9 software. **Probes and cables have to be ordered separately.**

HD2128.2: The kit consists of **two inputs** instrument HD2128.2**, data logger**, 4 per 1.5V alkaline Batteries, instruction manual, case and DeltaLog9 software. **Probes and cables have to be ordered separately.**

HD2110CSNM: 8-pole connection cable MiniDin - Sub D 9-pole female for RS232C.

C.206: Cable for instruments of the series HD21…1 and .2 to connect directly to USB input of PC.

HD2101/USB: Connection cable USB 2.0 connector type A - 8-pole MiniDin.

DeltaLog9: Software for download and management of the data on PC using Windows 98 to XP and Vista operating systems.

SWD10: Stabilized power supply at 230Vac/12Vdc-300mA-1000mA mains voltage.

HD40.1: Upon request, portable, serial input, 24 column thermal printers, 58mm paper width.

Thermocouple probes

Any thermocouple probe with standard miniature connector available on the price list can be connected to these instruments.

Please see pages from 17 to 21.

HD2101/USB

HD40.1

HD2328.0
TWO INPUTS THERMOCOUPLE THERMOMETER

HD2328.0 with **two inputs** is a portable instrument with a large LCD display. It measures temperature by means of immersion, penetration, contact or aria probes. Its sensor can be a K, J, T or E thermocouple type.
Functions Max, Min and Avg calculate maximum, minimum and average values. Further functions are: REL relative measure, HOLD and automatic switching-off system**. The instrument has IP67 protection degree.**

TECHNICAL SPECIFICATIONS OF THE INSTRUMENTS

Instrument

Dimensions (Length x Width x Height)	140x88x38mm
Weight	160g (complete with batteries)
Materials	ABS
Display	2x4½ digits plus symbols Visible area: 52x42mm

Operating conditions

Operating temperature	-5 … 50°C
Storage temperature	-25 … 65°C
Working relative humidity	0 … 90% RH, no condensation
Protection degree	**IP67**

Power supply

Batteries	3 Batteries 1.5V type AA
Autonomy	200 hours with 1800mAh alkaline batteries
Current consumption with instrument off	< 20µA

Unit of measurement — *°C - °F*

Connections

Probes input	2 per 2-pole female polarized standard miniature connector

Temperature measure of the instrument

TC measuring range: K	-200…+1370°C
TC measuring range: J	-100…+750°C
TC measuring range: T	-200…+400°C
TC measuring range: E	-200…+750°C
Resolution	**0.1°C**
Instrument accuracy	
Thermocouple K	±0.1°C up to 600°C ±0.2°C over 600°C
Thermocouple J	±0.1°C up to 400°C ±0.2°C over 400°C
Thermocouple T	±0.1°C
Thermocouple E	±0.1°C up to 300°C ±0.2°C over 300°C

Accuracy is referred to the instrument only; error due to the thermocouple or to the cold junction reference sensor is not included.

Temperature drift @20°C	0.02%/°C
Drift after 1 year	0.1°C/year

Thermocouple probes accuracy:
Tolerance of a type of thermocouple corresponds to the maximum acceptable shift from the e.m.f. of any thermocouple of that type, with reference junction at 0°C. The tolerance is expressed in degrees Celsius, preceded by the sign. The percentage tolerance is given by the ratio between the tolerance expressed in degrees Celsius and the measurement junction temperature, multiplied by one hundred.
The tolerances refer to the operating temperature expected for the thermocouple, in agreement with the thermo-elements' diameter.
Those thermocouples that comply with the limits for temperatures over 0°C, do not necessarily comply with the limits for ranges below 0°C.

Tolerance classes for thermocouples (reference junction at 0°C)

Type of thermocouple	Tolerance Class 1	Tolerance Class 2	Tolerance Class 3 [1]
Type T Temperature interval Tolerance Temperature interval Tolerance	from -40 to +125°C ± 0.5°C from 125 to 350°C ± 0.004 · |t|	from -40 to +133°C ± 1°C from 133 to 350°C ± 0.0075 · |t|	from -67 to+40°C ± 1°C from -200 to -67°C ± 0.015 · |t|
Type E Temperature interval Tolerance Temperature interval Tolerance	from -40 to +375°C ± 1.5°C from 375 to 800°C ± 0.004 · |t|	from -40 to +333°C ± 2.5°C from 333 to 900°C ± 0.0075 · |t|	from -167 to +40°C ± 2.5°C from -200 to -167°C ± 0.015 · |t|
Type J Temperature interval Tolerance Temperature interval Tolerance	from -40 to +375°C ± 1.5°C from 375 to 750°C ± 0.004 · |t|	from -40 to +333°C ± 2.5°C from 333 to 750°C ± 0.0075 · |t|	- - - -
Type K, type N Temperature interval Tolerance Temperature interval Tolerance	from -40 to +375°C ± 1.5°C from 375 to 1000°C ± 0.004 · |t|	from 40 to +333°C ± 2.5°C from 333 to 1200°C ± 0.0075 · |t|	from -167 to+40°C ± 2.5°C from -200 to -167°C ± 0.015 · |t|

[1] Materials for thermocouples are generally supplied so to comply with the factory tolerances specified in the table for temperatures over -40°C. However these materials can sometimes not comply with the factory tolerances for the low temperatures reported under Class 3, for thermocouples of T, E, K and N type, when thermocouples have to comply at the same time the limits of Class 3 and Class 1 and/or Class 2.

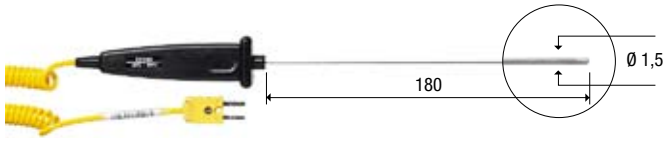
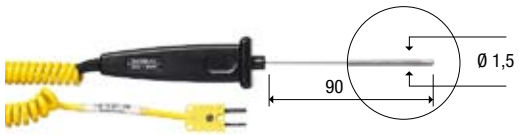
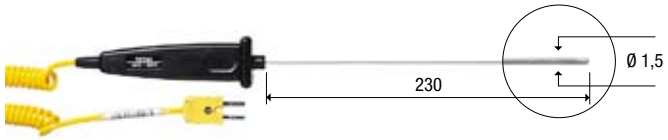
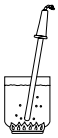
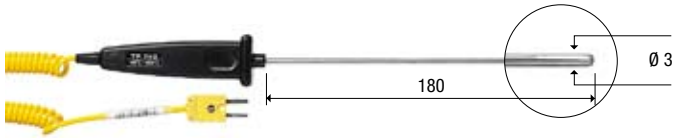
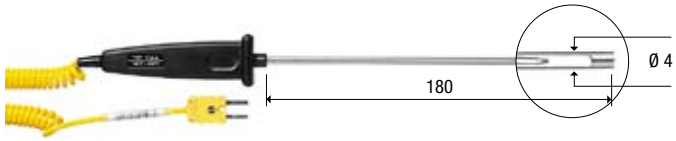
PURCHASING CODES

HD2328.0: The kit consists of **two inputs** instrument HD2328.0, 3 per 1.5V alkaline Batteries, instruction manual, case. **Probes have to be ordered separately.**

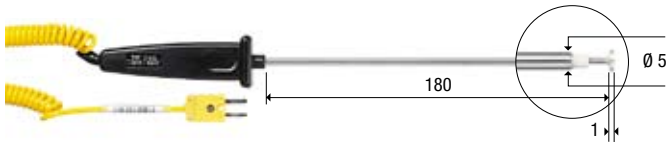
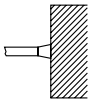
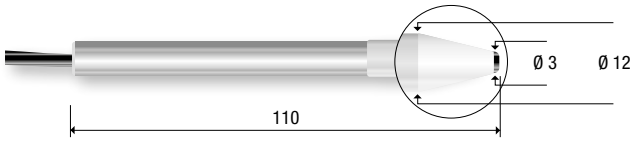
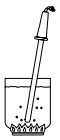
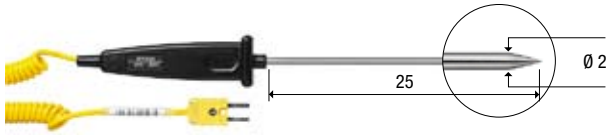
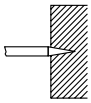
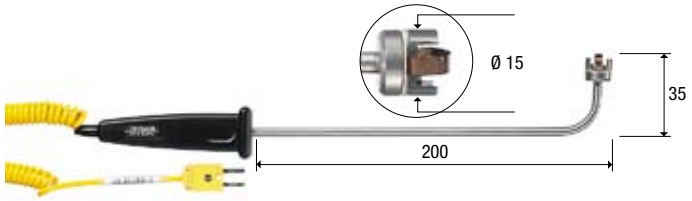
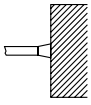
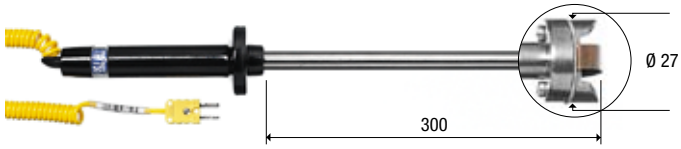
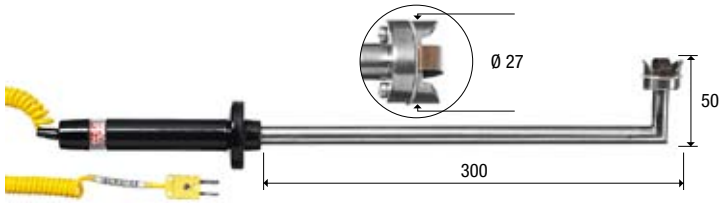
Thermocouple probes
Any thermocouple probe with standard miniature connector available on the price list can be connected to these instruments.
Please see pages from 17 to 21.

THERMOCOUPLE PROBES FOR PORTABLE INSTRUMENTS

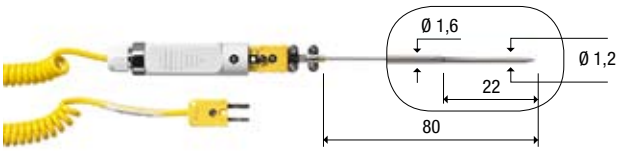
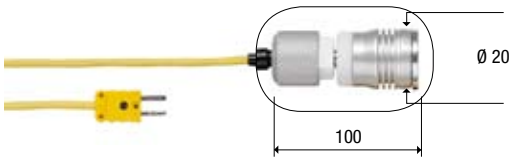
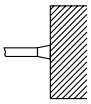
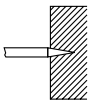
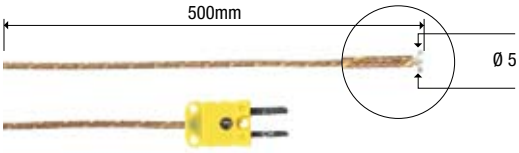
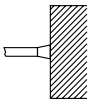
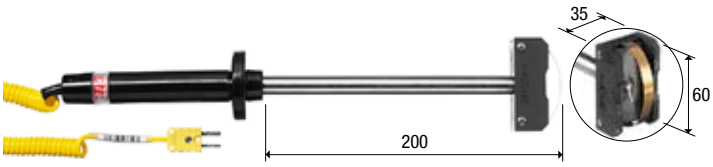
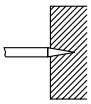
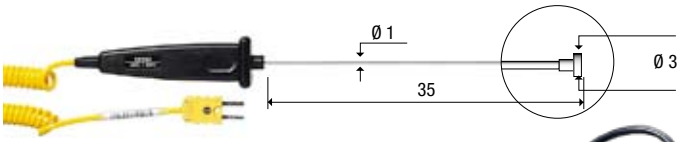
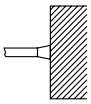
TYPE “K” (CHROMEL - ALUMEL) THERMOCOUPLE PROBES

CODE	°C max	τ s	DIMENSIONS	USE
TP 741	800	2s		
TP 741/1	400	2s		
TP 741/2	800	2s		
TP 742	800	2s		
TP 742/1	400	2s		
TP 742/2	800	2s		
TP 743	800	3s		
TP 744	400	4s		

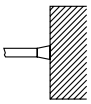
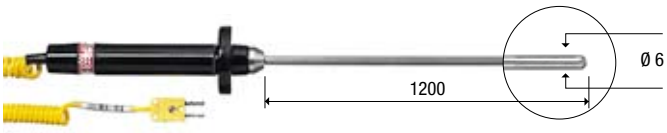
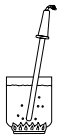
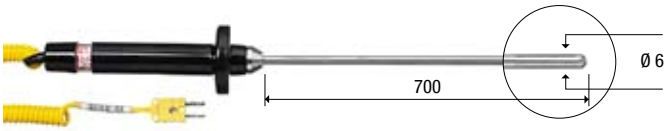
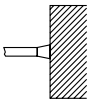
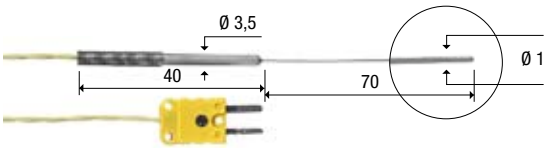
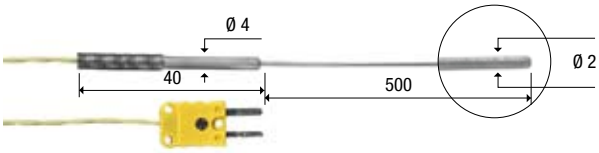
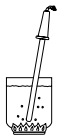
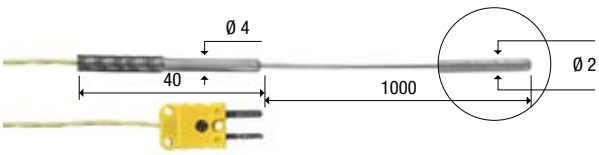
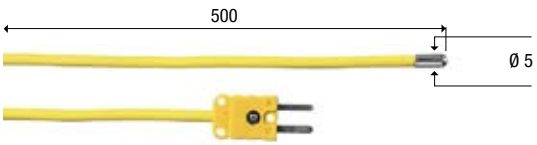
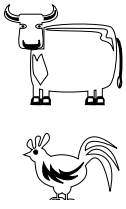
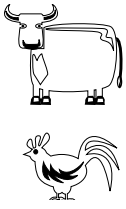
TYPE “K” (CHROMEL - ALUMEL) THERMOCOUPLE PROBES

CODE	°C max	τ s	DIMENSIONS	USE
TP 745	500	5s		
TP 746	250	2s		
TP 750	1000	3s		
TP 750.0	800	3s		
TP 751	200	2s		
TP 754	500	2s		
TP 754/9	500	2s		
TP 755	800	2s		
TP 755/9	800	2s		

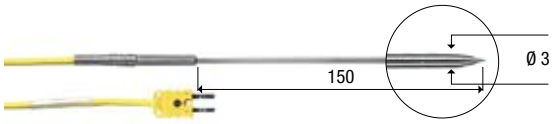
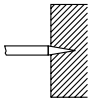
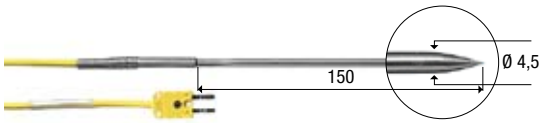
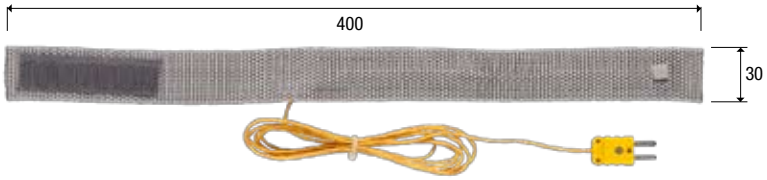
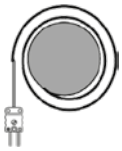
TYPE “K” (CHROMEL - ALUMEL) THERMOCOUPLE PROBES

CODE	°C max	τ s	DIMENSIONS	USE
TP 756	200	2s		
TP 757	180	30s	MAGNETIC PROBE FOR CONTACT MEASURE ON MAGNETIC METALLIC SURFACES 	
TP 758	400	4s		
TP 758.1	400	4s		
TP 772	400	3s		
TP 774	250	2s		
TP 776	200	2s		
TP 777	200	3s		

TYPE “K” (CHROMEL - ALUMEL) THERMOCOUPLE PROBES

CODE	°C max	τ s	DIMENSIONS	USE
TP 647 **TP 647/2** **TP 647/3** **TP 647/5**	300 300 300 300	2s 2s 2s 2s	For SIT calibration up to 300°C. 	
TP 651	1200	6s		
TP 652	1200	6s		
TP 655	180	2s		
TP 656	200	1s		
TP 656/1	1000	1s		
TP 656/2	1000	1s		
TP 657/1	100	5s		
TP 658	100	2s		

TYPE “K” (CHROMEL - ALUMEL) THERMOCOUPLE PROBES

CODE	°C max	τ s	DIMENSIONS	USE
TP 659	400	3s		
TP 660	400	4s		
TP 661	-60 +50	30s		
TP 662	110	120s	PROBE WITH VELCRO TAPE FOR MEASURES ON PIPES MAX 110 DIAM. 	
CM **CS**	“K” “K”			
PW	“K”			

Response time for a 63% variation ($\tau_{0.63}$)

Response time τ **s** is the reaction time of the sensor to a temperature variation, with a variation of the measured signal to a given percentage (63%) of the variation.
Response times are referred to:

Immersion probes when into water at 100°C.
Contact probes when in contact with a metallic surface at 200°C.
Air probes at air temperature of 100°C.

HD 2178.1
HD 2178.2

HD2178.1 AND HD2178.2
Pt100 AND TC INPUT THERMOMETERS

HD2178.1 and HD2178.2 are portable instruments with a large LCD display. These instruments measure temperature by means of immersion, penetration, contact or air probes with Pt100 or thermocouple probes. You can connect a 3 or 4 wires Pt100 sensor or a 2 wires Pt1000 sensor to B input, a K, J, T, N, E type thermocouple to input A. Probes to B input, a 8-poles DIN45326 connector, are equipped with an automatic detection module, with the factory calibration settings already being memorized inside. A input is equipped with a miniature female polarized connector for thermocouple probes. The instrument HD2178.2 is a **data logger**; it stores up to 80.000 samples that can be transferred to a PC when connected to the instrument through a multi-standard RS232C serial port and a USB 2.0 port. It is possible to configure the storage interval, the printing and the baud rate by the menu. HD2178.1 and HD2178.2 are equipped with RS232C serial port and are able to transfer the acquired measures, in real time, into a PC or a portable printer. Functions Max, Min and Avg calculate maximum, minimum and average values. Further functions are: REL relative measure, HOLD and automatic switching-off system, excludable. **Instruments have IP67 protection degree.**

TECHNICAL SPECIFICATIONS OF THE INSTRUMENTS

Instrument

Dimensions (Length x Width x Height)	185x90x40mm
Weight	470g (complete with Batteries)
Materials	ABS, rubber
Display	2x4½ digits plus symbols Visible area: 52x42mm

Operating conditions

Operating temperature	-5 … 50°C
Storage temperature	-25 … 65°C
Working relative humidity	0 … 90% RH, no condensation
Protection degree	**IP67**

Power supply

Batteries	4 Batteries 1.5V type AA
Autonomy	200 hours with 1800mAh alkaline batteries
Current consumption with instrument off	20µA
Main	12Vdc / 1000mA Output main adapter

Unit of measurement	*°C - °F*
Security of data stored	Unlimited, independent of battery charge conditions 1min/month max drift

Time

Date and time	Schedule in real time
Accuracy	1min/month max drift

*Measured values storage - model **HD2178.2***

Type	2000 pages each one containing 40 samples
Quantity	80000 samples in total
Storage interval	1s … 3600s (1 hour)

Serial interface RS232C

Type	RS232C electrically isolated
Baud rate	can be set from 1200 to 38400 baud
Data bit	8
Parity	None
Stop bit	1
Flow Control	Xon/Xoff
Serial cable length	Max 15m
Immediate print interval	1s … 3600s (1 hour)

*USB interface - model **HD2178.2***

Type	1.1 - 2.0 electrically isolated

Connections

Input for probes	8 pole male DIN45326 connector
Serial and USB interface	8-pole MiniDin connector
Mains adapter	2-pole connector (positive at centre)

*Temperature measurement by instrument - **RTD sensors***

Pt100 Measuring range	-200…+650°C
Pt1000Measuring range	-200…+650°C
Resolution	0.1°C
Accuracy	±0.05°C
Drift after 1 year	0.1°C/year

*Temperature measurement by instrument - **Tc***

TC measuring range: K	-200…+1370°C
TC measuring range: J	-100…+750°C
TC measuring range: T	-200…+400°C
TC measuring range: N	-200…+1300°C
TC measuring range: E	-200…+750°C
Resolution	0.1°C
Instrument accuracy	
Thermocouple K	±0.1°C up to 600°C ±0.2°C over 600°C
Thermocouple J	±0.05°C up to 400°C ±0.1°C over 400°C
Thermocouple T	±0.1°C
Thermocouple N	±0.1°C up to 600°C ±0.2°C over 600°C
Thermocouple E	±0.1°C up to 300°C ±0.15°C over 300°C

Accuracy is referred to the instrument only; error due to the thermocouple or to the cold junction reference sensor is not included.

Temperature drift @20°C	0.02%/°C
Drift after 1 year	0.1°C/year

Thermocouple probes accuracy:
Tolerance of a type of thermocouple corresponds to the maximum acceptable shift from the e.m.f. of any thermocouple of that type, with reference junction at 0°C. The tolerance is expressed in degrees Celsius, preceded by the sign. The percentage tolerance is given by the ratio between the tolerance expressed in degrees Celsius and the measurement junction temperature, multiplied by one hundred. The tolerances refer to the operating temperature expected for the thermocouple, in agreement with the thermo-elements' diameter.
Those thermocouples that comply with the limits for temperatures over 0°C, do not necessarily comply with the limits for ranges below 0°C.

HD2178

SWD10

Tolerance classes for thermocouples (reference junction at 0°C)

Type of thermocouple	Tolerance Class 1	Tolerance Class 2	Tolerance Class 3 [1]
Type T Temperature interval Tolerance Temperature interval Tolerance	from -40 to +125°C ± 0.5°C from 125 to 350°C ± 0.004 · ltr	from -40 to +133°C ± 1°C from 133 to 350°C ± 0.0075 · ltr	from -67 to+40°C ± 1°C from -200 to -67°C ± 0.015 · ltr
Type E Temperature interval Tolerance Temperature interval Tolerance	from -40 to +375°C ± 1.5°C from 375 to 800°C ± 0.004 · ltr	from -40 to +333°C ± 2.5°C from 333 to 900°C ± 0.0075 · ltr	from -167 to +40°C ± 2.5°C from -200 to -167°C ± 0.015 · ltr
Type J Temperature interval Tolerance Temperature interval Tolerance	from -40 to +375°C ± 1.5°C from 375 to 750°C ± 0.004 · ltr	from -40 to +333°C ± 2.5°C from 333 to 750°C ± 0.0075 · ltr	- - - -
Type K, type N Temperature interval Tolerance Temperature interval Tolerance	from -40 to +375°C ± 1.5°C from 375 to 1000°C ± 0.004 · ltr	from 40 to +333°C ± 2.5°C from 333 to 1200°C ± 0.0075 · ltr	from -167 to +40°C ± 2.5°C from -200 to -167°C ± 0.015 · ltr
Type R, type S Temperature interval Tolerance Temperature interval Tolerance	from 0 to +1100°C ± 1°C from 1100 to 1600°C ± [1 + 0.003 (t-1 100)] °C	from 0 to +600°C ± 1.5°C from 600 to 1600°C ± 0.0025 · ltr	- - - -
Type B Temperature interval Tolerance Temperature interval Tolerance	- - - -	- - from 600 to 1700 °C ± 0.0025 · ltr	from +600 to +800C + 4°C from 800 to 1700°C ± 0.005 · ltr

[1] Materials for thermocouples are generally supplied so to comply with the factory tolerances specified in the table for temperatures over -40°C. However these materials can sometimes not comply with the factory tolerances for the low temperatures reported under Class 3, for thermocouples of T, E, K and N type, when thermocouples have to comply at the same time the limits of Class 3 and Class 1 and/or Class 2.

TECHNICAL DATA OF PROBES AND MODULES EQUIPPED WITH INSTRUMENT
Temperature probes Pt100 sensor with SICRAM module

Model	Type	Application field	Accuracy
TP472I	Immersion	-196°C…+500°C	±0.25°C (-196°C…+350°C) ±0.4°C (+350°C…+500°C)
TP472I.0	Immersion	-50°C…+400°C	±0.25°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP473P	Penetration	-50°C…+400°C	±0.25°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP473P.0	Penetration	-50°C…+400°C	±0.25°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP474C	Contact	-50°C…+400°C	±0.3°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP474C.0	Contact	-50°C…+400°C	±0.3°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP475A.0	Air	-50°C…+250°C	±0.3°C (-50°C…+250°C)
TP472I.5	Immersion	-50°C…+400°C	±0.3°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP472I.10	Immersion	-50°C…+400°C	±0.30°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP49A	Immersion	-70°C…+400°C	±0.25°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP49AC	Contact	-70°C…+400°C	±0.25°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP49AP	Penetration	-70°C…+400°C	±0.25°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP875	Globe-thermometer Ø150mm	-30°C…+120°C	±0.25°C
TP876	Globe-thermometer Ø 50mm	-30°C…+120°C	±0.25°C
TP87	Immersion	-50°C…+200°C	±0.25°C
TP878 TP878.1	For solar panels	+5°C…+80°C	±0.25°C
TP879	For compost	-20°C…+120°C	±0.25°C

Common features
Temperature drift @20°C 0.003%/°C

4 wires Pt100 and 2 wires Pt1000 Probes

Model	Type	Application field	Accuracy
TP47.100	4 wires Pt100	-50…+400°C	Class A
TP47.1000	2 wires Pt1000	-50…+400°C	Class A

Common features
Temperature drift @20°C
Pt100 0.003%/°C
Pt1000 0.005%/°C

PURCHASING CODES
HD2178.1: The kit consists of instrument HD2178.1, 4 per 1.5V alkaline Batteries, instruction manual and case, software DeltaLog9. **Probes and cables have to be ordered separately**
HD2178.2: The kit consists of instrument **data logger** HD2178.2, 4 per 1.5V alkaline Batteries, instruction manual and case, software DeltaLog9. **Probes and cables have to be ordered separately**
HD2110CSNM: 8-pole connection cable MiniDin - Sub D 9-pole female for RS232C.
C.206: Cable for instruments of the series HD21…1 and .2 to connect directly to USB input of PC.
HD2101/USB: Connection cable USB 2.0 connector type A - 8-pole MiniDin.
DeltaLog9: Software for download and management of the data on PC using Windows 98 to XP and Vista operating systems.
SWD10: Stabilized power supply at 230Vac/12Vdc-300mA-1000mA mains voltage.
HD40.1: Upon request, portable, serial input, 24 column thermal printer, 58mm paper width.

Probes equipped with SICRAM module
TP472I: Immersion probe, Pt100sensor. Stem Ø 3 mm, length 300 mm. Cable 2 meters long.
TP472I.0: Immersion probe, Pt100sensor. Stem Ø 3 mm, length 230 mm. Cable 2 meters long.
TP473P: Penetration probe, Pt100sensor. Stem Ø 4mm, length 150 mm. Cable 2 meters long.
TP473P.0: Penetration probe, Pt100sensor. Stem Ø 4mm, length 150 mm. Cable 2 meters long.
TP474C: Contact probe, Pt100sensor. Stem Ø 4mm, length 230mm, contact surface Ø 5mm. Cable 2 meters long.
TP474C.0: Contact probe, Pt100sensor. Stem Ø 4mm, length 230mm, contact surface Ø 5mm. Cable 2 meters long.
TP475A.0: Air probe, Pt100sensor. Stem Ø 4mm, length 230mm. Cable 2 meters long.
TP472I.5: Immersion probe, Pt100sensor. Stem Ø 6mm, length 500 mm. Cable 2 meters long.
TP472I.10: Immersion probe, Pt100sensor. Stem Ø 6mm, length 1,000mm. Cable 2 meters long.
TP49A: Immersion probe, Pt100sensor. Stem Ø 2.7mm, length 150mm. Cable 2 meters long. Aluminium handle.
TP49AC: Contact probe, Pt100sensor. Stem Ø 4 mm, length 150mm. Cable 2 meters long. Aluminium handle.
TP49AP: Penetration probe, Pt100sensor. Stem Ø 2.7mm, length 150mm. Cable 2 meters long. Aluminium handle.
TP875: Globe thermometer Ø 150 mm with handle. Cable 2 meters long.
TP876: Globe thermometer Ø 50 mm with handle. Cable 2 meters long.
TP87: Immersion probe, Pt100sensor. Stem Ø 3 mm, length 70 mm. Cable 2 meters long.
TP878: Contact probe for solar panels. Cable 2 meters long.
TP878.1: Contact probe for solar panels. Cable 5 meters long
TP879: Penetration probe for compost. Stem Ø 8 mm, length 1 meter. Cable 2 meters long.

Temperature probes without SICRAM module
TP47.100: Direct 4 wires Pt100 sensor immersion probe. Stem Ø 3 mm, length 230mm. 4 wires connection cable with connector, 2 meters long.
TP47.1000: Pt1000 sensor immersion probe. Stem Ø 3 mm, length 230mm. 2 wires connection cable with connector, 2 meters long.
TP47: Only connector for probe connection: direct 3 and 4 wires Pt100, 2 wires Pt1000.

Thermocouple probes
Any thermocouple probe with standard miniature connector available on the price list can be connected to these instruments.
Please see pages from 17 to 21.

HD 32.7
HD 32.8.8
HD 32.8.16

HD32.7 - HD32.8.8 - HD32.8.16
DATALOGGER

HD32.7
8 INPUTS DATA LOGGER FOR PT100 SENSOR PROBES

The instrument **HD32.7** is a robust 8 inputs data logger for Pt100 sensor temperature probes equipped with SICRAM module. 4 wires Pt100 Probe.

- Unit of measurement °C, °F, °K configurable.
- Flash memory organized in 64 sections with a total capacity of 96.000 acquisitions for each one of the 8 inputs. Storage can be managed in two ways:
  - when the available memory is full, data are overwritten by starting from the oldest ones (circular memory),
  - storage stops when the available memory is full.
- Simultaneous display of the 8 inputs.
- Maximum, minimum or average of the stored values.
- Selectable storage interval: 2, 5, 10, 15, 30 seconds, 1, 2, 5, 10, 15, 20, 30 minutes and 1 hour.
- Data logging: instantaneous or postponed, with the possibility of selecting the storage start and end.
- Data download: RS232C, 1200...38400 baud or USB 1.1 – 2.0.
- DeltaLog9 software for data download and processing.
- LCD backlit graphic display 128x64 pixel.
- Instrument setup through the keyboard; no connection required to the PC.
- Security password for keyboard locking.
- Power supply: 4 1.5V alkaline C-BABY type batteries or external power supply 12VDC-1A.
- Consumption @6VDC:
  - <60µA when the instrument is off
  - <60µA in sleep mode with 8 probes connected
  - <40mA during data logging with 8 probes connected
- Use of the HD32.7 data logger: in the field for machine or equipment measurements, plant or machine testing, production check, oven mapping.

TECHNICAL SPECIFICATIONS

Number of Inputs	8 DIN 45326 8-poles male connectors.
Instrument accuracy when storing	±0.01°C ±1digit (in the range ±199.99°C) ±0.1°C ±1digit in the remaining range
Internal watch accuracy	1min/month max drift
Unit of measurement	°C, °F, °K
Resolution	0.01°C (in the range ±199.99°C) 0.1°C in the remaining range
Measuring range	-200°C … 650°C
Display	Backlit graphic LCD 128x64 pixel.
Keyboard	15 keys, configurable also without PC.
Keyboard locking function	with password.
Memory	divided into 64 blocks.
Memory capacity	96.000 storages for each one of the inputs.
Security of data stored	unlimited
Power supply	4 per 1.5V alkaline Batteries type C-BABY External 12Vdc-1A power supply. Connector, external ∅ 5.5mm, internal ∅ 2.1mm.
Current consumption @6Vdc	<60µA when the instrument is off <60µA in sleep mode with 8 probes connected <40mA during data logging with 8 probes connected
Autonomy	200 hours with 7800mAh alkaline batteries and 8 probes connected
Data download	RS232C from 1200 to 38400 baud, galvanically isolated. Sub D 9-pole male connector. USB 1.1 – 2.0 galvanically isolated.

Operating conditions

Operating temperature	-5 … 50°C
Storage temperature	-25 … 65°C
Working relative humidity	0 … 90% RH no condensation
Protection degree	IP64

Instrument

Dimensions (Length x Width x Height)	220x180x50 mm
Weight	1100 g (complete with batteries)
Materials	ABS, polycarbonate and aluminium

Probes

all Delta Ohm Pt100 probes equipped with SICRAM module belonging to the series TP47..., TP49...., TP87 and 4 wires Pt100 sensor probes can be connected. Please see pages 9 and 10. Probes of different form can be supplied upon request.

PURCHASING CODES

HD32.7: Instrument **Data logger** with **8 inputs** for temperature Pt100 sensor probes equipped with SICRAM module and 4 wires Pt100 probes. The kit consists of instrument HD32.7, 4 per 1.5Vdc alkaline C-Baby type Batteries, instruction manual, software DeltaLog9 and support and carrying strap. **Probes, tripod, carrying case and cables have to be ordered separately.**

DeltaLog9: Further copy of the software for download and management of data by PC for Windows from 98 to Vista operating systems.

PROBES FOR HD32.7

All temperature Pt100 probes equipped with SICRAM module and 4 wires Pt100 sensor probes can be connected to the instrument. **Probes of different form can be supplied upon request.**

ACCESSORIES FOR HD32.7

9CPRS232: Connection cable with Sub D 9-pole female connectors for RS232C (null modem)
CP22: Connection cable USB 2.0 connector type A - connector type B.
BAG32.2: Carrying case for the HD32.7 instrument and accessories.
HD32CS: Support and carrying strap
SWD10: 100-240VAC/12VDC-1A stabilized mains power supply
VTRAP32: Tripod complete with 6-input head and 5 probe holders code HD3218K
HD3218K: Shaft for another probe

HD32.8.8
8 INPUTS DATA LOGGER FOR PT100 SENSOR PROBES

HD32.8.16
16 INPUTS DATA LOGGER FOR THERMOCOUPLES

Instruments **HD32.8.8** and **HD32.8.16** are two robust data loggers with 8 inputs the first, 16 inputs the second, for K, J, T, N, R, S, B and E type thermocouple with miniature connector temperature probes.

- Unit of measurement °C, °F, °K configurable.
- Flash memory organized in 64 sections with a total capacity of 800.000 acquisitions to be divided among all the present inputs. Storage can be managed in two ways:
  - when the available memory is full, data are overwritten by starting from the oldest ones (circular memory),
  - storage stops when the available memory is full
- Simultaneous display of the 8 inputs.
- Maximum, minimum or average of the stored values.
- Selectable storage interval: 2, 5, 10, 15, 30 seconds, 1, 2, 5, 10, 15, 20, 30 minutes and 1 hour.
- Data logging: instantaneous or postponed, with the possibility of selecting the storage start and end.
- Data download: RS232C, 1200...38400 baud or USB 1.1 – 2.0.
- DeltaLog9 software for data download and processing.
- LCD backlit graphic display 128x64 pixel.
- Instrument setup through the keyboard; no connection required to the PC.
- Security password for keyboard locking.
- Power supply: 4 1.5V alkaline C-BABY type batteries, or external power supply 12VDC-1A or by means of the USB port of the PC.
- Consumption @6VDC:
  - <60µA when the instrument is off
  - <60µA in sleep mode with 8 probes connected
  - <40mA during data logging with 8 probes connected
- Use of data loggers HD32.8.8 and HD32.8.16: in field for measurement campaigns on complex systems with many measurement points, testing facilities, in pharmaceutical and food sectors, ovens mapping, air conditioning centrals etc.

TECHNICAL SPECIFICATIONS

Number of inputs

8 for HD32.8.8
16 for HD32.8.16

Connection

Miniature female socket for thermocouple

Measuring range and accuracy of the instrument

Tc: K	-200…+1370°C / ±0.1°C up to 600°C ±0.2°C over 600°C
Tc: J	-100…+750°C / ±0.1°C up to 400°C ±0.2°C over 400°C
Tc: T	-200…+400°C / ±0.1°C
Tc: N	-200…+1300°C / ±0.1°C up to 600°C ±0.2°C over 600°C
Tc: R	+200…+1480°C / ±0.3°C
Tc: S	+200…+1480°C / ±0.3°C
Tc: B	+200…+1800°C / ±0.4°C
Tc: E	-200…+750°C / ±0.1°C up to 300°C ±0.2°C over 300°C

Accuracy is referred to the instrument only; error due to the thermocouple or to the cold junction reference sensor is not included.

Resolution

0.05°C in the range ±199.95°C
0.1°C in the remaining range

Drift in temperature @20°C

0.02%/°C

Drift after 1 year

0.1°C/year

Internal watch accuracy

1min/month max drift

Unit of measurement

°C, °F, °K

Display

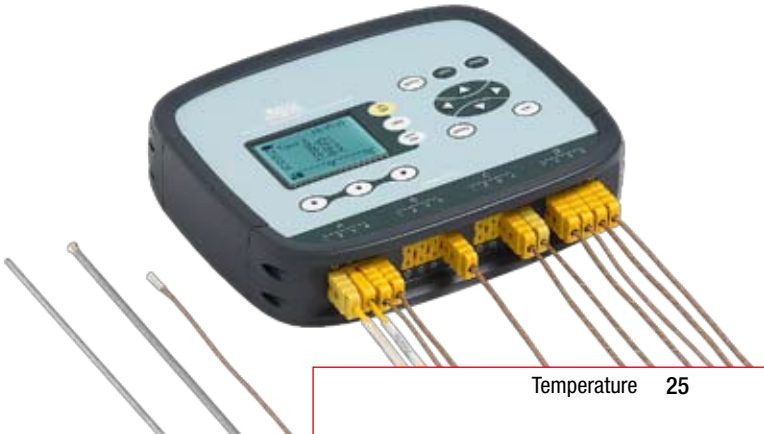
LCD backlit graphic display 128x64 pixel.

Keyboard

15 keys; the instruments can be configured also without a PC.

HD 32.8.16

HD 32.8.8



Keyboard locking function

with password.

Memory

Memory capacity	divided into 64 blocks up to 800.000 acquisitions to be divided among all the present inputs. For example, when one probe is connected you get 800.000 acquisitions. When 8 probes are connected you get 96.000 acquisitions each probe.

Security of data stored

Unlimited.

Power supply

4 per 1.5V 4 1.5V alkaline C-BABY type batteries
External power supply 12VDC-1A. Connector, external ∅ 5.5mm, internal ∅ 2.1mm.
Power supply via the PC USB port.

Current consumption @6Vdc

<60µA when the instrument is off
<60µA in sleep mode with all probes connected
<40mA during data logging with all probes connected

Autonomy

200 hours with 7800mAh alkaline batteries and all probes connected

Data download

RS232C from 1200 to 38400 baud, galvanically isolated. Sub D 9-pole male connector.
USB 1.1 – 2.0 galvanically isolated.

Operating conditions

Operating temperature	-5 … 50°C
Storage temperature	-25 … 65°C
Working relative humidity	0 … 90% RH no condensation
Protection degree	IP64

Instrument

Dimensions (Length x Width x Height)	220x180x50 mm
Weight	1100 g (complete with batteries)
Materials	ABS, polycarbonate and aluminium

Probes

All thermocouples K, J, T, N, R, S, B and E type probes with male miniature connector can be connected.
Further to the K probes available on the catalogue from page 17 to 21, Delta Ohm can supply other kind of probes with different forms as well, upon request.

PURCHASING CODES

HD32.8.8: Instrument **Data logger with 8 inputs** for thermocouples K, J, T, N, R, S, B and E type temperature probes. The kit consists of instrument HD32.8.8, 4 per 1.5Vdc alkaline C-Baby type Batteries, instruction manual, software DeltaLog9 and support and carrying strap. **Probes, tripod, carrying case and cables have to be ordered separately.**

HD32.8.16: Instrument **Data logger with 16 inputs** for thermocouples K, J, T, N, R, S, B and E type temperature probes. The kit consists of instrument HD32.8.8, 4 per 1.5Vdc alkaline C-Baby type Batteries, instruction manual, software DeltaLog9 and support and carrying strap. **Probes, tripod, carrying case and cables have to be ordered separately**

DeltaLog9: Further copy of the software for download and management of data by PC for Windows from 98 to Vista operating systems.

Probes for HD32.8.8 and for HD32.8.16

All thermocouples K, J, T, N, R, S, B and E type temperature probes with miniature standard connector can be connected to the instruments.
Probes of different form can be supplied upon request.

Accessories for HD32.8.8 and for HD32.8.16

9CPRS232: Connection cable with Sub D 9-pole female connectors for RS232C (null modem)
CP22: Connection cable USB 2.0 connector type A - connector type B.
BAG32.2: Carrying case for the HD32.7 instrument and accessories.
HD32CS: Support and carrying strap
SWD10: 100-240VAC/12VDC-1A stabilized mains power supply
VTRAP32: Tripod complete with 6-input head and 5 probe holders code HD3218K
HD3218K: Shaft for another probe

HD32CS

SWD10

HD 788TR1
HD 788TR1-I
HD 786TR1
HD 988TR1
HD 988TR1-I
HD 988TR2

4÷20 mA CONFIGURABLE TEMPERATURE TRANSMITTERS FOR Pt100 SENSORS

HD 788TR1, HD 788TR1-I, HD 786TR1, HD 988TR1, HD 988TR1-I and HD 988TR2 are 4÷20 mA configurable transmitters with microprocessor for Pt100 Platinum temperature sensor. They convert the temperature variations found with any standard Pt100 sensor (100Ω at 0°C) into a linear current signal with two leads in the field 4÷20 mA. Linearization with a digital technique allows excellent precision and stability to be obtained. User can set the 4÷20 mA output (or 20÷4 mA) in any temperature range within the field -200...+650°C, with a minimum amplitude of 25°C; it may be simply reprogrammed by pressing a key, without any need to regulate jumpers, potentiometers, software, etc. A led indicates any alarm situations (temperature outside the set range, broken or short-circuiting sensor) and assists the user in the programming phase. **The 4÷20mA output of models HD788TR1-I and HD988TR1-I is galvanically isolated from the Pt100 input.** The transmitters are also protected against inversions of polarity. The HD 788TR1, HD 788TR1-I are specifically designed for installing in type DIN B connecting heads, while the HD 988TR1, HD988TR1-I and HD 988TR2 are suitable for fitting in containers with a 35 mm DIN bar connection. As well as the 4÷20 mA output, the HD 988TR2 has a convenient 3 digit display (height 10 mm) which allows the display of the measured temperature.

Technical data (20°C and 24VDC)

INPUT	HD 788TR1 HD 788TR1-I HD 786TR1 HD 988TR1 HD 988TR1-I	HD 988TR2
Sensor	Pt100 (100Ω at 0°C)	
Connection	3 (or 2) wires	
Linearization	EN 60751, IEC 751 BS 1904 (α=0,00385)	
Current into sensor	<1 mA	
Measuring range	-200…+650°C	
Default range	0…100°C	
Minimum measuring amplitude	25°C	
Influence of the connecting leads	Negligible with coupled lead	
Conversion speed	2 measurements per second	
Accuracy	±0,1°C ±0,1% of the reading (-100…+500°C) ±0,2°C ±0,2% of the reading (-200…+650°C)	
Sensibility to variations of env. temperature	0,01°C/°C	
Working temperature	0…70°C	
Storage temperature	-40…+80°C	
OUTPUT		
Output	4…20 mA (or 20…4 mA) 22 mA in case of incorrect programming or temperature out of range note 1 and Fig. 2	
Resolution	4 µA	Analogue output: 4 µA Display: 0,1°C up to 200°C 1°C over 200°C
Power supply voltage	7…30Vdc (protection against inversions of polarity)	
Sensibility to variations of the feeding voltage Vcc	0,4 µA/V	
Load resistance	$R_{LMax} = \frac{Vdc-9}{0,022}$ => R_{LMax} = 680 Ω @ Vdc = 24 Vdc	
Red led	It switches on while programming and when the measured temperature is out of the set range	
Input-Output isolation for models HD 788TR1-I and HD 988TR1-I	500 Vdc	-

Note 1) If the measured temperature T is out of the set range T1…T2 (T1<T2), HD 788TR1, HD 788TR1-I, HD 988TR1, HD 988TR1-I and HD 988TR2 maintain 4 mA for T<T1 and 20 mA for T>T2 for a dead band of 10°C before going into error status at 22 mA.

Fig. 2 reports the connection diagrams for the transmitters in the current loop. In order to obtain the maximum precision, the connection to the Pt100 should be performed with 3 wires and with wires having the same diameter so to grant the same impedance in each connection. The symbol RL (load) represents any device in the current loop that is to say an indicator, a controller, a data logger or a recorder.

°C	Ω	°C	Ω	°C	Ω
-200	18.52	70	127.08	200	175.86
-100	60.26	80	130.90	220	183.19
-50	80.31	90	134.71	250	194.10
-30	88.22	100	138.51	280	204.90
-20	92.16	110	142.29	300	212.05
-10	96.09	120	146.07	350	229.72
0	100.00	130	149.83	400	247.09
10	103.90	140	153.58	450	264.18
20	107.79	150	157.33	500	280.98
30	111.67	160	161.05	550	297.49
40	115.54	170	164.77	600	313.71
50	119.40	180	168.48	650	329.64
60	123.24	190	172.17		

Tab. 1

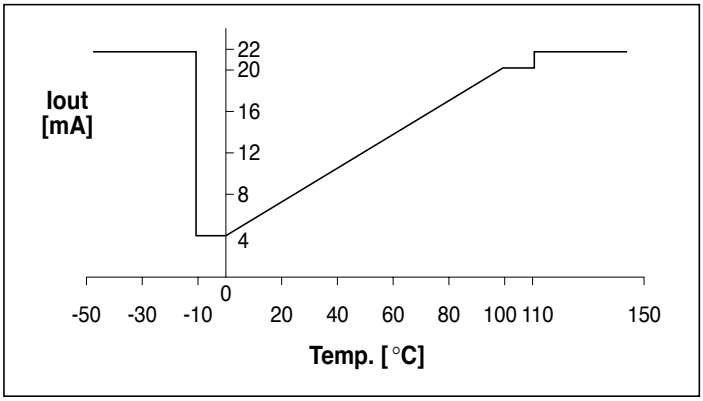


Fig. 1 Range 0...100°C, output current according to the temperature function.

Programming

All transmitters are supplied by default with a range 0…100°C, anyway user can set a different range by using the following accessories:

- continuous 7-30 Vdc power source,
- Pt100 calibrator or set of precision resistors,
- precision ammeter with minimum range 0…25 mA,

And by following this procedure:

1. Connect the transmitter to set-up as shown in Fig. 2 and set the Pt100 calibrator at the required temperature suitable for 4 mA (for example, assuming that you want to set the range -50...+200°C, you will set the calibrator to -50°C or equivalently you will connect a resistance of 80,31Ω between terminals 1 and 3 while 1 and 2 shorted).
2. Wait 10 seconds until the measurement becomes settled, then keep pressed the programming key for at least 4 seconds, until the LED flashes once and remains lit. When the key is released the LED flashes.
3. Set the Pt100 calibrator at the required temperature for 20 mA (according to the above example, set the calibrator at +200°C, or alternatively connect 175.86Ω resistance between terminals 1 and 3 with 1 and 2 shorted).
4. Wait 10 seconds until the measurement becomes settled, then press the programming key for at least 4 seconds, until the LED stops flashing. Now release the key and the LED flashes twice. At this point the SET POINT procedure is completed.
5. Verify that the setting complies with the required specifications, setting the calibrator (or connecting the precision resistances) at the values corresponding to 4 and 20 mA and checking the current on the ammeter.

The temperature range programming can be performed by using some precision resistances of fixed value that simulate a Pt100 sensor value.
For example, the resistance values corresponding to some temperature values are reported (see Tab. 1).

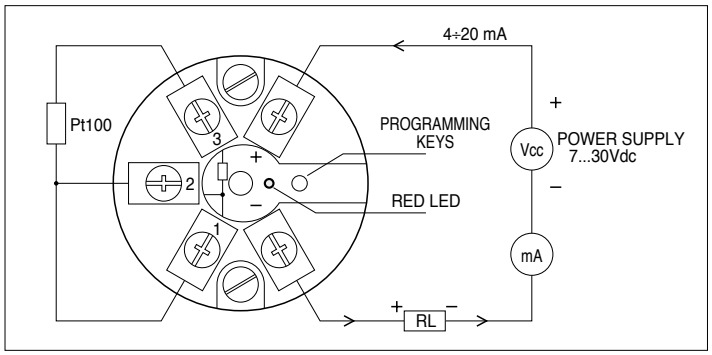


Fig. 2 Wiring diagram of the transmitters.

Fig. 4

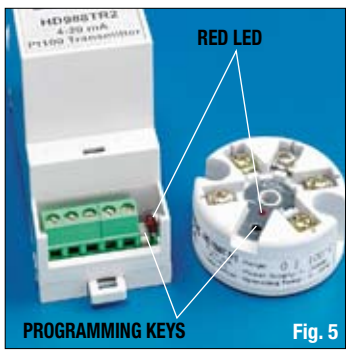


Fig. 5

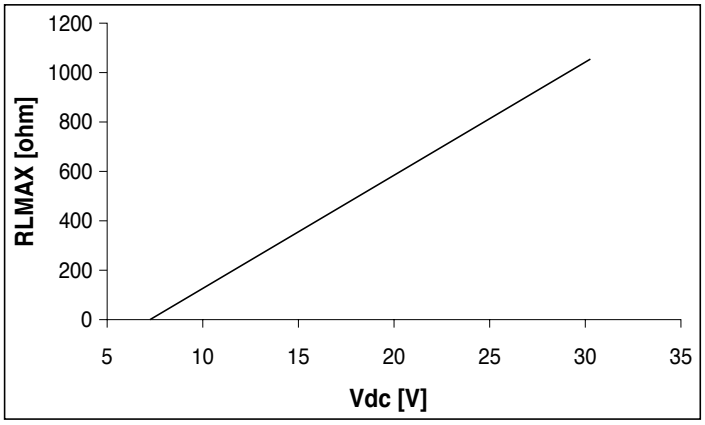


Fig. 3 Load with relation to the feeding voltage.

PURCHASING CODES

HD 788TR1: 4÷20 mA/20÷4 mA temperature transmitter for 2 or 3 wires Pt100 sensor configurable in the range -200...+650°C with minimum amplitude range 25°C, in a container for DIN B 43760 heads.

HD 788TR1-I: 4÷20 mA/20÷4 mA temperature **isolated** transmitter for 2 or 3 wires Pt100 sensor configurable in the range -200...+650°C with minimum amplitude range 25°C, in a container for DIN B 43760 heads.

HD 786TR1: 4÷20 mA/20÷4 mA temperature transmitter for 3 wires Pt100 sensor configurable in the range -200...+650°C with minimum amplitude range 25°C. Suitable for mounting on wall.

HD 988TR1: 4÷20 mA/20÷4 mA temperature transmitter for 2 or 3 wires Pt100 sensor configurable in the range -200...+650°C with minimum amplitude range 25°C, in a container for 35 mm DIN bar connection, dimension 1 module.

HD 988TR1-I: 4÷20 mA/20÷4 mA temperature **isolated** transmitter for 2 or 3 wires Pt100 sensor configurable in the range -200...+650°C with minimum amplitude range 25°C, in a container for 35 mm DIN bar connection, dimension 1 module.

HD 988TR2: 4÷20 mA/20÷4 mA temperature transmitter for 2 or 3 wires Pt100 sensor configurable in the range -200...+650°C with minimum amplitude range 25°C, in a container for 35 mm DIN bar connection, dimension 2 modules, with 3½ digit LCD, height 10 mm.

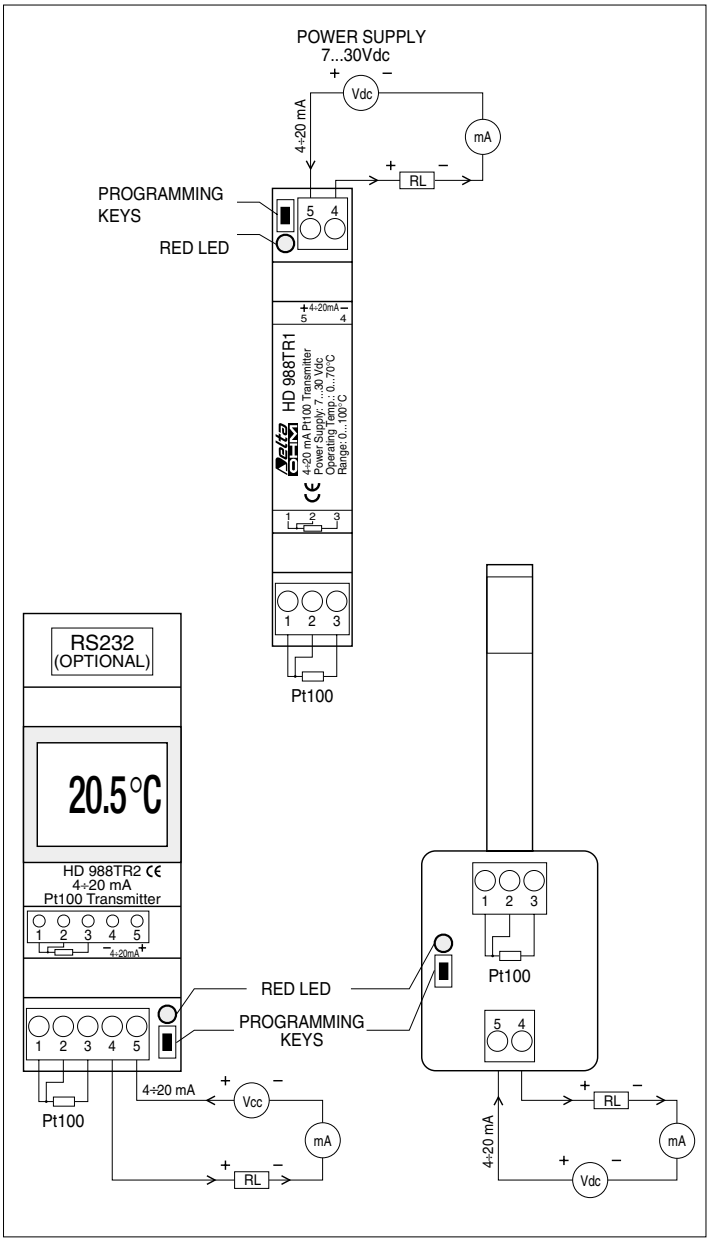


Fig. 6

HD 688T
MODULAR TEMPERATURE TRANSMITTER

HD 688T modular temperature transmitter, Pt100 sensor, with galvanic separation between input/output and power supply

Output analogue signal: 0÷20 mA / 4÷20 mA / 0÷10 Vcc.

The HD 688T transmitter is made up of the following stages:
- input stage including linearization of the curves and equalization of the resistance of the line cable (3 wires) of Pt100, conversion from voltage into frequency;
- universal output stage through jumper connection, conversion from frequency into voltage;
- power supply stage.

The configuration of the measuring range or the output signal can be modified at any time; an outstanding feature is that any variation does not require calibrating the transmitter again.

SPECIFICATIONS

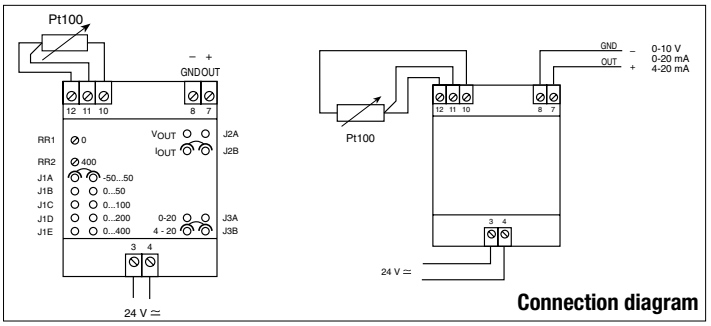
INPUT:	**CONFIGURATION:**
Input signal:	Pt100 (IEC 751)
Measuring range:	-50...+50°C / 0...+50°C / 0...+100°C 0...+200°C / 0...+400°C
Measuring current:	1 mA
OUTPUT:	
Output signals:	0÷10Vdc, 0÷20 mA, 4÷20 mA
Maximum load:	5 mA 500Ω
Output impedance:	0,1Ω, 1MΩ, 1MΩ

POWER SUPPLY:	
Input voltage:	12÷24 V ± 10%, 65 mA
Linearity:	0,2%
Zero drift:	0,02%/°C referred to full scale
Full scale drift:	0,02%/°C referred to applied signal
Response time:	0,3 seconds at 63% of final value 1 second at 99,9% of final value
Insulation:	3kV at 50 Hz for 1 minute
Operating Temperature:	-10°C...+50°C (it is the maximum temperature electronics can operate in)

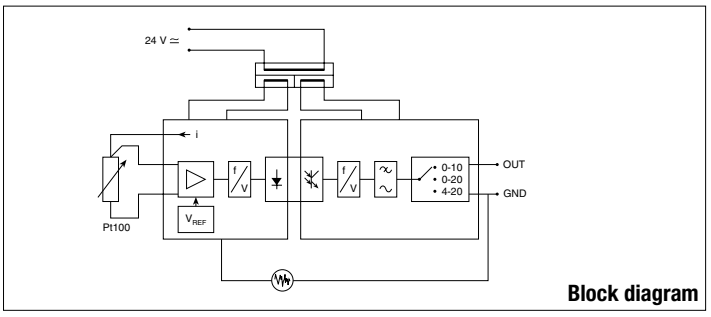
Variation of jumper connections according to the output measuring range, relative retouch trimmers for start of scale and full scale.

Measuring range		Output	Setup of jumper connections			TRIMMER*	
			J1	J2	J3	Start of scale	End of scale
1	-50 ÷ 50°C	0÷10Vcc	A	A	A	RR1	RR2
2	0 ÷ 50°C	0÷10Vcc	B	A	A	RR1	RR2
3	0 ÷100°C	0÷10Vcc	C	A	A	RR1	RR2
4	0 ÷200°C	0÷10Vcc	D	A	A	RR1	RR2
5	0 ÷400°C	0÷10Vcc	E	A	A	RR1	RR2
1	-50 ÷ 50°C	0÷20mA	A	B	A	RR1	RR2
2	0 ÷ 50°C	0÷20mA	B	B	A	RR1	RR2
3	0 ÷100°C	0÷20mA	C	B	A	RR1	RR2
4	0 ÷200°C	0÷20mA	D	B	A	RR1	RR2
5	0 ÷400°C	0÷20mA	E	B	A	RR1	RR2
1	-50 ÷ 50°C	4÷20mA	A	B	B	RR1	RR2
2	0 ÷ 50°C	4÷20mA	B	B	B	RR1	RR2
3	0 ÷100°C	4÷20mA	C	B	B	RR1	RR2
4	0 ÷200°C	4÷20mA	D	B	B	RR1	RR2
5	0 ÷400°C	4÷20mA	E	B	B	RR1	RR2

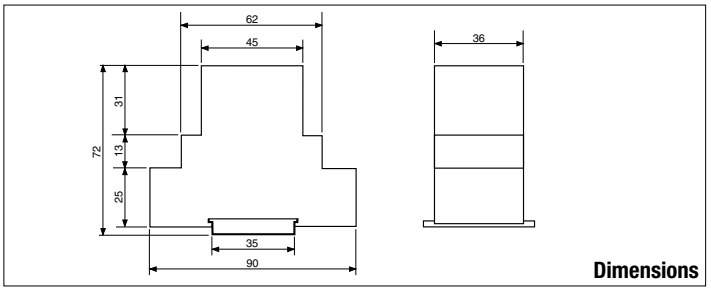
* Multi-turn trimmers RR1 RR2 are needed for slight calibration adjustments of start of scale and full scale. If not strictly necessary it is advisable not to operate them, calibration being already carried out in the laboratory.
Setup of connection terminals, jumper connections of output and range configuration, retouch trimmers of scale beginning and full scale.



Connection diagram



Block diagram



Dimensions

HD 2047
Pt100 SIMULATOR

HD 2047 is a portable instrument specially designed for testing and calibrating instruments with Pt100 (100Ω a 0°C) type input and voltage/current outputs such as, for instance, active and passive temperature transmitters, recorders, testers and data loggers, etc

HD 2047 simulates up to 24 fixed values of a Pt100 sensor in the range from -100°C up to +500°C, with a 2, 3 or 4 -wire connections. The selection of the value to simulate is via a rotary switch placed on the front of the instrument. Whatever operating mode you choose, the Pt100 output is always active

HD 2047 can measure with high accuracy voltage/current outputs of any transmitter connected to the instrument input: -20V...+20V continuous voltage range and 0...22mA continuous current range. Eventually it can also calibrate and test the functioning of a passive transmitter by simulating the temperature input, providing power supply to the transmitter and at the same time reading the current flowing in: all this is performed without external power supply auxiliary.

The instrument is equipped with three keys:

ON/OFF switches the instrument on and off. Once switched on, HD 2047 is ready for the voltage measurement.

MODE selects in cycling the type of operation; by pressing the button in succession, you enable in order:
1. voltage measurement;
2. current measurement;
3. current measurement by 4...20mA loop power supply.

RANGE in voltage or current measurement it allows to select the more suitable full range and resolution for the measurement under process: -1.999...+1.999, -19.99...+19.99 e -199.9...+199.9.

HD 2047 is internally protected against any kind of connecting error made by the operator: it is highly recommended anyway not to exceed voltage/current limits shown in technical specifications.

The battery signal appears on the display in order to indicate that batteries are low and need to be replaced.

Operating modes

1) How to measure DC voltage input

The instrument measures positive and negative continuous voltages up to 20V maximum amplitude..

Procedure (see fig.1):

- select “input voltage” operating mode by pressing MODE key. The red led corresponding to “READ V” lights up;
- connect the wires to the sockets, as reported in fig.1;
- select the correct range depending on the voltage, by pressing RANGE key. An OverRange measurement is indicated by a 1 sign, lighted on the display left part: in this case you just press RANGE key to pass to the following measuring range.

Note: a) **For safety reasons, never apply any voltage superior to 48Vdc to the sockets.**
b) **The instrument only measures continuous voltage.**

2) Hot to measure DC current input

The instrument measures positive and negative current up to 22mA maximum amplitude.

Procedure (see fig.2):

- select “input current” operating mode by pressing MODE key. The red led corresponding to “READ mA” lights up;”
- connect the wires to the sockets, as reported in fig.2 observing the correct polarity: in order to be read, current must be from the bush +
- select the correct range depending on the current, by pressing RANGE key. An OverRange measurement is indicated by a 1 sign, lighted on the display left part: in this case you just press RANGE key to pass to the following measuring range.

Note: a) **The instrument measures continuous current up to a 22mA maximum amplitude.**
b) **The instrument only measures continuous current.**
c) **The instrument is provided with an internal protection circuit to limit the current within 25mA.**

3) How to calibrate and test passive transmitters

The instrument can power a 4...20mA loop, measure the current and simulate 24 fixed values of a Pt100 at the input of a temperature transmitter, with no external power supply required.

Procedure (see fig.3):

- select “2 WIRE” operating mode by pressing MODE key. The corresponding red led lights up
- connect the 4...20mA loop wires to the left sockets, as shown in fig. 3, without changing the correct polarity; the current supplied by HD 2047 is delivered through the positive (+) socket
- select the correct range depending on the current, by pressing RANGE key. An OverRange measurement is indicated by a 1 sign, lighted on the display left part: in this case you just press RANGE key to pass to the following measuring range
- select the temperature value by turning the rotary switch.

Note: a) **The maximum amplitude of the output current equals 25mA.**
b) **A 14Vdc voltage is supplied to the current loop.**
c) **In case of 2 or 3-wire connections, do not make jumpers on unused sockets; it is highly recommended to leave them free.**

4) How to simulate a Pt100 sensor

The instrument can simulate 24 temperature fixed values of a Pt100 sensor (100Ω at 0°C, coefficient α=0.003850) with 2, 3 or 4-wire connections. The selection is made through a rotary switch placed on the front part of the instrument.

Procedure:

- perform the connection as reported in figures 3, 4 or 5 according to the number of wires;
- select the temperature value by turning the rotary switch.

Note: a) **In case of 2 or 3- is highly recommended to leave them free.**
b) **MODE and RANGE keys have no effects on the resistance selection..**
c) **The internal protection circuit reduces to approximately 1.2V the drop on resistances: this means the measuring current has a maximum amplitude of 20mA.**

TECHNICAL DATA (@ 20°C)

GENERAL	
Power supply	4 batteries 1.5V, AA size (the input for the 9Vdc external supplier is provided only upon request)
Autonomy with 1.5V Batteries and 2250mAh capacity	160 h (in "V READ" and "mA READ" operating mode)
	30 h @ loop current = 12mA (in "2 WIRE" operating mode)
Low batteries signal	The battery sign lights up with a battery voltage of about 3.6V
Operating temperature	-5...+50°C
Operating relative humidity	0...90%RH (no condensation)
Weight/dimensions	580 g (without Batteries) / 23x70x230 mm
CONTINUOUS VOLTAGE MEASURE	
Measuring range	-1.999V...+1.999V: resolution 1mV -19.99V...+19.99V: resolution 10mV
Accuracy	±1mV: nel range -1.999V...+1.999V ±10mV: nel range -19.99V...+19.99V
Input resistance	1MΩ
Maximum voltage applied to terminals	48Vdc
CONTINUOUS CURRENT MEASURE	
Measuring range	0.00mA...19.99mA: resolution 10µA 0.0...22.0mA: resolution 100µA
Accuracy	±(0.01mA+0.05% of the range): in the range 0.00mA...19.99mA ±0.1mA: in the range 0.0mA...22.0mA
Shunt resistance	20Ω
Overload protection	Current limit: 25mA
PASSIVE TRANSMITTERS: POWER SUPPLY/ MEASURE	
Measuring range	0.00mA...19.99mA: resolution 10µA 0.0...22.0mA: resolution 100µA
Accuracy	±(0.01mA+0.05% of the range): in the range 0.00mA...19.99mA ±0.1mA: in the range 0.0mA...22.0mA
Shunt resistance	20Ω
Overload protection	Current limit: 25mA
Maximum load @20mA	700Ω
Applied voltage	14Vdc
SIMULATING A Pt100	
Type of RTD	Pt100 (100Ω a 0°C, α=0.003850, EN60751, IEC751, BS1904)
Temperature values	24 fixed values from -100 to +500°C
Precision	±0.05% of the simulated value
Room temperature effect	±5ppm / °C
Maximum power loss	125mW
Maximum load current	20mA

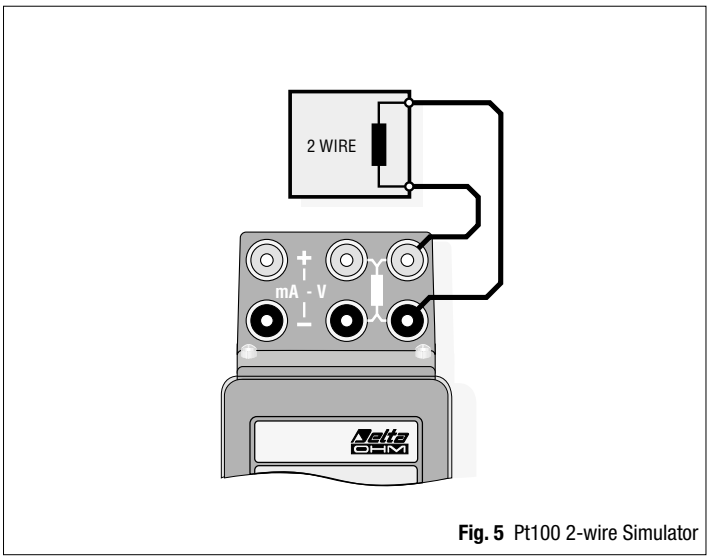


Fig. 5 Pt100 2-wire Simulator

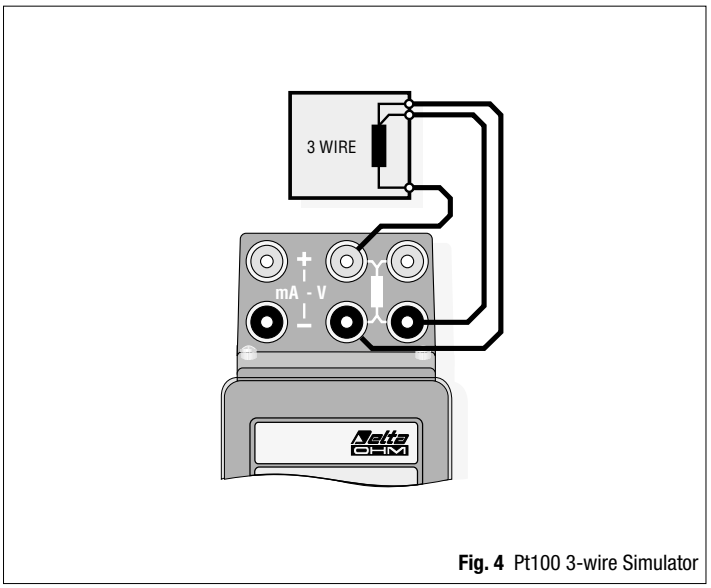


Fig. 4 Pt100 3-wire Simulator

PURCHASING CODES

HD 2047: Pt100 Simulator measures current loop and voltage signals coming from transmitters. The kit consists of instrument equipped with Batteries, 2 connection cables L=600 mm, one is a 4 wires, the other is a 2 wires.

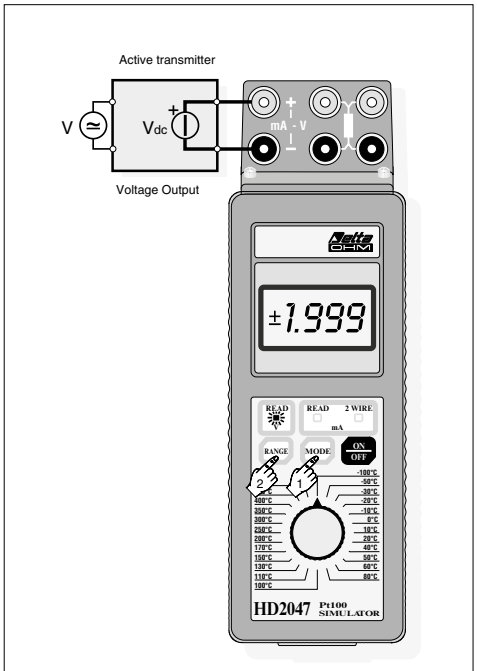


Fig. 1 Continuous voltage measurement

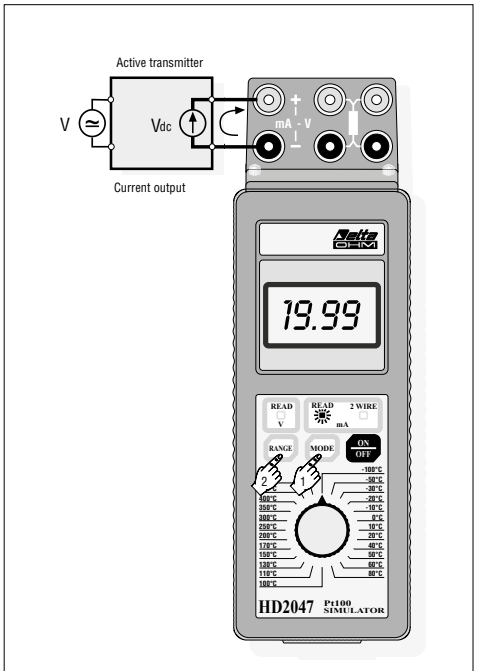


Fig. 2 Continuous current measurement

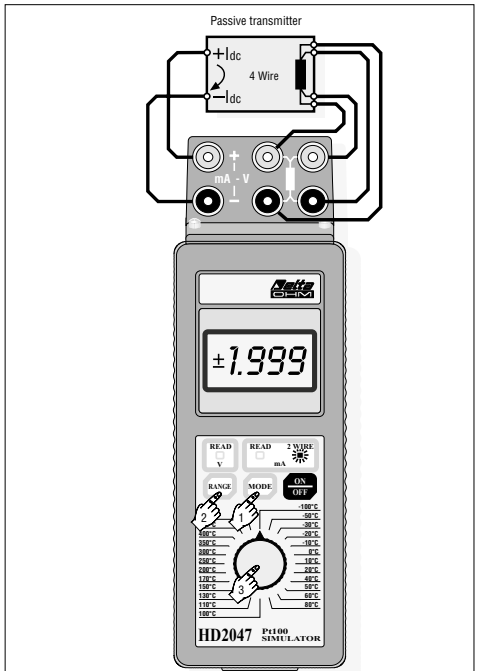


Fig. 3 Testing a Pt100 input passive transmitter

HD 778TR1
HD 978TR1
HD 978TR2
HD 778-TCAL

4÷20mA CONFIGURABLE TEMPERATURE TRANSMITTERS FOR K-J-T-N TYPE THERMOCOUPLE THERMOCOUPLE GENERATOR MANAGED BY PC THROUGH RS232C HD778-TCAL

HD 778TR1, HD 978TR1 and HD 978TR2 are 4…20mA two-wired configurable passive transmitters with microprocessor for **K, J, T** and **N** type thermocouple sensors. They convert the voltage value generated by the thermocouple into a linear current signal included in the range 4…20mA. The use of digital devices allows obtaining an excellent precision and stability in time. User can set the 4…20mA (or 20…4mA) output into any temperature range in the measuring range included in the measuring range of the single thermocouple with **a minimum range of 50°C**. The range and type of thermocouple are set by simply using one button. A led indicates the alarm situation (broken or not connected sensor) and it helps user during the programming. Moreover, transmitters are protected against polarity inversions. HD778TR1 is specifically designed to be installed in DIN B type connection heads, HD978TR1 and HD978TR2 are suitable for mounting on 35 mm DIN bars. Beyond 4…20mA output, HD978TR2 has a 3½ digit (Height 10 mm) display which allows displaying the measured temperature.

TECHNICAL DATA @ 25°C e 24Vcc

INPUT	HD778TR1	HD978TR1	HD978TR2
Sensor	Thermocouple type K, J, T and N		
Connection	2 wires passive transmitter		
Measuring range	Thermocouple K: -200°C … +1200°C Thermocouple J: -200°C … +800°C Thermocouple T: -200°C … +300°C Thermocouple N: -200°C … +1200°C		
Linearization	EN 60584-1-2 ASTM E 230 - ANSI (MC96-1)		
Default range	Tc = K - Range = 0...1000°C		
Minimum measuring range	50°C		
Conversion speed	2 measures per second		
Accuracy	±0,04%FS±0,04% of the reading or 0.5°C (the greater of the two values)		
Operating temperature of the cold junction	-30 … +80°C	0 … +70°C	
Operating temperature	-30 … +80°C	0 … +70°C	
Storage temperature	-40...+80°C		
OUPUT			
Type of ouput (note 1)	4...20 mA (or 20...4 mA) two wires 22 mA if sensor is broken or not connected		
Resolution	4 µA		4 µA Display: 0,1°C T<200°C 1°C T>200°C
Power voltage	9...30V dc (protection against polarity inversion)		
Sensitivity to Vdc power voltage variations	0,4 µA/V		
Load resistance	R_L Max = (Vdc-9)/0.022 R_L Max = 625Ω con Vdc = 24 Vdc		
Input/output galvanic insulation	50Vdc (verified at 250V)		
Red led	It turns on while programming, when the probe is broken or not connected		
Heating time	2 minutes		

Note 1) If the measured temperature T goes out of the T1...T2 (T1<T2) set range, the transmitters linearly regulate the current for T<T1 and T>T2 for an interval of 10°C. (See the current diagram.)

Installation and connection

Fig. 1 shows the mechanical dimensions of the HD778TR1 transmitter and highlights the holes of 5 mm diameter for fastening the DIN head and the central hole for the entrance of the wires in the thermocouple. Fig. 1 reports the mechanical dimensions of the HD978TR1 and of the HD978TR2.

The width of the HD978TR1 is a DIN (17,5 mm) module, the HD978TR2 is a 2 DIN (35mm) modules. The working temperature should be included in operating temperature declared. Fig. 4 and 5 report the wiring diagrams of the HD778TR1, HD978TR1 and HD978TR2. In order to obtain the maximum precision, the connection to the thermocouple should not exceed 3 meters long. In the diagrams reported, the RL (Load) symbol represents any device introduced in the current loop, that is to say any indicator, controller, data logger or recorder.

CHOICE OF TYPE OF THERMOCOUPLE

The transmitter accepts four types of thermocouple. The thermocouple set is highlighted by the number of flashes of the led when power is supplied.

N° of lad flashes	Type ofthermocouple
1	K
2	J
3	T
4	N

Transmitters come with the default set K thermocouple and range 4…20mA = 0…1000°C.

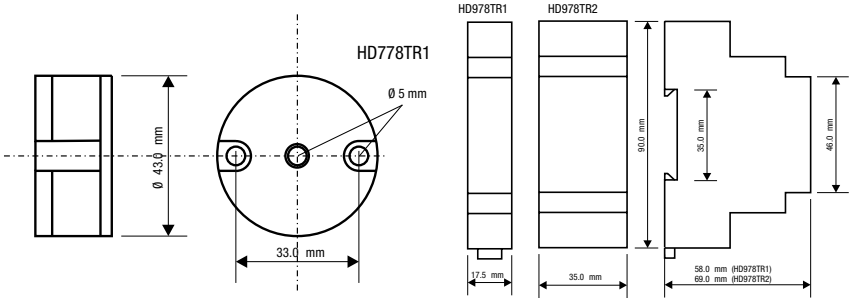


Fig.1 Mechanical dimensions.

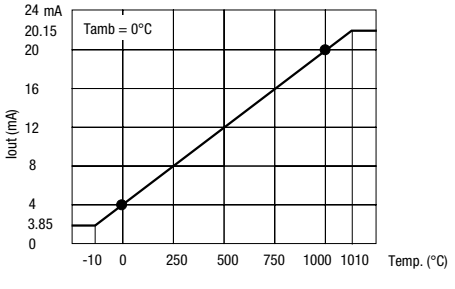
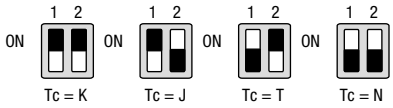


Fig. 2 0… 1000°C current output according to temperature

User can change the thermocouple type and the operating range according to the following procedure.
Note: after changing the thermocouple type the operating range should be programmed.

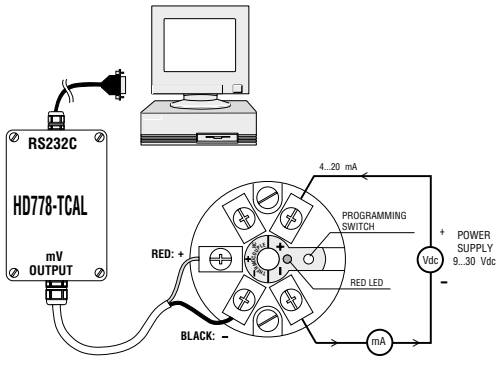
HD778TR1 and HD978TR1
Giving power to the transmitter, the led flashes for a number of times equal to the type of thermocouple previously configured.
In order to change the setting, remove and reapply supply to the transmitter **by pressing the button.**
This way you enter the programming for choosing the type of thermocouple: if you chose the **thermocouple K**, the led flashes once.
If you release the button and press it again within 10 seconds, the led flashes twice: **thermocouple J** has been chosen**.**
If you press the button in 10 seconds, the led flashes 3 times: **thermocouple T** has been chosen**.**
If you press the button in 10 seconds, the led flashes 4 times: **thermocouple N** has been chosen**.**
If you press the button in 10 seconds again, the led flashes once indicating that you chose thermocouple K again and the cycle re-starts.
In order to save the selected type of thermocouple, wait for 15 seconds without touching any key: the transmitter saves the type of thermocouple and exits programming, the led flashes for the number of times equal to the type of thermocouple selected.
If you changed the type of thermocouple, you have to re-programme the operating range: see paragraph "Programming the operating range".

HD978TR2
This transmitter has a double dip-switch for selecting the type of thermocouple. The selection must be set before ignition and is acquired when the instrument is on: **a change in the dip-switch when the instrument is powered has no effect until the next power cycle.**
Procedure:
when the instrument is off, select the type of thermocouple by setting the switches as shown in the figure below.



By powering the transmitter, the led flashes for a number of times equal to the type of thermocouple selected.
If you changed the type of thermocouple, you have to re-programme the operating range: see paragraph "Programming the operating range".

Programming of the operating range
Transmitters HD778TR1, HD978TR1 and HD978TR2 are supplied by default with K type thermocouple and range 0...1000°C. The user can set a different range according to his requirements with a minimum span of 50°C. The correspondence between the read temperature and the output current can be direct (e.g. 4mA = 0°C and 20mA = 1000°C) or inverse (e.g. 4mA = 1000°C and 20mA = 0°C).
Acquire the following tools for programming:
- 9…30 Vdc direct current power source,
- thermocouple calibrator,
- Copper connection cables
- Precision ammeter with 0...25 mA minimum range.



In place of the thermocouple calibrator, you can use the Delta Ohm **HD778-TCAL**: this instrument has to be connected to a serial port of the PC and, by means of a proper software, automates all the steps described below for programming the operating range.

If you have a thermocouple calibrator, the steps are:
in order to set the type of thermocouple, proceed as described in the paragraph "CHOICE OF THE TYPE OF THERMOCOUPLE".
The voltage values generated by the calibrator must be uncompensated.
The setting must be done with the instrument already powered.
Set the calibrator with the output of the desired type of thermocouple (K, J, T o N), connect the calibrator to the transmitter thermocouple input according to the polarity. **(Pay attention to polarity)**.
Set the calibrator so that it generates the voltage corresponding to the temperature at 4mA, wait for 30 seconds for the voltage to stabilise.
Press and hold the button until the led flashes. Release the button. The instrument has acquired the first value of the transmitter working range, the led keeps on flashing. The instrument is now awaiting the second data of the full scale range.
Set the calibrator in order to generate a voltage corresponding to the temperature at 20mA.
Press and hold the button until the led stops flashing.
Release the button and wait **20 seconds, without changing the calibrator's data**, so that the transmitter saves the calibraton data and is ready for working normally. The operation ends with a flashing of the led.
The instrument has acquired the second point corresponding to the range you want to set and is working normally.
The minimum value accepted by the instrument span is 50°C. If the user tries to insert a second value T2 with (T2-T1)<50, after entering the first value T1 of the range, the instrument does not accept it and remains in standby while the led continuous flashing.

The HD778-TCAL is supplied with its software. Linked to the HD778-TCAL serial output of a PC, the user can configure the transmitter by following the instructions on the screen.

PURCHASING CODES
HD778TR1: 4…20mA/20…4mA 2 wire temperature transmitter for K, J, T and N thermocouples, configurable with minimum amplitude range 50°C, in a container for DIN B 43760 heads.
HD978TR1: 4…20mA/20…4mA 2 wire temperature transmitter for K, J, T and N thermocouples, configurable with minimum amplitude range 50°C, in a container for 35 mm DIN bar connection, dimension 1 module.
HD978TR2: 4…20mA/20…4mA 2 wire temperature transmitter for K, J, T and N thermocouples, configurable with minimum amplitude range 50°C, in a container for 35 mm DIN bar connection dimension 2 modules, with 3½ digit display, height 10 mm..
HD778-TCAL: power generator in the range -60mV…+60mV, regulated by PC through RS232C serial port, DELTALOG7 software for setting K, J, T and N thermocouple transmitters.

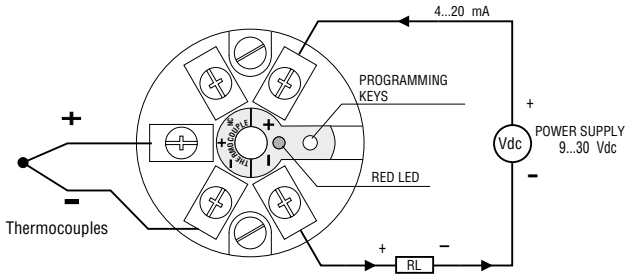


Fig.4 connection diagram of the HD778TR1

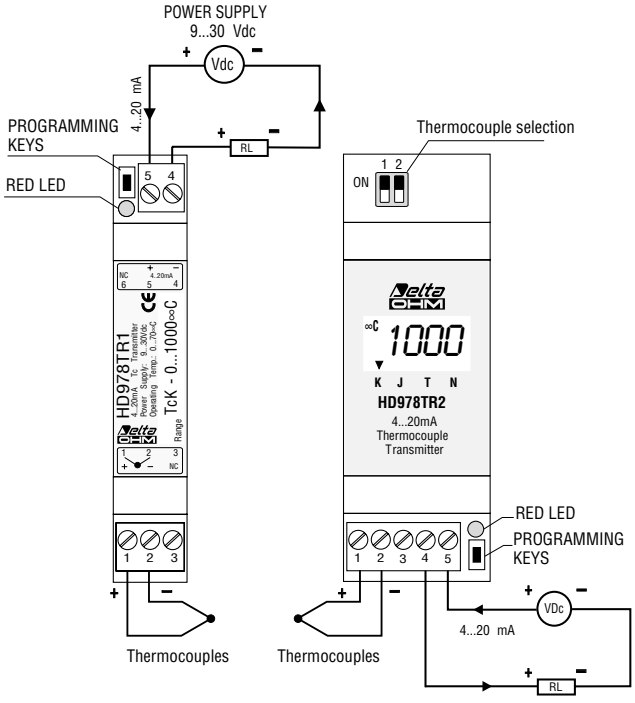


Fig.5 connection diagrams of the HD978TR1 and HD978TR2

HD 978TR3
HD 978TR4
HD 978TR5
HD 978TR6

HD 978TR3, HD 978TR4, HD 978TR5, HD 978TR6
SIGNAL CONVERTERS / AMPLIFIERS WITH 4÷20mA OR 0÷10Vdc OUTPUT CONFIGURABLE WITH HD788-TCAL BY PC THROUGH RS232C

Configurable signal converters/amplifiers with current or voltage output.
HD978TR3 and HD978TR4 are signal converters/amplifiers that can be configured using mV input. The mV input signal range can be configured from -10mV to +60mV through a button, by using the **HD778-TCAL simulator and DeltaLog7 software** or a gauge with mV output. HD978TR3 has a 4…20mA current output. HD978TR4 has a 0…10Vdc voltage output, with 0…1Vdc, 0…5Vdc and 1…5Vdc outputs available upon request.
A led indicates the alarm situation and it helps user during the programming. The instrument is also protected against polarity inversions.
Input and output are galvanically isolated between them: this is necessary to eliminate problems due to the mutual influence of the devices originated by disturbs caused by the different earth/ground paths.
The instrument is housed in a 2 modules Din (Width 35mm) container with standard connection for 35mm omega bar for the models HD978TR3 and HD978TR4; a wall container for the models HD978TR5 and HD978TR6.
The 4…20mA current output stage of HD978TR3 and HD978TR5 is a passive two-wire and it supplies power to the converter through the current loop.

TECHNICAL DATA @ 25°C e 24Vdc

INPUT	HD978TR3 - HD978TR5	HD978TR4 - HD978TR6
Measuring range	-10mV … +60mV configurable	
Default range	0…20mV	
Minimum measuring range	2mV	
Input impedance	> 1 MOhm	
Conversion speed	2 measures per second	
Accuracy	±0.04%F.S. ±20mV	
Operating temperature	-30 … +70°C	
Storage temperature	-40...+80°C	
Relative humidity	0…90%RH (without condensation)	
OUTPUT	**HD978TR3 - HD978TR5**	**HD978TR4 - HD978TR6**
Type of output (note 1)	4...20 mA (or 20...4 mA) two-wired 22 mA, in case of unconnected input	0 … 10Vdc (0…1Vdc, 0…5Vdc, 1…5Vdc upon request)
Resolution	4 mA	20mV
Power supply	9...30Vdc for the 4…20mA current output	15…30Vdc (4mA) for the 0 … 10Vdc current output, 10…30Vdc (4mA) for the other outputs
Protection against polarity inversion	40Vmax	
Sensitivity to Vdc power voltage variations	0,4 µA//V	2µA/V
Load resistance	R_LMax = (Vdc-9)/0.022 R_LMax = 625Ω with Vdc = 24 Vdc	> 10kΩ
Input/output galvanic isolation	50Vdc (verified at 250V)	
Red led	It turns on while programming, when the probe is broken or not connected	
Heating time	2 minutes	
Thermal drift	0.02% F.S./°C	

Nota 1: If the measured voltage V goes out of the V1...V2 (V1<V2) set range, the transmitters linearly regulate the output for V<V1 and V>V2 for an interval of 0.1mV. (See the diagrams of the outputs.)

Installation and connection
Fig.1 shows the mechanical dimensions of the HD978TR3 and TR4: the width of the container is a 2 modules DIN (35mm). Fig.5 reports the wiring diagrams of the HD978TR3 and a DeltaOhm pyranometer. Fig.6 indicates the typical connection of the HD978TR4.
In order to obtain the maximum precision, the connection to the thermocouple should not exceed 3 meters long and should be performed with a shielded cable. It is also recommended not to pass wiring near cable for power signals (electric motors, induction furnaces, inverter etc.). The working temperature should be included in declared operating temperature.
In the diagrams reported, the RL (Load) symbol represents any device introduced in the current loop, that is to say any indicator, controller, data logger or recorder. The two terminals reporting EARTH are connected internally between them and they are necessary to connect the ground terminal coming, for instance, by a pyranometer to the grounded, as you can see from the diagrams.
The response curves of the instruments are reported in figures 2 (current output of HD978TR3) and 3 (voltage output of HD978TR4).
Fig.7 reports, a san example, the connection to be performed for reading the voltage measured on a shunt DC: the converter assures the galvanic isolation between device and voltage or current output; also configurability allows to obtain the best correlation between read and amplified output voltage. We recommend that you pick up the signal by using a sheltered cable and by connecting the screen (shield) to terminal 9.

Programming of the operating range
Converters HD978TR3, HD978TR4, HD978TR5 are HD978TR6 are supplied by default with

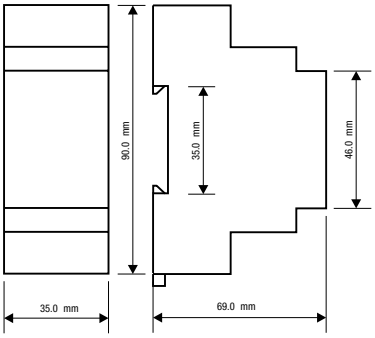


Fig. 1 Dimensions

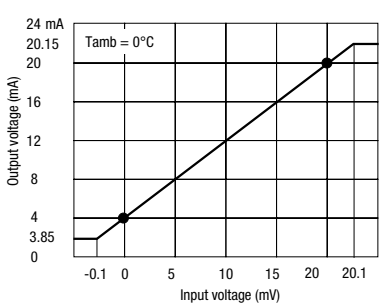


Fig. 2 HD978TR3 continuous current measure

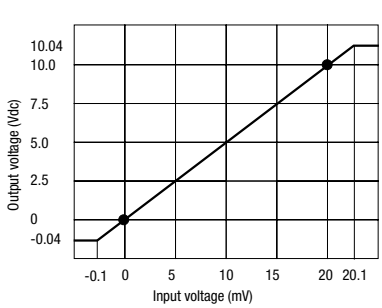


Fig. 3 HD978TR4 continuous voltage measure

range 0…20mV. The user can set a different range according to his requirements with a **minimum span of 2mV**. The correspondence between the read voltage and current or voltage output can be directed (for ex. 0mV / 4mA and 20mV / 20mA) or reverse (for ex. 20mV / 20mA and 0mV / 4mA).

Acquire the following tools for programming:

- source constant supply of suitable value (please see the specifications table),
- calibrator con mV output,
- connection cables,
- precision ammeter with 0...25 mA minimum range or 0…10Vdc voltmeter.

The setting must be done with the instrument already powered.

Set the calibrator so that it generates the voltage corresponding to the output of the initial scale of the converter (4mA or 0V according to the model), **by paying attention to polarity**. Wait 30 seconds for the voltage to stabilize.

Press and hold the button until the led starts flashing. Release the button. The instrument has acquired the first value of the transmitter working range, the led keeps on flashing. The instrument is now awaiting the second data of the full scale range.

Set the calibrator in order to generate a voltage corresponding to the output of the full scale (20mA or 10Vcc).

Press and hold the button until the led stops flashing.

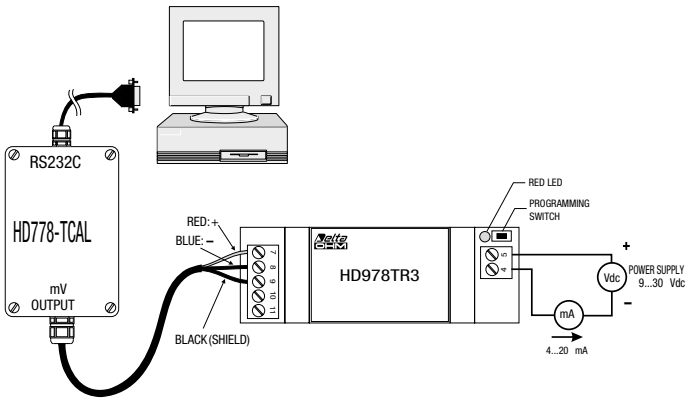
Release the button and wait 20 seconds, **without changing the calibrator's data**, so that the converter saves the calibration data and is ready for working normally. The operation ends with a flashing of the led.

The instrument has acquired the second point corresponding to the range you want to set and is working normally.

The minimum value accepted by the instrument is 2mV. If the user tries to insert a second value V2 with V2-V1 lower than 2mV, after entering the first value first value V1 of the range, the instrument does not accept it and remains in standby while the led continuous flashing.

Note: in place of the current/voltage calibrator, you can use the Delta Ohm **HD778-TCAL**. This instrument has to be connected to a serial port of the PC and, by means of the proper **DELTALOG7**software, automates all the steps described above for programming the operating range.

The HD778-TCAL is supplied with its software. Linked to the HD778-TCAL serial output of a PC, the user can configure the HD978TR3 and HD978TR5 (4…20mA or 20…4mA



current) or the HD978TR4 and HD978TR6 (0…10Vdc or 10…0Vdc voltage) by following the instructions on the screen.

PURCHASING CODES

HD978TR3: Configurable signal converter amplifier with 4÷20mA (20÷4mA) output, for DIN bar
Input measuring range –10..+60mV. Default setting 0÷20mV.
Minimum measuring range 2mV.

HD978TR4: Configurable signal converter amplifier with 0÷10 (10÷0Vdc) output, for DIN bar
Input measuring range –10..+60mV. Default setting 0÷20mV.
Minimum measuring range 2mV.

HD978TR5: Wall mounting configurable signal converter amplifier with 4÷20mA (20÷4mA) output.
Input measuring range –10..+60mV. Default setting 0÷20mV.
Minimum measuring range 2mV.

HD978TR6: Wall mounting configurable signal converter amplifier with 0÷10 (10÷0Vdc) output.
Input measuring range –10..+60mV. Default setting 0÷20mV.
Minimum measuring range 2mV.

HD778-TCAL: power generator in the range -60mV…+60mV, regulated by PC through RS232C serial port, DELTALOG7 software for setting K, J, T and N thermocouple transmitters.

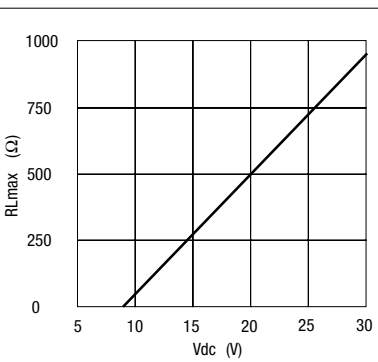


Fig.4 Load resistance according to power supply (output 4…20mA)

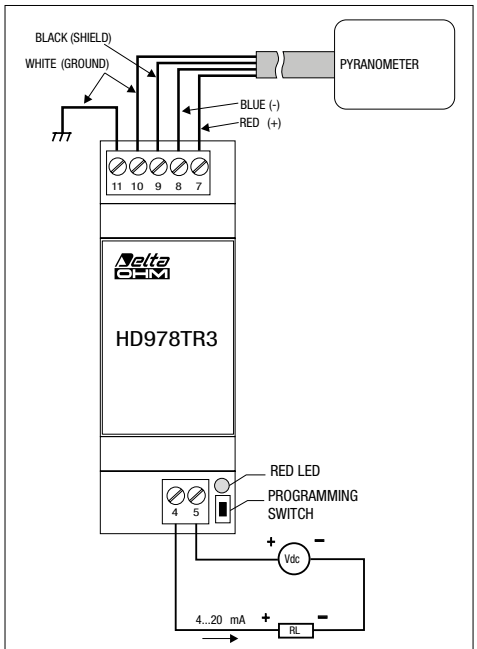


Fig.5 Connection diagram of HD 978TR3 to a pyranometer.

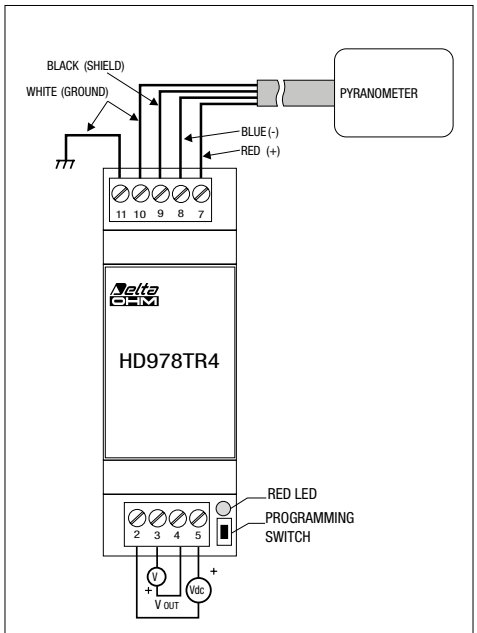


Fig.6 Connection diagram of HD978TR4 to a pyranometer

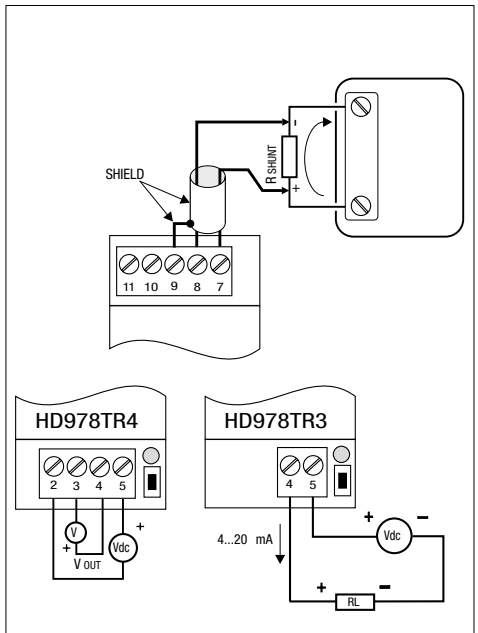


Fig.7 Connection diagram of HD978TR3 and HD978TR4 to a SHUNT.

HD 9022
CONFIGURABLE MICROPROCESSOR INDICATOR
VOLTAGE, CURRENT OR Pt100 INPUT

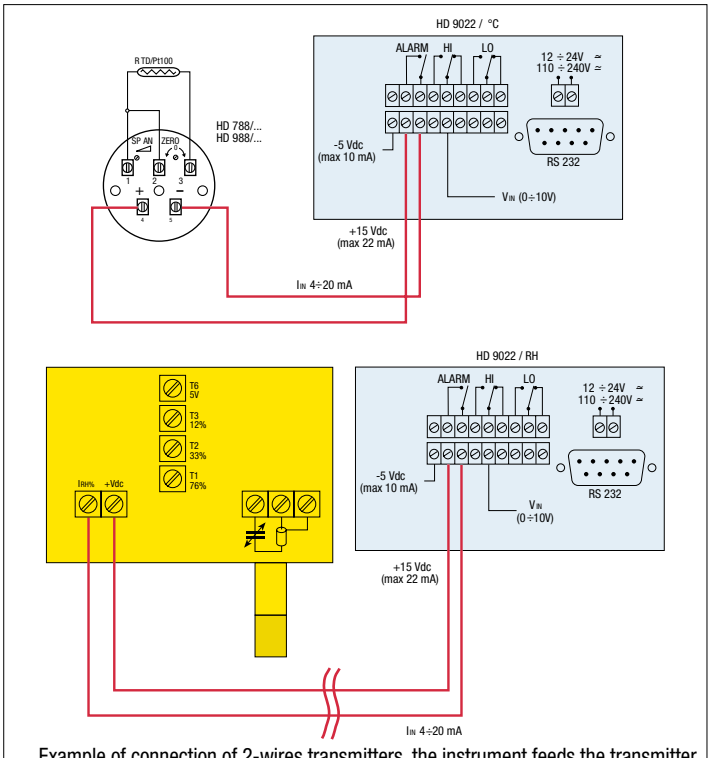
The microprocessor-controlled panel instrument HD 9022 is an indicator with alarm thresholds that may be programmed and configured by the user. It accepts input signals from 2 or 3 wires transmitters both 0÷1V, 0÷10V voltage and 0÷20 mA, 4÷20 mA current or 4 wires Pt100. Configurability is always all present inside the instrument, no add-on cards are required.
The choice for the configuration of the input signals is via keypad on the front of the instrument.
The dimensions of the instrument are 96x48 mm, width 145 mm according to DIN 45700.
The operating mode of HD 9022 is chosen according to the application and configuring the instrument by the keyboard. In a very easy way it is possible to configure the instrument in a range so to adapt it to changing process requirements. The configuration regards input, field scale, set point and auxiliary outputs.

Applications
Typical applications are the display of signals sent by transmitters which may concern temperature, humidity, pressure, speed, capacity, level, force, etc., for the most varied industrial sectors, operating machines and automated systems.

Specifications
- Configurable set point from -9999 to +19999.
- red leds Indication with seven 1/2 inch segments,
- Separate clamp for voltage input 0÷1 / 0÷10V, current input 0÷20 / 4÷20 mA and Pt100 input (-200÷+800°C).
- The instrument has an auxiliary power supply: -5 Vdc max 10 mA and +15 Vdc non stabilized max 40 mA for the possible supply of 2-wire transmitters.
- $R_{I_{IN}}$= 25 Ω, $R_{V_{IN}}$ = 200 kΩ.
- Instrument accuracy: ±0.1% Rdg ± 1 Digit.
- A/D converter resolution: 0.05 mV/Digit, 1µA/Digit.
- Functions: One relay with independent exchange contact for output HI (SP1, SP2).
  One relay with independent exchange contact for output LO (SP3, SP4).
  One relay with maximum or minimum alarm closing contact (L max, L min.) ALARM.
  Resistive relay contacts 3A/220V 50Hz.
- Instrument working temperature: (electronic components) 5÷50°C.
- Power supply: there is a terminal board for input **12÷24Vac/Vdc** or **110÷240Vac/Vdc (the one or the other; not both kinds of power supply).**
- Instrument absorption: 5VA.
- Minimum power of the supply transformer: 20VA.

Function of buttons on the frontal panel ,the LEDs
❶ Numeric display. While programming you see: F0, F1, F2, F3, F4, F5, F6, F7, F8, SP1, SP2, SP3, SP4, S10.
❷ Satus indicator relay HI.
❸ Satus indicator relay LO.
❹ Satus indicator relay ALARM.
❺ Decimal point.

SEQUENTIAL PROGRAMMING OF WORKING PARAMETERS
❻ **PROG** Each time you press this button, the program advances one instruction (F0, F1, F2, F3, F4, F5, F6, F7, F8, SP1, SP2, SP3, SP4, S10).
❼ **ENTER** Pressing the button during programming you receive the value of the selected variable that can be changed with the buttons ▲ ▼; when pressing **ENTER** you confirm the value stored.
❽▲ Pressing the button during programming you increase the displayed value; in F2, you move the decimal point to the right. In normal operation it flashes to indicate the value in Volts, mA or Pt100 corresponding to the input; with a second impulse it returns to normal operation.
❾▼ Pressing the button during programming you decrease the displayed value; in F2, you move the decimal point to the left. In normal operation it flashes to indicate the value in Volts, mA or temperature corresponding to the input; with a second impulse it returns to normal operation.



Example of connection of 2-wires transmitters, the instrument feeds the transmitter.

Configuration of the HD 9022 panel indicator

1) Supply power to the instrument.
2) The instrument performs an internal check, the wording C.E.I. appears for a few seconds followed by a number at random.
3) Press **PROG** and the message **F0** appears
4) Press **PROG** and the message **F1** appears.
5) Press **ENTER** and the symbol U, A or **Pt** appears. Using the ▲ ▼ buttons, choose the input for voltage: U, current: A or Pt100: **Pt** signals. Press **ENTER** to confirm.
6) Press **PROG** and the message **F2** appears; press **ENTER**; with the ▲ ▼ keys, set the decimal point in the desired position.

Press **ENTER** to confirm.

7) Press **PROG** and the message **F3** appears; press **ENTER**, with the ▲ ▼ keys, set the voltage, current or Pt100 value (as desired) corresponding to the beginning of the scale S1 for example 0V, 4 mA or 0°C. Press **ENTER** to confirm.
8) Press **PROG** and the message **F4** appears; press **ENTER**, with the ▲ ▼ keys, set the numerical value corresponding to the beginning of the scale R1 for example 0°C. Press **ENTER** to confirm.
9) Press **PROG** and the message **F5** appears; press **ENTER**, with the ▲ ▼ keys, set the voltage or current value (as selected in point 5) corresponding to the end of the scale S2 for example 10V, 20 mA or 200.0°C. Press **ENTER** to confirm.
10) Press **PROG** and the message **F6** appears; press **ENTER**, with the ▲ ▼ keys, set the numerical value corresponding to the end of the scale R2 for example 100°C. Press **ENTER** to confirm.
11) Press **PROG** and the message **F7** appears; press **ENTER**, with the ▲ ▼ keys, set the maximum alarm threshold value L max for the Alarm relay for example 110°C. Press **ENTER** to confirm.
12) Press **PROG** and the message **F8** appears; press **ENTER**, with the ▲ ▼ keys, set the minimum alarm threshold value L min for the Alarm relay for example -10°C. Press **ENTER** to confirm.
13) Press **PROG** and the message **SP1** appears; press **ENTER**, with the ▲ ▼ keys, set the Set value for the first threshold "SET relay HI" for example 40°C. Press **ENTER** to confirm.
14) Press **PROG** and the message **SP2** appears; press **ENTER**, with the ▲ ▼ keys, set the Reset value for the first threshold "RESET relay HI" for example 45°C. Press **ENTER** to confirm.
15) Press **PROG** and the message **SP3** appears; press **ENTER**, with the ▲ ▼ keys, set the Set value for the second threshold "SET relay LO" for example 50°C. Press **ENTER** to confirm.
16) Press **PROG** and the message **SP4** appears; press **ENTER**, with the ▲ ▼ keys, set the reset value for the second relay "RESET relay LO" for example 48°C. Press **ENTER** to confirm.
17) Press **PROG** and the message **S10** appears. Press **ENTER**, with the ▲ ▼ keys, set the desired speed of RS232 serial transmission among the following ones: 300, 600, 1200, 2400, 4800, 9600 baud. Press **ENTER** to confirm.
18) Press **PROG** and the message **F0** appears. AT THIS POINT THE CONFIGURATION OF THE INSTRUMENT IS COMPLETE.
19) Connect the input of the instrument, press the **ENTER** key and the display will indicate the value corresponding to the input signal.

Varying the configuration

To vary a stored parameter at any stage of the program it is sufficient to the step of the program to be changed with the **PROG** key (F1, F2, F3, etc.). Press **ENTER** and use the ▲ ▼ keys to modify the parameter previously set; press **ENTER** to confirm, return to **F0** and press **ENTER**.
This simple procedure modifies the desired step of the program.

Note

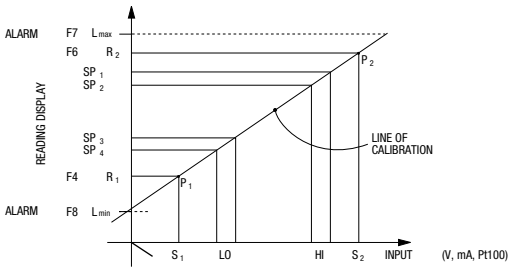
If the **ENTER**, ▲ or ▼ key is pressed independently during operation, the instrument input value (V, mA or °C) flashes on the display. To return to normal operation, press the ▲ ▼ or **ENTER** key independently again.

Error report

The instrument indicates an error signal in the following cases:

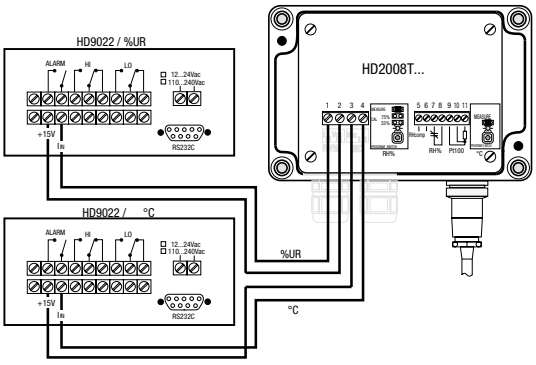
OFL: this appears when the set value of **R max** is exceeded.
-OFL: this appears when the set value of **R min** is exceeded.
E1: this appears when the set points P1 and P2 require a resolution of the A/D converter higher than the one available.
E2: this appears when the values of F7 and F8 are inverted.

THE MAXIMUM RESOLUTION OF THE CONVERTER IS: 0.05 mV/Digit, 1µA/ Digit.
Summary of programming steps

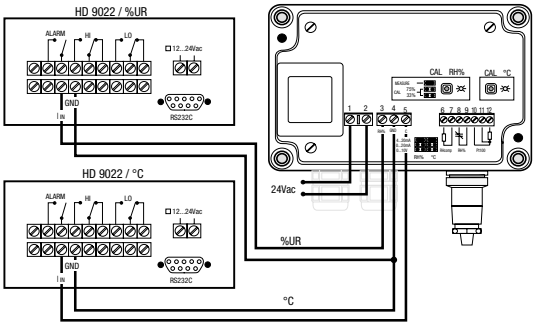


INPUT mA		INPUT V	
0 ÷ 1 mA 0 ÷ 10 mA 0 ÷ 16 mA 0 ÷ 20 mA 0 ÷ 5 mA 0 ÷ 10 mA 0 ÷ 20 mA	Input resistance 25 Ω ± 0,1%	0 ÷ 100 mV 0 ÷ 1 V 0 ÷ 5 V 0 ÷ 10 V 1 ÷ 5 V -10V a +10V	Input inpedance 200K Ω ± 0,1%

PROG Programming start. Selects the programming step, F0.
PROG Selects the programming step, **F1**.
PROG Selects the programming step, **F2**.
PROG .....
ENTER Exit program mode.
ENTER Allows modification of the variable.
▲ ▼ Modifies the variable on display.
ENTER Confirms the modification.
PROG Moves to next programming step.



Example of connection of HD4917T... transmitter with HD 9022 indicator



Example of connection of HD4817T... transmitter with HD 9022 indicator

STEP	COMMENT	LIMITS
F0	Exit,by pressing **ENTER you exit the programming**	
F1	Select of the type of input: Voltage, Current, Pt100	*U* - *A* - Pt
F2	Decimal point position	0 - 0.0 - 0.00 - 0.000
F3	Value of zero scale input (Voltage, Current, °C)	0...10,00V, 0...20,00 mA -200,0...+800,0°C
F4	Value of initial scale of the display	-9999...19999
F5	Value of full scale input (Voltage, Current, °C	0...10,00V, 0...20,00 mA -200,0...+800,0°C
F6	Value of full scale input	-9999...19999
F7	MAXIMUM ALARM threshold for intervention	-9999...19999
F8	MINIMUM ALARM threshold for intervention	-9999...19999
SP1	ON set-point threshold HI	-9999...19999
SP2	OFFset-point threshold HI	-9999...19999
SP3	ON set-point threshold LO	-9999...19999
SP4	OFF set-point threshold LO	-9999...19999
S10	Serial transmission speed	300, 600, 1200, 2400, 4800, 9600

Serial interface RS-232C

The HD 9022 is equipped with standard serial interface RS-232C which is available on the SUB D male 9-pin connector. The arrangement of the signals on this connector is as follows:

Pin	Signal	Description
2	TD	Datum transmitted by the HD 9022
3	RD	Datum received by the HD 9022
5	GND	Reference logic mass

The transmission parameters with which the instrument is supplied are:

- baud rate	9600 baud
- parity	None
- n. bits	8
- stop bit	1

The data transmission speed may be changed by altering the set-up parameter S10 with the keyboard; the possible baud rates are: 9600, 4800, 2400, 1200, 600, 300. The other transmission parameters are fixed.

All the messages reaching and leaving the HD 9022 must be inserted in a "Communication frame" with the following structure:

<Stx><Record><Etx>

Where:

<Stx> Start of text (ASCII 02)
<Record> constitutes the message
<Etx> End of text (ASCII 03)

Host commands

The structure of the command records is as follows:

<Command character> <Sub-command> <Values>

Where:

<Command character>	is characterized by an alphabetic character indicating the set of commands.
<Sub-command>	is characterized by a character indicating the type of command.
<Values>	is characterized by ASCII characters that depend on the type of command.

The answers given by the HD 9022 are basically of two types:
"Information" and "Data"

The former allow information on the status and programming of the HD 9022 to be obtained, as well as the diagnosis of the message received; the latter contain data on the two channels at the moment the request is made.
It is also possible to make use of the serial line for the complete programming of the HD 9022, with the exception of the data transmission speed which may be set only with the keyboard.
The diagnostic replies of the HD 9022 are composed of the following control characters, sent individually (not inserted in the communication frame):

-ack- Command executed (ASCII 06)
-nak- Incorrect command (ASCII 15H)

COMMAND A

Sub-command		Values	Replies
A	Type of terminal	HD 9022	ack/nak
C	Company	DELTA OHM	ack/nak
D	Firmware Version	Vxx Rxx	ack/nak
E	Firmware Date	dd/mm/yy	ack/nak
F	Serial Number (rd)	xxxxxx	ack/nak
	(wr)	stxAFxxxxxxetx	ack/nak

COMMAND M

Sub-command	Values	Replies
1	Measure Channel 1	ack/nak
2	Measure Channel 2	ack/nak

RESET COMMAND

	Values	Replies
(wr)	stxRESETetx	ack/nak

CHANNEL 1

C1F01	**x**	Input in	V/A/Pt	ack/nak
C1F02	**x**	Point	0/1/2/3	ack/nak
C1F03	**xxxx**	Start of scale	-9999...19999	ack/nak
C1F04	**xxxx**	V/I Start of scale	0000...10000 (2000 if I)	ack/nak
C1F05	**xxxx**	End of scale	-9999...19999	ack/nak
C1F06	**xxxx**	V/I End of scale	0000...10000 (2000 if I)	ack/nak
C1F07	**xxxx**	Energ. Relay HI	-9999...19999	ack/nak
C1F08	**xxxx**	De-energ. Relay HI	-9999...19999	ack/nak
C1F09	**xxxx**	Energ. Relay LO	-9999...19999	ack/nak
C1F10	**xxxx**	De-energ. Relay LO	-9999...19999	ack/nak
C1F11	**xxxx**	Min Relay Alarm	-9999...19999	ack/nak
C1F12	**xxxx**	Max Relay Alarm	-9999...19999	ack/nak

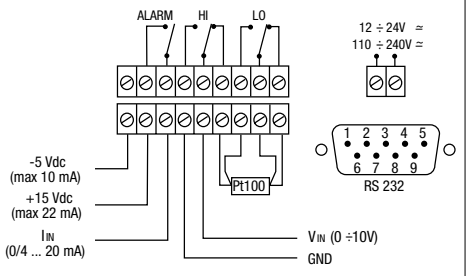
As regards the command just described, a few remarks must be made:
- There is no command character.
- For the other controls of the type C1F01 etc., the present programming status is supplied for the specific command if only the sequence of the sub-command characters is sent.

Ex:	StxC1F01Etx	Request from Host
	StxC1F01:1Etx	Reply

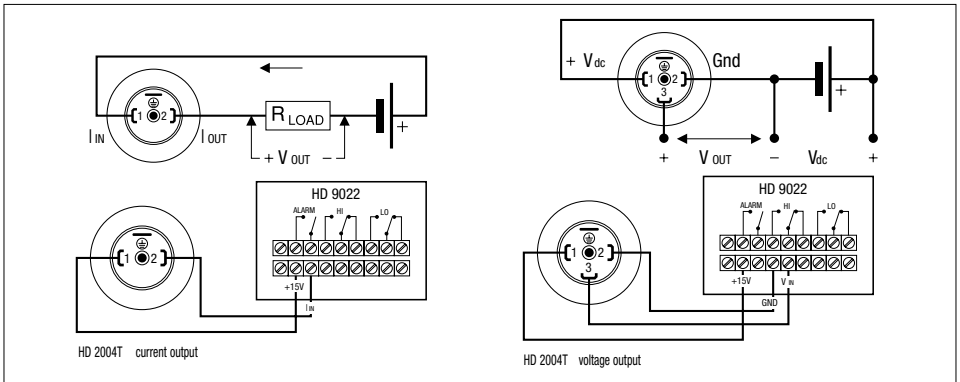
If the sequence of the sub-command characters is followed by a space and then the desired programming value, the programming of the parameter is produced.

Ex:	StxC1F01 1Etx	Command from Host
	ack / nak	Reply
	StxC1F03 1000Etx	Command from Host
	ack / nak	Reply
	StxC1F03-2000Etx	Command from Host
	ack / nak	Reply
	StxC1F0512000Etx	Command from Host
	ack / nak	Reply

Note: for programming of the point F03...F12, the value field has fixed length of 5 characters. The first character in the value field may be a space, the minus sign, or the number 1.



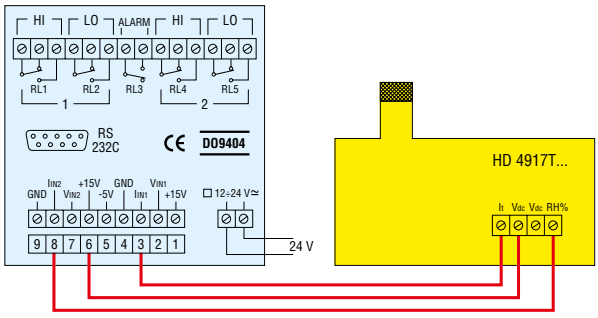
Connections



Example of connection with HD 9022 indicator, regulator

DO 9404
DUAL REGULATING INDICATOR WITH MICROPROCESSOR CONFIGURATION AND TWO INPUTS, FOR VOLTAGE OR CURRENT

The DO double indicator controller 9404 is an instrument for panel with LED 96x96 microprocessor with programmable alarm thresholds and user-configurable.
Accepts two-channel input signals from two separate transmitters or transmitters by a double. The transmitters can be 2 wires, passive, or 3 wires, active both in tension 0 to 1 V, 0 to 5 V, 0 to 10 V DC 0 to 20 mA, 4 to 20 mA.
Configurability for both input channels is always present in the instrument requires no add-on cards.
The choice of configurations for input signals is via the keypad on the front of the instrument. The DO 9404 is equipped with RS232C serial output, the baud rate is configurable from the keyboard, the command is bidirectional, the output connector SUB D 9 pin female. The dimensions of the instrument are in accordance with DIN 45700 96x96 mm, depth 120 mm. The operating mode of the DO 9404 is chosen depending on the application by configuring the instrument from the keyboard. With ease you can configure the instrument in the field to adapt to changing process requirements.
The configurability regards inputs, extension ladders, set points, alarms and the baud rate.



Example of connection of passive transmitter which sends two current signals (4÷20 mA) to DO 9404

Applications
A typical application of the DO 9404 is the display and regulation of signals arriving from passive 2-wire or active 3-wire transmitters, of any physical quantity: temperature, humidity, pressure, speed, level, etc. for a wide variety of industrial sectors and automation.

Specifications
- Set point may be configured from -9999 to +19999
- Indication with 1/2" red LEDS
- Separate terminal for each channel for voltage input 0÷10 V and current input 0÷20 mA, 4÷20 mA
- On the terminal board an auxiliary power supply is available at -5 Vdc max. 10 mA and +15 Vdc non-stabilized max. 44 mA for the possible feeding of passive 2-wire transmitters
- Instrument accuracy ±0.1% Rdg ± 1 digit
- A/D converter resolution: 0.05 mV/digit, 1 µA/digit
- Functions: Two relays with insulated HI LO exchange contact for channel 1: RL1, RL2
  Two relays with insulated HI LO exchange contact for channel 2: RL4, RL5
  One relay for the overall maximum and minimum alarms: RL3
  Resistive 3A/230 Vac relay contacts
- Instrument working temperature: (electronic components) -5°C..50°C
- Power supply: 12÷24 ±10% Vac/Vdc.

Error report
Error signals
The instrument gives error signals in the following cases:
OFL: appears when the SET value is set higher than the high alarm value (maximum).
-OFL: appears when the SET value is set lower than the low alarm value (minimum).
E1: appears when a resolution of the AD converter has been asked for that is higher than what is available: **THE MAXIMUM AD RESOLUTION IS 0.1mV/digit or 2µA/digit**.
E2: appears when there is an analog value at input that is lower or higher than that of the instrument: voltage 0 V..+10 V, current 0-20 mA.
E3: appears when the values of the alarm thresholds are inverted.
E4: reading/writing mistake on the Eeprom.

Configuration of the regulating indicator DO 9404
1) Supply power to the instrument: 11÷30 Vac; 11÷40 Vdc.
2) The dual display indicates OFL on both channels (1 and 2) at the first programming, or values depending on previous programming operations.
3) When the PROG key is pressed, the message F0 appears alternately on channel 1 or 2.
4) Select which channel (1 or 2) you want to program, for example channel 1.
5) Press the ▲ key, the message F1 appears; confirm with the ENTER key and the symbol A (Ampere = current signal 0÷20 mA, 4÷20 mA) or the symbol U (voltage V = voltage signal 0÷10 V) appears; with the ▲ and ▼ keys, prepare the input for the desired signal, current A or voltage; for example, set A current input, confirm with the ENTER key, then F1 appears. Press the ▲ key and the message F2 appears.
6) Press the ENTER key, four figures 8888 appear with the decimal point placed at random; using the ▲ and ▼ keys, set the decimal point in the desired position, the possible configurations are:

8888
8.8
8.88
8.888

Press the ENTER key to confirm, then the message F2 appears; press the ▲ key and the message F3 appears.
7) Press ENTER , then using the ▲ and ▼ keys set the start of scale value for channel 1, for example -30.0°C; confirm with ENTER , the message F3 appears, press the ▲ key and the message F4 appears.
8) Press the ENTER key, then using the ▲ and ▼ keys set the analog value corresponding to the start of scale in voltage or current, depending on the choice made in point 5, for example 4.00 mA; confirm with ENTER, the message F4 appears, press the ▲ key and the message F5 appears.

9) Press ENTER , then using the ▲ and ▼ keys set the full scale value for channel 1, for example 130.0°C; confirm with ENTER , the message F5 appears, press the ▲ key and the message F6 appears.
10) Press the ENTER key, then using the ▲ and ▼ keys set the analog value corresponding to the end of scale in voltage or current, depending on the choice made in point 5, for example 20.00 mA; confirm with ENTER , the message F6 appears, press the ▲ key and the message F7 appears.
11) Press the ENTER key, then using the ▲ and ▼ keys set the SET LO value (closing of contact RL1) for channel 1, for example 0.0°C; confirm with ENTER , the message F7 appears, press the ▲ key and the message F8 appears.
12) Press the ENTER key, then using the ▲ and ▼ keys set the Reset HI value (opening of contact RL1) for channel 1, for example 10.0°C; confirm with ENTER , the message F8 appears, press the ▲ key and the message F9 appears.
13) Press the ENTER key, then using the ▲ and ▼ keys set the SET LO value (closing of contact RL2) for channel 2, for example 20.0°C (control of a refrigerating unit, for example); confirm with ENTER , the message F9 appears, press the ▲ key and the message F10 appears.
14) Press the ENTER key, then using the ▲ and ▼ keys set the Reset HI value (opening of contact RL2) for channel 2, for example 15.0°C (switching off a refrigerating unit, for example); confirm with ENTER , the message F10 appears, press the ▲ key and the message F11 appears.
15) Press the ENTER key, then using the ▲ and ▼ keys set the low ALARM value for the relay RL3, for example -5.0°C; confirm with ENTER , the message F11 appears, press the ▲ key and the message F12 appears.
16) Press the ENTER key, then using the ▲ and ▼ keys set the high ALARM value for the relay RL3, for example 25.0°C; confirm with ENTER , the message F12 appears, press the ▲ key and the message F13 appears.
17) Function F13 is used to select the baud rate for serial transmission; press the ENTER key and a baud rate value appears, then using the ▲ and ▼ keys set the desired rate, choosing one of the following: 300, 600, 1200, 2400, 4800, 9600; the other serial transmission parameters are fixed and cannot be changed; they are:

8 bit
No Parity
1 Stop bit

Note: the baud rate is the same for both channels. Press ENTER to confirm, press the ▼ key until F0 appears indicating the end of programming; press the ENTER key. This operation concludes the programming of channel 1 as described up to this point.

- Programming is the same for both channels, 1 and 2; all that has been described for channel 1 also applies to channel 2.
- The function of the set and reset relays (close LO contact, open HI contact), of relays RL1 and RL2 or RL4 and RL5, depends on what the process requires.
- To alter the parameters it is sufficient to enter the program by pressing the PROG key; when F0 appears, choose the channel in which you want to change the parameter, press the ▲ key until the function that you want to change appears, then make the change with the ▲ and ▼ keys; press ENTER to confirm, then return to F0 function with the ▼ key, press ENTER thus returning to normal operation.
- In normal operation, pressing one of the ▲ or ▼ keys passes from the measurement of the physical quantity to the voltage or current value corresponding to the measurement in progress; this applies to both channels.
  When one of the or keys is pressed the instrument returns to normal measuring status.
- The serial interface is active only during normal operation.
- The programming parameters remain in the memory even when the instrument is receiving no power.
- The relays are disconnected during programming.

Serial interface RS-232C

The DO 9404 is equipped with standard serial interface RS-232C which is available on the SUB D female 9-pin connector. The arrangement of the signals on this connector is as follows;

Pin	Signal	Description
2	TD	Datum transmitted by the DO 9404
3	RD	Datum received by the DO 9404
5	GND	Reference logic mass

The transmission parameters with which the instrument is supplied are:

- baud rate 9600 baud
- parity None
- n. bits 8
- stop bit 1

The data transmission speed may be changed by altering the set-up parameter F13 with the keyboard; the possible baud rates are: 9600, 4800, 1200, 600, 300. The other transmission parameters are fixed.

All the messages reaching and leaving the DO 9404 must be inserted in a “Communication frame” with the following structure:

<Stx> <Record> <Etx>

where:

<Stx> Start of text (ASCII 02)
<Record> constitutes the message
<Etx> End of text (ASCII 03)

Host commands

The structure of the command records is as follows:

<Command character><Sub-command><Values>

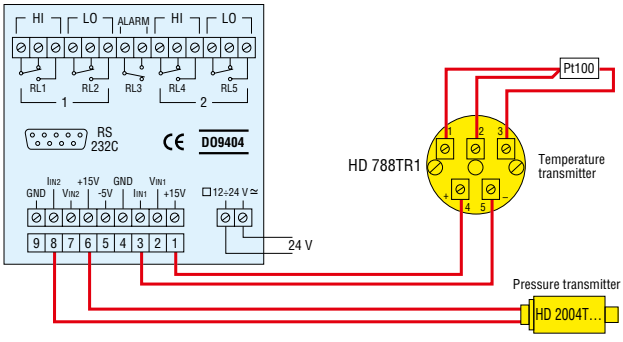
Where:

<Command character> is characterized by an alphabetic character indicating the set of commands.
<Sub-command> is characterized by a character indicating the type of command.
<Values> is characterized by ASCII characters that depend on the type of command.

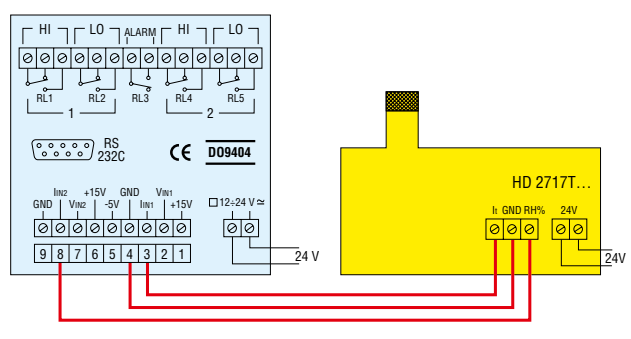
The replies provided by the DO 9404 are essentially of two types: “Information” and “Data”.

The former allow information on the status and programming of the DO 9404 to be obtained, as well as the diagnosis of the message received; the latter contain data on the two channels at the moment the request is made.
It is also possible to make use of the serial line for the complete programming of the DO 9404, with the exception of the data transmission speed which may be set only with the keyboard.
The diagnostic replies of the DO 9404 are composed of the following control characters, sent individually (not inserted in the communication frame):

-ack- Command executed (ASCII 06)
-nak- *Incorrect command (ASCII 15H)*



Example of connection of transmitters connected to the DO 9404:
-1 temperature transmitter which sends a current signal (4÷20 mA)
-1 pressure transmitter which sends a current signal (4÷20 mA)



Example of powered transmitter connection which sends two current signals (4÷20 mA) to DO 9404

COMMAND A

Sub-command		Values	Replies
A Type of terminal			DO 9404
C Company			DELTA OHM
D Firmware Version			Vxx Rxx
E Firmware Date			dd/mm/yy
F Serial number	(rd)		AFxxxxxx
	(wr)	xxxxxx	ack/nak

COMMAND M

Sub-command	Values	Replies
1 Measure Channel 1		Measure Channel 1
2 Measure Channel 2		Measure Channel 2

RESET COMMAND

		Values	Replies
RESET	(wr)		

COMMAND

Sub-command	Values	Replies
1 Set-up Channel 1		Set-up Channel 1
2 Set-up Channel 2		Set-up Channel 2

CHANNEL 1

C1F01	**x**	Input in	V/A	ack/nak
C1F02	**x**	Point	0/1/2/3	ack/nak
C1F03	**xxxx**	Start of scale	-9999...19999	ack/nak
C1F04	**xxxx**	V/I Start of scale	0000...10000 (2000 if I)	ack/nak
C1F05	**xxxx**	End of scale	-9999...19999	ack/nak
C1F06	**xxxx**	V/I End of scale	0000...10000 (2000 if I)	ack/nak
C1F07	**xxxx**	Energ. Relay 1	-9999...19999	ack/nak
C1F08	**xxxx**	De-energ. Relay 1	-9999...19999	ack/nak
C1F09	**xxxx**	Energ. Relay 2	-9999...19999	ack/nak
C1F10	**xxxx**	De-energ. Relay 2	-9999...19999	ack/nak
C1F11	**xxxx**	Min1 Relay 3	-9999...19999	ack/nak
C1F12	**xxxx**	Min1 Relay 3	-9999...19999	ack/nak
C1F12	**xxxx**	Max1 Relay 3	0000-9999	ack/nak

CHANNEL 2

C2F01	**x**	Input in	V/A	ack/nak
C2F02	**x**	Point	0/1/2/3	ack/nak
C2F03	**xxxx**	Start of scale	-9999...19999	ack/nak
C2F04	**xxxx**	V/I Start of scale	0000...10000 (2000 if I)	ack/nak
C2F05	**xxxx**	End of scale	-9999...19999	ack/nak
C2F06	**xxxx**	V/I End of scale	0000...10000 (2000 if I)	ack/nak
C2F07	**xxxx**	Energ. Relay 4	-9999...19999	ack/nak
C2F08	**xxxx**	De-energ. Relay 4	-9999...19999	ack/nak
C2F09	**xxxx**	Energ. Relay 5	-9999...19999	ack/nak
C2F10	**xxxx**	De-energ. Relay 5	-9999...19999	ack/nak
C2F11	**xxxx**	Min2 Relay 3	-9999...19999	ack/nak
C2F12	**xxxx**	Max2 Relay 3	-9999...19999	ack/nak

Regarding the command just described, a few remarks must be made:
- There is no command character.
- In the first two cases (Sub-command 1 and 2) the complete set-up of the DO 9404, for Channel 1 and for Channel 2, is made available in the serial line.
- For all the other controls of the type C1F01 etc., the present programming status is supplied for the specific command if only the sequence of the subcommand characters is sent.

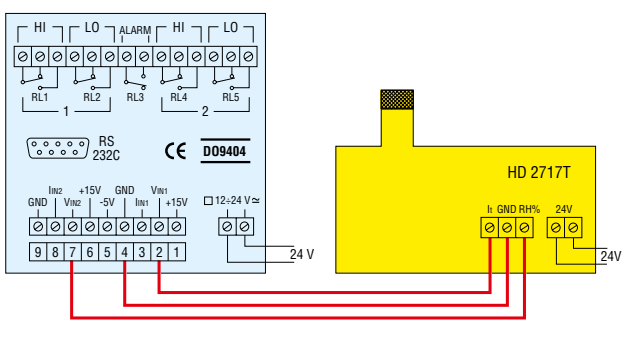
Example: StxC1F01Etx Request from Host
StxC1F01:1Etx Reply

If the sequence of the sub-command characters is followed by a space and then the desired programming value, the programming of the parameter is produced.

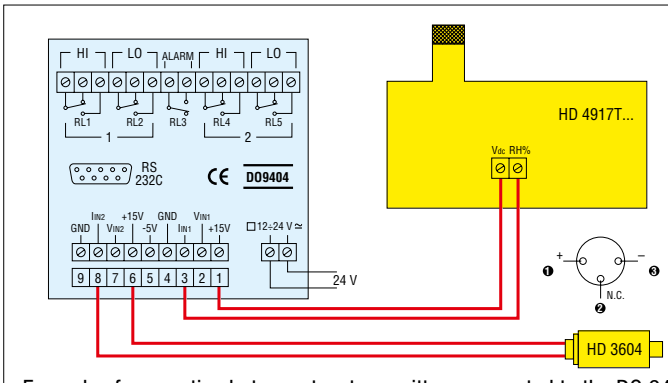
Example: StxC1F01 1Etx Command from Host
ack / nak Reply

Note: for programming of the point F03...F12, the value field has fixed length of 5 characters. The first character in the value field may be a space, the minus sign, or the number one.

StxC1F03 1000Etx Request from
Host ack / nak Reply
StxC1F03-2000Etx Request from
Host ack / nak Reply
StxC1F0512000Etx Request from
Host ack / nak Reply

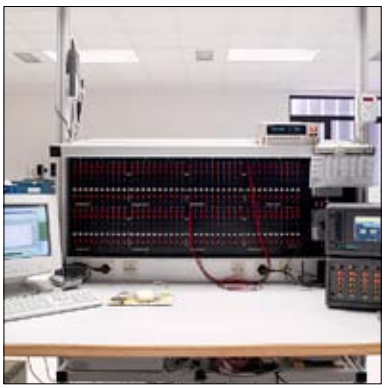


Example of powered transmitter connection which sends two voltage signals (0÷10 V) to DO 9404



Example of connection between two transmitters connected to the DO 9404:
- 1 transmitter of RH % which sends a signal in current (4÷20 mA)
- 1 pressure transmitter which sends a signal in current (4÷20 mA)

SIT N° 124 Laboratory for temperature



Calibration Service in Italy

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E-mail: deltaohm@tin.it
URL http://www.deltaohm.com

Permanent Laboratory **SIT ACCREDITATION TABLE**

Quantity	Instrument to calibrate	Measuring range	Uncertainty (*)	Note
Temperature	Noble metal thermocouples	-196 °C, -80°C...250°C 250°C ... 600°C 600°C ... 1100°C 1100°C...1250°C	0,4 °C 0,3 °C 0,4 °C 1,0 °C 2,0 °C	
	Common metal thermocouples	-196 °C, -80°C...250°C 250°C ... 600°C 600°C ... 1100°C 1100°C...1250°C	0,40 °C 0,40 °C 0,53 °C 1,1 °C 2,2 °C	
	Resistance thermometers	-196 °C, -80°C...250°C 0°C ... 100°C 100°C ... 250°C 250°C...600°C	0,20 °C 0,15 °C 0,05 °C 0,10 °C 0,20 °C	
	Thermometric chains Indicators for - Noble metal thermocouples	-196 °C, -80°C...250°C 250°C ... 600°C 600°C ... 1100°C 1100°C...1250°C	$2\sqrt{0,20^2+u_{ris}^2}$ °C $2\sqrt{0,15^2+u_{ris}^2}$ °C $2\sqrt{0,20^2+u_{ris}^2}$ °C $2\sqrt{0,50^2+u_{ris}^2}$ °C $2\sqrt{1,0^2+u_{ris}^2}$ °C	□
	Thermometric chains Indicators for - Noble metal thermocouples	-196 °C, -80°C...250°C 250°C ... 600°C 600°C ... 1100°C 1100°C...1250°C	$2\sqrt{0,20^2+u_{ris}^2}$ °C $2\sqrt{0,20^2+u_{ris}^2}$ °C $2\sqrt{0,26^2+u_{ris}^2}$ °C $2\sqrt{0,55^2+u_{ris}^2}$ °C $2\sqrt{1,1^2+u_{ris}^2}$ °C	□
	- Resistances	-196°C -80°C ... 250°C 0°C ... 100°C 100°C ... 250°C 250°C ... 600°C	$2\sqrt{0,10^2+u_{ris}^2}$ °C $2\sqrt{0,075^2+u_{ris}^2}$ °C $2\sqrt{0,025^2+u_{ris}^2}$ °C $2\sqrt{0,050^2+u_{ris}^2}$ °C $2\sqrt{0,10^2+u_{ris}^2}$ °C	□
	Calibrators-Simulators and Meters - For resistance thermometers - For thermocouples	National and international standards	$2\sqrt{0,025^2+u_{ris}^2}$ °C $2\sqrt{0,10^2+u_{ris}^2}$ °C	□

(*)The measuring uncertainties are expressed as corresponding to a confidence level of about 95%.
□ u_{ris} is the resolution of the instrument (1 digit or ½ division) or uncertainty of multimeter to witch it will be connected with

Humidity

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  Portable instruments for combined humidity and temperature probes
- Combined humidity and temperature probes pag. 50
- Saturated salt solutions for calibration verification. Sensor protection. How to verify the calibration. pag. 51
- HD 37AB17D, HD 37B17D pag. 53
  Data logger for temperature, humidity, CO, CO_2
- HD 40.1, HD 40.2 pag. 55
  Printing
- HD 45..., HD 46... pag. 56
  Transmitter and regulator wall mounting series for air quality. With or without display and relay.
- HD 48...T...active, HD 49...T...passive pag. 59
  Series of temperature and humidity transmitters with analogue or digital output (RS485). With or without display and relay.
- HD 2717T... pag. 63
  Series of temperature and humidity transmitters with interchangeable probe. With or without display and relay, analogue and digital output.
- HD 2817T... pag. 66
  Series of temperature and humidity transmitters with interchangeable probe. Graphic display, relays, analogue and digital output.
- HD 2001T... pag. 69
  Temperature, humidity, barometric pressure and air speed transmitters. With display, analogue and digital output.
- HD 9008TRR, HD 9009TRR, HD 2007 pag. 73
  Temperature and humidity transmitter with analogue output, for weather stations. Solar radiation shield.
- HD 9817T... pag. 76
  Temperature and humidity transmitters with analogue and digital outputs
- HD 3817T... pag. 78
  Absolute humidity transmitters with analogue output.
- HD 2601V.1, HD 2601V.2 pag. 81
  Transmitters and indicators for temperature and humidity with one or two 4÷20mA inputs
- HD 4049, HD 5002, HD 404, HD 9022, DO 9404 pag. 83
  Indicators, regulators

• Accredited SIT calibration laboratory no.124 for Humidity pag. 90

The qualitative level of our instruments is the result of a continuous evolving of the product itself. This may bring to slight differences between what written in the following manual and the instrument you bought. We cannot completely exclude the presence of errors inside the manual, which we apologise for. Data, images and descriptions included in this manual cannot be enforced legally. We reserve the right to perform modifications and corrections at any time without notice.

HD 2101.1
HD 2101.2

HD2101.1 AND HD2101.2
HYGRO-THERMOMETERS

The **HD2101.1** and **HD2101.2** are portable instruments with a large LCD display. They measure relative humidity and temperature using a Pt100 sensor or thermocouple humidity/temperature combined probe. Temperature only is measured by immersion, penetration or contact probes. The sensor can be a Pt100 or Pt1000.
When the humidity/temperature combined probe is connected, the instrument calculates and displays the absolute humidity, the dew point, the partial vapour pressure, and the **comfort indices**.
The probes are fitted with an automatic detection module, with the factory calibration data already stored inside.

The HD2101.2 is a **datalogger**. It stores up to 38,000 samples which can be transferred from the instrument connected to a PC via the multi-standard RS232C serial port and USB 2.0. The storing interval, printing, and baud rate can be configured using the menu.
The HD2101.1 and HD2101.2 models are fitted with an RS232C serial port and can transfer the acquired measurements in real time to a PC or to a portable printer.
The Max, Min and Avg function calculate the maximum, minimum or average values.
Other functions include: the relative measurement REL, the HOLD function, and the automatic turning off that can also be excluded.
The instruments have IP67 protection degree.

HD2101.2

HD2101/USB

INSTRUMENT TECHNICAL CHARACTERISTICS

Instrument

Dimensions (Length x Width x Height)	185x90x40mm
Weight	470g (complete with batteries)
Materials	ABS, rubber
Display	2x4½ digits plus symbols Visible area: 52x42mm

Operating conditions

Operating temperature	-5…50°C
Storage temperature	-25…65°C
Working relative humidity	0…90%RH without condensation
Protection degree	**IP67**

Power

Batteries	4 1.5V type AA batteries
Autonomy	200 hours with 1800mAh alkaline batteries
Power absorbed with instrument off	20µA
Mains	Output mains adapter 12Vdc / 1000mA

Measuring unit	*°C - °F - %RH - g/kg - g/m³ - hPa - J/g - Td Tw - DI - NET*
Security of stored data	Unlimited, independent of battery charge conditions

Time

Date and time	Schedule in real time
Accuracy	1min/month max drift

*Measured values storage - model **HD2101.2***

Type	2000 pages containing 19 samples each
Quantity	Total of 38000 samples
Storage interval	1s…3600s (1hour)

Serial interface RS232C

Type	RS232C electrically isolated
Baud rate	Can be set from 1200 to 38400 baud
Data bit	8
Parity	None
Stop bit	1
Flow Control	Xon/Xoff
Serial cable length	Max 15m
Immediate print interval	1s…3600s (1hour)

*USB interface - model **HD2101.2***

Type	1.1 - 2.0 electrically isolated

Connections

Input module for the probes	8-pole male DIN45326 connector
Serial interface and USB	8-pole MiniDin connector
Mains adapter	2-pole connector (positive at centre)

Measurement of relative humidity by Instrument

Measurement range	0…100%RH
Resolution	0.1%RH
Accuracy	±0.1%RH
Drift after 1 year	0.1%RH/year

Measurement of temperature by Instrument

Pt100 measurement range	-200…+650°C
Pt1000 measurement range	-200…+650°C
Resolution	0.1°C
Accuracy	±0.1°C
Drift after 1 year	0.1°C/year

Relative humidity and temperature probes using SICRAM module

Model	Temperature sensor	Working range		Accuracy	
		%RH	Temperature	%RH	Temp
HP472ACR	Pt100	0…100%RH	-20°C…+80°C	±1,5%RH (10…90%RH) ±2,5%RH (in the remaining range)	±0.3°C
HP572ACR	Thermocouple K	0…100%RH	-20°C…+80°C		±0.5°C
HP473ACR	Pt100	0…100%RH	-20°C…+80°C		±0.3°C
HP474ACR	Pt100	0…100%RH	-40°C…+150°C	-40°C…150°C (180°C) ±(1,5+0,02 times the displayed value)	±0.3°C
HP475ACR	Pt100	0…100%RH	-40°C…+150°C		±0.3°C
HP475AC1R	Pt100	0…100%RH	-40°C…+150°C		±0.3°C
HP477DCR	Pt100	0…100%RH	-40°C…+150°C		±0.3°C
HP478ACR	Pt100	0…100%RH	-40°C…+150°C		±0.3°C

Common characteristics
Relative humidity

Sensor	Capacitive
Typical capacity @30%RH	300pF±40pF
Sensor operating temperature (depending on model)	-20°C…+80°C -40°C…+150°C
Measuring range	0÷100%RH
Uncertainty	±1,5%RH (10…90%RH) ±2,5%RH in the remaining range)
Resolution	0.1%RH
Temperature drift @ 20°C	0.02%RH/°C
Response time %RH at constant temperature	10sec (10÷80%RH; air speed=2m/s)

Temperature with sensor Pt100

Resolution	0.1°C
Temperature drift @ 20°C	0.003%/°C

Temperature with thermocouple K - HP572AC

Resolution	0.1°C
Temperature drift @ 20°C	0.02%/°C

TECHNICAL DATA OF PROBES AND MODULES EQUIPPED WITH INSTRUMENT
Temperature probes Pt100 sensor with SICRAM module

Model	Type	App. range	Accuracy
TP472I	Immersion	-196°C…+500°C	±0.25°C (-196°C…+350°C) ±0.4°C (+350°C…+500°C)
TP472I.0	Immersion	-50°C…+400°C	±0.25°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP473P	Penetration	-50°C…+400°C	±0.25°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP473P.0	Penetration	-50°C…+400°C	±0.25°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP474C	Contact	-50°C…+400°C	±0.3°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP474C.0	Contact	-50°C…+400°C	±0.3°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP475A.0	Air	-50°C…+250°C	±0.3°C (-50°C…+250°C)
TP472I.5	Immersion	-50°C…+400°C	±0.3°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP472I.10	Immersion	-50°C…+400°C	±0.30°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP49A	Immersion	-70°C…+400°C	±0.25°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP49AC	Contact	-70°C…+400°C	±0.25°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP49AP	Penetration	-70°C…+400°C	±0.25°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP875	Globethermometer Ø 150mm	-30°C…+120°C	±0.25°C
TP876	Globethermometer Ø 50mm	-30°C…+120°C	±0.25°C
TP87	Immersion	-50°C…+200°C	±0.25°C
TP878 TP878.1	For solar panel	+5°C…+80°C	±0.25°C
TP879	For compost	-20°C…+120°C	±0.25°C

Common characteristics
Temperature drift @ 20°C 0.003%/°C

4 wire Pt100 and 2 wire Pt1000 Probes

Model	Type	Application range	Accuracy
TP47.100	Pt100 4 wires	-50…+400°C	Class A
TP47.1000	Pt1000 2 wires	-50…+400°C	Class A

Common characteristics

Temperature drift @ 20°C	
Pt100	0.003%/°C
Pt1000	0.005%/°C

ORDER CODES

HD2101.1: The kit is composed of the instrument HD2101.1, 4 1.5V alkaline batteries, operating manual, case and DeltaLog9 software. **Probes and cable must be ordered separately.**

HD2101.2K: The kit is composed of the HD2101.2 **datalogger,** 4 1.5V alkaline batteries, operating manual, case and DeltaLog9 software. **The probes and cable must be ordered separately.**
HD2110CSNM: 8-pole connection cable MiniDin - Sub D 9-pole female for RS232C.
HD2101/USB: Connection cable USB 2.0 connector type A - 8-pole MiniDin.
DeltaLog9: Software for download and management of the data on PC using Windows 98 to Vista operating systems.
SWD10: Stabilized power supply at 230Vac/12Vdc-1000mA mains voltage.
HD40.1: On request, portable, serial input, 24 column thermal printer, 58mm paper width.

Relative humidity and temperature probes complete with SICRAM module

HP472ACR: %RH and temperature combined probe, dimensions Ø 26x170 mm. 2 m connecting cable.
HP572ACR: %RH and temperature combined probe, **K thermocouple sensor**. Dimensions Ø 26x170 mm. 2 m connecting cable.
HP473ACR: %RH and temperature combined probe. Dimensions: handle Ø 26x130 mm, probe Ø 14x110 mm. 2m connecting cable.
HP474ACR: %RH and temperature combined probe. Dimensions: handle Ø 26x130 mm, probe Ø 14x210 mm. 2m connecting cable.
HP475ACR: %RH and temperature combined probe. 2 m connecting cable. Handle Ø 26x110 mm. Stainless-steel tube Ø 12x560 mm. Terminal tip Ø 13.5x75 mm.
HP475AC1R: %RH and temperature combined probe. 2 m connection cable. Handle Ø 26x110 mm. Stainless steel stem Ø 14x480 mm.
HP477DCR: %RH and temperature combined sword probe. 2 m connecting cable. Handle Ø 26x110 mm. Probe tube 18x4 mm, length 520 mm.
HP478ACR: %RH and temperature combined probe. Dimensions Ø 14x130 mm. 5m connection cable.

Temperature PROBES complete with SICRAM module

TP472I: Immersion probe, Pt100 sensor. Stem Ø 3 mm, length 300 mm. Cable length 2 metres.
TP472I.0: Immersion probe, Pt100 sensor. Stem Ø 3 mm, length 230 mm. Cable length 2 metres.
TP473P: Penetration probe, Pt100 sensor. Stem Ø 4mm, length 150 mm. Cable length 2 metres.
TP473P.0: Penetration probe, Pt100 sensor. Stem Ø 4mm, length 150 mm. Cable length 2 metres.
TP474C: Contact probe, Pt100 sensor. Stem Ø 4mm, length 230mm, contact surface Ø 5mm. Cable length 2 metres.
TP474C.0: Contact probe, Pt100 sensor. Stem Ø 4mm, length 230mm, contact surface Ø 5mm. Cable length 2 metres.
TP475A.0: Air probe, Pt100 sensor. Stem Ø 4mm, length 230mm. Cable length 2 metres.
TP472I.5: Immersion probe, Pt100 sensor. Stem Ø 6mm, length 500 mm. Cable length 2 metres.
TP472I.10: Immersion probe, Pt100 sensor. Stem Ø 6mm, length 1000mm. Cable length 2 metres.
TP875: Globe thermometer Ø 150mm with handle, cable length 2 metres.
TP876: Globe thermometer Ø 50mm with handle. Cable 2 metres.
TP87: Immersion probe, Pt100sensor. Stem Ø 3mm, length 70mm. Cable 2 metres.
TP878: Contact probe for solar panels. Cable 2 metres
TP878.1: Contact probe for solar panels. Cable 5 metres.

Temperature probes without SICRAM module

TP47.100: 4 wire direct Pt100 sensor immersion probe,. Probe's stem Ø 3mm, length 230mm. Connection cable 4 wires with connector, length 2 metres.
TP47.1000: Pt1000 sensor immersion probe. Probe's stem Ø 3mm, length 230mm. Connection cable 2 wires with connector, length 2 metres.
TP47: Only connector for probe connection: direct 4 wires Pt100 and 2 wires Pt1000.

Accessories

HD11: Saturated solution at 11.3%RH@20°C for calibration of relative humidity probes, fixing adapter M24x1.5, M12x1.
HD33: Saturated solution at 33.0%RH@20°C for calibration of relative humidity probes, fixing adapter M24x1.5, M12x1.
HD75: Saturated solution at 75.4%RH@20°C for calibration of relative humidity probes, fixing adapter M24x1.5, M12x1.

Protection for humidity probes Ø 26 M24x1,5
P1: Stainless steel grid protection for probes Ø 26 mm.
P2: 20µ sintered polyethylene PE protection for probes Ø 26 mm.
P3: 20µ sintered bronze protection for probes Ø 26 mm.
P4: 20µ sintered PE complete cap for probes Ø 26 mm.

Protection for humidity probes Ø 14 M12x1
P5: Stainless steel grid protection for probes Ø 14 mm.
P6: 20µm sintered complete protection made of stainless steel for probes Ø 14 mm.
P7: 10µm sintered complete protection made of PTFE for probes Ø 14 mm.
P8: Stainless steel grid and Pocan protection for probes Ø 14 mm.

HD2301.0
HYGRO-THERMOMETER

The **HD2301.0** is a portable instrument with a large LCD display. It measures relative humidity and temperature using a Pt100 sensor or thermocouple humidity/temperature combined probe. Temperature only is measured by immersion, penetration or contact probes. The sensor can be a Pt100 or Pt1000.
When the humidity/temperature combined probe is connected, the instrument calculates and displays the absolute humidity, the dew point, the partial vapour pressure. The probes are fitted with an automatic detection module, with the factory calibration data already stored inside. The Max, Min and Avg function calculate the maximum, minimum or average values. Other functions include: the relative measurement REL, the HOLD function, and the automatic turning off that can also be excluded. **The instruments have IP67 protection degree.**

INSTRUMENT TECHNICAL CHARACTERISTICS

Instrument

Dimensions (Length x Width x Height)	140x88x38mm
Weight	160g (complete with batteries)
Materials	ABS
Display	2x4½ digits plus symbols Visible area: 52x42mm

Operating conditions

Operating temperature	-5…50°C
Storage temperature	-25…65°C
Working relative humidity	0…90%RH without condensation
Protection degree	**IP67**

Power

Batteries	3 1.5V type AA batteries
Autonomy	200 hours with 1800mAh alkaline batteries
Power absorbed with instrument off	< 20µA

Measuring unit — *°C - °F - %RH - g/m³ - Td - hPa*

Connections

Input module for the probes	8-pole male DIN45326 connector

Measurement of relative humidity by Instrument

Measurement range	0…100%RH
Resolution	0.1%RH
Accuracy	±0.1%RH
Drift after 1 year	0.1%RH/year

Measurement of temperature by Instrument

Pt100 measurement range	-200…+650°C
Pt1000 measurement range	-200…+650°C
Resolution	0.1°C
Accuracy	±0.1°C
Drift after 1 year	0.1°C/year

Relative humidity and temperature probes using SICRAM module

Model	Temperature sensor	Working range		Accuracy	
		%RH	Temperature	%RH	Temp
HP472ACR	Pt100	0…100%RH	-20°C…+80°C	±1,5%RH (10…90%RH) ±2,5%RH (in the remaining range)	±0.3°C
HP572ACR	Thermocouple K	0…100%RH	-20°C…+80°C		±0.5°C
HP473ACR	Pt100	0…100%RH	-20°C…+80°C		±0.3°C
HP474ACR	Pt100	0…100%RH	-40°C…+150°C	-40°C…150°C (180°C) ±(1,5+0,02 times the displayed value)	±0.3°C
HP475ACR	Pt100	0…100%RH	-40°C…+150°C		±0.3°C
HP475AC1R	Pt100	0…100%RH	-40°C…+150°C		±0.3°C
HP477DCR	Pt100	0…100%RH	-40°C…+150°C		±0.3°C
HP478ACR	Pt100	0…100%RH	-40°C…+150°C		±0.3°C

Common characteristics
Relative humidity

Sensor	Capacitive
Typical capacity @30%RH	300pF±40pF
Sensor operating temperature (depending on model)	-20°C…+80°C -40°C…+150°C
Measuring range	0÷100%RH
Uncertainty	±1,5%RH (10…90%RH) ±2,5%RH in the remaining range)
Resolution	0.1%RH
Temperature drift @ 20°C	0.02%RH/°C
Response time %RH at constant temperature	10sec (10÷80%RH; air speed=2m/s)

Temperature with sensor Pt100

Resolution	0.1°C
Temperature drift @ 20°C	0.003%/°C

Temperature with thermocouple K - HP572ACR

Resolution	0.1°C
Temperature drift @ 20°C	0.02%/°C

TECHNICAL DATA OF PROBES AND MODULES EQUIPPED WITH INSTRUMENT
Temperature probes Pt100 sensor with SICRAM module

Model	Type	App. range	Accuracy
TP472I	Immersion	-196°C…+500°C	±0.25°C (-196°C…+350°C) ±0.4°C (+350°C…+500°C)
TP472I.0	Immersion	-50°C…+400°C	±0.25°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP473P	Penetration	-50°C…+400°C	±0.25°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP473P.0	Penetration	-50°C…+400°C	±0.25°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP474C	Contact	-50°C…+400°C	±0.3°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP474C.0	Contact	-50°C…+400°C	±0.3°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP475A.0	Air	-50°C…+250°C	±0.3°C (-50°C…+250°C)
TP472I.5	Immersion	-50°C…+400°C	±0.3°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP472I.10	Immersion	-50°C…+400°C	±0.30°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP49A	Immersion	-70°C…+400°C	±0.25°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP49AC	Contact	-70°C…+400°C	±0.25°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP49AP	Penetration	-70°C…+400°C	±0.25°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP875	Globethermometer Ø 150mm	-30°C…+120°C	±0.25°C
TP876	Globethermometer Ø 50mm	-30°C…+120°C	±0.25°C
TP87	Immersion	-50°C…+200°C	±0.25°C
TP878 TP878.1	For solar panel	+5°C…+80°C	±0.25°C
TP879	For compost	-20°C…+120°C	±0.25°C

Common characteristics

Temperature drift @ 20°C	0.003%/°C

4 wire Pt100 and 2 wire Pt1000 Probes

Model	Type	Application range	Accuracy
TP47.100	Pt100 4 wires	-50…+400°C	Class A
TP47.1000	Pt1000 2 wires	-50…+400°C	Class A

Common characteristics
Temperature drift @ 20°C
Pt100 0.003%/°C
Pt1000 0.005%/°C

ORDER CODES
HD2301.0: The kit is composed of the instrument HD2301.0, 3 1.5V alkaline batteries, operating manual, case. **Probes and cable must be ordered separately.**

Relative humidity and temperature probes complete with SICRAM module
HP472ACR: %RH and temperature combined probe, dimensions Ø 26x170 mm. 2 m connecting cable.
HP572ACR: %RH and temperature combined probe, **K thermocouple sensor**. Dimensions Ø 26x170 mm. 2 m connecting cable.
HP473ACR: %RH and temperature combined probe. Dimensions: handle Ø 26x130 mm, probe Ø 14x110 mm. 2m connecting cable.
HP474ACR: %RH and temperature combined probe. Dimensions: handle Ø 26x130 mm, probe Ø 14x210 mm. 2m connecting cable.
HP475ACR: %RH and temperature combined probe. 2 m connecting cable. Handle Ø 26x110 mm. Stainless-steel tube Ø 12x560 mm. Terminal tip Ø 13.5x75 mm.
HP475AC1R: %RH and temperature combined probe. 2 m connection cable. Handle Ø 26x110 mm. Stainless steel stern Ø 14x480 mm.
HP477DCR: %RH and temperature combined sword probe. 2 m connecting cable. Handle Ø 26x110 mm. Probe tube 18x4 mm, length 520 mm.
HP478ACR: %RH and temperature combined probe. Dimensions Ø 14x130 mm. 5m connection cable.

Temperature PROBES complete with SICRAM module
TP472I: Immersion probe, Pt100 sensor. Stem Ø 3 mm, length 300 mm. Cable length 2 metres.
TP472I.0: Immersion probe, Pt100 sensor. Stem Ø 3 mm, length 230 mm. Cable length 2 metres.
TP473P: Penetration probe, Pt100 sensor. Stem Ø 4mm, length 150 mm. Cable length 2 metres.
TP473P.0: Penetration probe, Pt100 sensor. Stem Ø 4mm, length 150 mm. Cable length 2 metres.
TP474C: Contact probe, Pt100 sensor. Stem Ø 4mm, length 230mm, contact surface Ø 5mm. Cable length 2 metres.
TP474C.0: Contact probe, Pt100 sensor. Stem Ø 4mm, length 230mm, contact surface Ø 5mm. Cable length 2 metres.
TP475A.0: Air probe, Pt100 sensor. Stem Ø 4mm, length 230mm. Cable length 2 metres.
TP472I.5: Immersion probe, Pt100 sensor. Stem Ø 6mm, length 500 mm. Cable length 2 metres.
TP472I.10: Immersion probe, Pt100 sensor. Stem Ø 6mm, length 1000mm. Cable length 2 metres.
TP875: Globe thermometer Ø 150mm with handle, cable length 2 metres.
TP876: Globe thermometer Ø 50mm with handle. Cable 2 metres.
TP87: Immersion probe, Pt100sensor. Stem Ø 3mm, length 70mm. Cable 2 metres.
TP878: Contact probe for solar panels. Cable 2 metres
TP878.1: Contact probe for solar panels. Cable 5 metres.

Temperature probes without SICRAM module
TP47.100: 4 wire direct Pt100 sensor immersion probe,. Probe's stem Ø 3mm, length 230mm. Connection cable 4 wires with connector, length 2 metres.
TP47.1000: Pt1000 sensor immersion probe. Probe's stem Ø 3mm, length 230mm. Connection cable 2 wires with connector, length 2 metres.
TP47: Only connector for probe connection: direct 4 wires Pt100 and 2 wires Pt1000.

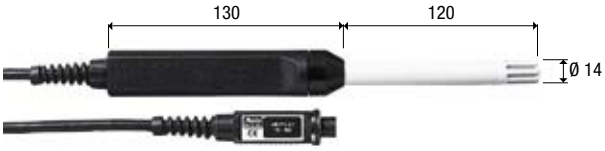
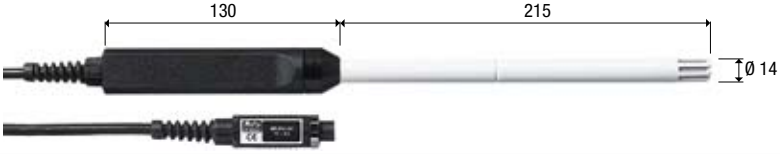
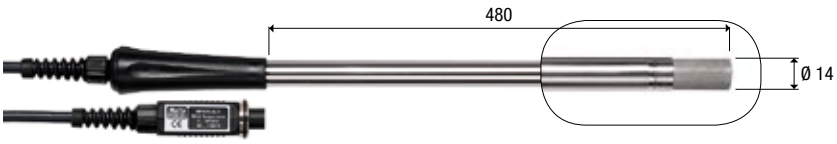
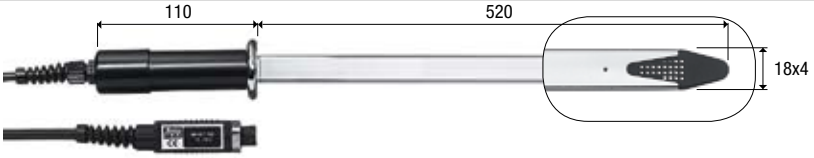
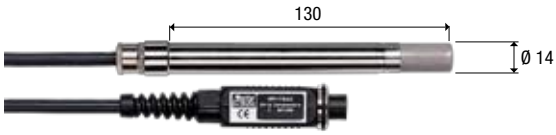
Accessories
HD11: Saturated solution at 11.3%RH@20°C for calibration of relative humidity probes, fixing adapter M24x1.5, M12x1.
HD33: Saturated solution at 33.0%RH@20°C for calibration of relative humidity probes, fixing adapter M24x1.5, M12x1.
HD75: Saturated solution at 75.4%RH@20°C for calibration of relative humidity probes, fixing adapter M24x1.5, M12x1.

Protection for humidity probes Ø 26 M24x1,5
P1: Stainless steel grid protection for probes Ø 26 mm.
P2: 20µ sintered polyethylene PE protection for probes Ø 26 mm.
P3: 20µ sintered bronze protection for probes Ø 26 mm.
P4: 20µ sintered PE complete cap for probes Ø 26 mm.

Protection for humidity probes Ø 14 M12x1
P5: Stainless steel grid protection for probes Ø 14 mm.
P6: 20µm sintered complete protection made of stainless steel for probes Ø 14 mm.
P7: 10µm sintered complete protection made of PTFE for probes Ø 14 mm.
P8: Stainless steel grid and Pocan protection for probes Ø 14 mm.

HD11 / HD33 / HD75

RELATIVE HUMIDITY AND TEMPERATURE PROBES

Code	Sensors	Range RH - Temp.	
HP472ACR	RH Pt100	5 ÷ 98% RH -20°C…+80°C	
HP572ACR	RH TC.K		
HP473ACR	RH Pt100		
HP474ACR		5 ÷ 98% RH -40°C…+150°C	
HP475ACR			
HP475AC1R			
HP477DCR			
HP478ACR			

SATURATED SOLUTIONS AND PROBE PROTECTIONS

CODE			USE
HD75 HD33 HD11	**Threaded ring nut M24 x 1,5 for probes Ø 26 Threaded ring nut M12 x 1 for probes Ø 14**		
P1 P2 P3 P4	Ø 26	M 24x1,5	**P1** **P2** **P3** **P4**
P5 P6 P7 P8	Ø 14	M 12x1	**P5** **P6** **P7** **P8**

HD 75
HD 33
HD 11

HD 75, HD 33, HD 11
HOW TO USE SATURATED SALT SOLUTIONS FOR CHECKING, SETTING UP OR CALIBRATING INSTRUMENTS WITH RELATIVE HUMIDITY SENSORS.

Before starting.

1. Make sure that inside the chamber containing the saturated salt solutions there are at the same time:
   • solid salt
   • liquid solution or wet salt
2. The instrument and the saturated solutions to be used are to be kept in an environment at stable temperature while checking or calibrating them.
3. Wait for at least a couple of hours at stable temperature so that the instrument and the salt solutions reach thermal equilibrium with the environment.
4. Unscrew the cap of the first saturated salt solution to be used for checking or calibrating the instrument. Use:
   • for probes with thread M24X1,5, the bottle threaded hole M24X1,5 directly;
   • for probes with thread M12X1, the supplied adapter M24X1,5 / M12X1.
5. If there is any liquid inside the measurement chamber, dry it with clean absorbent paper. The uncertainty of the solution or measurement is not influenced by any liquid left inside the measurement chamber.
6. Screw the probe to the bottom of the thread; do not touch the sensitive element with your hands or any other object or liquid.
7. The temperature of the salt solution and that of the sensor must be the same or very close. Once the sensor is inserted, wait for at least 30 minutes.
8. Connect the probe to the instrument or transmitter. Power or turn them on as per instructions.
9. After 30 minutes, start the calibration procedure for the first calibration point according to the instruction manual of the specific instrument.
10. Once you have checked, set up or calibrated the first point, take the probe out of the bottle and put the cap back on the bottle. Make sure you do not mix it up with that of other saturated solutions.
11. Repeat points 1, 2, 3 and 4 to perform the second calibration point with the second saturated solution.
12. Repeat points 1, 2, 3 and 4 to perform a possible third point with the third saturated solution (if necessary).

Notes and warnings:

I. Keep salt solutions in the dark at a temperature of about 20°C.
II. Salt solutions are effective and can be used as long as there is salt to be melted as well as liquid inside them. As a rule, in 33% RH and 11%RH solutions make sure that there is some solid salt left, while in 75%RH solution make sure that there is some liquid left or salt is wet.
III. For better results, the temperature of the probe and that of the saturated solution must be as close as possibile. Do not forget that plastic materials are bad conductors of heat. Any difference of tenths of degree between the sensor and the saturated salt solution leads to errors of RH points.
IV. Do not touch the sensitive element with your hands or other objects . Scratches and dirt alter the instrument measurement and may damage the sensor.
V. The measurement chamber must be closed, otherwise the equilibrium cannot be reached.
   Screw the probe to the bottom of the bottle thread.
VI. The check or calibration sequence for Delta Ohm instruments or transmitters is always as follows:
   first solution: 75% RH
   second solution: 33%RH
   third solution: 11% RH (if any)
   No sequence is compulsory for checking the sensor.
VII. To calibrate or set up the instrument, follow the instruction manual of the instrument that you are using.
VIII. If you check, set up or calibrate the instrument at a temperature of other than 20°C, see the following table to find out the equilibrium relative humidity reference value of the salt solution corresponding to the working temperature. In this table, you will find the saturated salt relative humidity variation when temperature changes.

Equilibrium relative humidity of selected saturated salt solutions from 0 to 100°C

Temp. °C	Lithium Chloride	Magnesium Chloride	Sodium Chloride
0	11.23 ± 0.54	33.66 ± 0.33	75.51 ± 0.34
5	11.26 ± 0.47	33.60 ± 0.28	75.65 ± 0.27
10	11.29 ± 0.41	33.47 ±0.24	75.67 ± 0.22
15	11.30 ± 0.35	33.30 ± 0.21	75.61 ± 0.18
20	11.31 ± 0.31	33.07 ± 0.18	75.47 ± 0.14
25	11.30 ± 0.27	32.78 ± 0.16	75.29 ± 0.12
30	11.28 ± 0.24	32.44 ± 0.14	75.09 ± 0.11
35	11.25 ± 0.22	32.05 ± 0.13	74.87 ± 0.12
40	11.21 ± 0.21	31.60 ± 0.13	74.68 ± 0.13
45	11.16 ± 0.21	31.10 ± 0.13	74.52 ± 0.16
50	11.10 ± 0.22	30.54 ± 0.14	74.43 ± 0.19
55	11.03 ± 0.23	29.93 ± 0.16	74.41 ± 0.24
60	10.95 ± 0.26	29.26 ± 0.18	74.50 ± 0.30
65	10.86 ± 0.29	28.54 ± 0.21	74.71 ± 0.37
70	10.75 ± 0.33	27.77 ± 0.25	75.06 ± 0.45
75	10.64 ± 0.38	26.94 ± 0.29	75.58 ± 0.55
80	10.51 ± 0.44	26.05 ± 0.34	76.29 ± 0.65
85	10.38 ± 0.51	25.11 ± 0.39	
90	10.23 ± 0.59	24.12 ± 0.46	
95	10.07 ± 0.67	23.07 ± 0.52	
100	9.90 ± 0.77	21.97 ± 0.60	

1

2

3

4

1

2

3

4

5

6

7

HUMISET HD33
MAGNESIUM CHLORIDE
HUMISET HD11
LITHIUM CHLORIDE
HUMISET HD75
SODIUM CHLORIDE
HUMISET HD33
MAGNESIUM CHLORIDE

HD 37AB17D
HD 37B17D

HD 37AB17D, HD 37B17D
DATALOGGER
RELATIVE HUMIDITY - TEMPERATURE - CO - CO_2

HD37AB17D and **HD37B17D** instrument are **data loggers** able to measure and memorize simultaneously the following parameters:
- Relative Humidity **RH**
- Environment temperature **T**
- Carbon monoxide **CO** (**only HD37AB17D**)
- Carbon dioxide **CO_2**

HD37AB17D and **HD37B17D** instruments have the ability to investigate and monitor the indoor air quality.
Typical applications include checking air quality inside buildings occupied by people (schools, hospitals, auditoria, canteens, etc.); and work places to optimize the comfort and to generally check for small leaks of CO with danger of explosions or fire. This analysis allows the management of conditioning plants (temperature and humidity) and ventilation (recycle air/hour) in order to reach a double purpose: getting a good quality of the air in accordance with ASHRAE and IMC regulations and energy saving.
HD37AB17D and **HD37B17D** are instruments which are very useful to fight the so-called syndrome of sick building.
RH (Relative Humidity) measurement is obtained with a capacitive sensor.
T temperature is measured with a high precision NTC sensor.
The **CO** measurement (Carbon monoxide, only for **HD37AB17D**) is made by an electrochemical cell with two electrodes indicated to detect the presence of Carbon monoxide, lethal for men, in his living or working environment.
The **CO_2** measurement (Carbon dioxide) is obtained with a special infrared sensor (NDIR technology: Non-Dispersive Infrared Technology) that, thanks to the use of double filter and a special measurement techniques, guarantees accurate and stable measurements over time. The infrared sensor is equipped with a protection membrane which provides protection from dust particles and aggressive air agents to assure the sensor's long life.
HD37AB17D and **HD37B17D** are **data loggers** able to memorize the detected measurements at an interval set by the user.
HD37AB17D and **HD37B17D** are connected to the PC by ***USB*** input.
DeltaLog13 communication **software** via the USB port , designed to perform data transfer, data collection and recording and printing of all the instrument parameters and stored measurements. In addition the software allows the calibration adjustments of the RH, CO (only HD37B17D) and CO_2 sensors.

Using appropriate procedure, the Software DeltaLog13 can evaluate the parameter **% OA** (percentage of external air), according to the following formula:.

$$\%OA = \frac{X_r - X_s}{X_r - X_0} \cdot 100$$

whereas:
X_r = CO_2 in return air
X_s = CO_2 in the outlet air
X_0 = CO_2 in the external air

The power supply of the instrument is provided by a 2 Ni-MH **rechargeable** batteries package (code BAT-20), that that allows 8 hours of continuous working in acquisition mode.

Technical Features

Dimensions	275 mm x 45 mm x 40 mm
Weight	230 g (batteries included)
Materials	ABS
Mains power supply **(code SWD06)**	Batteries charger **100-240Vac/6Vdc-1A**
Batteries	Package with 2 rechargeable batteries 1.2V type AA (NiMH)
Autonomy	8 hours of continuous working in measurement mode
Current absorbed with instrument off	200µA
Instrument working temperature	0°C ... 50°C
Working relative humidity	0%RH ... 95%RH no condensation
Temperature / Storage humidity	-25°C ... +70°C / 10%RH ... 90%RH no condensation
Safety of the stored data	Unlimited

Connections

USB interface	USB 2.0 cable B type Baudrate 460800
Charger Batteries power supply (code SWD06)	2 - poles connector (positive at the centre) Output voltage: **6Vdc** Maximum current: 1600mA (9, 60 VA Max).
Measuring rate	1 sample every three seconds
Storage capacity	20000 Records Every record includes the following: - date and time - measurement of the carbon dioxide (CO2) - measurement of the carbon monoxide (CO- only HD37AB17D) - measurement of the relative humidity (RH) - measurement of the temperature (T)

Logging interval	selectable within: 3,6,12,15,30,60 seconds, 2,3,4,5 minutes The stored values represent the average value of the samples that are stored every three seconds.
Printing interval	selectable within: 3,6,12,15,30,60 seconds, 2,3,4,5 minutes The printed values represent the average value of the samples that are stored every three seconds.

Sensor Features

Relative Humidity RH	Capacitive sensor
Sensor protection	Net filter made of stainless steel (on request filter P6 in AISI316 sintered 20µm or filter P7 in PTFE sintered 10µm)
Measurement range	0...100 % RH
Sensor working range	-40...+80°C
Accuracy	±2% (5÷90%RH) ±2,5% in the remaining range
Resolution	0,1%
Thermal effects	±2% on whole temperature range
Hysteresis and repeatability	1% RH
Response time (T_{90})	< 20 sec. (air speed = 2m/sec) without filter
Long term stability	1%/year

Temperature T

Sensor type	NTC 10KΩ
Measurement range	-40...+60°C
Accuracy	±0.2°C ±0.15% of the measure
Resolution	0,1°C
Response time (T_{90})	< 30 sec. (air speed = 2m/sec)
Long term stability	0.1°C/year

Carbon monoxide CO (only HD37AB17D)

Sensor	Electro chemical cell
Measurement range	0…500ppm
Sensor working range	-5…50°C
Accuracy	±3ppm+3% of the measured value
Resolution	1ppm
Response time (T_{90})	< 50 sec.
Long term stability	5% of the measure/year
Expected life	> 5 years in normal environmental conditions

Carbon dioxide CO_2

Sensor	NDIR with a double wave length
Measurement range	0…5000 ppm
Sensor working range	-5…50°C
Accuracy	±50ppm+3% of the measurement
Resolution	1ppm
Thermal effects	0,1%f.s./°C
Response time (T_{90})	< 120 sec. (air speed = 2m/sec)
Long term stability	5% of the measure/ 5 years

Ordering codes

HD37AB17D: The kit consisting of: **HD37AB17D** instrument to measure CO (Carbon monoxide), CO_2 (Carbon dioxide), RH (Relative Humidity), T (Temperature), **DeltaLog13** Software, USB cable code **CP22**, **SWD06** power supply, **BAT-2** batteries pack, instruction manual, carrying case.

HD37B17D: instrument to measure CO_2 (Carbon dioxide), CO (Carbon monoxide), RH (Relative Humidity), T (Temperature), **DeltaLog13** Software, USB cable code **CP22**, **SWD06** power supply, **BAT-2** batteries pack, instruction manual, carrying case.

Accessories:

VTRAP20: Instrument tripod, maximum height 270mm.

SWD06: 100-240Vac/6Vdc-1A mains voltage power supply.

BAT-20: Replacement batteries pack for HD37AB17D and HD37B17D instruments with integrated temperature sensor.

P5: Stainless steel grid protection for probes diameter 14, thread M12×1.

P6: Sintered stainless steel 10µ grid protection, for probes diameter 14, thread M12×1.

P7: 10µ, PTFE protection for probes diameter 14, thread M12×1.

P8: Stainless steel and Pocan protection for probes diameter 14, thread M12×1.

HD75: Saturated solution for testing the Relative Humidity with 75% HR, complete with adapter for probes diameter 14, thread M12×1.

HD33: Saturated solution for testing the Relative Humidity with 33% HR, complete with adapter for probes diameter 14, thread M12×1.

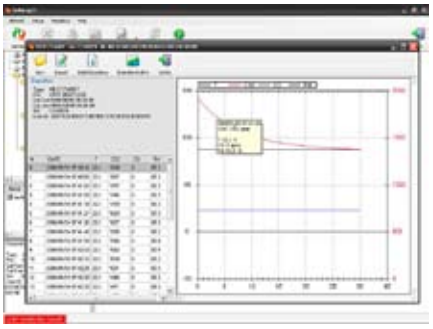
MINICAN.12A: Cylinder of nitrogen for the calibration of CO and CO_2 at 0ppm. Volume 12 litres. **With adjustment valve**.

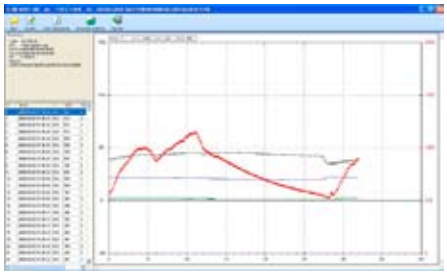
MINICAN.12A1: Cylinder of nitrogen for the calibration of CO and CO_2 at 0ppm. Volume 12 litres. **Without adjustment valve**.

ECO-SURE-2E CO: Spare CO sensor.

HD37.36: Kit connection pipe between instrument and MINICAN.12A for the calibration of CO.

HD37.37: Kit connection pipe between instrument and MINICAN.12A for the calibration of CO_2.





HD 40.1
HD 40.2

HD 40.1, HD 40.2
PORTABLE THERMAL PRINTER

The **HD40.1** and **HD40.2** are lightweight, compact, portable thermal printers.
The HD40.1 is connected to instruments or PC through the RS232 serial input.
The HD40.2 features a dual mode data reception system - RS232 serial and Bluetooth.
The Bluetooth wireless connection makes the HD40.2 printer very useful "in the field", since it does not require any connection to the instrument. A careful design allows you to replace the thermal paper roll in a few seconds. A four NiMH **rechargeable** battery pack provides power supply and ensures long autonomy: you can print up to 3000 lines at full charge.
Standard thermal paper roll width: 57mm.
Print resolution: 203 dpi
Print characters (each line): 24
Protection degree: IP40.

SPECIFICATIONS

Printing method	Thermal
Resolution	203 DPI (8 dot/mm)
Printing width	48mm centered in the paper roll
Paper roll width	57mm ... 58mm
Max. paper roll diameter	32mm
Number of columns	24
Printing speed	Up to 90 mm/sec (depending on battery charge and ambient conditions)
Sensors	Paper detection
Character set	IBM II 858 table
Printing formats	Normal or extended
Character font	1 (16 x 24 dot – 2mm x 3mm)
Thermal head durability	
Mechanism life	100 million pulses (temperature: 20...25°C)
Abrasion resistance	50km of paper (temperature: 20...25°C)
Cover group durability	2000 opening/closing cycles or more
Communication interfaces	RS232
Bluetooth (for HD40.2)	
RS232 Baud rate	9600, 19200 and 38400 baud (**the factory parameter is 38400 baud**)
Bluetooth Baud rate	38400 baud (for HD40.2)
Bluetooth operating distance	Up to 10m without hindrance (for HD40.2)
Mains power supply (cod. SWD10)	100-240Vac/12Vdc-1A mains battery charger
Batteries	Four 1.2V AA rechargeable batteries (NiMH)
Printing autonomy	3000 lines 24 characters each. It prints one line every 10 seconds
Switch-off function	0, 5, 10 or 15 minutes
Dimensions	105mm x 165mm x 53mm
Weight	380g (with batteries and paper roll)
Material	ABS

OPERATING CONDITIONS

Operating temperature	0°C ... 50°C
Operating relative humidity	20%RH ... 85%RH not condensing
Storage Temperature / Relative humidity	-25°C ... +70°C / 10%RH ... 90%RH not condensing
Protection degree	IP40

Connections

Serial interface	9-pole D sub male connector
Battery charger power supply (cod. SWD10)	2-pole connector (positive in the middle)

ORDERING CODES

HD40.1: The kit includes: 24-column portable thermal printer, **serial interface RS232**, 57mm paper width, four NiMH 1.2V rechargeable batteries, SWD10 power supply, instruction manual, 5 thermal paper rolls.

HD40.2: The kit includes: 24-column portable thermal printer, **Bluetooth and serial interface RS232**, 57mm paper width, four NiMH 1.2V rechargeable batteries, SWD10 power supply, instruction manual, 5 thermal paper rolls.

The serial cable for PC/instrument connection must be ordered separately.

HD2110CSNM: RS232C 8-pole MiniDin - 9-pole D Sub female null-modem cable for connecting the printer to instruments with MiniDIN connector (HD21xx.1 and HD21xx.2 series, HD34xx.2, HD2010, HD2110, etc.).

9CPRS232: RS232C 9-pole D Sub female null-modem cable for connecting the printer to instrument with 9-pole D Sub connectors (Delta Ohm instruments: HD22xx.2 series, HD98569, HD25.2, etc.).

SWD10: 100-240Vac/12Vdc-1A Mains battery charger.

BAT.40: Spare battery pack for HD40.1 and HD40.2 printers with in-built temperature sensor.

RCT: The kit includes 4 thermal paper rolls 57mm wide and 32mm diameter.

HD 45…
HD 46…

HD45… AND HD46… SERIES
TRANSMITTERS AND REGULATORS FOR HUMIDITY, TEMPERATURE AND CO_2

The instruments of the series **HD45** and **HD46** are transmitters, indicators and controllers, they measure and control, depending on the model, the following environmental parameters:
- Relative humidity (RH)
- Ambient temperature (T)
- Carbon dioxide (CO_2)
- Dew point temperature (DP, calculated measurement)

They are suitable for monitoring the air quality in indoor environments.
Typical applications include checking air quality in all buildings occupied by people (schools, hospitals, auditoria, work places, canteens, etc.).. This analysis allows the managing of conditioning plants (temperature and humidity) and ventilation (recycle air/hour) in order to reach a double purpose: getting a good air quality in accordance with ASHRAE and IMC regulations and energy saving.
The measurement of RH (Relative Humidity) is obtained with a capacitive sensor. In models **HD46** ... the relative humidity and temperature sensor with their calibration data are contained within an easily replaceable module. The instrument can also calculate the information on the dew point.
The temperature T is measured with a high precision NTC sensor.
The measurement of CO_2 (carbon dioxide) is obtained with a special infrared sensor (**NDIR** technology: Non-Dispersive Infrared Technology), which, thanks to a double filter and a particular measurement technique, ensures accurate measurements and stable measurements over time. The infrared sensor is equipped with a protection membrane which provides protection from dust particles and aggressive air agents to assure the sensor's long life. The instrument can be wall mounted and sensors are all inside.
The instruments are factory calibrated and require no further adjustment by the installer.
Versions are available with analog voltage output 0÷10V or connectable to a PC via RS485 with **MODBUS RTU** protocol, which allows connection of multiple transmitters on the same network.
The versions with **relay** allow to monitor the measured environmental parameters when the user-settable thresholds are exceeded. The activation of the control is highlighted by the LED indicators (only on models HD46 ... R). The operation of the relay is very versatile, having modes of activation above and below the threshold, and with single or double threshold modes. The thresholds are configurable by the user throughout the whole measurement range.
The LCD display option allows instant viewing of all the measurements taken by the instrument.
The model **HD45 BVR** is distinguished by the ability to indicate an immediate level of air quality, through turning on of the LED indicators associated with graphic symbols.
All the functions of the instrument can be quickly and intuitively configured connecting the instrument to the PC.
The instruments are easy to use, with complete configuration possibilities, which makes them versatile and able to meet many needs in various application fields. The instruments come with a standard configuration that makes them immediately operational. Upon request, the devices can be supplied with custom configurations.
HD46 Series models can be equipped with keyboard that allows you to easily configure the instrument even without a connection to a PC. The models having a keypad are fitted with backlit display, activated by pushing a button.
Models of the series **HD45** ... provided with relay have a hardware switch that allows quick selection of the threshold between a set of preset values.
All models perform continuous "logging" of the measures, and data can be transferred to the PC.
The instruments work with 24Vac or 15…35Vdc power supply.

Technical data
Characteristics of the sensors

Relative humidity RH *(for models HD45 17…, HD46 17… and HD46 17B…)*	
Sensor	Capacitive
Measuring range	5...98 % RH -40…+85°C Dew point Td
Working range of the sensor	-40...+80°C
Accuracy	±2% (10..90%RH) @ 20°C, ±2.5% in the remaining range. For Dew point, see table
Resolution	0,1%
Temperature dependance	2% on the whole temperature range
Hysteresis and repeatability	1%RH
Response time (T_{90})	<20 sec. (air speed = 2m/sec and stable temperature)
Long-term stability	1%/year

Temperature T *(for models HD45 17…, HD45 7B…, HD46 17… and HD46 17B…)*	
Sensor type	NTC 10KΩ
Measuring range	-30...+85°C (-22…+185°F)
Accuracy	±0.2°C ±0.15% of the measured value within 0…70°C ±0.3°C ±0.15% of the measured value within -30…0°C and 70…85°C
Resolution	0,1°C
Response time (T_{90})	<30 sec. (air speed = 2m/sec)
Long-term stability	0.1°C/year

Carbon dioxide CO_2 *(for models HD45 7B…, HD45 B…and HD46 17B…)*	
Sensor	Dual wavelength NDIR
Measuring range	0…5000 ppm
Working range of the sensor	-5…50°C
Accuracy	±(50ppm+3% of the measured value) @ 20°C and 1013hPa
Resolution	1ppm
Temperature dependance	0,1%f.s./°C
Response time (T_{90})	<120 sec. (air speed = 2m/sec and stable temperature)
Long-term stability	5% of the measured value /5years

Accuracy of the dew point Td (°C)
The dew point is a calculated quantity that depends on the accuracy of the calibration of relative humidity and temperature. The values given below refer to accuracy of ± 0.25 ° C, 1013.25mbar, ± 2.5% RH.

	Relative humidity(%)						
Temperature (°C)		**10**	**30**	**50**	**70**	**90**	**100**
	-20	2.50	1.00	0.71	0.58	--	--
	0	2.84	1.11	0.78	0.64	0.56	0.50
	20	3.34	1.32	0.92	0.75	0.64	0.62
	50	4.16	1.64	1.12	0.90	0.77	0.74
	100	5.28	2.07	1.42	1.13	0.97	0.91

Characteristics of the instrument

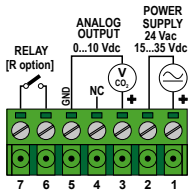
Measuring frequency	1 sample every 3 seconds
Storage capacity	2304 records
Storage interval	Selectable within 30s, 1m, and 5m The stored values represent the average values of samples collected every 3 seconds in selected storage interval.
Serial output	Serial output for USB (mini-USB/USB cable with adapter cod. RS45 or RS45I) RS485 MODBUS-RTU (only HD45…S… and HD46…S…)
Safety of stored data	Unlimited
Analogue output	0…10Vdc (R_L > 10kΩ) (only HD45…V…and HD46…V) 11Vdc outside the measuring range
Relay output	Two-state (only HD45…R and HD46…R) Contact: max 1A @ 30Vdc resistive load
Power supply	24Vac ± 10% (50…60Hz) or 15…35Vdc
Power consumption	100 mW
Stabilising time	15 minutes (to guarantee the declared accuracy)
Working temperature of the instrument	0°C ... 50°C
Working humidity of the instrument	0%RH ... 95%RH no condensate
Dimensions (LxHxW)	80 x 80 x 30 mm *(HD45.17…)* 80 x 80 x 34 mm *(HD45.B… and HD45.7B…)* 120 x 80 x 30 mm *(HD46.17…)* 120 x 80 x 34 mm *(HD46.17B…)*
Housing material	ABS

Installation

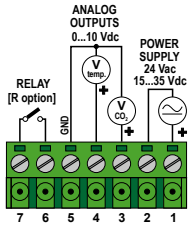
The container is easy and quick to open. Simply press the two tabs of the container to remove the front panel to have immediately access to the terminal block connections and fixing holes.

Electrical connections

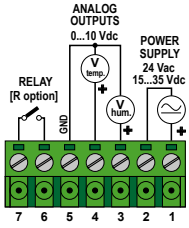
Series HD45...



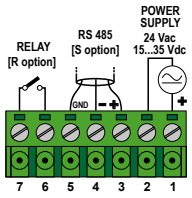
HD45 B...V
HD45 B...VR



HD45 7B...V
HD45 7B...VR

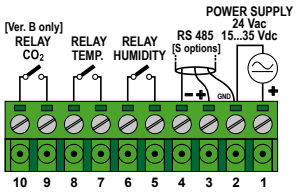


HD45 17...V
HD45 17...VR

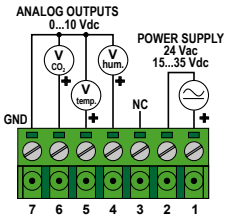


HD45...R
HD45...S
HD45...SR

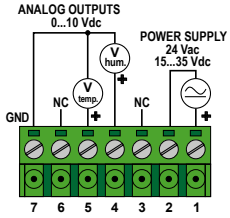
Series HD46...



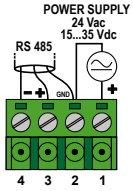
HD46...R
HD46...SR



HD46 17B...V



HD46 17...V



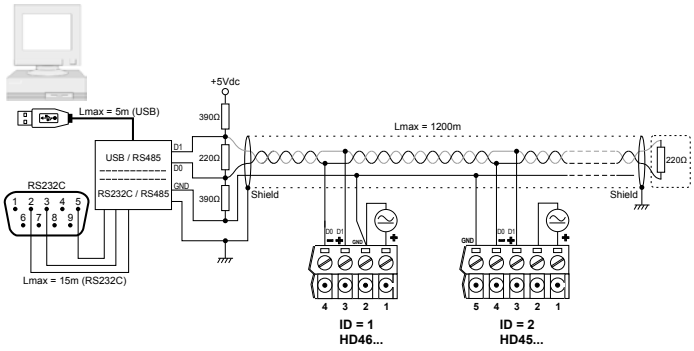
HD46...S

Configuration

Instruments are provided with serial output, easily accessible on the side of the instrument that allows you to connect to the USB port of your PC using the cable **RS45** or **RS45I** with built-in adapter, to get custom configurations. With the **RS45** cable, the instrument is powered directly from the USB port of your PC, thus enabling the configuration of the instrument in the field using a laptop before installing fixed.

RS485 Connection

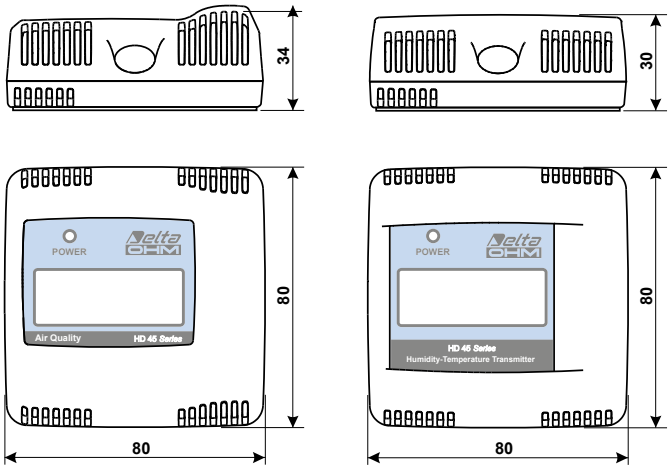
Models with RS485 output use the **MODBUS RTU** protocol.
To connect to the PC, interpose a RS232C/RS485 or USB/RS485 converter.



Dimensions of the housing

All dimensions are expressed in mm.

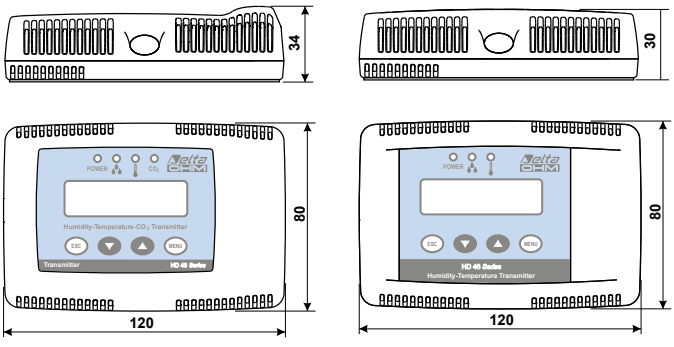
Series HD45...



HD45 B...
HD45 7B...

HD45 17...

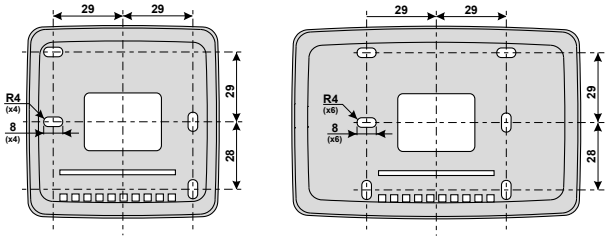
Series HD46...



HD46 17B...

HD46 17...

Fixing holes



HD45...

HD46...

Available models

The instruments are available in the following versions:

HD45 17… Humidity and temperature
HD45 7B… Temperature and CO_2
HD45 B… CO_2
HD46 17B… Humidity, temperature, and CO_2
HD46 17… Humidity and temperature

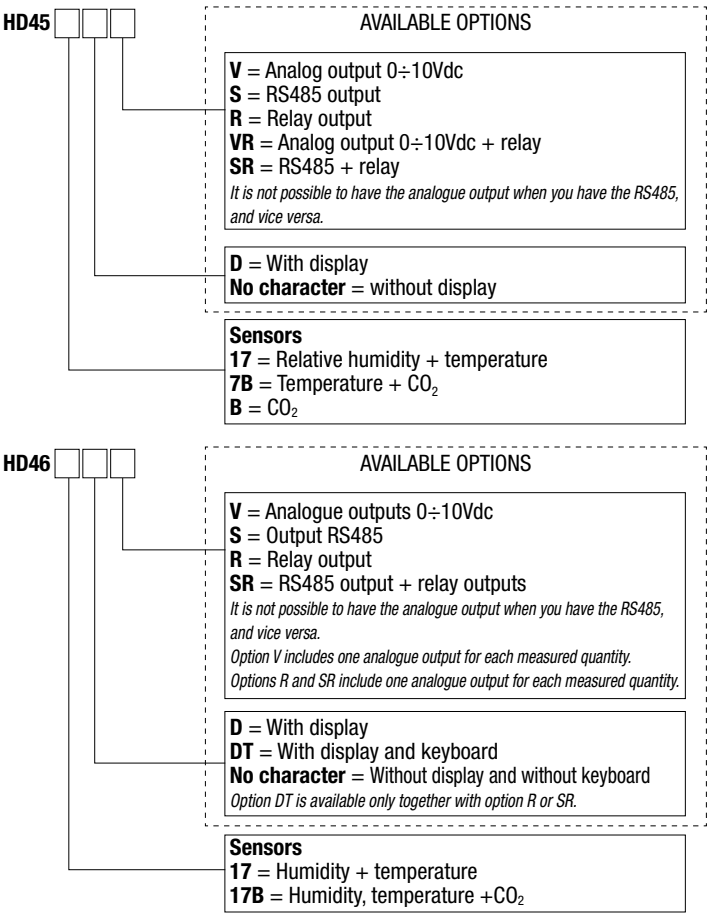
Optionally you can have the analog output 0 ... 10Vdc for each quantity measured by the instrument (option **V**), or RS485 serial output (option **S**). There are no models with both types of output.
There is the option with only relay (option **R**). In models **HD46 ...** there is one relay for each quantity measured by the instrument. In models **HD45** ... there is one relay that can be associated with one of the quantities measured by the instrument
It is possible to have the relay output (or the outputs) together with serial output RS485 (option **SR**).
The relay output together with the analog output (option **VR**) is only available on models HD45. All models can be supplied with LCD (option **D**).
In the series **HD46** ..., versions with relay outputs are available with display and keyboard (option **DT**)

The following table lists the available models:

Model	RH	T	CO_2	Analog output	RS485 output	Relay output	LCD	LED
HD45 17V	✓	✓		✓ (2 outputs)				Power
HD45 17S	✓	✓			✓			Power
HD45 17R	✓	✓				✓ (1 output)		Power
HD45 17SR	✓	✓			✓	✓ (1 output)		Power
HD45 17VR	✓	✓		✓ (2 outputs)		✓ (1 output)		Power
HD45 17DV	✓	✓		✓ (2 outputs)			✓	Power
HD45 17DS	✓	✓			✓		✓	Power
HD45 17DR	✓	✓				✓ (1 output)	✓	Power
HD45 17DSR	✓	✓			✓	✓ (1 output)	✓	Power
HD45 17DVR	✓	✓		✓ (2 outputs)		✓ (1 output)	✓	Power
HD45 7BV		✓	✓	✓ (2 outputs)				Power
HD45 7BS		✓	✓		✓			Power
HD45 7BR		✓	✓			✓ (1 output)		Power
HD45 7BSR		✓	✓		✓	✓ (1 output)		Power
HD45 7BVR		✓	✓	✓ (2 outputs)		✓ (1 output)		Power
HD45 7BDV		✓	✓	✓ (2 outputs)			✓	Power
HD45 7BDS		✓	✓		✓		✓	Power
HD45 7BDR		✓	✓			✓ (1 output)	✓	Power
HD45 7BDSR		✓	✓		✓	✓ (1 output)	✓	Power
HD45 7BDVR		✓	✓	✓ (2 outputs)		✓ (1 output)	✓	Power
HD45 BV			✓	✓ (1 output)				Power
HD45 BS			✓		✓			Power
HD45 BR			✓			✓ (1 output)		Power
HD45 BSR			✓		✓	✓ (1 output)		Power
HD45 BVR			✓	✓ (1 output)		✓ (1 output)		**4 LED CO_2 level**
HD45 BDV			✓	✓ (1 output)			✓	Power
HD45 BDS			✓		✓		✓	Power
HD45 BDR			✓			✓ (1 output)	✓	Power
HD45 BDSR			✓		✓	✓ (1 output)	✓	Power
HD45 BDVR			✓	✓ (1 output)		✓ (1 output)	✓	Power

Model	RH	T	CO_2	Analog output	RS485 output	Relay output	LCD keyboard	LED
HD46 17V	✓	✓		✓ (2 outputs)				Power
HD46 17S	✓	✓			✓			Power
HD46 17R	✓	✓				✓ (2 outputs)		Power RH + T
HD46 17SR	✓	✓			✓	✓ (2 outputs)		Power RH + T
HD46 17DV	✓	✓		✓ (2 outputs)			only LCD	Power
HD46 17DS	✓	✓			✓		only LCD	Power
HD46 17DTR	✓	✓				✓ (2 outputs)	✓	Power RH + T
HD46 17DTSR	✓	✓			✓	✓ (2 outputs	✓	Power RH+ T
HD46 17BV	✓	✓	✓	✓ (3 outputs)				Power
HD46 17BS	✓	✓	✓		✓			Power
HD46 17BR	✓	✓	✓			✓ (3 outputs)		Power RH+T+ CO_2
HD46 17BSR	✓	✓	✓		✓	✓ (3 outputs		Power RH +T+ CO_2
HD46 17BDV	✓	✓	✓	✓ (3 outputs)			only LCD	Power
HD46 17BDS	✓	✓	✓		✓		only LCD	Power
HD46 17BDTR	✓	✓	✓			✓ (3 outputs)	✓	Power RH +T+ CO_2
HD46 17BDTSR	✓	✓	✓		✓	✓ (3 outputs)	✓	Power RH +T+ CO_2

ORDERING CODES



Examples of ordering codes

HD45 7BDVR: Transmitter, indicator and regulator for temperature and CO_2. Two analogue outputs 0 ÷ 10V, one configurable relay to control temperature or CO_2.
HD45 BVR: Transmitter, indicator and regulator for CO_2. Without display, with LED indicators of the CO_2 level, with analogue output 0 ÷ 10V, with relay.
HD45 17VR: Transmitter and regulator for humidity and temperature. Without display, with two analogue outputs 0 ÷ 10V, one configurable relay to control the humidity or temperature.
HD45 17DV: Transmitter and indicator for humidity and temperature. With display, two analogue outputs 0 ÷ 10V, without relay.
HD45 7BSR: Transmitter and regulator for temperature and CO_2. Without display, with RS485 output, no analogue output, with one configurable relay to control temperature or CO_2.
HD46 17BDV: Transmitter and indicator for humidity, temperature and CO_2. With display, without keyboard, with three analogue outputs 0 ÷ 10V, without relays and without RS485.
HD46 17BDTSR: Transmitter, indicator and regulator for humidity, temperature and CO_2. Display and keyboard, three relay outputs, RS485 output.
HD46 17S: Humidity and temperature transmitter. No display and no keyboard, no relays, with RS485 output.

Accessories

DeltaLog14.: Software for connecting to the PC via the serial output, for the configuration of the instrument and data download. For operating systems from Windows® 98 to Windows Vista®.
HDM46: Calibrated humidity and temperature replacement module (only for models HD46…)
RS45: Not isolated serial connection cable with built-in adapter. USB connector for PC and mini-USB connector for the serial port of the instrument. The cable powers the instrument.
RS45I: Isolated serial connection cable with built-in adapter. USB connector for PC and mini-USB connector for the serial port of the instrument. The cable does not power the instrument.
HD45TCAL: The Kit includes the **RS45** cable with built-in adapter and the CD-ROM with the **DeltaLog14** software for Windows operating systems. The cable is provided with USB connector on the PC side and mini-USB connector for the serial port of the instrument.
HD45TCALI: The Kit includes the **RS45I** cable with built-in adapter and the CD-ROM with the **DeltaLog14** software for Windows operating systems. The cable is provided with USB connector on the PC side and mini-USB connector for the serial port of the instrument.

HD 4807T… HD 4907T…
HD 48V07T… HD 4901T…
HD 4801T… HD 4917T…
HD 48V01T… HD 4977T…
HD 4817T…
HD 48V17T…
HD 4877T…
HD 48V77T…

HD 4807T…, HD 48V07T…, HD 48S07T…, HD 4801T..., HD 48V01T..., HD 4817T..., HD 48V17T..., HD 4877T... HD 48V77T..., HD 4907T…, HD 4901T..., HD 4917T..., HD 4977T...

TEMPERATURE AND RELATIVE HUMIDITY TRANSMITTERS, RELATIVE HUMIDITY, TEMPERATURE AND RELATIVE HUMIDITY, TEMPERATURE AND DEW POINT

HD48.. and HD49.. series of transmitters measure temperature, relative humidity and dew point. Versions with only standard analog output or with only RS485 output with **MODBUS-RTU** protocol are available. The models with analog output provide a signal suitable for transmission to a remote display, recorder or PLC. The models with RS485 output are suitable for connection to a PC or PLC.

The models of the HD48.. series are active transmitters and accept both direct and 24Vac alternating power supply; they have standard current (4…20mA) or voltage (0…10V) outputs, or a serial RS485 output, depending on the model. The models of the HD49.. series are passive transmitters instead, and thus suitable to be inserted in a 4…20mA current loop.

The HD48.. and HD49.. series of transmitters are designed for temperature and humidity control in conditioning and ventilation applications (HVAC/BEMS) in the following sectors: pharmacy, museums, clean rooms, ventilation ducts, industrial and civil sectors, crowded places, canteens, auditoria, gyms, high-density farms, greenhouses, etc.

The HD48.. and HD49.. transmitters measure relative humidity with a well proven temperature compensated capacitive sensor that assures precise and reliable measurements in the course of time. The transmitters of the HD48.. and HD49.. series are available in two probe temperature ranges: standard **-20…+80°C and extended -40…+150°C for the most critical applications**. A stainless steel 20µm filter protects the sensors against dust and particles (other filters are available for different applications).

The transmitters are factory calibrated and no further adjustments are required.

Each series is available in three different versions: with horizontal probe for duct mounting (HD48...T0..., HD49…T0…), with vertical probe for wall mounting (HD48...TV..., HD49…TV…) or with remote probe connected to the transmitter by means of a cable (HD48...TC..., HD49…TC…), cable lengths available are 2, 5 and 10m.

The probes can be supplied in two different lengths (135mm or 335mm).

Various accessories are available for the installation: for example to fix the probe to the duct, it can be used the HD9008.31 flange, a 3/8" universal biconical connection or a PG16 metal cable gland (∅10…14mm). A 4-digit optional LCD ("L" model) allows to display the measured parameters in a continuous or sequential mode.

Technical specifications

	STANDARD RANGE	EXTENDED RANGE
Relative Humidity		
Sensor	Capacitive	
Measuring range	0…100%RH	
Accuracy	±2% (10..90%RH), ±2.5% outside	
Repeatability	0.4%RH	
Sensor working temperature	-20…+80°C	-40…+150°C
Temperature		
Measuring range	-20…+80°C	-40…+150°C
Sensor	NTC 10kΩ	Pt100 class A
Accuracy	±0.3°C (0..+70°C) ±0.4°C (-20..0°C, +70..+80°C)	±0.3°C
Repeatability	0.05°C	0.05°C
Dew Point		
Sensor	Parameter calculated from relative humidity and temperature	
Measuring range	-20…+80°C DP	
Accuracy	See table TAB.1	
Repeatability	0.5°C DP	

Output type (depending on model)		
Models HD4807T..	Temperature	4…20mA (-20...+80°C), R_L < 500Ω 22mA outside the measuring range
Models HD4807ET..	Temperature	4…20mA (-40...+150°C), R_L < 500Ω 22mA outside the measuring range
Models HD48V07T..	Temperature	0…10Vdc (-20...+80°C), R_L > 10kΩ 11Vdc outside the measuring range
Models HD48V07ET..	Temperature	0…10Vdc (-40...+150°C), R_L > 10kΩ 11Vdc outside the measuring range
Models HD48S07T.. HD48S07ET..	Temperature	Only RS485 with MODBUS-RTU protocol
Models HD4907T..	Temperature	4…20mA (-20...+80°C), R_L Max = (Vdc-12)/0,022 22mA outside the measuring range
Models HD4907ET..	Temperature	4…20mA (-40...+150°C), R_L Max = (Vdc-12)/0,022 22mA outside the measuring range
Models HD4801T.. HD4801ET..	Relative Humidity	4…20mA (0...100%RH), R_L < 500Ω 22mA outside the measuring range
Models HD48V01T.. HD48V01ET..	Relative Humidity	0…10Vdc (0...100%RH), R_L > 10kΩ 11Vdc outside the measuring range
Models HD48S01T.. HD48S01ET..	Relative Humidity	Only RS485 with MODBUS-RTU protocol
Model HD4901T.. HD4901ET..	Relative Humidity	4…20mA (0...100%RH), R_L Max = (Vdc-12)/0.022 22mA outside the measuring range
Models HD4817T..	Relative Humidity	4…20mA (0...100%RH), R_L < 500Ω 22mA outside the measuring range
	Temperature	4...20mA (-20...+80°C), R_L < 500Ω 22mA outside the measuring range
Models HD4817TV..	Relative Humidity	4…20mA (0...100%RH), R_L < 500Ω 22mA outside the measuring range
	Temperature	4...20mA (0...+60°C), R_L < 500Ω 22mA outside the measuring range
Models HD4817ET..	Relative Humidity	4…20mA (0...100%RH), R_L < 500Ω 22mA outside the measuring range
	Temperature	4...20mA (-40...+150°C), R_L < 500Ω 22mA outside the measuring range
Models HD48V17T..	Relative Humidity	0…10Vdc (0...100%RH), R_L > 10kΩ 11Vdc outside the measuring range
	Temperature	0…10Vdc (-20...+80°C), R_L > 10kΩ 11Vdc outside the measuring range
Models HD48V17ET..	Relative Humidity	0…10Vdc (0...100%RH), R_L > 10kΩ 11Vdc outside the measuring range
	Temperature	0…10Vdc (-40...+150°C), R_L > 10kΩ 11Vdc outside the measuring range
Models HD48S17T.. HD48S17ET..	Relative Humidity Temperature	Only RS485 with MODBUS-RTU protocol
Models HD4917T..	Relative Humidity	4…20mA (0...100%RH), R_L Max = (Vdc-12)/0.022 22mA outside the measuring range
	Temperature	4...20mA (-20...+80°C), R_L Max = (Vdc-12)/0.022 22mA outside the measuring range
Models HD4917TV..	Relative Humidity	4…20mA (0...100%RH), R_L Max = (Vdc-12)/0.022 22mA outside the measuring range
	Temperature	4...20mA (0...+60°C), R_L Max = (Vdc-12)/0.022 22mA outside the measuring range
Models HD4917ET..	Relative Humidity	4…20mA (0...100%RH), R_L Max = (Vdc-12)/0.022 22mA outside the measuring range
	Temperature	4...20mA (-40...+150°C), R_L Max = (Vdc-12)/0.022 22mA outside the measuring range
Models HD4877T..	Dew Point	4...20mA (-20...+80°C DP), R_L < 500Ω 22mA outside the measuring range
	Temperature	4...20mA (-20...+80°C), R_L < 500Ω 22mA outside the measuring range
Models HD48V77T..	Dew Point	0…10Vdc (-20...+80°C DP), R_L > 10kΩ 11Vdc outside the measuring range
	Temperature	0…10Vdc (-20...+80°C), R_L > 10kΩ 11Vdc outside the measuring range
Models HD48S77T..	Dew Point Temperature	Only RS485 with MODBUS-RTU protocol
Models HD4977T..	Dew Point	4...20mA (-20...+80°C DP), R_L Max = (Vdc-12)/0.022 22mA outside the measuring range
	Temperature	4...20mA (-20...+80°C), R_L Max = (Vdc-12)/0.022 22mA outside the measuring range

	STANDARD RANGE	EXTENDED RANGE
Power supply and connections		
	HD48..	HD49..
Power supply	16...40Vdc or 24 Vac ±10%	12...40Vdc
Electrical connections	Screw type terminal block, max 1,5mm², M16 cable gland for input cable	
General specifications		
Electronics working temperature	0...+60°C	
Probe working temperature	STANDARD RANGE	EXTENDED RANGE
	-20…+100°C	-40…+150°C
Storage temperature	-20…+80°C	
Electronics protection class	IP66	
Case dimensions	80x84x44	

TAB.1 - Accuracy of dew point measurement:

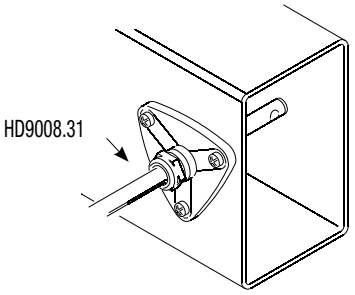
Temperature °C \ DP °C	-20	-10	0	10	20	30	40	60	80
-20	≤±1								
-10	≤±1	≤±1							
0	≤±1	≤±1	≤±1						
10	≤±3	≤±1	≤±1	≤±1					
20	≤±4	≤±2	≤±1	≤±1	≤±1				
30	NOT SPECIFIED	≤±3	≤±1,5	≤±1	≤±1	≤±1			
40				≤±2	≤±1	≤±1	≤±1		
60				≤±5	≤±2,5	≤±2	≤±1	≤±1	
80						≤±4	≤±2	≤±1	≤±1

DP LIMIT

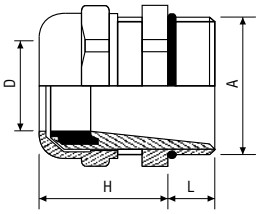
For example at 20°C a Dew Point value of 0°C DP is measured with an accuracy better than 1°C DP.

Installation notes

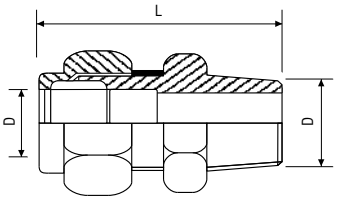
To fix the probe inside a ventilation duct, a pipe , etc., use for example the HD9008.31 flange, a PG16 metal cable gland (Ø10…14mm) or a 3/8" universal biconical connection.



HD9008.31 Flange



PG16 metal cable gland
D = 10…14mm
L = 6.5mm
H = 23mm
A = PG16



Universal biconical connector
L = 35mm
D = 14mm
A = 3/8"

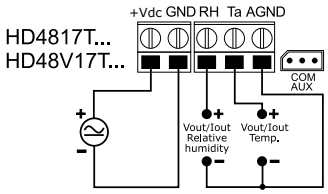
Electrical connections

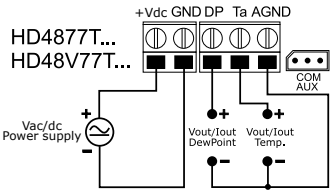
HD48.. series with analog output

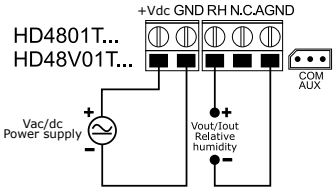
Power the instrument as shown in the below connection schemes, the power supply terminals are marked as +Vcc and GND.

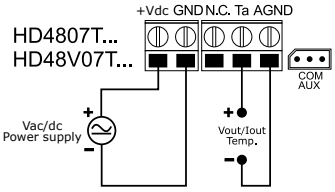
Depending on the model, the output signal is available between:

- Ta and AGND terminals for the transmitters of the HD4807T.. and HD48V07T.. series
- RH% and AGND terminals for the transmitters of the HD4801T.. and HD48V01T.. series
- RH% and AGND, Ta and AGND terminals for the transmitters of the HD4817T.. and HD48V17T.. series
- DP and AGND, Ta and AGND terminals for the transmitters of the HD4877T.. and HD48V77T.. series.



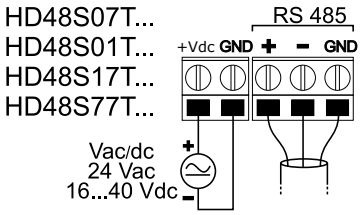




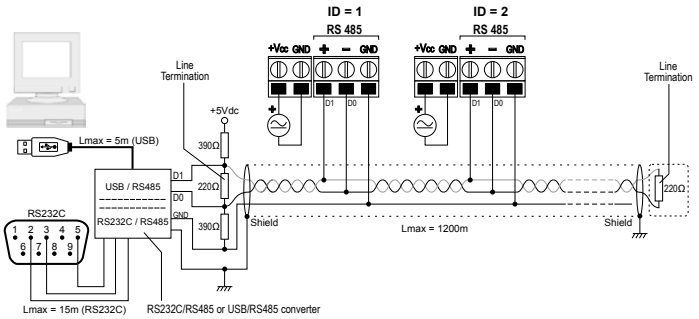


HD48.. series with RS485 output

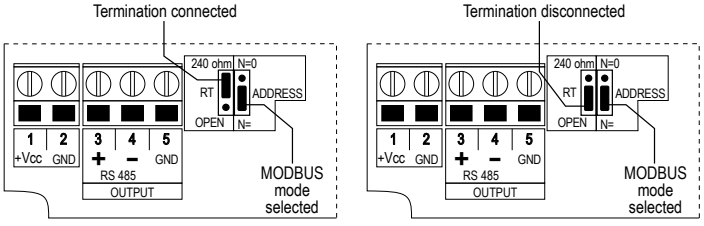
Connect the instrument as shown in the below connection schemes, the power supply terminals are marked as +Vcc and GND.



Thanks to RS485 output, several instruments can be connected to form a network, consisting of a minimum of 1 instrument to a maximum of **247**, connected in a sequence through a shielded cable with twisted pair for signals and a third wire for the common.



Line termination must be set at the two network ends. To polarize the line during non-transmission periods, resistors are connected between signal and power supply lines. If more than 32 devices have to be connected, place a signal repeater between a group and the next one. The line termination must be connected at both ends of each segment. The instrument has a built-in line termination that can be connected or removed through a short jumper placed next to the terminal block. If the instrument is the last or the first device of a network group, connect the termination placing the short jumper between the "RT" and "240 ohm" indications. If the instrument is not at the end of a network group, remove the termination placing the short jumper between the "RT" and "OPEN" indications.



The cable shield must be connected to both line ends. The cable should have the following features:

- Characteristic impedance: 120 ohm
- Capacity: less than 50pF/m
- Resistance: less than 100 ohm/km
- gauge: 0,22 mm² (AWG24) at least

The cable maximum length depends on baud rate and cable characteristics. Typically, the maximum length is 1200m. The data line must be kept separated from any power lines in order to prevent interferences on the transmitted signal.

For connection to a PC, a RS232/RS485 or a USB/RS485 converter must be used.

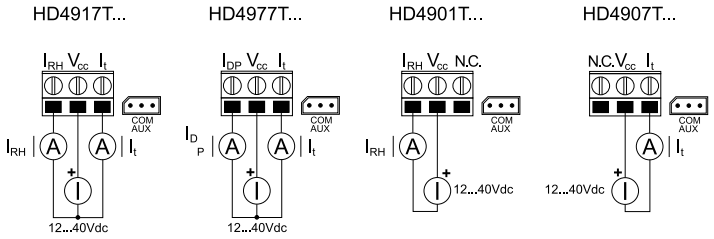
To operate with the MODBUS-RTU protocol be sure that the ADDRESS short jumper is between "ADDRESS" and "N=" indications.

Each transmitter of the network is univocally identified by an address. **Transmitters having the same address shall not be present in the network**. The address must be configured before connecting the instrument to the network. To set the instrument address use the **HD48STCAL** kit. The kit includes the **RS48** cable with built-in USB/RS485 adapter and a CD-ROM for Windows® operating systems. To configure the instrument it is necessary to move the ADDRESS short jumper between the "ADDRESS" and "N=0" indications to select the setup mode. After the configuration, move the short jumper back between the "ADDRESS" and "N=" indications.

HD49.. series

Follow the connection schemes shown below, the maximum load resistance that can be connected to each 4…20mA output depends on the power supply Vcc applied, according to the relation:

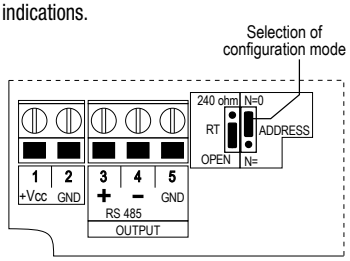
R_LMax = (Vcc-12)/0.022V, e.g. if Vcc=24Vdc the max load is R_LMax =545 ohm.



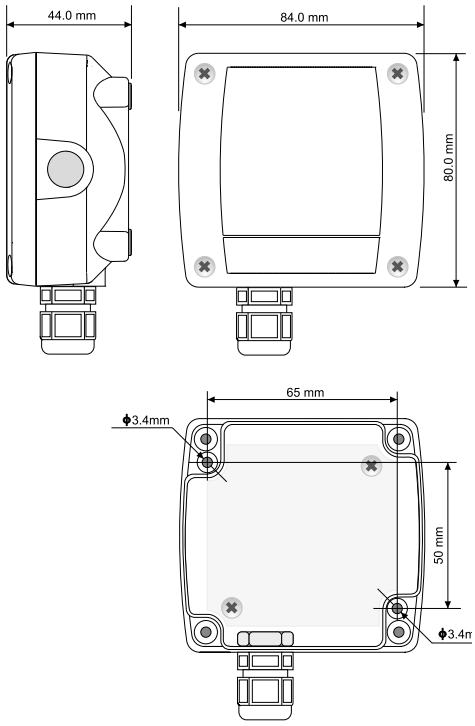
Relative humidity probe calibration

The HD48.. and HD49.. transmitters are supplied factory calibrated and ready to use. If necessary, it is possible to calibrate the relative humidity sensor using the saturated salt solutions **HD75** (75% RH saturated salt solution) and **HD33** (33% RH saturated salt solution) and connecting the instrument to the PC. For the models with analog output, provided with RS232 (COM AUX) serial connector, use the **HD48TCAL** kit. The kit includes the **RS27** cable for the serial connection of the transmitters to the PC and a CD-ROM for Windows® operating systems, that guides the user in the relative humidity probe calibration procedure.

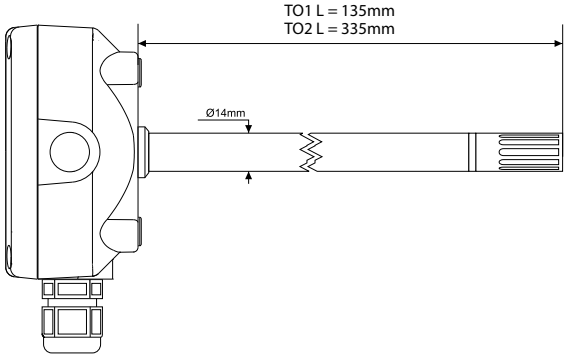
For the models with RS485 output, use the **HD48STCAL** Kit. The kit includes the **RS48** cable with built-in USB/RS485 adapter and a CD-ROM for Windows® operating systems, that guides the user in the relative humidity probe calibration procedure. To calibrate the instrument it is necessary to move the ADDRESS short jumper between the "ADDRESS" and "N=0" indications to select the setup mode. After the calibration, move the short jumper back between the "ADDRESS" and "N=" indications.



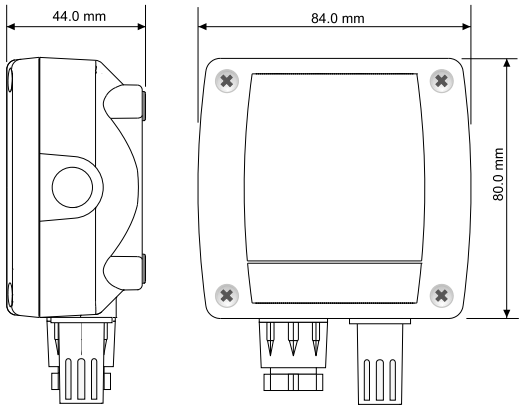
Case dimensions



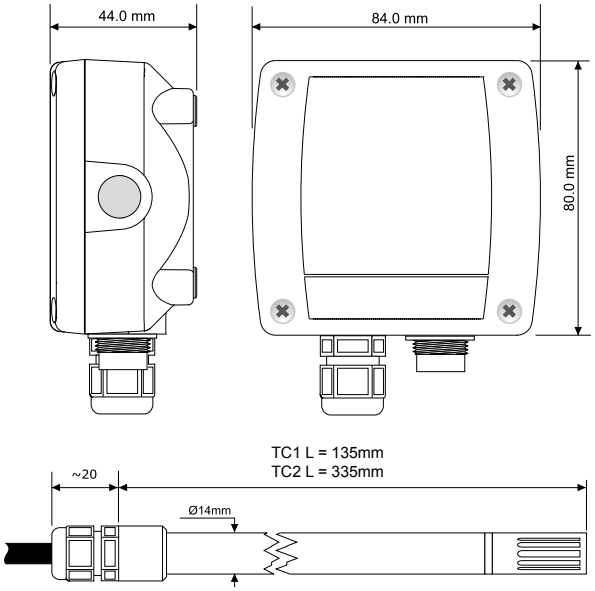
Probe dimensions:
TO series



TV series



TC series



ORDERING CODES

HD48
HD49

			T			**L**	**L** = with LCD display
			T				Cable length **2** = 2m **5** = 5m **10** = 10m
			T				Probe type **TO1** = 135mm **TO2** = 335mm **TC1** = 135mm **TC2** = 335mm **TV** = wall mounting
							No sign = standard range –20…+80°C **E** = extended range –40…+150°C
							07 = temperature output **01** = %RH output **17** = Temperature and %RH outputs **77** = Temperature and dew point outputs
							No sign = 4…20mA analogue output **V** = 0…10Vdc analog output (only HD48.. models) **S** = solo uscita RS485 Note: Versions with analogue output have one analogue output for each measured quantity.

Ordering code examples

HD4801TV: Wall mounting digital active relative humidity transmitter.
Relative humidity range 0...100%RH. Analog output: 4…20mA (0...100%RH).
Probe working range -20...+80°C. Power supply 16...40Vdc or 24Vac.

HD4917T01: Digital passive (current loop) temperature and relative humidity transmitter for duct mounting. AISI304 steel probe, diameter 14mm and stem length 135mm, joined to the electronics enclosure.
Relative humidity range 0...100%RH, temperature range -20...+80°C.
Analog outputs: 4…20mA (0...100%RH) for RH and 4...20mA (-20...+80°C) for temperature.
Probe working range -20...+80°C. Power supply 12...40Vdc.

HD4817TC25L: Digital active temperature and relative humidity transmitter with LCD display. AISI304 steel probe, diameter 14mm and stem length 335mm, connected to the electronics enclosure through a 5m cable.
Relative humidity range 0...100%RH, temperature range -20...+80°C.
Analog outputs: 4…20mA (0...100%RH) for RH and 4...20mA (-20...+80°C) for temperature.
Probe working range -20...+80°C. Power supply 16...40Vdc or 24Vac.

HD48V17ETC25: Digital active temperature and relative humidity transmitter, extended range. AISI304 steel probe, diameter 14mm and stem length 335mm, connected to the electronics enclosure through a 5m cable.
Relative humidity range 0...100%RH, temperature range -40...+150°C.
Analog outputs: 0…10V (0...100%RH) for RH and 0...10V (-40...+150°C) for temperature.
Probe working range -40...+150°C. Power supply 16...40Vdc or 24Vac.

HD48S17TC25L: Digital active temperature and relative humidity transmitter with LCD. AISI304 steel probe, diameter 14mm and stem length 335mm, connected to the electronics enclosure through a 5m cable.
Relative humidity range 0...100%RH, temperature range -20...+80°C.
RS485 output only. Probe working range -20...+80°C. Power supply 16...40Vdc or 24Vac.

HD4877T02: Digital active temperature and dew point transmitter for duct mounting. AISI304 steel probe, diameter 14mm and stem length 135mm, joined to the electronics enclosure.
Dew point range -20...+80°C DP, temperature range -20...+80°C.
Analog outputs: 4…20mA (-20...80°C DP) for DP and 4...20mA (-20...+80°C) for temperature.
Probe working range -20...+80°C. Power supply 16...40Vdc or 24Vac.

HD4977T02: Digital passive (current loop) temperature and dew point transmitter for duct mounting. AISI304 steel probe, diameter 14mm and stem length 335mm, joined to the electronics enclosure.
Dew point range -20...+80°C DP, temperature range -20...+80°C.
Analog outputs: 4…20mA (-20...+80°C DP) for DP and 4...20mA (-20...+80°C) for temperature. Probe working range -20...+80°C. Power supply 12...40Vdc.

Accessories

HD48TCAL: The kit includes the **RS27** serial connection cable, RS232 null modem, with 9-pole sub-D female connector for PC and 3-pole connector for transmitter COM port, and CD-ROM for Windows operating systems that guides the user in the relative humidity probe calibration procedure. The kit is for the models with analog output only.

HD48STCAL: The kit includes the **RS48** cable with built-in USB/RS485 adapter and CD-ROM for Windows operating systems that guides the user in the relative humidity probe calibration procedure. The cable is provided with USB connector for the PC and 3 free wires on the instrument side. The kit is for the models with RS485 output only.

HD75: 75% RH saturated solution for the verification of the relative humidity sensor, complete with thread for probes with Ø 14mm and Ø 26mm.

HD33: 33% RH saturated solution for the verification of the relative humidity sensor, complete with thread for probes with Ø 14mm and Ø 26mm.

HD9008.31: Wall flange with cable gland to fix Ø 14mm probes.

PG16: AISI304 steel cable gland for Ø 14mm probes.

P5: Stainless steel grid protection for Ø 14mm probes.

P6: 20µ sintered stainless steel protection for Ø 14mm probes.

P7: 10µ PTFE protection for Ø 14mm probes.

P8: Stainless steel grid and Pocan protection for Ø 14mm probes.

HD 2717T…
TRANSMITTER, INDICATOR, ON/OFF REGULATOR, TEMPERATURE AND HUMIDITY DATA LOGGER WITH INTERCHANGEABLE PROBE

The instruments of the HD2717T... series are transmitters, indicators, and ON/OFF regulators with data logging functions, they measure temperature and humidity.
The main feature of these instruments is their **interchangeable probe.** The probe can be replaced by the user without process interruption. Thus, the probe can be calibrated or repaired at a later time.
The instrument is available in three different versions: with horizontal probe (**S.TO**), vertical probe (**S.TV**) or with remote probe (**S.TC**), having the probe connected to the electronics by means of a cable of various lengths. The S.TO and S.TV probes are made of stainless steel AISI304, the S.TC probes can be of stainless steel AISI304 or POCAN (plastic material).
The probe is factory calibrated and ready to use, it is provided with a **SICRAM2** module which stores the calibration data of the probe, allowing the interchangeability of the probes.

The instruments measure:
- Temperature in Celsius or Fahrenheit temperature scale
- Relative humidity

and calculate:
- Absolute humidity
- Mixing Ratio
- Dew point

All models have both current and voltage outputs.
Some models are fitted with two control relays and one alarm relay, configurable by the user.
All models are fitted with a multistandard RS232/RS485 serial port and an auxiliary RS232C standard serial output. The RS485 serial output allows the management of more than one device in a network.
The models HD2717T... can be with or without LCD. The display shows on the first line the relative humidity or a derived parameter and on the second line the temperature in degrees Celsius or Fahrenheit.
The **data logger** function allows to store the measures with a selectable storage interval.
The instrument setup remains permanently stored, while the real time clock is protected by an apposite Lithium battery against temporary mains voltage interruptions.
The power supply can be chosen, at the time of placing the order, between 24Vac/dc or universal 90...240Vac.

Instrument versions and available probes

Display	
HD2717Tx-0x	Absent
HD2717Tx-Dx	Custom LCD

Relay	
HD2717Tx-x0	Absent
HD2717Tx-xR	2 control relays with change-over contact. 1 alarm relay with normally open contact.

Type of probe	
HD2717T.xx	Instrument with vertical probe S.TV or probe with cable S.TC.
HD2717TO.xx	Instrument with horizontal probe S.TO.

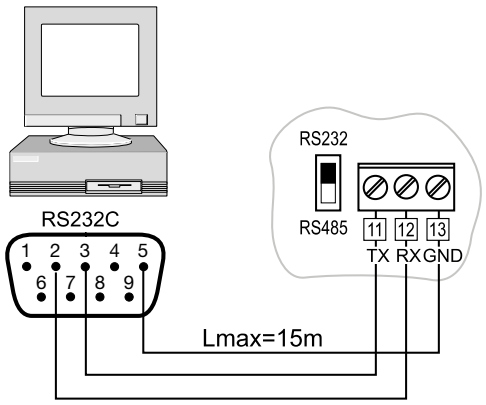
Probes complete with SICRAM2 module for instruments HD2717T.xx	
S.TV	Vertical probe L=130mm
The material of the **S.TC**...probes can be chosen between stainless steel AISI304 or POCAN plastic material.	
S.TC1.2	Probe L=130mm with cable 2m
S.TC1.2P	Probe L=130mm with cable 2m (POCAN probe)
S.TC1.5	Probe L=130mm with cable 5m
S.TC1.5P	Probe L=130mm with cable 5m (POCAN probe)
S.TC1.10	Probe L=130mm with cable 10m
S.TC1.10P	Probe L=130mm with cable 10m (POCAN probe)
S.TC2.2	Probe L=330mm with cable 2m
S.TC2.2P	Probe L=330mm with cable 2m (POCAN probe)
S.TC2.5	Probe L=330mm with cable 5m
S.TC2.5P	Probe L=330mm with cable 5m (POCAN probe)
S.TC2.10	Probe L=330mm with cable 10m
S.TC2.10P	Probe L=330mm with cable 10m (POCAN probe)

Probes complete with SICRAM2 module for instruments HD2717TO.xx	
S.TO1	horizontal probe L= 130mm
S.TO2	horizontal probe L= 330mm

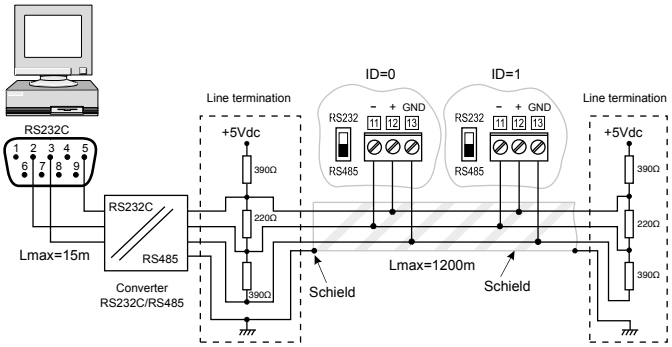
Version with display HD2717Tx.Dx

Version without display HD2717TO.0R

Probe TO: HD2717TO.0R

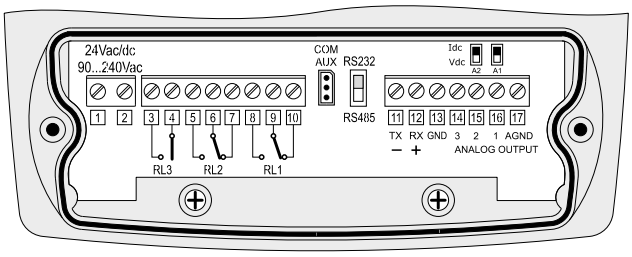


PC: instrument connection with serial communication protocol RS232C.



Connection PC / instrument with the RS485 communication protocol for distances up to 1200 m using the RS232C/RS485 converter.
On both ends of the network, line termination have to be used. To polarize the line during periods of non transmission, resistors connected between the signal line and power line are used. If you need to connect over 32 instruments, insert a signal repeater between a group and the next one. At the beginning and at the end of each segment you should apply the line terminator. The data line should be kept separate from any power line in order to avoid interferences on the transmitted signal. The cable shield should be connected at both ends of the line. The cable should have the following characteristics:
- Impedance 120 Ohm
- Capacity <50pF/m
- Resistance <100 Ohm/km
- Section > 0.22mm^2, (AVG24)

The maximum cable length depends on the data transmission velocity and on the characteristics of the cable. Typically, the maximum length is 1200m. The data line should be kept separate from any power line in order to avoid interferences on the transmitted signal.



Terminal board

Wall fastening plate.

Technical specifics (@ 24Vac and 20°C)

Inputs		
Temperature	Sensor	Pt100 classe 1/3 DIN
	Working range of the sensor	-50 ... +200°C (-58 ...+392°F)
Humidity	Relative humidity %RH	5 ... 98%RH
	Working range of the sensor in temperature	-50 ... +150°C (Special configurations up to 180°C available on request)
	Dew point TD	-50 ... +100°C
	Absolute humidity	0 ... 600g/m^3
	Mixing ratio	0 ... 2000g/kg of dry air
	Wet bulb temperature	-50 ... +100°C
Accuracy of the measured physical quantities	Temperature Pt100	±0.25°C
	Relative humidity %RH	±2.5%RH (10...90%RH) ±2.5%RH in the remaining range
Accuracy of the calculated physical quantities	See table in the following chapter	
Response time		3min with grid protection (at 20°C and 0.5m/s)

Outputs		
Communications	Type	RS232C and RS485 Multidrop
	Baud Rate	9600 baud 57600 baud non-permanent
Physical quantities	Measured	Temperature, relative humidity
	Calculated	Dew point, absolute humidity, (mixing ratio).
Analog outputs	Output types	4...20mA; 0...20mA 0...10Vdc; 2…10Vdc
	Load resistance	Current output: 500Ω max Voltage output: 100kΩ min
	Resolution	16bit
	Accuracy analog outputs	±0.05% f.s. @20°C
	In case of measuring error (exceeding of the operating limits, faulty or not connected probe,....)	Idc = 22mA Vdc = 11V
Relay	Working relay	2 x 3A/250Vac Load resistance, 1 change-over contact
	Alarm relay	1 x 3A/250Vac Load resistance, 1 with normally open contact

Instrument		
Power supply	Versions	24Vdc / 24Vac 50…60Hz, ±10%
		90 ... 240Vac 50…60Hz
	Average consumption	3W
Data logger	Storage capacity	9000 samples in max. 256 sessions
	Storage type	Circular memory
	Stored parameters	Temperature, relative humidity, dew point, absolute humidity, mixing ratio, analog outputs 1 and 2, relay status1, 2, 3.
	Storage interval	1, 2, 5, 10, 20, 60 seconds, 2 and 4 minutes
Real time clock	Type	Real time with Lithium buffer battery
	Accuracy	±1min/month
Software		DeltaLog12 for Windows® 98 to Vista operating systems
Display	LCD	Custom segment LCD
Ambient working conditions of the electronics	Operating temperature	-20…+60°C
	Relative humidity	0…90%RH - No condensate
	Static working pressure of the sensors	12 bar max.
	Storage temperature	-30…+80°C
Housing	L x H x W	143x154x61
	Weight	600g
	Material	ABS
	Degree of protection	Electronics IP65

Accuracy of the calculated physical quantities

The accuracy of the calculated physical quantities depends on the accuracy of the relative humidity and temperature calibration. The provided values refer to an accuracy of ±2.5%RH, ±0.25°C, 1013.25mbar.

Accuracy of the Dew Point Td (°C)

		Relative Humidity (%)					
		10	**30**	**50**	**70**	**90**	**100**
Temperature (°C)	**-20**	2.50	1.00	0.71	0.58	--	--
	0	2.84	1.11	0.78	0.64	0.56	0.50
	20	3.34	1.32	0.92	0.75	0.64	0.62
	50	4.16	1.64	1.12	0.90	0.77	0.74
	100	5.28	2.07	1.42	1.13	0.97	0.91

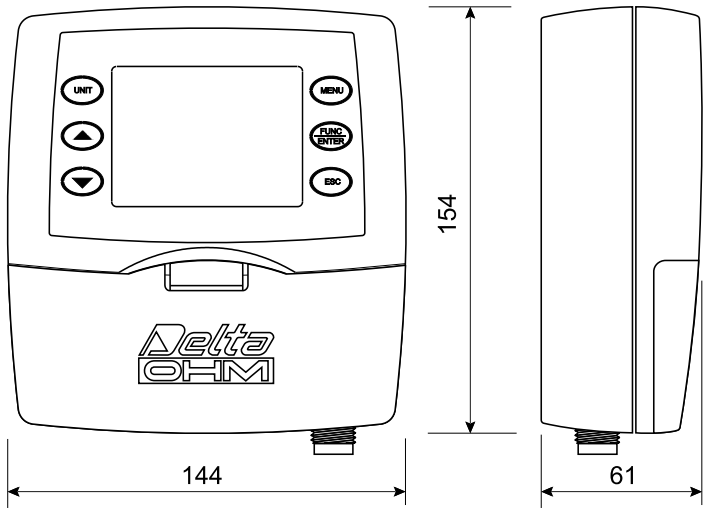
Accuracy of the absolute humidity (g/m³)

		Relative Humidity (%)					
		10	**30**	**50**	**70**	**90**	**100**
Temperature (°C)	**-20**	0.020	0.030	0.035	0.038	---	---
	0	0.12	0.15	0.16	0.18	0.20	0.21
	20	0.45	0.49	0.54	0.59	0.64	0.66
	50	2.07	2.27	2.48	2.67	2.87	2.96
	100	14.81	15.78	16.75	17.72	18.57	19.06

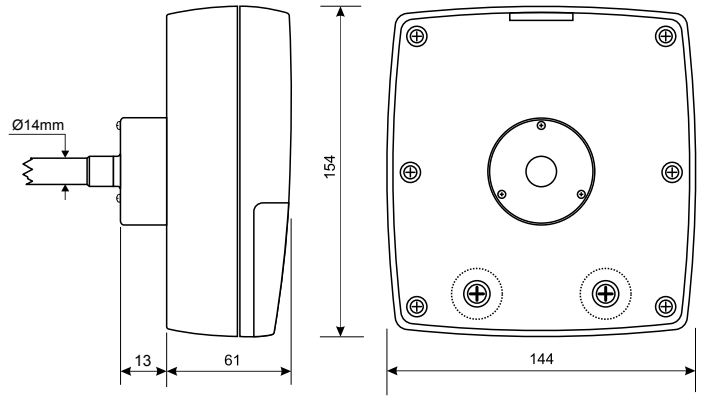
Accuracy of the mixing ratio (g/kg)

		Relative Humidity (%)					
		10	**30**	**50**	**70**	**90**	**100**
Temperature (°C)	**-20**	0.020	0.022	0.026	0.029	---	---
	0	0.09	0.11	0.12	0.13	0.15	0.15
	20	0.37	0.41	0.46	0.51	0.55	0.58
	50	2.04	2.32	2.61	2.90	3.25	3.42
	100	19.06	36.00	75.9	228.9	---	---

Dimensions



Versions HD2717Tx.xx for vertical probes or with cable



Version HD2717TO... for horizontal probes

Ordering codes

HD2717TO…: Transmitter, indicator, and ON/OFF regulator for temperature and humidity, with data logging functions. Fitted with 2 analogue current outputs (0...20mA and 4...20mA) or voltage outputs (0...10Vdc and 2...10Vdc). RS232/RS485 serial ports for connection to PC. **Uses interchangeable SICRAM2** probes with microprocessor for the storage of the probe's calibration data. Power supply 24Vac/dc or universal 90...240Vac. Includes software DeltaLog12, instructions manual. (Transmitters without display are supplied with serial cable RS27).

Power supply, type of probe and accessories have to be specified at the time of placing the order.

Models with vertical probe (S.TV) or separated probe with cable (S.TC)

HD2717T.00: Model of without display and without relay.

HD2717T.0R: Model of without display, with configurable control relays (2) and alarm relay (1).

HD2717T.D0: Model of with custom display, without relay.

HD2717T.DR: Model of with custom display, with configurable control relays (2) and alarm relay (1).

Models for horizontal duct probe (S.TO)

HD2717TO.00: Model without display and without relay.

HD2717TO.0R: Model without display, with configurable control relays (2) and alarm relay (1).

HD2717TO.D0: Model with custom display, without relay.

HD2717TO.DR: Model with custom display, with configurable control relays (2) and alarm relay (1).

Interchangeable temperature and humidity probes with SICRAM2 module, vertical S.TV or with cable S.TC

S.TV: Vertical probe. Length of stem 130mm.

The material of the S.TC...probes can be chosen between stainless steel AISI304 or POCAN plastic material.

S.TC1.2: Probe with cable. Length of stem 130mm, length of the cable 2m.

S.TC1.2P: Probe with cable. Length of stem 130mm, length of the cable 2m. Made of POCAN.

S.TC1.5: Probe with cable. Length of stem 130mm, length of the cable 5m.

S.TC1.5P: Probe with cable. Length of stem 130mm, length of the cable 5m. Made of POCAN.

S.TC1.10: Probe with cable. Length of stem 130mm, length of the cable 10m.

S.TC1.10P: Probe with cable. Length of stem 130mm, length of the cable 10m. Made of POCAN.

S.TC2.2: Probe with cable. Length of stem 330mm, length of the cable 2m.

S.TC2.2P: Probe with cable. Length of stem 330mm, length of the cable 2m. Made of POCAN.

S.TC2.5: Probe with cable. Length of stem 330mm, length of the cable 5m.

S.TC2.5P: Probe with cable. Length of stem 330mm, length of the cable 5m. Made of POCAN.

S.TC2.10: Probe with cable. Length of stem 330mm, length of the cable 10m.

S.TC2.10P: Probe with cable. Length of stem 330mm, length of the cable 10m. Made of POCAN.

Interchangeable temperature and humidity probe with SICRAM2 module, horizontal S.TO

S.TO1: Horizontal probe for instrument HD2717TO.xx. Length of stem 130mm.

S.TO2: Horizontal probe for instrument HD2717TO.xx. Length of stem 330mm.

Accessories

RS27: RS232 null-modem serial connection cable with 9 poles sub-D 9 female connector and 3 pole connector for COM AUX port. (Included in the supply of the instruments without display).

DeltaLog12: Further unit of software for PC connection, data download, instrument setup, and management of an instrument network. For operative systems Windows® 98 to Vista.

HD75: 75%RH saturated solution for checking the relative humidity sensor, complete with thread for probes with Ø 14mm and Ø 26mm.

HD33: 33%RH saturated solution for checking the relative humidity sensor, complete with thread for probes with Ø 14mm and Ø 26mm.

HD9008.21.1: Flange with support, Ø 26mm hole for the installation of S.TC probes in vertical position, 250mm distance from the wall. The probes of the series S.TC require the adapter HD9008.26/14 from Ø 26mm to Ø 14mm.

HD9008.21.2: Flange with support, Ø 26mm hole for the installation of S.TC in vertical position, 125mm distance from the wall. The probes of the series S.TC require the adapter HD9008.26/14 from Ø 26mm to Ø 14mm.

HD9008.26/14: Adapter from Ø 26mm to Ø 14mm for the supports HD9008.21.1 and HD9008.21.2, for probes of the series S.TC.

HD9008.31: Wall flange with cable outlet to fix probes with Ø 14mm.

PG16: Stainless steel gland (AISI304) for probes with Ø 14mm.

P5: Stainless steel grid protection for probes Ø 14mm.

P6: 20µ sintered stainless steel protection for probes Ø 14mm.

P7: 10µ PTFE protection for probes Ø 14mm.

P8: Stainless steel grid and Pocan protection for probes Ø 14mm.

HD2717 Tx . x x

Relay
0 = without relay
R = with relay

Display
0 = without display
D = with display

Tipo di sonda
T = Model for vertical probe or with cable (S.TV, S.TC)
TO = Model for horizontal probe (S.TO)

HD 2817T…
TRANSMITTER, INDICATOR, ON/OFF REGULATOR, TEMPERATURE AND HUMIDITY DATA LOGGER WITH INTERCHANGEABLE PROBE

The instruments of the HD2817T... series are transmitters, indicators, and ON/OFF regulators with data logging functions, they measure temperature and humidity.
They are fitted with a graphic 128x64 backlit display.
The main feature of these instruments is their **interchangeable probe**. The probe can be replaced by the user without process interruption. Thus, the probe can be calibrated or repaired at a later time.
The instrument is available in three different versions: with horizontal probe (**S.TO**), vertical probe (**S.TV**) or with remote probe (**S.TC**), having the probe connected to the electronics by means of a cable of various lengths. The S.TO and S.TV probes are made of stainless steel AISI304, the S.TC probes can be of stainless steel AISI304 or POCAN (plastic material).
The probe is factory calibrated and ready to use, it is provided with a **SICRAM2** module which stores the calibration data of the probe, allowing the interchangeability of the probes. The instruments measure:
- Temperature in Celsius or Fahrenheit temperature scale
- Relative humidity

and calculate:
- Dew point
- Absolute humidity
- Mixing Ratio

All models have both current and voltage outputs.
Some models are fitted with two control relays and one alarm relay, configurable by the user.
All models are fitted with a multistandard RS232/RS485 serial port and an auxiliary RS232C standard serial output. The RS485 serial output allows the management of more than one device in a network.
The models HD2817T... are fitted with a large graphic backlit LCD (128x64 pixel). The display shows contemporaneously three measured physical quantities or the real time graphic of one of the measured quantities.
The **data logger** function allows to store the measures with a selectable storage interval.
The instrument setup remains permanently stored, while the real time clock is protected by an apposite Lithium battery against temporary mains voltage interruptions.
The power supply can be chosen, at the time of placing the order, between 24Vac/dc or universal 90...240Vac.

Instrument versions and available probes

Relay	
HD2817Tx.D0	Absent
HD2817Tx.DR	2 control relays with change-over contact. 1 alarm relay with normally open contact.

Type of probe	
HD2817Tx.Dx	Instrument with vertical probe **S.TV** or probe with cable **S.TC**.
HD2817TO.Dx	Instrument with horizontal probe **S.TO**.

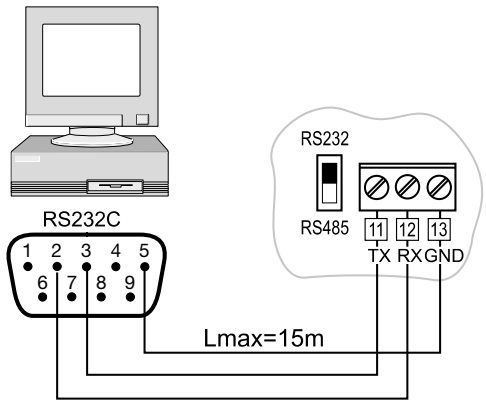
Probes complete with SICRAM2 module for instruments HD2817Tx.Dx	
S.TV	Vertical probe L= 130mm
The material of the S.TC...probes can be chosen between stainless steel AISI304 or POCAN plastic material.	
S.TC1.2	Probe L=130mm with cable 2m
S.TC1.2P	Probe L=130mm with cable 2m (POCAN probe)
S.TC1.5	Probe L=130mm with cable 5m
S.TC1.5P	Probe L=130mm with cable 5m (POCAN probe)
S.TC1.10	Probe L=130mm with cable 10m
S.TC1.10P	Probe L=130mm with cable 10m (POCAN probe)
S.TC2.2	Probe L=330mm with cable 2m
S.TC2.2P	Probe L=330mm with cable 2m (POCAN probe)
S.TC2.5	Probe L=330mm with cable 5m
S.TC2.5P	Probe L=330mm with cable 5m (POCAN probe)
S.TC2.10	Probe L=330mm with cable 10m
S.TC2.10P	Probe L=330mm with cable 10m (POCAN probe)

Probes complete with SICRAM2 module for instruments HD2817TO.xx	
S.TO1	horizontal probe L= 130mm
S.TO2	horizontal probe L= 330mm

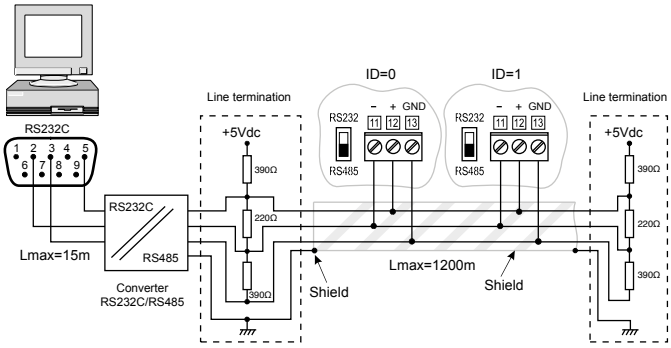
HD2817TC.Dx

HD2817TO.Dx

Sonda TO: HD2817TO1.DR

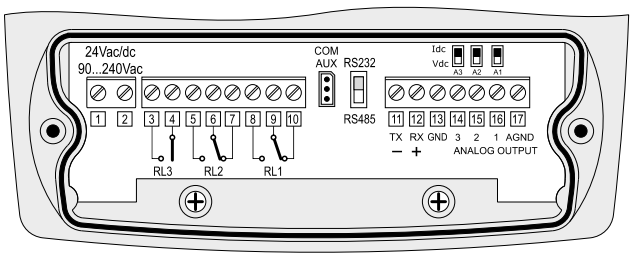


PC: instrument connection with serial communication protocol RS232C.



Connection PC / instrument with the RS485 communication protocol for distances up to 1200 m using the RS232C/RS485 converter.
On both ends of the network, line termination have to be used. To polarize the line during periods of non transmission, resistors connected between the signal line and power lien are used. If you need to connect over 32 instruments, insert a signal repeater between a group and the next one. At the beginning and at the end of each segment you should apply the line terminator. The data line should be kept separate from any power line in order to avoid interferences on the transmitted signal. The cable shield should be connected at both ends of the line. The cable should have the following characteristics:
- Impedance 120 Ohm
- Capacity <50pF/m
- Resistance <100 Ohm/km
- Section > 0.22mm^2, (AVG24)

The maximum cable length depends on the data transmission velocity and on the characteristics of the cable. Typically, the maximum length is 1200m. The data line should be kept separate from any power line in order to avoid interferences on the transmitted signal.



Terminal board

Wall fastening plate

Technical specifics (@ 24Vac and 20°C)

Inputs		
Temperature	Sensor	Pt100 classe 1/3 DIN
	Working range of the sensor	-50 ... +200°C (-58 ...+392°F)
Humidity	Relative humidity %RH	0 ... 100%RH
	Working range of the sensor in temperature	-50 ... +150°C (Special configurations up to 180°C available on request)
	Dew point TD	-50 ... +100°C
	Absolute humidity	0 ... 600g/m^3
	Mixing ratio	0 ... 2000g/kg of dry air
	Wet bulb temperature	-50…+100°C
Accuracy of the measured physical quantity	Temperature Pt100	±0.25°C
	Relative humidity %RH	±2.5%RH (10...90%RH) ±2.5%RH in the remaining field
Accuracy of the calculated physical quantity	See table in the following chapter	
Response time		3min with grid protection (at 20°C and 0.5m/s)

Outputs		
Communications	Type	RS232C and RS485 Multidrop
	Baud Rate	9600 baud 57600 baud non-permanent
Physical quantities	Measured	Temperature, relative humidity
	Calculated	Dew point, absolute humidity, mixing ratio.
Analog outputs	Number	3
	Output types	4...20mA; 0...20mA 0...10Vdc; 2…10Vdc
	Load resistance	Current output: 500Ω max Voltage output: 100kΩ min
	Resolution	16bit
	Accuracy analog outputs	±0.05% f.s. @20°C
	In case of measuring error (exceeding of the operating limits, faulty or not connected probe,....)	Idc = 22mA Vdc = 11V
Relay	Control relay	2 x 3A/250Vac Load resistance, 1 change-over contact
	Alarm relay	1 x 3A/250Vac Load resistance, 1 with normally-open contact

Instrument		
Power supply	Versions	24Vdc / 24Vac 50…60Hz, ±10%
		90 ... 240Vac 50…60Hz
	Average consumption	3W
Data logger	Storage capacity	9000 samples in max. 256 sessions
	Storage type	Circular memory
	Stored parameters	Dew point, temperature, relative humidity, absolute humidity, mixing ratio, analog outputs 1 and 2, relay status 1, 2, 3.
	Storage interval	1, 2, 5, 10, 20, 60 seconds, 2 and 4 minutes
Real time clock	Type	Real time with Lithium buffer battery
	Accuracy	±1min/month
Software		DeltaLog12 for Windows® 98 to Vista operating systems
Display	Graphic backlit LCD	128x64 pixel
Ambient working conditions of the electronics	Operating temperature	-20…+60°C
	Relative humidity	0…90%RH - No condensate
	Static working pressure of the sensors	12 bar max.
	Storage temperature	-30…+80°C
Housing	L x H x W	143x154x61
	Weight	600g
	Material	ABS
	Degree of protection	Electronics IP65

Accuracy of the calculated physical quantities
The accuracy of the calculated physical quantities depends on the accuracy of the relative humidity and temperature calibration. The provided values refer to an accuracy of ±2.5%RH, ±0.25°C, 1013.25mbar.

Accuracy of the Dew Point Td (°C)

		Relative Humidity (%)					
		10	30	50	70	90	100
Temperature (°C)	-20	2.50	1.00	0.71	0.58	--	--
	0	2.84	1.11	0.78	0.64	0.56	0.50
	20	3.34	1.32	0.92	0.75	0.64	0.62
	50	4.16	1.64	1.12	0.90	0.77	0.74
	100	5.28	2.07	1.42	1.13	0.97	0.91

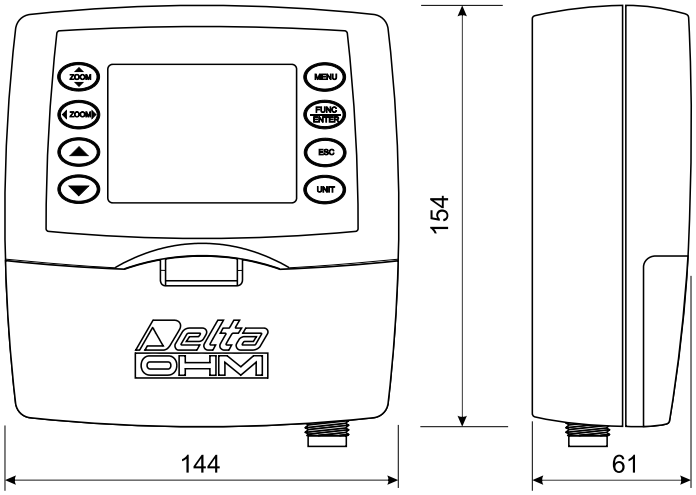
Accuracy of the absolute humidity (g/m³)

		Relative Humidity (%)					
		10	30	50	70	90	100
Temperature (°C)	-20	0.020	0.030	0.035	0.038	---	---
	0	0.12	0.15	0.16	0.18	0.20	0.21
	20	0.45	0.49	0.54	0.59	0.64	0.66
	50	2.07	2.27	2.48	2.67	2.87	2.96
	100	14.81	15.78	16.75	17.72	18.57	19.06

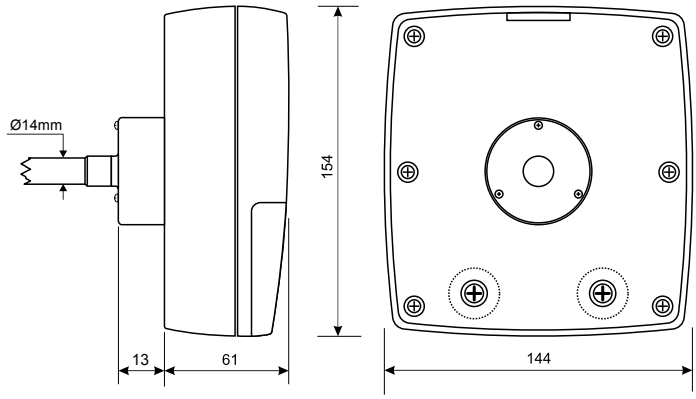
Accuracy of the mixing ratio (g/kg)

		Relative Humidity (%)					
		10	30	50	70	90	100
Temperature (°C)	-20	0.020	0.022	0.026	0.029	---	---
	0	0.09	0.11	0.12	0.13	0.15	0.15
	20	0.37	0.41	0.46	0.51	0.55	0.58
	50	2.04	2.32	2.61	2.90	3.25	3.42
	100	19.06	36.00	75.9	228.9	---	---

Dimensions



Versions HD2817Tx.Dx for vertical probes TV or with cable TC



Version HD2817TOx.Dx for horizontal probes

ORDERING CODES

HD2817T...: Transmitter, indicator, and ON/OFF regulator for temperature and humidity, with data logging functions. Fitted with 2 analogue current outputs (0...20mA and 4...20mA) or voltage outputs (0...10Vdc and 2...10Vdc). RS232/RS485 serial ports for connection to PC. **Uses interchangeable SICRAM2 probes** with microprocessor for the storage of the probe's calibration data. **Visualizes the data on a large graphic backlit LCD.** Power supply 24Vac/dc or universal 90...240Vac. Includes software DeltaLog12, instructions manual. **Power supply, type of probe and accessories have to be specified at the moment of placing the order.**

Models with vertical probe (S.TV) or separated probe with cable (S.TC)
HD2817T.D0: Model without relay.
HD2817T.DR: Model with configurable control relays (2) and alarm relay (1).

Models for horizontal duct probe (S.TO)
HD2817TO.D0: Model without relay.
HD2817TO.DR: Model with configurable control relays (2) and alarm relay (1).

Interchangeable temperature and humidity probes with SICRAM2 module, vertical S.TV or with cable S.TC
S.TV: Vertical probe. Length of stem 130mm.
The material of the S.TC...probes can be chosen between stainless steel AISI304 or POCAN plastic material.
S.TC1.2: Probe with cable. Length of stem 130mm, length of the cable 2m.
S.TC1.2P: Probe with cable. Length of stem 130mm, length of the cable 2m. Made of POCAN.
S.TC1.5: Probe with cable. Length of stem 130mm, length of the cable 5m.
S.TC1.5P: Probe with cable. Length of stem 130mm, length of the cable 5m. Made of POCAN.
S.TC1.10: Probe with cable. Length of stem 130mm, length of the cable 10m.
S.TC1.10P: Probe with cable. Length of stem 130mm, length of the cable 10m. Made of POCAN.
S.TC2.2: Probe with cable. Length of stem 330mm, length of the cable 2m.
S.TC2.2P: Probe with cable. Length of stem 330mm, length of the cable 2m. Made of POCAN.
S.TC2.5: Probe with cable. Length of stem 330mm, length of the cable 5m.
S.TC2.5P: Probe with cable. Length of stem 330mm, length of the cable 5m. Made of POCAN.
S.TC2.10: Probe with cable. Length of stem 330mm, length of the cable 10m.
S.TC2.10P: Probe with cable. Length of stem 330mm, length of the cable 10m. Made of POCAN.

Interchangeable temperature and humidity probe with SICRAM2 module, horizontal S.TO
S.TO1: Horizontal probe for instrument HD2817TO.xx. Length of stem 130mm.
S.TO2: Horizontal probe for instrument HD2817TO.xx. Length of stem 330mm.

Accessories
RS27: RS232 null-modem serial connection cable with 9 poles sub-D 9 female connector and 3 pole connector for COM AUX port. (Included in the supply of the instruments without display).
DeltaLog12: Further unit of software for PC connection, data download, instrument setup, and management of an instrument network. For operative systems Windows® 98 to Vista.
HD75: 75%RH saturated solution for checking the relative humidity sensor, complete with thread for probes with Ø 14mm and Ø 26mm.
HD33: 33%RH saturated solution for checking the relative humidity sensor, complete with thread for probes with Ø 14mm and Ø 26mm.
HD9008.21.1: Flange with support, Ø 26mm hole for the installation of S.TC probes in vertical position, 250mm distance from the wall. The probes of the series S.TC require the adapter HD9008.26/14 from Ø 26mm to Ø 14mm.
HD9008.21.2: Flange with support, Ø 26mm hole for the installation of S.TC in vertical position, 125mm distance from the wall. The probes of the series S.TC require the adapter HD9008.26/14 from Ø 26mm to Ø 14mm.
HD9008.26/14: Adapter from Ø26mm to Ø14mm for the supports HD9008.21.1 and HD9008.21.2, for probes of the series S.TC.
HD9008.31: Wall flange with cable outlet to fix probes with Ø 14mm.
PG16: Stainless steel gland (AISI304) for probes with Ø 14mm.
P5: Stainless steel grid protection for probes Ø 14mm.
P6: 20µ sintered stainless steel protection for probes Ø 14mm.
P7: 10µ PTFE protection for probes Ø 14mm.
P8: Stainless steel grid and Pocan protection for probes Ø 14mm.

HD2817 Tx . D x

Relay
0 = without relay
R = with relay

Probe type
T = Model for vertical probe or with cable (S.TV, S.TC)
TO = Model for horizontal probe (S.TO)

HD2001
HD2001.1
HD2001.2
HD2001.3

HD 2001, HD 2001.1, HD 2001.2, HD 2001.3 INDICATORS OF TEMPERATURE, HUMIDITY, PRESSURE AND AIR SPEED ENVIRONMENTAL MEASUREMENTS WITH DIGITAL OR ANALOG OUTPUT

The devices of the HD2001 series…, according to the models, measure temperature, relative humidity, barometric pressure and, for the model HD2001.2, air speed by hot-wire probes. All the models are provided with RS232C or RS485 serial output and the management of more than one device connected to a network. In addition, all the models are fitted with an open collector type low-activated configurable alarm output.
The HD2001.1 and HD2001.3 model have three configurable analog outputs: 4…20mA or 0…20mA current output, or 0…10Vdc or 2…10Vdc voltage output. The choice of output type is made by means of the jumpers set on the board.
Wind speed measurement is detected by the HD2001.2 model with a hot-wire probe set on the upper part of the instrument.
The large display with dual indication on all models allows one of the process variables on the first line and the temperature on the second line, to be displayed.

Tables 1 and 4 show the main characteristics of the three models.

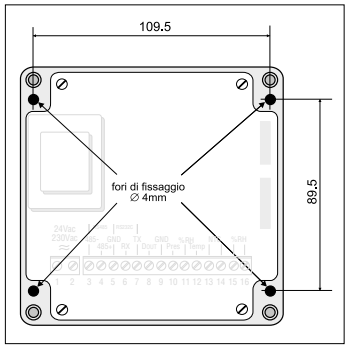


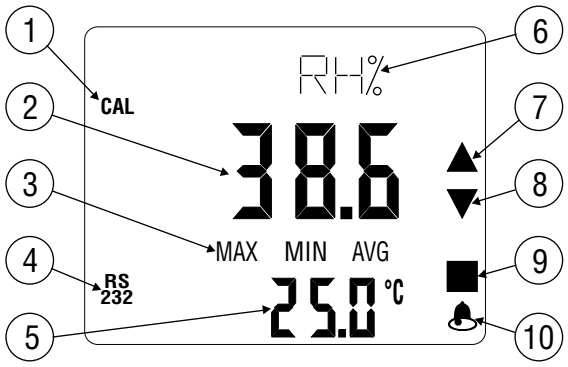
Fig.1 Position of the fixing holes.

Fig.2 Hot-wire probe mod. HD2001.2.

Table 1

	Input			Output	
Model	Temperature % RH	Pressure	Air speed	RS232-RS485 Open collector output	Analog outputs 0…20mA, 4…20mA, 0…10Vdc, 2…10Vdc
HD2001	*	*	---	*	---
HD2001.1	*	*	---	*	*
HD2001.2	*	*	*	*	---
HD2001.3	*	---	---	*	*

Display description



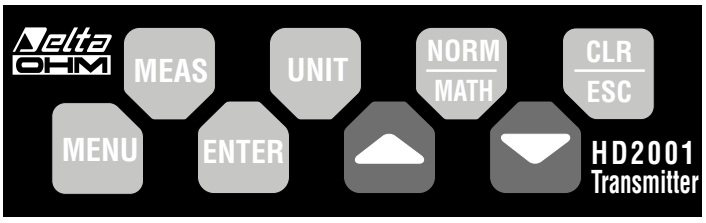
The display constantly shows the measurements of two values. While in the first line ② the value can be selected through the MEAS button, the second line ⑤ below always shows the temperature. During measurement, the first line ⑥ displays the unit of measurement of the main variable; inside the menu it provides information about the active item.
On the right-hand side of the display there are four symbols:

- The two arrows ⑦ and ⑧ are lit when the pressure measured by the barometric sensor differs at least 1 mbar from that measured 6 hours previously;
- The framed arrow ⑨ i indicates the pressure drop alarm and is lit when a pressure drop occurred during the previous 6 hours which was higher than or equal to the BAR DROP value, which can be set in the menu within the range 1…9 mbar;
- The bell symbol ⑩ is lit when any of the alarms is exceeded (see paragraph "Programming the alarms").

Symbols

- CAL ① turns on during calibration of the RH sensor (see the paragraph on calibration).
- MAX MIN AVG ③ indicate that the main measurement ② reached the maximum (MAX), minimum (MIN) or average (AVG) value since last reset (see the function of the NORM/MATH button).
- RS232 ④ is turned on when the instrument is connected to a PC.

Keyboard description



MEAS By repeatedly pressing this button the main variable displayed in the first line of the display can be selected. This function is cyclic: %RH >> Barometric Pressure >> Wind speed (for the HD2001.2 model) >> %RH…
The temperature measured is always visible in the second line of the display.
UNIT This button selects the unit of measurement or the secondary variable correlated to the main variable displayed in the first line of the display.
Humidity: %RH (relative humidity %) >> g/m^3 (absolute humidity) >> g/kg (mixing ratio) >> Tdew (Dew Point temperature in °C or °F).
Pressure: hPa >> kPa >> mbar.
Wind speed: m/s >> ft/min.
NORM/MATH This tool provides the chance to display the maximum (MAX), average (AVG) and minimum (MIN) value for all calculated variables from the moment the MATH button is pressed. This function memorizes the values of the previous measuring session and treats them as initial values for the new calculations. Press the CLEAR/ESC button to reset the memory.
CLR/ESC It resets the initial values during measurement of the maximum, average, minimum value. Within the menu, it allows the current function to be exited without the changes being saved.

ENTER Within the menu confirms the current selection and returns to the measurement. To confirm a parameter without exiting the menu, all that needs to be done is to display it and continue using the MENU button.

UP Within the menu, it increases the current value.

DOWN Within the menu, it decreases the current value.

MENU Using this button the instrument's menu can be accessed: the single items are described in the upper part of the display by flowing text. To modify an individual item, use the arrows; to confirm it and remain in the menu, press the MENU button; to confirm it and return to measurement, press the ENTER button.

NOTE: to help clarity, in the following explanation the terms appearing on the display are indicated by capital letters in bold (e.g. TEMP indicates the temperature, CEN means Centigrade).

1. **TEMP**erature **CEN**tigrade or **FAHR**enheit: Selection of the unit of measurement for the temperature between Centigrade or Fahrenheit.
2. **BAUD RATE**: Selection of the data transmission speed for data communication using the RS232C or RS485 serial port. Various values are available: 300, 1200, 2400, 4800 and 9600. We recommend using the maximum speed of 9600 baud.
3. **PRiNT AUTO**: 1 = YES, 0 = NO. Enables (= 1) or disables (= 0) the continuous data transmission on the serial port (continuous printing) according to a frequency equal to the interval set in the item **INTV SEC**. Date, time, temperature, relative humidity, absolute humidity, mixing ratio, dew point, barometric pressure, wind speed (in m/s or in ft/min) are printed. The units of measurement are the same as those used on the display.
4. **INT**er**V**al **SEC**onds. Print interval in seconds.
5. **YEAR**: Menu item to set the year. **The date is kept until the instrument is on**. If the instrument is turned off when not connected to a PC, the date must be reset from the keyboard. If it is connected to a PC and a power failure occurs, when reconnecting the power the PC automatically updates the instrument date without needing to use the keyboard.
6. **MON**th: Current month.
7. **DAY**: Current day.
8. **HOUR**: Current hour.
9. **ESC ZERO**s **SEC**onds, **MIN**utes: Current minutes. The seconds can be reset by pressing ESC. In order to set the hour precisely, simply set it one minute in advance and when the new minute strikes, press ESC. For example, if it is 11:20.10 and you wish to correct the time, set it to HOUR=11, MIN=21 and when the new minute strikes (21), press ESC: thus the time is synchronized to the second at 11:21.00.
10. **NUM**ber **INST**ument **ADDR**ess: Sets the identification (ID) of the instrument to be able to use it within a network. The numbers from 0 (first instrument) to 255 are available. For the details see the paragraph dealing with serial communication.
11. **SET ALaRM** 1 = YES, 0 = NO: Enables (=1) or disables (=0) the open collector low-activated alarm output. The settings submenu can be entered using the upward arrow (UP). For the details see the paragraph on alarm programming.
12. **ENaBLe CALi**bration: Enables the calibration of the relative humidity sensor. For the details see the paragraph on calibration.

Installation and connections

The instrument is set up to work indoors. The pressure and humidity sensors are set downwards so that the accumulation of dust and dirt is reduced to the minimum.

Four holes fix the container: the position of the holes is outlined in the figure.

Model HD2001.2

The HD2001.2 model is fitted with an omnidirectional hot-wire probe: the sensor set on the top of the probe is very delicate and must be protected with the special frame provided with the instrument. During transportation, the sensor is closed into a cylinder screwed on the end part of the probe: during installation, unscrew this cylinder and screw the protection frame in its place.

In order to measure the wind speed accurately, the instrument must be set at a certain distance from the wall using the HD2001.2.30 pole, as indicated in fig. 3.

HD2001: Temperature, humidity, pressure, serial output.

HD2001.1: Temperature, humidity, pressure, serial and analogue output.

Serial communication and instruments' network

The instrument is fitted with RS232C and Multidrop RS485 serial ports for connection to a PC. Thanks to the RS485 protocol it is possible to connect more than one instrument to form a network managed by the **DeltaMet8** software provided.

The protocol is selected by using dip-switch no. 1 set on the display board.

When only one instrument is used, set at a maximum distance of 15 m from the PC, use the RS232C serial connection, as this port, unlike RS485, is present on all PCs. To cover longer distances (until 1200 m) or to create a network of instruments, the RS485 port must be used with a special RS232/RS485 converter.

A network is formed by a maximum of 256 devices tandem-connected through a shielded twisted pair cable. The first element of the network connected to the PC may use the RS232C protocol and can be an interface between the PC and the rest of the network: so using an RS232C/RS485 converter can be avoided (**only if the first instrument is less than 15 m away from the PC**).

In order that communication along the network work correctly, each instrument needs to be identified by an ID number differing from all the others. On the first start up, after commuting the protocol selection dip-switch, the ID of the instrument is automatically set to "0" if the RS232C protocol is selected, and set to "1" if the RS485 protocol is selected: using the menu item "**NUM**ber **INST**ument **ADDR**ess" these IDs can be changed and memorized in order to set up new components on the network. To maximally speed up the data transmission, we recommend using the highest baud rate available of 9600 baud: you should only reduce this value when communication problems occur.

Programming the alarms

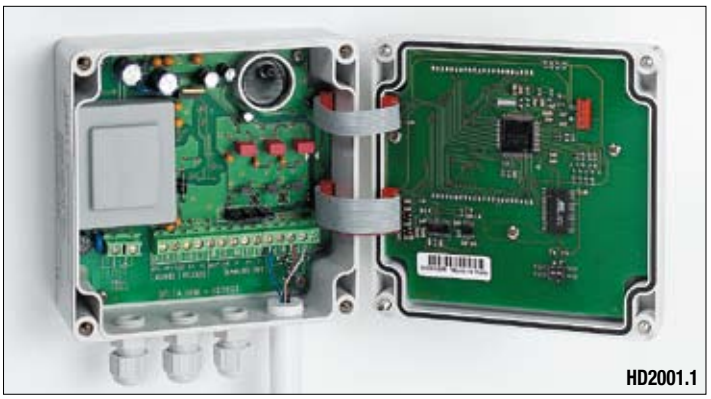
Each of the three HD2001 models… is fitted with an open collector low-activated alarm output.

This output commutes when enabled if any of the limits, associated with the measurement variables of all the instrument's values, exceeds the maximum level or goes below the minimum level. The activation and deactivation of the alarm effects only the physical output and not the display indication which in contrast always remains enabled. **To avoid one of the variables intervening, simply set the limits to the extreme working limits of the measurement range**. For each physical value, except for pressure drop, the lower level (LOW) and the upper level (HIGH) with LOW smaller than HIGH must be entered.

Setting

Browse the menu items until the item SET ALaRM 1 = YES, 0 = NO: press the up arrow (UP) to access the setting of the limits. The writing changes and becomes **ReLAY ALaRM ENaBLed** (Alarm output enabled): to enable the output maintaining the previous settings, press ENTER. To enable the output and modify the settings, press MENU: after this, the lower (**LOW**) and upper (**HIGH**) alarm limits for each physical value available will be prompted. For example, "**SET TEMP**erature **LOW**" sets the minimum alarm limit of the temperature; using the arrows enter the desired value and then proceed with the MENU button to modify the other parameters. Pressing ESC, the current parameter on display is reset to the initial value.

The variables are listed in this order: temperature, relative humidity, dew point, barometric pressure, pressure drop (DROP) in the last 6 hours and, for the HD2001.2 model, wind speed.



HD2001.1

HD2001

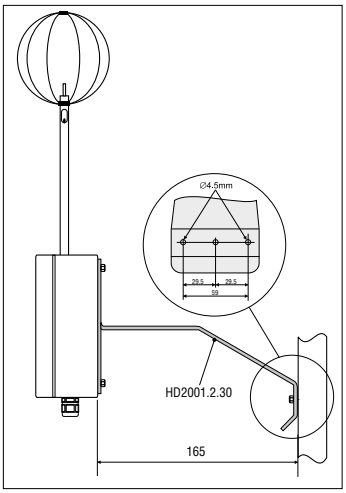


Fig.3 Support for model HD2001.2

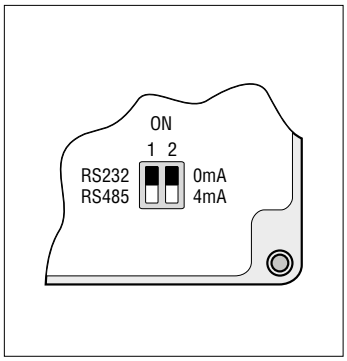


Fig.4 Selection dip switch for protocol RS232/ RS485 and analogue output.

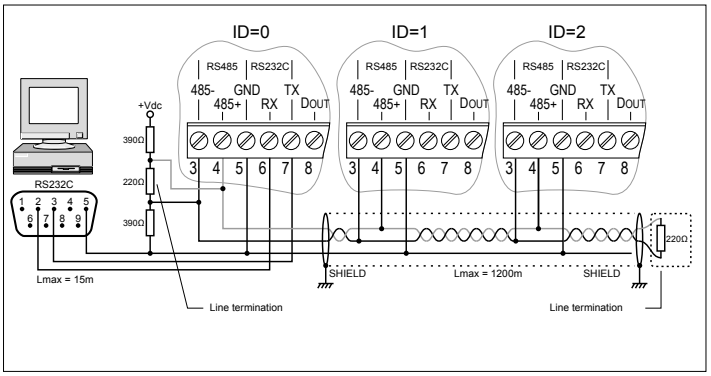


Fig.7 RS485 network in which the conversion function is performed by first instrument of the network. The instrument that is connected directly to PC is identified by the ID = 0 and must be placed no more than 15m away from the PC. If your PC does not have the RS232 connection, you must insert a USB/RS232 converter between the PC and the first instrument of the network.

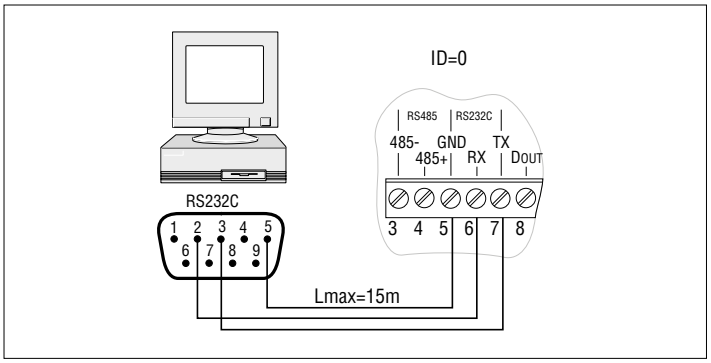


Fig.5 Connection to PC/ device with RS232C protocol.

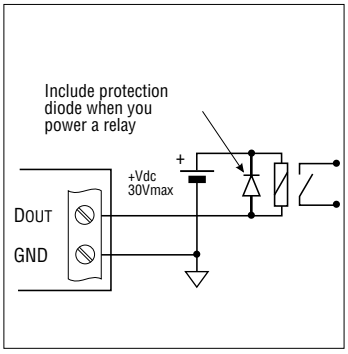


Fig.8 Typical connection for alarm relay activation

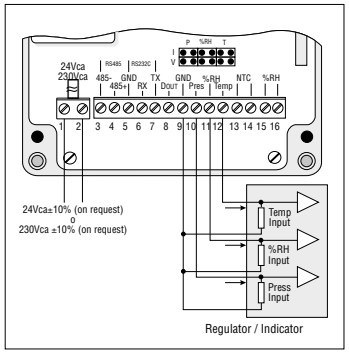


Fig.9 Connection example of the analogue output to an indicator/regulator.

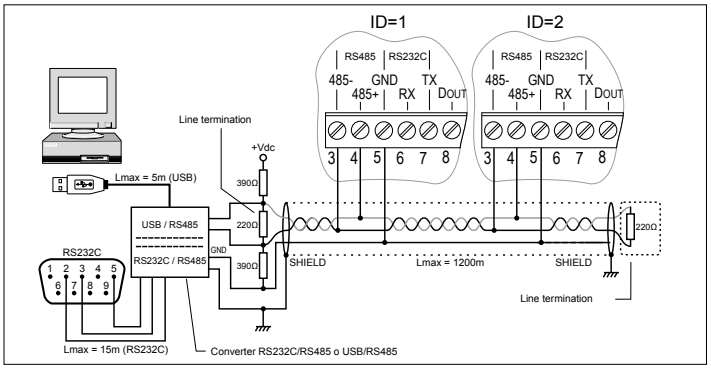


Fig.6 PC Connection with the RS485 communication protocol for distances up to 1200 m. The instruments are tandem-connected through a shielded twisted pair cable for signals and a third wire for grounding. Both ends of the network need to have resistors for impedance matching (Line terminations). To polarize the line during periods of non-transmission, resistors connected between the signal and the power line have to be used. For PC connection it is necessary to use a RS232/485 or USB/RS485 converter.

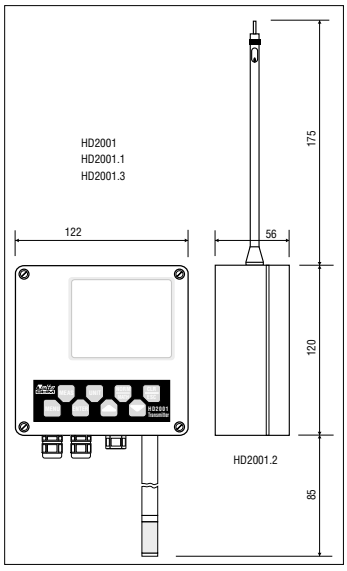


Fig.10 Dimensions.

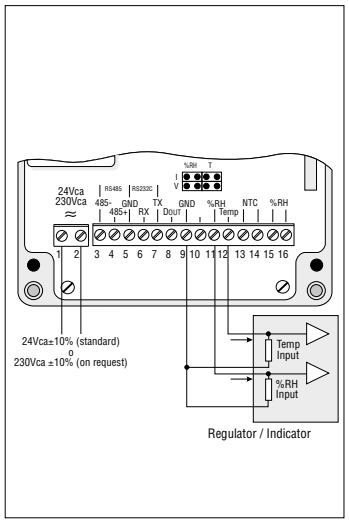


Fig.11 Connection example to an indicator/ regulator with analogue input HD2001.3.

Current and voltage analog outputs for the HD2001.1 and HD2001.3 models
The models are provided with current or voltage analog outputs, one for each value, each associated with a physical value measured by the instrument. The available outputs are 0…20mA, 4…20mA, 0…10Vdc and 2…10Vdc. The relation between output range (current and voltage) and input range is fixed: the output minimum and maximum values are associated with the minimum and maximum values of the input variables.

HD2001.1 and HD2001.3 Inputs / analog outputs ratio	
Inputs	Analog outputs
-20 … +80°C 0…100%RH 600…1100mbar	4...20mA 0...20mA 0...10Vdc 2 … 10Vdc
Table 2	

The type of output is selected using dip-switch no. 2 set on the display card (see fig. 4) and the jumpers set near the analog output terminals (see fig. 9): the various combination are outlined in the following table in which the relevant output is reported according to the position of the switches.

Table 3				
Dip-switch no. 2	0mA	0mA	4mA	4mA
Position of the jumper	I	V	I	V
Output selected	0 … 20mA	0 … 10Vdc	4 … 20mA	2 … 10Vdc

It is possible to use voltage or current outputs contemporarily provided that they belong in the first two columns or the last two of table 3. For example the outputs 0…20mA and 0…10Vdc or 4…20mA and 2…10Vdc can coexist, but for example, the outputs 0…20mA and 4…20mA cannot coexist. For correct functioning, **we recommend observing the load specifications concerning the analog outputs reported in the technical information**.

Calibration of the relative humidity sensor HD2001 - HD2001.1 - HD2001.3
ATTENTION: to calibrate the relative humidity sensor correctly it is fundamental to know and abide by the physical phenomena on which the measurement is based: this is the reason we recommend evaluating a new calibration carefully before intervening and, in case it is to be performed, we recommend following

Calibration of the humidity sensor offset:
all that is reported below rigorously.

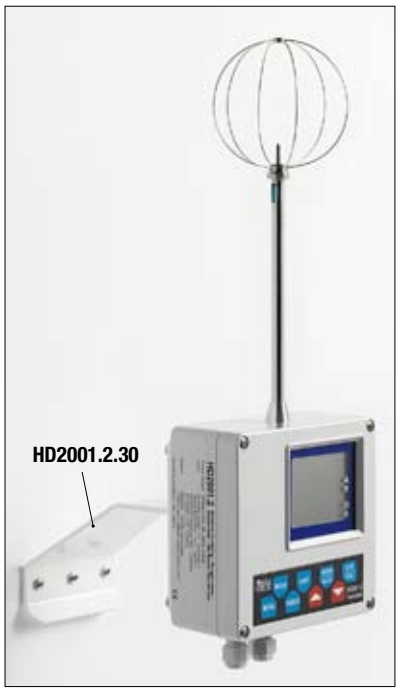
1. Enter the probe in the container with the saturated solution at 75% relative humidity at about 20°C. Wait at least 30 minutes.
2. Using the MENU button select the item "**EN**a**BL**e **CAL**ibration", press the UP arrow until reaching #51: the calibration procedure is started automatically.
3. The display indicates "**CAL RH**". Using the arrows, adjust the relative humidity value indicated on the display according to the temperature of the calibration salts: the value to be set is shown on the container's label of the saturated salt used.
4. Wait a few minutes to ensure the reading is stable.
5. Press ENTER to confirm this value. The instrument returns to normal measurement.
6. Remove the probe from the container and close it immediately using its lid.

Calibration of the humidity sensor slope:

1. Enter the probe in the container with the saturated solution at 33% of relative humidity. Wait at least 30 minutes.
2. Using the MENU button select the item "**EN**a**BL**e **CAL**ibration", press the UP arrow until reaching #51: the calibration procedure is started automatically.
3. The display indicates "**CAL RH**". Using the arrows, adjust the relative humidity value indicated on the display according to the temperature of the calibration salts: the value to be set is shown on the container's label of the saturated salt used.
4. Wait a few minutes to ensure the reading is stable.
5. Press ENTER to confirm this value. The instrument returns to normal measurement.
6. Remove the probe from the container and close it immediately using its lid.

Note: the calibration of the sensor is usually carried out on both points, first at 75%RH and then at 33%RH, but can be carried out on one of the points only, to regulate a small departure at 75% or 33%, for example. On exiting calibration the instrument checks if the procedure was carried out correctly and signals any anomaly by making the CAL symbol blink. If the blinking occurs at the end of the calibration of one of the two points, it means the other point also needs calibrating.

Note: the calibration of the relative humidity of the model HD2001.2 has to be performed in a chamber with controlled humidity and temperature conditions.



HD2001.2: Temperature, humidity, pressure, air speed, RS232 / RS485 output.

HD2001.2

HD2001.2

Table 4 - Technical information (@ 24Vac and 25°C)

		HD2001	HD2001.1	HD2001.2	HD2001.3
Inputs					
Temperature	Sensor	NTC 10kΩ			
	Working range	-20 … +80°C			
	Accuracy	±0.3°C in the range 0…+70°C ±0.4°C outside this range			
Humidity	Sensor capacity	300pF			
	%RH working range	0…100%RH			
	TD working range	-20 … +80°C			
	Accuracy	±2.0% (10…90%RH), ±2.5%RH in the remaining range			
Pressure	Working range	600…1100mbar - 600…1100hPa - 60.0…110.0kPa			----
	Accuracy	±0.5mbar @25°C			----
	Fluid contacting the membrane	Air – Non corrosive gas - **No liquids**			----
Wind speed	Type of sensor	----	----	Hot-wire	----
	Working range	----	----	0…5m/s	----
	°C working range	----	----	-20 … +80°C	----
	Accuracy	----	----	±0.15m/s @25°C	----
Outputs					
Communications	Type	RS232C and Multidrop RS485			
	Maximum Baud Rate	9600 baud			
Alarm	Type of output	Open collector (low-activated)			
	Maximum voltage	30Vdc			
	Maximum power	200mW			
Variables		Temperature, %RH, dew point TD, barometric pressure, pressure drop.		Temperature, %RH, dew point TD, barometric pressure, pressure drop and wind speed	Temperature, %RH, dew point TD
Analog	Type of outputs	---	4...20mA 0...20mA 0...10Vdc 2 … 10Vdc	---	4...20mA 0...20mA 0...10Vdc 2 … 10Vdc
	Load resistance	---	Current output: 500Ω max Voltage output: 100kΩ min	---	Current output: 500Ω max Voltage output: 100kΩ min
	Resolution	---	16bit	---	16bit
Power		24Vac ±10% 50…60Hz (230Vac ±10% on request)			
Software		DeltaMet8			
Environmental conditions	Temperature range	-20 … +80°C			
	Humidity range	0…90%RH - (without condensation)			
	Protection degree	Electronic IP67			

ORDER CODES

HD2001 Temperature, relative humidity, barometric pressure indicator. Open collector alarm output and RS232C and RS485 PC connection. DeltaMet8 software for PC connection.

HD2001.1 Active indicator/transmitter of temperature range, relative humidity, barometric pressure with selectable 0…20mA, 4…20mA, 0…10V e 2…10V outputs. Open collector alarm output and RS232C and RS485 PC connection. DeltaMet8 software for PC connection.

HD2001.2 Temperature range, relative humidity, barometric pressure and wind speed indicator. Open collector alarm output and RS232C and RS485 PC connection. DeltaMet8 software for PC connection.

HD2001.3 Temperature, relative humidity active indicator/transmitter with selectable 0..20mA, 4..20mA, 0..10V and 2..10V outputs. Open collector alarm output and RS232C and RS485 PC connection. DeltaMet8 software for PC connection.

HD2001.2.30: Wall mounting support for HD2001.2.

HD75 Saturated salt solution 75% R.H. Adapter M 12x1.

HD33 Saturated salt solution 33% R.H. Adapter M 12x1

HD 9008TRR
HD 9009TRR
HD 9007

HD 9008TRR, HD 9009TRR, HD 9007
TEMPERATURE AND HUMIDITY TRANSMITTERS, MULTIPLATE RADIATION SHIELD

CHARACTERISTICS
The HD9008TRR and HD9009TRR are single block RH and temperature microprocessor transmitters, temperature configurable. The HD9008TRR is a passive transmitter with a 4…20mA output and 10…30Vdc power supply; the HD9009TRR is a transmitter with a 0…1V standard voltage output (other outputs available on demand) and 10…30Vdc power supply. Sensors are mounted at the end of a plastic tube: a capacitive humidity sensor and a Platinum temperature sensor (100Ω @0°C).
The instrument can be reprogrammed by means of a key, and no jumper or potentiometer actions are required. The humidity input can be recalibrated by using two saturated solutions: the first one at 75%, the second one at 33%; the 0%RH…100%RH relative humidity range is fixed, 4mA (or 0Vdc) correspond to 0%RH, 20mA (or 1Vdc) equal 100%RH.
Temperature standard configuration is –40…+80°C for the HD9008TRR and –40…+60°C for the HD9009TRR, corresponding to 4…20mA and 0…1Vdc, respectively.
The user can configure the temperature output in ranges different from the standard one by means of a Pt100 simulator or of a set of fixed resistances, provided that it is included in the -40°C…+80°C range with a minimum amplitude of 25°C. Two LEDs give alarm indications (temperature exceeding set range, sensor breakage or short-circuit) and help the operator when programming.

An out-of-standard temperature operating range can be requested when placing the order.
Important Warning: probes work in the -40°C…+80°C temperature range. Outside this range data are not correct; electronics is designed to operate in this range.

SENSORS
The humidity sensor is a condenser which dielectric is made up by an hygroscopic polymer. As water dielectric constant is approximately 80, you'll get a strong change in capacity as the humidity content of this polymer changes. The advantages of this kind of sensor are: good linearity, insensitivity to temperature changes, fast response time and long-lasting life. The sensor temporary looses its accuracy if some condensation develops on its surface (the transmitted value is higher than the real one because of an increase in effective capacity).
The temperature sensor is a Platinum resistance thermometer (100Ω @0°C). The Pt100 resistance variation is transformed into a current or voltage signal, linear to temperature.

SIGNAL TRANSMISSION
The electronic circuit design provides the signal to increase linearly as humidity and temperature raise.
In presence of cables transmitting high currents or machines causing electromagnetic noises, the transmitter connection cables have to be placed in a separate raceway, or far from them, to prevent these noises. It is recommended to use a shielded cable for the connections of instruments having a voltage output (HD9009TR).

INSTALLATION AND ASSEMBLY
Figures 1 and 2 show the connection diagram of the two models. R_{RH} and $R_{°C}$ represent the current input of any device connected to the 4…20mA loop, that is: an indicator, a controller, a data logger or a recorder. In figure 2, "Vin%RH and Vin°C" symbols have the same meaning.

Accuracy in measuring does not depend on the transmitter position. However, it is suggested to install the transmitter with the sensor faced downwards (where possible) to reduce dust deposit on the sensor protection filter. The transmitter shall not be mounted next to doors, in draughtiness, in areas with scarce air circulation, or near a heat source, as heating air involves a decrease of relative humidity (the quantity of available water vapour being equal).
Protection degree: IP54.
Ensure that the sensor is compatible with the atmosphere where it is installed.

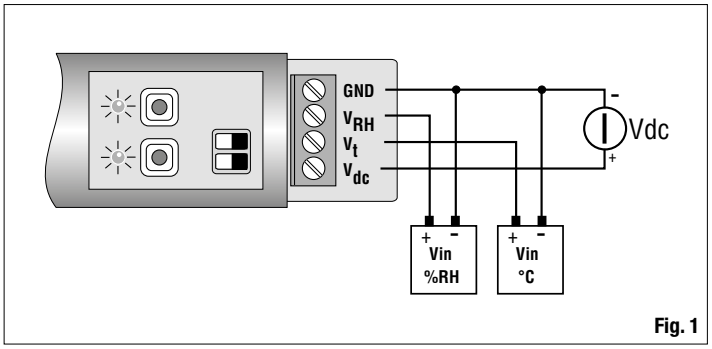


Fig. 1

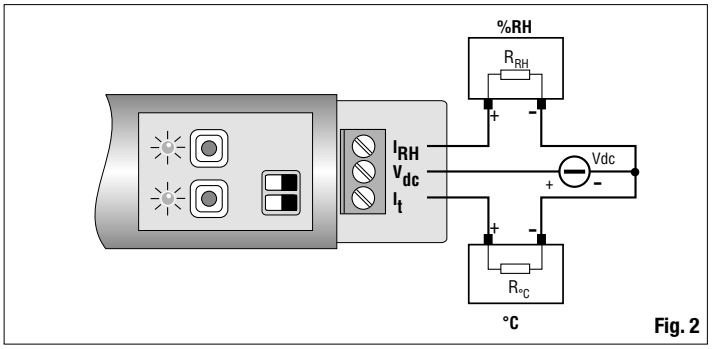


Fig. 2

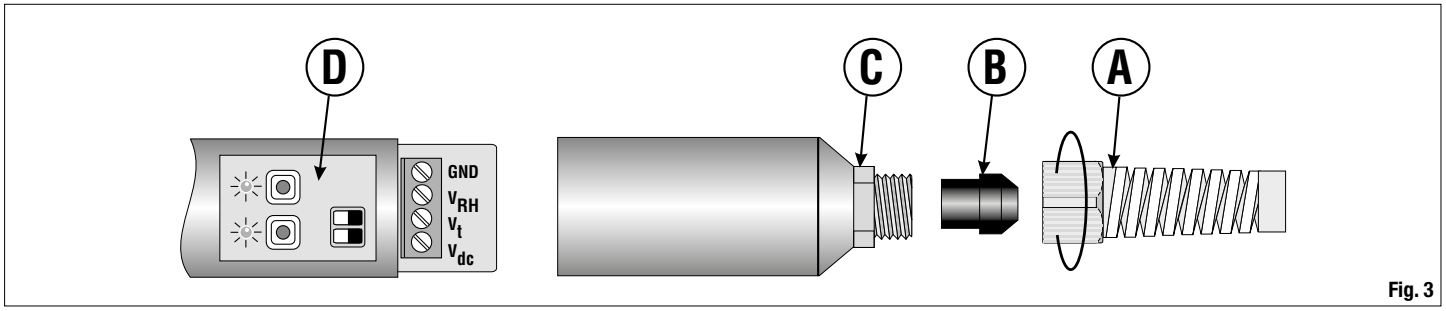


Fig. 3

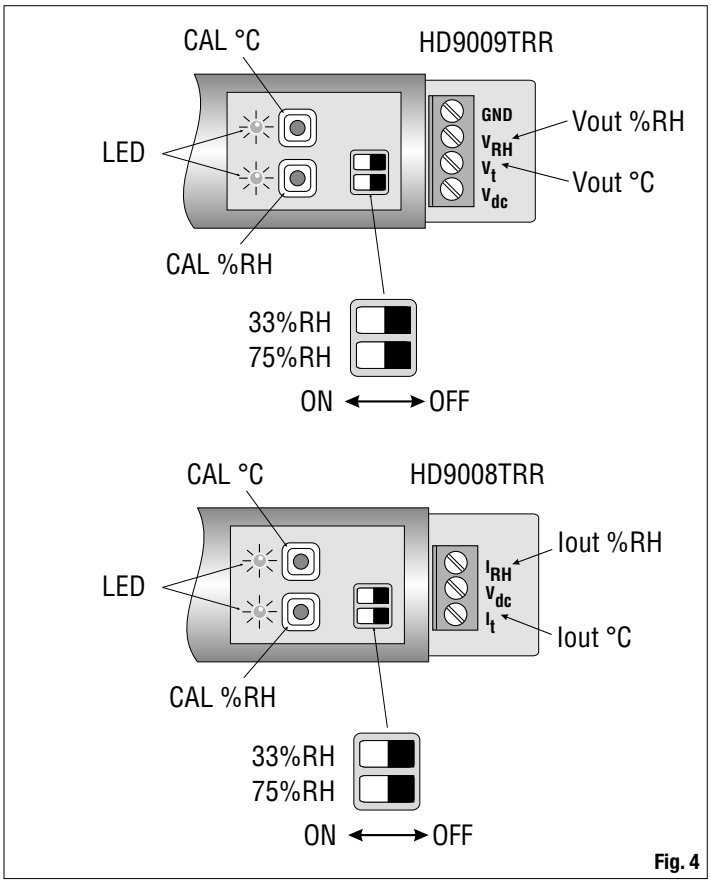


Fig. 4

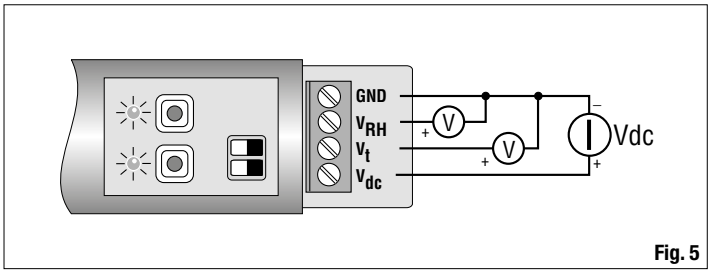


Fig. 5

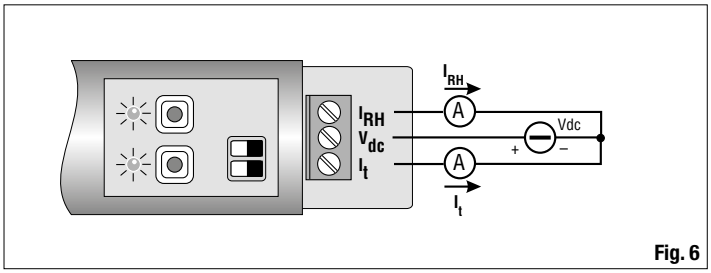


Fig. 6

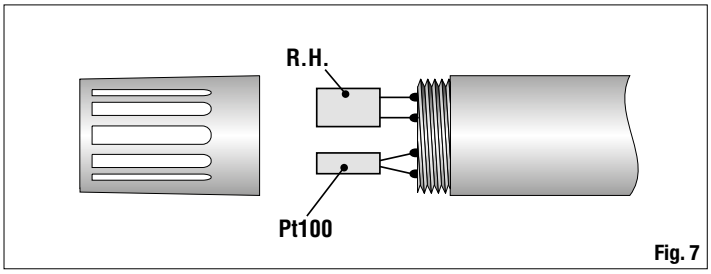


Fig. 7

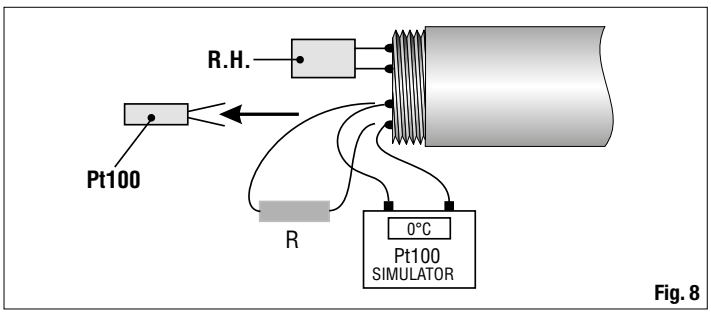


Fig. 8

Follow these procedures to access the transmitter terminal board (see fig.3):
Unscrew grommet "A", take off rubber bulb "B" and unscrew bottom "C". Insert the cable through A, B and C elements and connect it to the terminal board. Hold the cable firmly while screwing grommet "A" to avoid twisting.

PROGRAMMING

HD9008TRR and HD9009TRR relative RH and temperature transmitters are factory calibrated. The HD9008TRR is provided with a 4…20mA current output, while the HD9009TR with a 0…Vdc voltage output.

In the HD9008TRR standard configuration, 4mA correspond to 0%RH and –40°C, while 20mA equal 100%RH and +80°C.

In the HD9009TRR one, 0Vdc corresponds to 0%RH and –40°C, while 1Vdc equals 100%RH and +80°C.

The user can re-calibrate the RH probe holding the 0%…100%RH range and setting a different range for temperature, as long as it is within –40 and +80°C limits.
Figure 4 shows the transmitter programming elements.

Humidity Sensor Calibration

The following accessories are needed.
HD9008TRR model: a 10…30Vdc continuous voltage power supply, a precision ammeter with a 0…25mA min. range.
HD9009TRR: a 10…30Vdc continuous voltage power supply, a precision voltmeter with a 0…1Vdc min. range.
The calibration of the humidity sensor is carried out at two fixed points: at 75.4%RH – **always as first point** – and at 33%RH – second point.

Procedure:

1. To access the panel board, unscrew grommet "A" (see fig. 3) and hold the cable firmly to avoid twisting. Take off the rubber bulb and unscrew the bottom of the instrument.
2. Connect the wires to provide the instrument with power supply, as shown in the connection diagrams (Fig. 5: HD9008TR and Fig.6: HD9009TR).
3. Insert the probe in the container with the saturate solution at 75%RH and wait **30 minutes at least.** Probes and solutions have to be at the same temperature.
4. Turn 75%RH dip-switch on ON.
5. Press the CAL%RH little key and **hold it down for 5 seconds, at least,** until the corresponding LED does not flash. Now the little key can be released: the LED will remain on. A built-in sensor compensates the temperature difference of the solution compared with 20°C.
6. Turn the 75%RH dip-switch on OFF.
7. Put the probe in the container with the saturate solution at 33%RH and **wait for 30 minutes, at least.** Probes and solutions have to be at the same temperature.
8. Turn the 33%RH dip-switch on ON.
9. Press the CAL%RH small key and **hold it down for 5 seconds, at least,** until the corresponding LED is not off. Now the little key can be released.
   If the solution is at 20°C, the output will equal 9.28mA (in HD9008TRR model) and 0.330V (in HD9009TRR model).
10. Turn the 33%RH dip-switch on OFF again.
11. Re-close the instrument: re-screw the bottom, put the rubber bulb again at its place and screw the grommet: hold the cable firmly to avoid twisting it.
12. The calibration of the RH probe is finished.

Important Note: the first calibration point has to be always at 75%RH

Programming of Temperature Operating Range

The following accessories are needed.
For HD9008TRR: a 10…30Vdc continuous voltage power supply, a precision ammeter with 0…25mA minimum range.
For HD9009TRR: a 10…30Vdc continuous voltage power supply, a precision voltmeter with 0…1Vdc minimum range.
Pt100 simulator or a set of precision resistances.

Procedure:

1. To access the panel board, unscrew grommet "A" (see figure 3) and hold the cable firmly to avoid twisting. Take the rubber bulb off and unscrew the bottom of the instrument.
2. Unscrew the sensor protection filter.
3. Unsolder the Pt100 sensor (the narrowest one) and in place of it, solder the output wires or those of a Pt100 simulator or of a precision resistance, as shown in figures 7 and 8. Then wait a few seconds for the junction to get cold.
4. Set the Pt100 simulator at the temperature corresponding to the scale upper value. For example, if you want to configure the –10°C…+80°C range, the simulator has to be set at –10°C; the equivalent resistance value will be 96.09Ω. If the calibration is carried out with a fixed resistance, connect a 96.09Ω fixed resistance to the terminals to which the sensor was soldered.
5. Wait 10 seconds until the measurement becomes steady, **press the "CAL °C" key** (calibration) **and hold it down for min. 5 seconds,** until the LED first flashes (once) and then remains on.
6. Set the Pt100 simulator at the temperature value provided for the full scale. According to the above example, the simulator will be set at +80°C; the equivalent resistance value will be 130.89Ω; if the calibration is carried out with a fixed resistance, a 130.89Ω fixed resistance will have to be connected to the terminals to which the sensor was soldered.
7. Wait 10 seconds until the measurement becomes steady, **press the "CAL °C" key** (calibration) **and hold it down for min. 5 seconds,** until the LED is off. **When you release the key,** the LED will flash twice to confirm that programming took

place. Now the procedure is over.

8. Check that the configuration corresponds to the requested specifications, by setting the simulator (or connecting the precision resistances) at the values corresponding to the upper and full scale value and by checking the output with the ammeter (HD9008TRR) or with the voltmeter (HD9009TRR).
9. Solder again the temperature sensor.
10. Insert again the sensor protection filter, screw the bottom, put the rubber bulb again at its place and screw the grommet holding the cable firmly to avoid twisting.
11. The temperature output programming is over.

Saturate reference solutions are available for RH calibration. Calibration is suggested every 12/18 months for instruments with continuous operation, according to the environment they are working in. **Check that the sensor and the atmosphere where it is employed be compatible, above all in case of aggressive environments** (they might corrode the sensor).

TECHNICAL DATA		HD9008TR	HD9009TR
Electronics Working Temperature		-40…+80°C	
Sensor Working Temperature		-40…+80°C	
Transmitter Power Supply		10...30Vdc (4…20mA)	10…30Vdc (2mA)
Capacity		300 pF typ.	
HUMIDITY	Measuring Range	0…100%RH	
	Accuracy at 20°C	±2%RH (10…90%RH) ±2.5%RH (for the remaining range values)	
	Response time at 63% of final variation	3 min. with filter; 6s without filter no thermal shock	
	Output Signal	0%RH = 4.0mA 100%RH = 20.0mA	0%RH = 0.00 Vdc 100%RH = 1.00 Vdc (*)
	Load Resistance	$R_{Lmax}=\frac{(Vdc - 10)}{22mA}$	R_{inMIN}=10KΩ
TEMPERATURE	Measuring Range – Standard Configuration - (**)	-40…+80°C	-40…+80°C
	Accuracy	±0.15°C ±0.1% of measurement	
	Response time at 63% of final variation	60s with filter; 5s without filter	
	Output Signal	-40°C = 4.0mA +80°C = 20.0mA	-40°C = 0.00 Vdc +80°C= 1.00 Vdc (*)
	Load Resistance	$R_{Lmax}=\frac{(Vdc - 10)}{22mA}$	R_{inMIN}=10KΩ
Dimensions		Ø 26 x 225mm	
Cable Dimensions			
Maximum Length (***)		200m	10m
Wire Min. Section		20 AWG - 0.5mm²	20 AWG - 0.5mm²
Cable Max. Diameter		Ø5mm	Ø5mm

(*) For HD9009TRR models, 0…5Vdc, 1…5Vdc, 1…6Vdc, 0…10Vdc voltage outputs can be provided on ordering.
(**) Out-of-standard measuring ranges have to be requested when ordering and have to be re-programmed with a Pt100 simulator.
(***) Use screened cables.

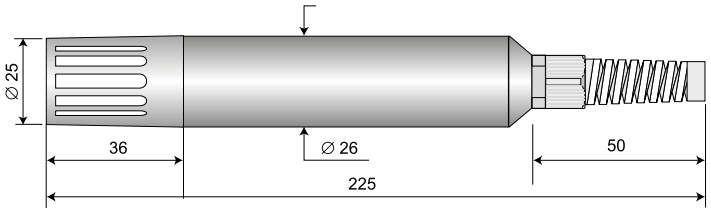
HD9007
MULTIPLATE RADIATION SHIELD

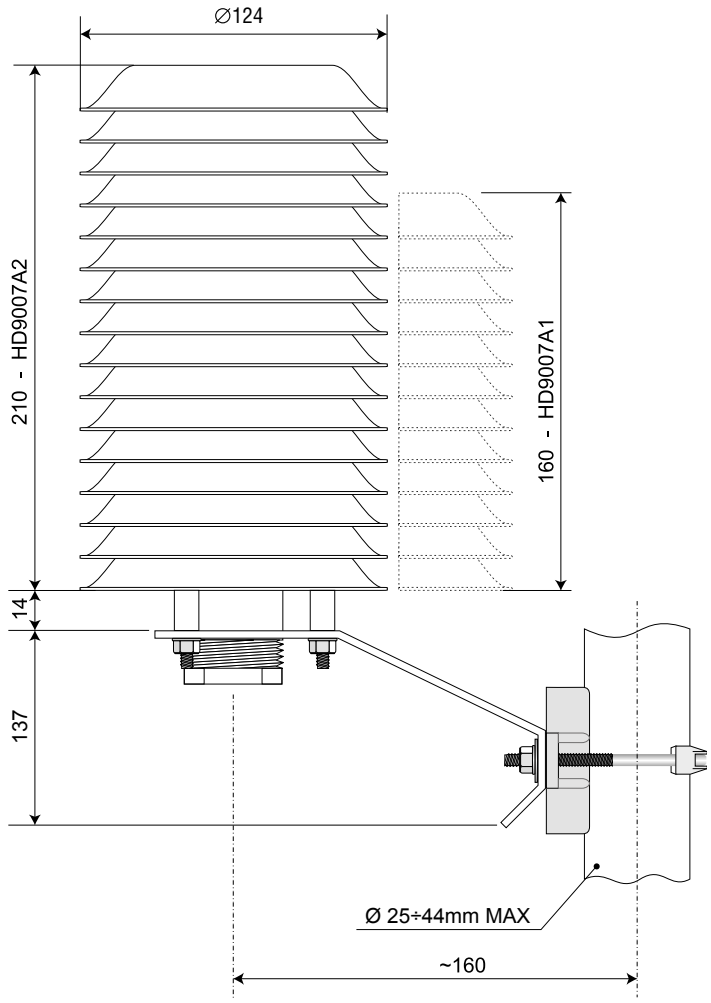
Characteristics
Luran S777K (BASF) antistatic UV-resistant thermoplastic material with low thermal conductivity and high reflection.
White power-painted, anticorodal aluminium support bracket. Stainless steel U-bar mounting bracket for shafts from 25 to 44mm.
Dimensions: external Ø : 130 mm.
Height, excluding bracket: HD9007 A1: 190 mm, weight: 640 gr.
HD9007 A2: 240 mm, weight: 760 gr.
Sensor fixing ring nuts: Ø 27 mm, Ø 25 mm on demand when ordering.

HD9007 ring-shield is suitable to protect temperature and RH/temperature sensors used in weather stations from solar radiations, rain and wind.

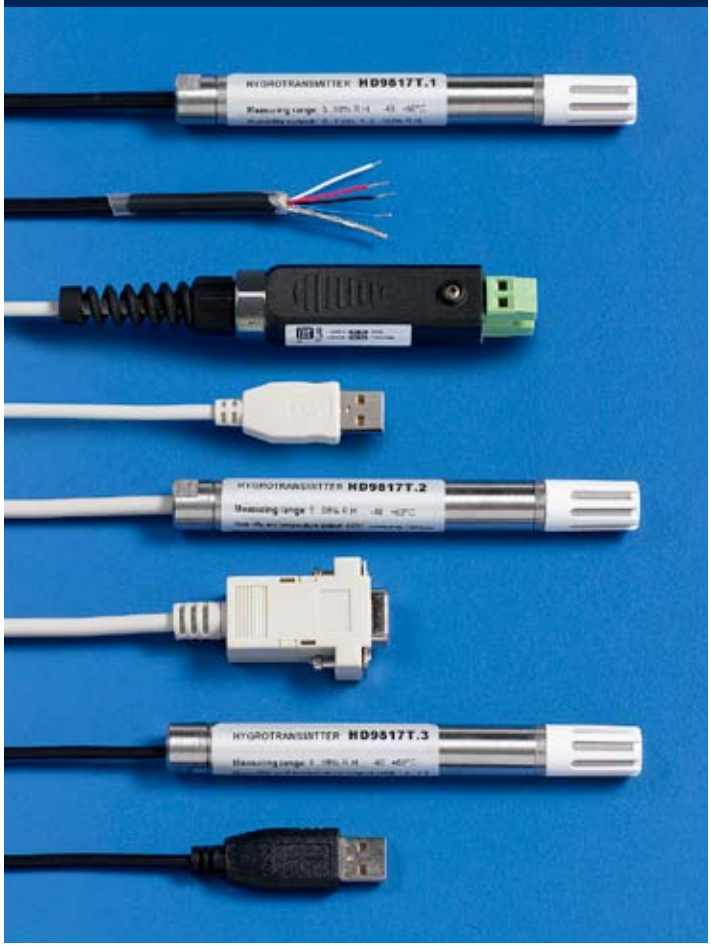
ORDERING CODES
HD9008TRR: dual passive RH and temperature microprocessor transmitter 4…20mA outputs in 0…100%RH and -40…+80°C ranges.
HD9009TRR: dual RH and temperature microprocessor transmitter. 0…1V output in 0…100%RH and -40…+80°C ranges.

HD9007 A1: 12-ring protection L=190 mm complete with mounting brackets.
HD9007 A2: 16-ring protection L=240 mm complete with mounting brackets.
HD75: saturated salt solution 75% R.H. with adapter M 24x1,5
HD33: saturated salt solution 33% R.H. with adapter M 24x1,5
HD9008.21.1: holder for vertical sensor, wall distance 250mm, hole Ø 26.
HD9008.21.2: holder for vertical sensor, wall distance 125mm, hole Ø 26.





HD 9817T1
HD 9817T2
HD 9817T3

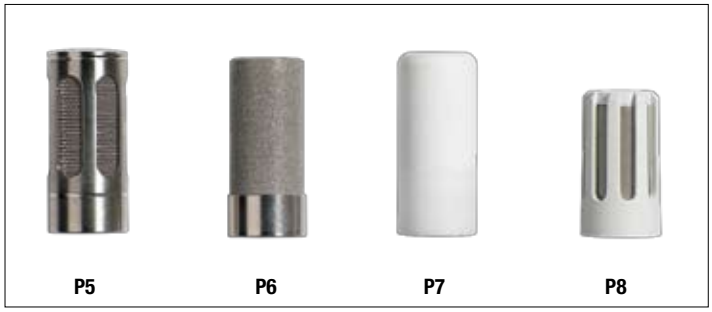


HD 9817T1, HD 9817T2, HD 9817T3
RELATIVE HUMIDITY AND TEMPERATURE TRANSMITTERS WITH DIGITAL OR ANALOGUE OUTPUT

Dual relative humidity and temperature transmitter for HVAC applications, environmental monitoring, pharmaceutical storage, food transport, greenhouse automation, etc. Equipped with an IP65 stainless steel AISI 304 housing, it is suitable even for severe environments; besides, its ultra-compact dimensions (∅ 14 x 133 mm) and wide range of outputs (analogue 0...1V or digital RS232C, USB 1.1-2.0) make it ideal for integrating into a variety of OEM applications. It is supplied with the HD9817TC software for reading measurements and calibrating the relative humidity sensor.

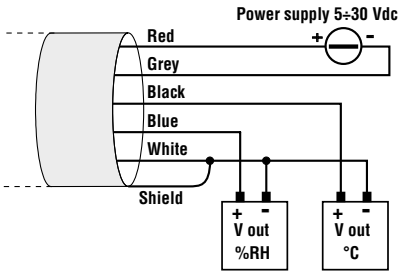
Versions, outputs and connections

	HD9817T1	HD9817T1.1	HD9817T2	HD9817T3
Output	0...1V = 0…100%RH 0...1V = –40…+60°C (-20…+80°C on request)		RS232C non insulated, 2400 baud rate	USB 1.1-2.0 non insulated
Temperature sensor	Pt100	NTC 10kΩ	Pt100	Pt100
Load resistance	R_L > 10kΩ			
Cable Connection	L=1,5m (7 wires + shield)		L= 2m DB9 female connector	L= 2m USB connector type A



Connections

HD9817T1 and HD9817T1.1 models with 0...1Vdc analogue output.



The instrument is equipped with a 7 wire + shield cable.
The **Yellow** and **Green** wires are used during calibration only for PC connection through the HD9817T.1CAL interface module (see the paragraph about the RH sensor calibration).
Power is supplied to the **Red** (+) and **Grey** (-) wires.
The output signal voltage is taken from:
- **Black** (+) and **White** (-) wires for temperature,
- **Blue** (+) and **White** (-) wires for relative humidity.

The **shield** must be connected to the White wire.

HD9817T2 model with RS232C output and HD9817T3 model with USB output.

The HD9817T2 cable ends in a RS232C 9-pole subD female connector, while the HD9817T3 cable ends in a USB type A connector.
The following set of commands is available for both instruments.

Command	Response	Description
G0	HD9817T_Pt100_RH_RS232	Model
G3	Firm.Ver.=01-00	Firmware version
HAnn.n	&	75% calibration point where nn.n stands for the actual humidity value
HBnn.n	&	33% calibration point where nn.n stands for the actual humidity value
S0	0072.7 I 063.9	It sends the current measurement (tttt.t I hhh.h) t = temperature h = RH
U0	&	International System of units
U1	&	Imperial units

Note for HD9817T3 model with USB ouput

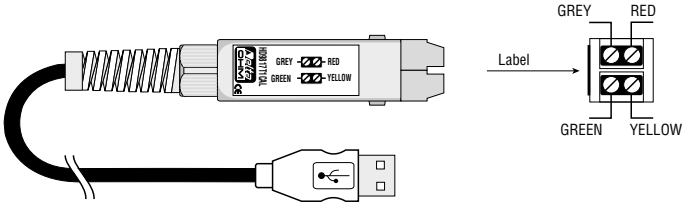
This model requires that you install USB drivers first in order to ensure a correct PC connection: **don't connect the instrument to your PC before installing the drivers**. For further details, see the guide in the CDRom which is supplied with the instrument.

Relative humidity calibration

The instruments are supplied factory calibrated and ready to use. The CDRom supplied with the instruments includes a relative humidity calibration procedure. The online help describes this procedure in detail.
No procedure exists for temperature calibration.
To connect HD9817T1 and HD9817T1.1 models to your PC, use the HD9817T.1CAL interface module: the module is equipped with a USB type A connector for your PC USB port connection as well as a 4-pole terminal board to connect the transmitter.
Before connecting the module to your PC, you need to install the USB drivers: **don't connect the module to your PC before installing the drivers**. For further details, see the guide in the CDRom which is supplied with the instrument.

Please connect the **Red** (power supply positive), **Grey** (power supply negative), **Yellow** (Tx) and **Green** (Rx) wires as shown in the figure below.

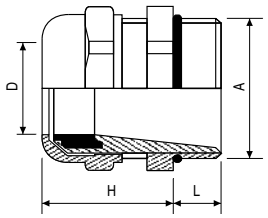
The terminal board is seen from above: in order to direct the clamps correctly, make sure that the label on the side of the module is placed as shown in the figure below.



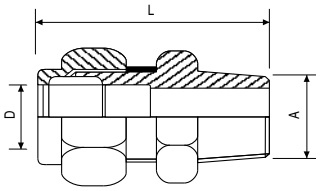
Installation notes

To fix the probe in a ventilation duct, pipe ,etc. you can use, for example, the HD9008.31.12 flange, a PG16 metal cable gland (∅10…14mm) or a 3/8" universal biconical connection.

HD9008.31 Flange



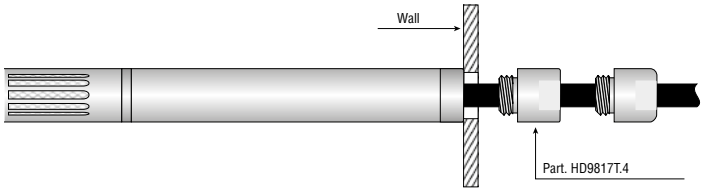
PG16.12 Metal cable gland
D = 10…14mm
L = 6.5mm
H = 23mm
A = PG16



Universal biconical connector
L = 35mm
D = 14mm
A = 3/8"

For wall-mounted installation, the HD9008.21.1 (distance from wall 250mm) and HD9008.21.2 (distance from wall 125mm) supports are available. Both require the HD9008.26/14 adapter.

For direct wall mounting on a metal support, the HD9817T.4 part is available as shown in the figure below (for HD9817T1 and HD9817T1.1 versions only).



The wall can be 2mm thick at most while the hole in the wall can be 10.5mm.

Electrical connection

HD9817T1 and HD9817T1.1 models

Power supply

The power supply voltage must be as per the electrical specifications (5...30Vdc) between the wires:
Red = (+) power supply positive
Grey = (-) power supply negative.

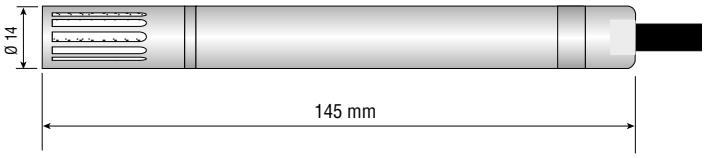
Analogue output

The voltage output signals are taken from the following wires:
Blue = (+)%RH output positive
Black = (+)Temperature output positive
White = (-) ground. Common reference between %RH and Temperature outputs.
Shield = the braid is connected to the common ground (White wire).

HD9817T2 and HD9817T3 models

These models are powered directly from your PC port and no external power supply is required.

HD9817T… Dimensions



Technical data		
HD9817T1R - HD9817T1.1R- HD9817T2R - HD9817T3R		
Relative humidity	Sensor	Capacitive
	Sensor protection	P8, stainless steel grid and PTFE, 20µ
	Measuring range	0..100%RH
	Sensor working range	-40…+80°C
	Accuracy	±2% (10…90%RH), ±2,5% in the remaining range
	Temperature dependence	2% on the whole temperature range
	Hysteresis and repeatability	1%RH
	Long term stability	1%/year
Temperature	Sensor type	Pt100 1/3 DIN (on request, NTC 10kΩ: code HD9817T1.1
	Measuring range	-40...+60°C
	Accuracy	±0.2°C ±0.15% of the measured value
	Long term stability	0.2°C/year
General	Power voltage	5…30Vdc
	Consumption	Typically 2mA
	Max. operating temperature	-40…+80°C (for short periods)
	Operating humidity	0…100%RH
Housing	Dimensions	Ø14x138mm
	Degree of protection	IP65

Order codes

HD9817T1R: Dual relative humidity and temperature transmitter, Pt100 sensor. 0...1Vdc analogue outputs. Temperature measuring range -40...+60°C (-20…+80°C on request). Power supply 5...30Vdc. AISI 304 housing. Probe protection class IP65. Dimensions ∅14x133mm. Output with cable L=1,5m (7 wires + shield). Max. working temperature -40°+80°C. **Supplied with HD9817TC software.**

HD9817T1.1R: Dual relative humidity and temperature transmitter, NTC sensor 10kΩ. 0...1Vdc analogue outputs. Temperature measuring range -40...+60°C (-20…+80°C on request). Power supply 5...30Vdc. AISI 304 housing. Probe protection class IP65. Dimensions ∅14x133mm. Output with cable L=1,5m (7 wires + shield). Max. working temperature -40°+80°C. **Supplied with HD9817TC software.**

HD9817T2R: Dual relative humidity and temperature transmitter, Pt100 sensor. RS232C digital output. Temperature measuring range -40...+60°C (-20…+80°C on request). Powered directly from your PC RS232C port. AISI 304 housing. Probe protection class IP65. Dimensions ∅14x133mm. Output with cable L= 2m with DB9 female connector. Max. working temperature -40°+80°C. **Supplied with HD9817TC software.**

HD9817T3R: Dual relative humidity and temperature transmitter, Pt100 sensor. USB1.1-2.0 digital output. Temperature measuring range -40...+60°C (-20…+80°C on request). Powered directly from your PC USB port. AISI 304 housing. Probe protection class IP65. Dimensions ∅14x133mm. Output with cable L= 2m with USB type A connector. Max. working temperature -40°+80°C. **Supplied with HD9817TC software.**

HD9817T.4: Wall-mounting adapter. Only for HD9817T1 and HD9817T1.1 on request.

HD9817T1CAL: USB interface module for connecting HD9817T1 and HD9817T1.1 transmitters to your PC USB port as well as calibrating or checking the humidity sensor. USB connector type A, cable L=1.5m. Connection through 4-pole terminal board.

HD75: saturated salt solution 75% R.H. thread M 12x1.

HD33: saturated salt solution 33% R.H. thread M 12x1.

HD9008.21.1: holder for vertical sensor, wall distance 250mm, hole Ø 26. Adapter is required HD9008.26.14

HD9008.21.2: holder for vertical sensor, wall distance 125mm, hole Ø 26. Adapter is required HD9008.26.14

HD9008.26/14: holders for Ø 26 and Ø 14mm holes, for HD9008.21.1 and HD9008.21.2

HD9008.31: flange with sensor block Ø 14mm for duct sensorsTC and TO series.

P5: 20µ stainless steel grid protection for probes Ø 14mm, thread M 12x1.

P6: 20µ sintered stainless steel protection for probes Ø 14mm, thread M 12x1.

P7: 10µ PTFE protection for probes Ø 14mm, thread M 12x1.

P8: 20µ stainless steel and Pocan grid protection, thread M 12x1.

HD 3817T…
HD 38V17T…

HD 3817T…, HD 38V17T…
ABSOLUTE HUMIDITY AND TEMPERATURE ACTIVE TRANSMITTER

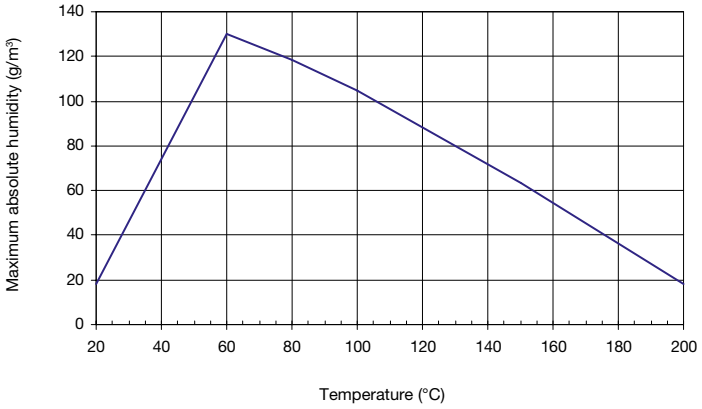
The HD3817T... and HD38V17T... are double **absolute humidity** and **temperature** active transmitters with 4...20mA current or 0...10Vdc voltage outputs, respectively. Absolute humidity is the ratio between the mass of water vapour and the measured volume of air, and is expressed in g/m³. The transmitters of the HD3817T... family may be used in materials humidity control during a drying process. When the materials are dried through heating or a hot air flow, the air absolute humidity increase is directly proportional to the quantity of water lost by the materials. A control system measuring absolute humidity, can maintain a certain humidity level by injecting vapour or water spray in the environment, if needed. Generally, these transmitters are employed in the chemical, textile, food industry, in the production and storage of paper, in the drying of wood,... even with high temperatures and wide humidity excursions. The type of sensor used is immune to most physical and chemical contaminants. The maximum working temperature is 200°C: This makes these instruments particularly suitable to heavy industrial applications where the traditional capacitive sensor cannot be used.
The response time is fast, as well as the recovery time from saturation.
The maximum measurement ranges are: 0...130 g/m³ for absolute humidity and -50...200°C for temperature: The instruments come out of the factory with the 0...60g/m³ and 0...200°C standard ranges. You can request, **when making the order**, different ranges both for absolute humidity and temperature, but within the set limits.
The standard power supply is 24VAC. On request, we can supply the 115VAC or 230VAC versions.
The probe, completely in stainless steel, has a 20µm sintered bronze filter. The case is in polycarbonate with an IP66 protection degree.

Technical Information

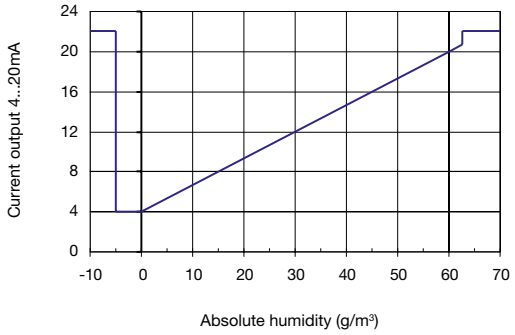
ABSOLUTE HUMIDITY	Type of sensor	Heat conductivity with double combined NTC.
	Sensor protection	20µm sintered bronze filter AISI304
	Measurement range	0...130 g/m³ (0...100% RH @60°C and 1013hPa) (*)
	Sensor working range	0 … +200°C
	Accuracy	±3g/m³ to 35 g/m³ and 40°C
	Startup stabilization time	120 seconds
	Response time	60 seconds with standard filter for a 63% variation of the final value
	Repeatability	±5%
TEMPERATURE	Sensors type	4 wire Pt100
	Measurement range	0 … +200°C
	Accuracy	1/3 DIN
	Response time	10 seconds for a 63% variation of the final value
Analog outputs (according to the models)	4…20mA (HD3817T...)	R_L < 500Ω
	0…10Vdc (HD38V17T...)	R_L > 10kΩ
GENERAL	Power supply voltage	24Vac ±10% 50...60Hz On request, 115Vac or 230Vac ±10% 50...60Hz
	Consumption	4VA typical
	Temperature / Electronic Working Humidity	-10°C ... +70°C / 5...90% RH without condensation
	Case size	120x80x55 mm
	Protection Degree	IP66 probe excluded
	Case material	Polycarbonate
	Probe material	Stainless steel AISI304

(*) **Note**: The 0...130g/m³ range is referred to a 60°C temperature. The absolute humidity maximum value varies with environment temperature according to the following diagram.

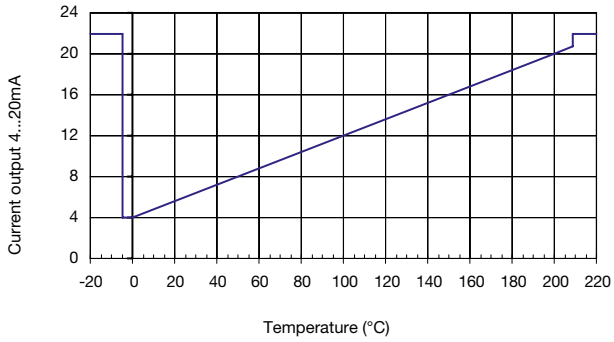
Diagram of the absolute humidity and temperature outputs
The graphs of the absolute humidity and temperature outputs are reported below.



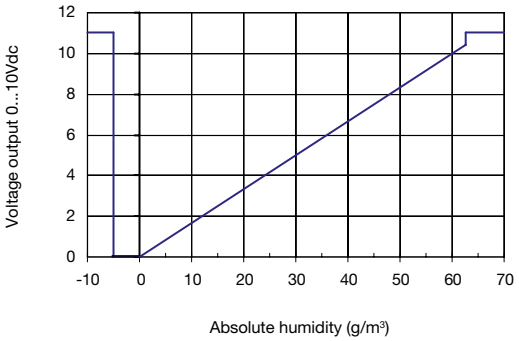
Absolute humidity (g/m³)
4...20mA current output according to 0...60g/m³ standard range



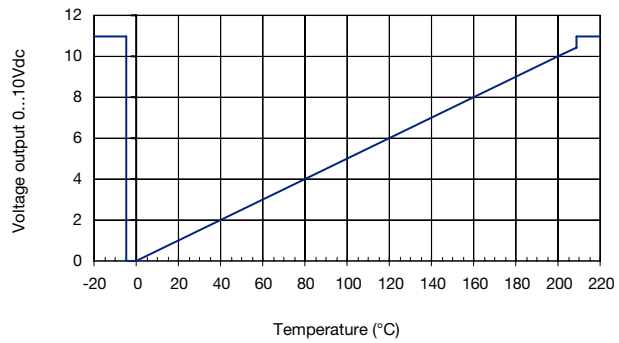
Temperature (°C)
4...20mA current output according to 0...200°C standard range



Absolute humidity (g/m³)
0...10Vdc voltage output according to 0...60g/m³ standard range

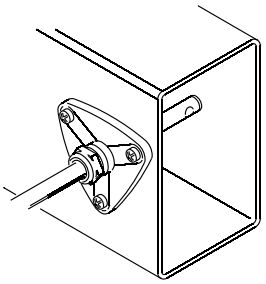


Temperature (°C)
0...10Vdc voltage output according to 0...200°C standard range

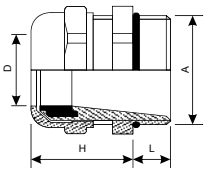


Calibration
The instruments are calibrated in the factory; no calibration is required by the user.

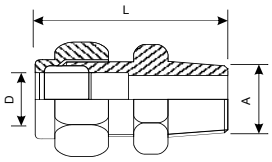
Installation Notes
Each probe is calibrated in the factory with its transmitter: **A probe cannot be used onto another transmitter**. The transmitter has to be installed into a position with good air circulation. The probe orientation is not important.
To set the probe in a ventilation channel, into a duct, inside a dryer, etc. you can use the HD9008.31.12 flange, a PG16 (∅10…14mm) metallic fairlead or a 3/8" biconical universal fitting.



HD9008.31.12 flange

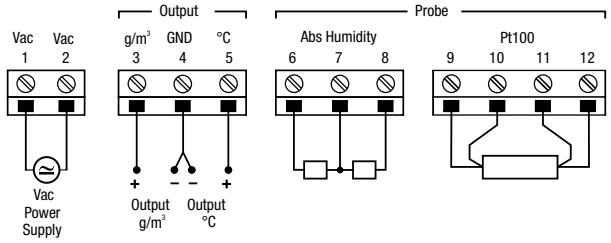


PG16.12 metallic fairlead
D = 14 mm
L = 6.5 mm
H = 23 mm
A = PG16



Biconical universal fitting
L = 35 mm
D = 14 mm
A = 3/8"

ELECTRIC CONNECTION

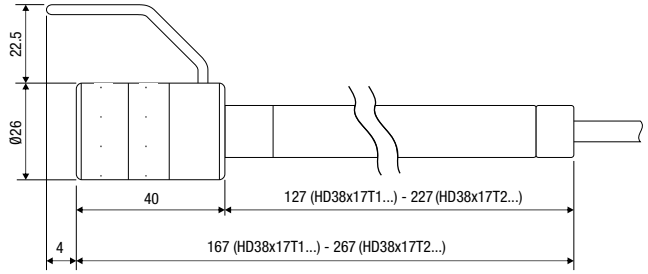


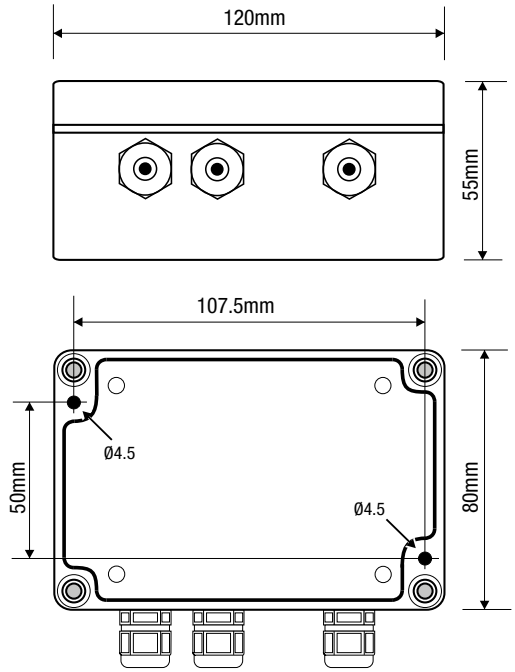
Power
Apply power to the instrument with the correct VAC voltage between the power supply terminals ① and ②.
Connection of the absolute humidity and temperature probe
Connect the probe respecting the colours and the numbers in the following table:

Function	Terminal Number	Cable Colour
Absolute Humidity	6	Red
	7	White
	8	Yellow
Pt100 Temperature	9	Blue
	10	Blue
	11	Black
	12	Black

Analog outputs
The output signals are acquired between the terminals:
③=g/m³ and ④=GND for absolute humidity,
⑤=°C and ④=GND for temperature.

Dimensions





HD38 X 17T X CX . X

Power
0 = Standard 24VAC power supply
1 = 115VAC power supply
2 = 230VAC power supply

Cable length
C2 = Cable 2 meters
C5 = Cable 5 meters

Stem length:
1 = Stem length 127 mm
2 = Stem length 227 mm

Analog output
No number = Current analog output 4...20mA
V = Voltage analog output 0...10VDC

ORDER CODES

HD3817T...: Absolute humidity and Pt100 temperature double transmitter. Analog outputs 4...20mA. Measurement range of absolute humidity 0...60g/m³, temperature 0...+200°C (on request, when making the order, other outputs in the ranges 0...130g/m³ and 0...+200°C). Probe with 20µm sintered bronze filter AISI304. Electronic working temperature -10°...+70°C. Probe working temperature 0C°...+200°C.
When making the order, please specify: 1) Power supply. 2) Stem length 127 mm or 227 mm. 3) Probe's cable length 2 m or 5 m.

HD38V17T...: Absolute humidity and Pt100 temperature double transmitter. Analog outputs 0...10Vdc. Measurement range of absolute humidity 0...60g/m³, temperature 0...+200°C (on request, when making the order, other outputs in the ranges 0...130g/m³ and 0...+200°C). Probe with 20µm sintered bronze filter AISI304. Electronic working temperature -10°...+70°C. Probe working temperature 0C°...+200°C.
When making the order, please specify: 1) Power supply. 2) Stem length: 127 mm or 227 mm. 3) Probe's cable length: 2 m or 5 m.

Relations between absolute humidity, relative humidity and mixing ratio

$$\%RH = \frac{100 \cdot E}{Es}$$

$$AH = \frac{804 \cdot E}{(1+0.00366 \cdot T) \cdot P_0}$$

$$MR = \frac{0.622 \cdot E}{P_0 - E}$$

%RH = % of relative humidity
AH = Absolute humidity in g/m³
MR = Mixing ratio in water vapour kg per air kg
E = Current value of vapour pressure in air in Pascal
E = Saturated vapour pressure in air in Pascal
P_0 = Atmospheric pressure in Pascal
T = Temperature in Celsius degrees
The Es value can be obtained from a psychrometric table

HD 2601V.1
HD 2601V.2

HD 2601V.1, HD 2601V.2
4…20MA TRANSMITTER DISPLAYS WITH DIN43650 CONNECTOR

The HD2601V.1 is a 4...20mA passive transmitter display with DIN43650 connector; the HD2601V.2 model is fitted with two independent dual-output transmitter viewers. The display is inserted between transmitter and connector. Power is supplied by the 4...20mA current loop.
The snap-in display can be programmed by the user. Two keys can be used to set scale factors, decimal point position, display update time, maximum, minimum and average values display, time passed after turn-on, open-collector digital output parameters of the single display version.
The programmable parameters are saved into a permanent memory and are not erased when power is disconnected.
All device functions are continuously monitored by an integral diagnostic system. In the single model HD2601V.1, the open-collector digital output can control a digital device or a relay coil.
The instrument display can be rotated at 90° or overturned to fit different installation conditions.

Installation and connections
Fig. 1 shows the typical configuration: the display is inserted between the transmitter (8) and the DIN43650 female connector (1).
The display has two keys: one externally accessible (5) used for data display: current measurement, maximum, minimum and average values, timer; the internal key (9) is accessible only after removing the cover, and is used together with the external key for programming.
In box (3) over the display window, the unit of measurement label can be applied.
The card supporting the display and relevant cover can be rotated at 90° pitches by unscrewing the 4 screws at the corners.

Fig. 2 and 3 illustrate the electrical connections of the single model HD2601V.1 and the dual model HD2601V.2.

Vdc represents the direct current power source.
RL, RL1 e RL2 are the devices inserted in the current loop (PLC, recorder,…).
In the HD2601V.1 model, Rd represents the load connected to the open-collector digital output.
NOTE on Fig. 2: if a relay coil is controlled, insert a diode protecting the device's output.

The numbers 1, 2 and 3 refer to the information on the instrument's connector:

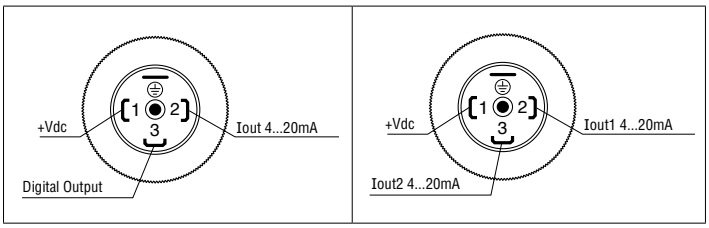


Fig.4 - HD2601V.1 **Fig.5** - HD2601V.2

To proceed with the electrical connections, open the connector by removing the screw (6) as shown in the Fig. 6:

Remove the gasket (1). Unscrew the fairlead (5) and take off the gasket (4). Use a screwdriver to pry and take off the connecting terminal (2). Make the connections as shown in the Fig. 7 and 8: if present, the shielded cable braid must be connected to the earth terminal.
Once the connections are made, close the connector.

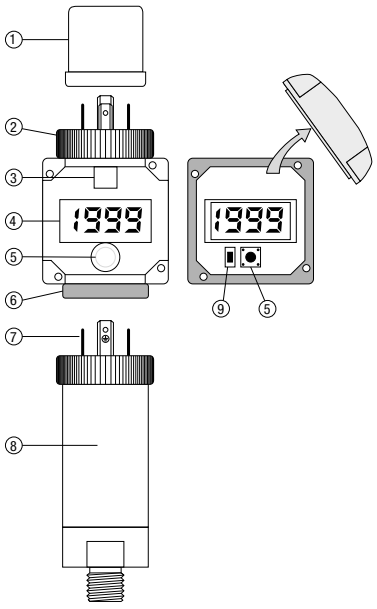


Fig.1

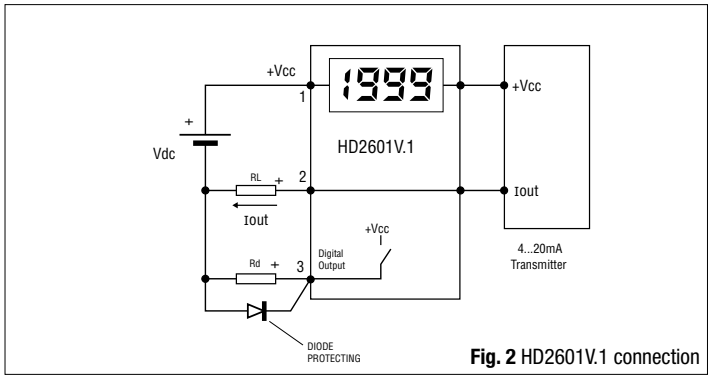


Fig. 2 HD2601V.1 connection

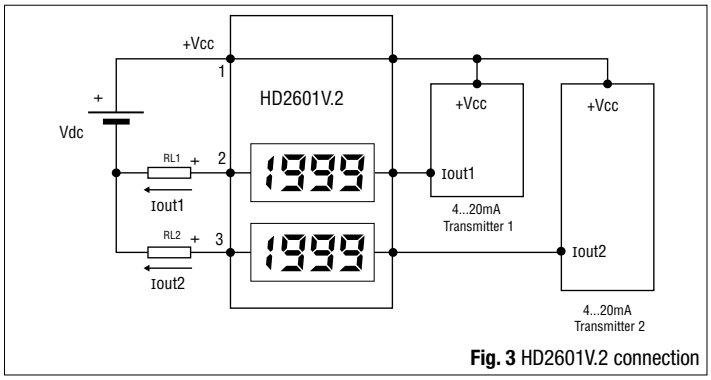


Fig. 3 HD2601V.2 connection

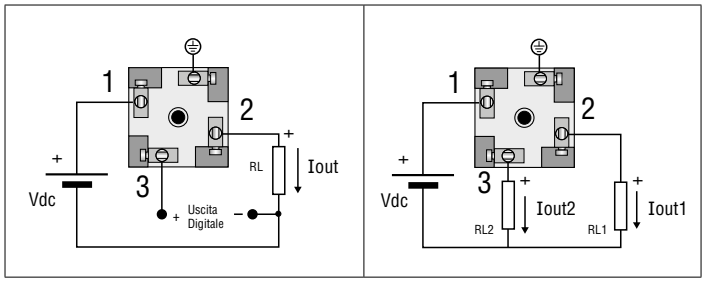


Fig. 7 - HD2601V.1
Electrical connections of the connecting terminal

Fig. 8 - HD2601V.2
Electrical connections of the connecting terminal

The display is now ready for use: proceed with the programming of the scale factors.

Maximum load
The **RL maximum load** applicable to the 4...20mA loop, after insertion of the display, can be calculated as follows (see Fig. 2 and 3):

$$RL\text{max} = \frac{\text{Vdc - (Vtx + 6)}}{0{,}022}$$

Vdc is the direct voltage, **Vtx** is the voltage drop on the transmitter (shown in the relevant technical characteristics).

Display
By pressing the external key (5) (see Fig. 1) it is possible to display, in sequence, the maximum, minimum and average of the captured measurements since the last reset (Record function), and the time passed since the last reset (Timer function).
The controls to reset the Record and Reset functions are independent.
The following table shows, in the same order, the indications provided by the display when repeatedly pressing the external key (5). The sequence starts from measurement mode:

Display indication	Notes
Current measurement	
“HIGH” message	It means “HIGH”
Maximum value	
“Lou” message	It means “LOW”
Minimum value	
“Aug” message	It means “AVERAGE”
Average value	
Y ##	## shows the years
d ##	## shows the days
H ##	## shows the hours
n ##	## shows the minutes
S ##	## shows the seconds
“MEAS”	returns to normal measurement
Current measurement	

To reset the Record (MAX, MIN and AVG) values, keep the external key pressed (5) for about 10 seconds until the display indicates “CLr” (CLEAR).
To reset the timer use the RST (RESET) function in the menu: for the details see the chapter dedicated to programming.

Programming
In order to program the display, the internal key needs to be accessed: unscrew the four screws in the corners of the display face-plate. The internal key (INT) is shown in Fig. 1 by number (9), the external key (EXT) by number (5).
Using the INT key the various menu items are scrolled. Use EXT to access the displayed item. Within the menu item, the two keys are used to increase or decrease the current information. To confirm the entered value press simultaneously the two keys.
To exit the menu, press INT and scroll all the items.

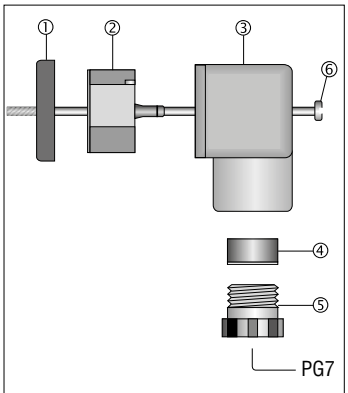


Fig. 6 DIN43650 connector

Menu Item	Description
dP	Selection of the decimal point position
ZP 4	Top scale value associated to the 4mA current
EP20	Bottom scale value associated to the 20mA current
filt	Sets the averaging filter on the measurement: this filter calculates the average current of the values captured. The instrument captures 4 measurements per second: one each 0.25s. By setting filt=0.25s no average is performed; with filt=5.00s the moving average is calculated on the last 20 samples. It is possible to set the intermediate values from 0.25s to 5.00s with 0.25s pitches.
HILO	If HILO=YES the display shows “Lo” if the current drops under the minimum threshold 4mA, and “HI” if the current raises over 20mA. If HILO=NO the display continues even outside the limits without showing any alarm.
S Fu (*)	Digital output (only HD2601V.1). By selecting YES the output is enabled, pressing NO the output is disabled.
S Pt (*)	Sets the digital output tripping point (see Fig. 9).
HYSt (*)	Sets the hysteresis width for digital output switching (see Fig. 9).
dir (*)	Sets the digital output tripping direction (see Fig. 9).
rst	Sets the timer to zero.

(*) This function is available only for the HD2601V.1 model.

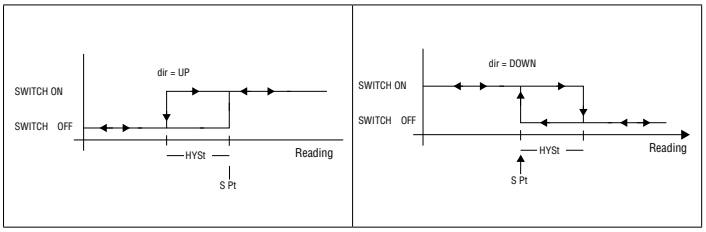


Fig. 9 Description of the Digital Output function

Technical characteristics

Display	4 digit LED, 7.6mm high. The decimal point position can be programmed.
Display range	-1999…+9999
Power	Power supplied by the 4…20mA current loop
Maximum voltage drop	6Vdc
Accuracy	0.2% of span ± 1 digit
Temperature drift	0.01%/°C
RL load resistance	RLmax = [Vdc-(Vtx + 6)] / 0,022
Speed of conversion	4 measurements per second
Electrical connections	DIN43650 connector
Parameter settings memory	Permanent
Programming	Using two keys (5 - 9), one internal
Display filter	Moving average that can be set from 1 (no average) to 20 samples
Error messages	HI = current over 20mA - LO = current under 4mA
Protection degree	IP65
Functioning temperature	-10…+80°C

Technical characteristics of the HD2601V.1 model digital output

Type of output	Open collector, ground output
Maximum current	100mA
Maximum reverse voltage	30Vdc

ORDERING CODES
HD2601V.1: Configurable sandwich LED indicator, plug-on, for transmitters with DIN 43650 connector and 4÷20 mA output, (i.e. HD2004T).
HD2601V.2: Configurable sandwich dual LED indicator, plug-on, for transmitters with DIN 43650 connector and 4÷20 mA outputs, (i.e. HD9008TR.K).

HD2601V.1

HD2601V.2

HD 4049
HD 5002
HD 404

HD 4049

HD 404

HD 5002

HD 4049, HD 5002, HD 404
78X48 OR 96X96 PANEL REGULATORS FOR CONNECTION TO TEMPERATURE AND RELATIVE HUMIDITY TRANSMITTERS

MODELS: HD 404, HD 4049

CHARACTERISTICS SHARED BY THE VARIOUS MODELS:
- Resolution: 0.1°C, 0.1% R.H.
- Display: red LEDS, height 12.7 mm
- Precision: instrument only ±0.1
- Power supply: 12÷24 V≃
- Relay contacts for the regulators: Clean exchange contact 3A/220 Vac resistive
- Electronics working temperature: -5...50°C

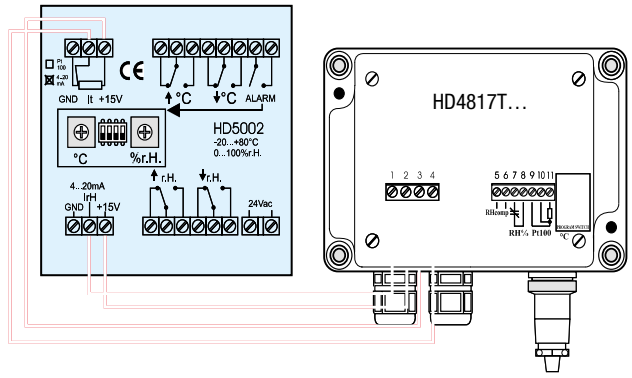
HD 404 ON/OFF temperature regulator
This regulator may be connected to the transmitters of the series:
HD 2008T, HD 2012T... as long as the temperature configuration of the transmitter is the same as the regulator
Regulating range: 4 mA ≙ -20°C, 20 mA ≙ +80°C Hysteresis: 0.6÷6°C.
Bridge for selecting the function: ☼ / ❄

HD 4049 ON/OFF relative humidity regulator
This regulator may be connected to the transmitters of the series:
HD4817T... OR HD4917T...
Regulating range: 4 mA ≙ 0% R.H., 20 mA ≙ 100% R.H.
Hysteresis: 1÷6 points of relative humidity
Bridge for selecting the function: humidify/dehumidify.

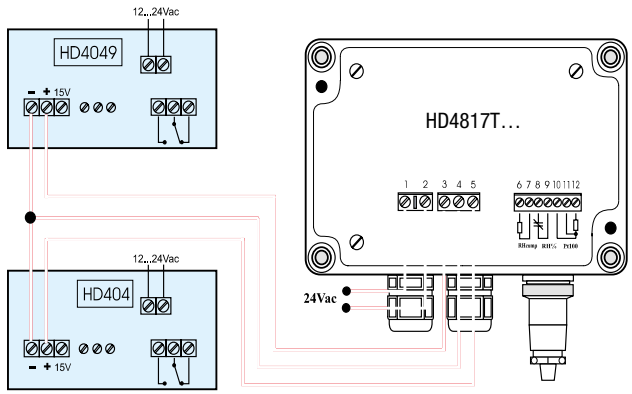
HD 5002, HD 5002/5
The HD 5002 or the HD 5002/5 in combination with temperature and relative humidity transmitters forms a complete temperature and humidity measuring and regulating system. Depending on the series, the HD 5002 feeds the transmitter and measures the absorbed current which is proportional to the relative humidity (terminal IR.H.) and the temperature (terminal It). Voltage drops along the connection wires do not influence the measurement precision, since the signal is a current and not a voltage. Regulation is of the three-point type (heat - OFF - cool for temperature, humidify - OFF - dehumidify for relative humidity). **Also, an alarm contact is made if the temperature differs by more than 8°C from the set value (or if humidity differs by more than 15% from the set R.H.).** A dip switch on the rear of the instrument selects the alarm conditions, high or low for temperature, high or low for humidity.

TECHNICAL DATA
Using range: humidity 0%...100% R.H.
Temperature: -20...+80°C (HD 5002), -30...+130°C (HD 5002/5) depending on the transmitter used
Resolution: 0.1°C, 0.1% R.H.
Accuracy: transmitter included, relative humidity: ±2,5% up to 90% R.H., ±3% beyond 90% R.H. Temperature: ±0.3°C
Hysteresis: 0.6°C÷6°C, 1÷10 points of relative humidity
Display: red LEDS; 3 ½ figures, height 12.7 mm
Outputs: 4 exchange contacts (↑°C,↓°C,↑%R.H.,↓%R.H.) plus alarm contact when made, capacity 3 A/220 Vac resistive
Power supply: 24 Vac
Instrument working temperature: -5...+50°C
Dimensions: front panel: 96x96 mm.
instrument body: 88x90x123 mm.

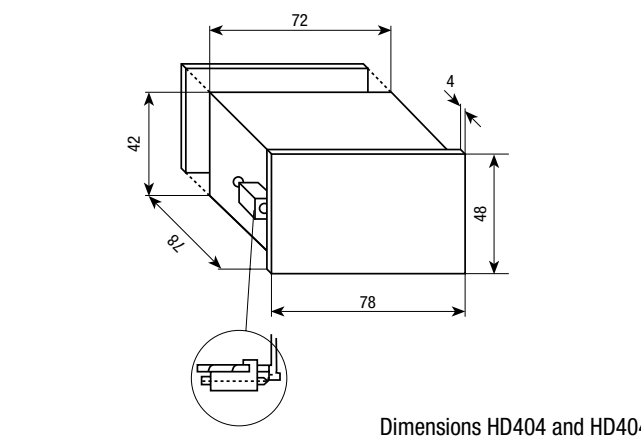
ATTENTION: For compatibility with DELTA OHM 4÷20 mA regulators place the jumper in the position 4÷20 mA .
With the multidrop technique, more than one regulator, indicator or recorder may be connected in series.



The temperature configuration of the transmitter HD4817T... connected to HD5002 has to be: 4mA = -20°C ... 20mA = +80°C.



The temperature configuration of the transmitter HD4817T, connected to HD404 has to be: 4mA = -20°C ... 20mA = +80°C.



Dimensions HD404 and HD4049

HD 9022

HD 9022
CONFIGURABLE MICROPROCESSOR INDICATOR, REGULATOR Pt100 4 WIRE CORRENT OR VOLTAGE INPUT

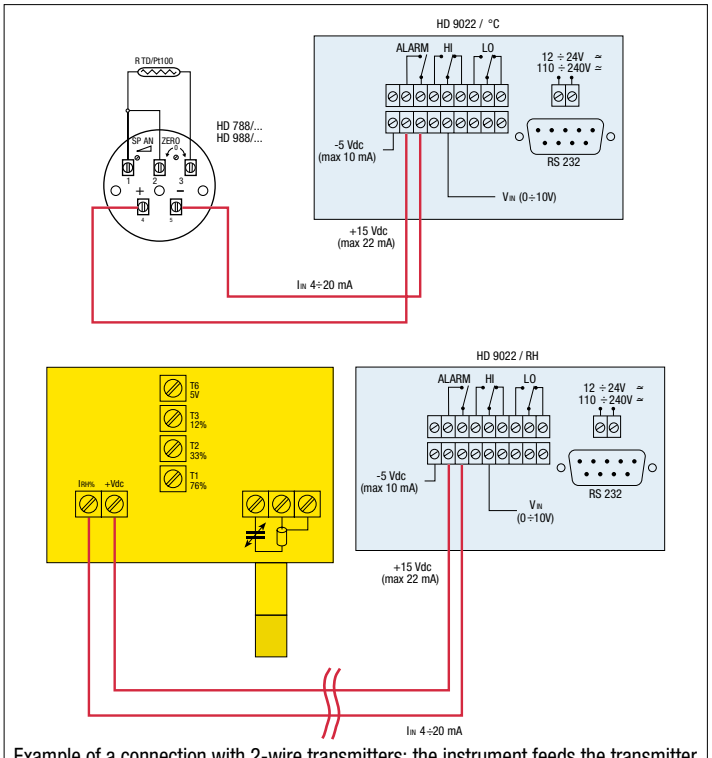
The microprocessor-controlled panel instrument HD 9022 is an indicator with alarm thresholds that may be programmed and configured by the user. At input it accepts signals arriving from transmitters with 2 or 3 wires, in voltage 0÷1V, 0÷10V or in current 0÷20 mA, 4÷20 mA, or Pt100 with 4 wires. Configuration is always completely present in the instrument, no additional cards are required. The choice for the configuration of the input signals is made by means of the keyboard on the front of the instrument. The dimensions of the instrument are 96x48 mm with depth 145 mm in conformity with DIN 45700. The mode of operation of the HD 9022 is chosen depending on the application, configuring the instrument with the keyboard. The instrument may also be reconfigured with absolute simplicity on the field in order to adapt it to changes in processing requirements.
The configuration involves the input, the scale range, the set point and the auxiliary outputs.

Applications
Typical applications are the display of signals sent by transmitters which may concern temperature, humidity, pressure, speed, capacity, level, force, etc., for the most varied industrial sectors, operating machines and automated systems.

Characteristics
- Set point configurable from -9999 to +19999.
- Indication provided by red leds with seven ½ inch segments.
- Separate clamp for voltage input 0÷1 / 0÷10V, current input 0÷20 / 4÷20 mA and Pt100 input (-200÷+800°C).
- The instrument has an auxiliary power supply: -5 Vdc max 10 mA and +15 Vdc non stabilized max 40 mA for the possible supply of 2-wire transmitters.
- R_{IIN} = 25 Ω, R_{VIN} = 200 kΩ.
- Instrument accuracy: ±0.1% Rdg ± 1 Digit.
- A/D converter resolution: 0.05 mV/Digit, 1µA/Digit.
- Functions: One relay with independent exchange contact for output HI (SP1, SP2).
  One relay with independent exchange contact for output LO (SP3, SP4).
  One relay with maximum or minimum alarm closing contact (L max, L min.) ALARM.
  Resistive relay contacts 3A/220V 50Hz.
- Instrument working temperature: (electronic componentry) 5°C÷50°C.
- Power supply: there is a terminal board for input **12÷24Vac/Vdc** or **110÷240Vac/Vdc (the one or the other; not both kinds of power supply).**
- Instrument absorption: 5VA.
- Minimum power of the supply transformer: 20VA.

Function of the keys on the front panel, the display and the leds
❶ Digital display. During programming the following wording appears: F0, F1, F2, F3, F4, F5, F6, F7, F8, SP1, SP2, SP3, SP4, S10.
❷ State indicator of HI relay.
❸ State indicator of LO relay.
❹ State indicator of ALARM relay.
❺ Decimal point.

SEQUENTIAL PROGRAMMING OF WORKING PARAMETERS
❻ **PROG** Every time this key is pressed the program moves one step forward (F0, F1, F2, F3, F4, F5, F6, F7, F8, SP1, SP2, SP3, SP4, S10).
❼ **ENTER** When this key is pressed during programming, the value of the selected variable, which can be modified by the ▲ ▼ keys, is displayed; pressing once again **ENTER** confirms the stored value.
❽ ▲ Pressing this key during programming increases the value indicated on the display; in F2, it moves the decimal point towards the right. In normal operation it flashes to indicate the value in Volts, mA or Pt100 corresponding to the input; with a second impulse it returns to normal operation.
❾ ▼ Pressing this key during programming decreases the value indicated on the display; in F2, it moves the decimal point towards the left. In normal operation it flashes to indicate the value in Volts, mA or temperature corresponding to the input; with a second impulse it returns to normal operation.



Example of a connection with 2-wire transmitters; the instrument feeds the transmitter.

Configuration of the HD 9022 panel indicator

1) Supply power to the instrument.
2) The instrument performs an internal check, the wording C.E.I. appears for a few seconds followed by a number at random.
3) Press **PROG** and the message **F0** appears.
4) Press **PROG** and the message **F1** appears.
5) Press **ENTER** and the symbol *U*, *A* or **Pt** appears. Using the ▲ ▼ buttons, choose the input for voltage: *U*, current: *A* or Pt100: **Pt** signals. Press **ENTER** to confirm.
6) Press **PROG** and the message **F2** appears; press **ENTER**; with the ▲ ▼keys, set the decimal point in the desired position.

Press **ENTER** to confirm.

7) Press **PROG** and the message **F3** appears; press **ENTER**, with the ▲ ▼ keys, set the voltage, current or Pt100 value (as desired) corresponding to the beginning of the scale S1 for example 0V, 4 mA or 0°C. Press **ENTER** to confirm.
8) Press **PROG** and the message **F4** appears; press **ENTER**, with the ▲ ▼ keys, set the numerical value corresponding to the beginning of the scale R1 for example 0°C. Press **ENTER** to confirm.
9) Press **PROG** and the message **F5** appears; press **ENTER**, with the ▲ ▼ keys, set the voltage or current value (as selected in point 5) corresponding to the end of the scale S2 for example 10V, 20 mA or 200.0°C. Press **ENTER** to confirm.
10) Press **PROG** and the message **F6** appears; press **ENTER**, with the ▲ ▼ keys, set the numerical value corresponding to the end of the scale R2 for example 100°C. Press **ENTER** to confirm.
11) Press **PROG** and the message **F7** appears; press **ENTER**, with the ▲ ▼ keys, set the maximum alarm threshold value L max for the Alarm relay for example 110°C. Press **ENTER** to confirm.
12) Press **PROG** and the message **F8** appears; press **ENTER**, with the ▲ ▼ keys, set the minimum alarm threshold value L min for the Alarm relay for example -10°C. Press **ENTER** to confirm.
13) Press **PROG** and the message **SP1** appears; press **ENTER**, with the ▲ ▼ keys, set the Set value for the first threshold "SET relay HI" for example 40°C. Press **ENTER** to confirm.
14) Press **PROG** and the message **SP2** appears; press **ENTER**, with the ▲ ▼ keys, set the Reset value for the first threshold "RESET relay HI" for example 45°C. Press **ENTER** to confirm.
15) Press **PROG** and the message **SP3** appears; press **ENTER**, with the ▲ ▼ keys, set the Set value for the second threshold "SET relay LO" for example 50°C. Press **ENTER** to confirm.
16) Press **PROG** and the message **SP4** appears; press **ENTER**, with the ▲ ▼ keys, set the reset value for the second relay "RESET relay LO" for example 48°C. Press **ENTER** to confirm.
17) Press **PROG** and the message **S10** appears. Press **ENTER**, with the ▲ ▼ keys, set the desired speed of RS232 serial transmission among the following ones: 300, 600, 1200, 2400, 4800, 9600 baud. Press **ENTER** to confirm.
18) Press **PROG** and the message **F0** appears. AT THIS POINT THE CONFIGURATION OF THE INSTRUMENT IS COMPLETE.
19) Connect the input of the instrument, press the **ENTER** key and the display will indicate the value corresponding to the input signal.

Varying the configuration

To vary a stored parameter at any stage of the program it is sufficient to the step of the program to be changed with the **PROG** key (F1, F2, F3, etc.). Press **ENTER** and use the ▲ ▼ keys to modify the parameter previously set; press **ENTER** to confirm, return to **F0** and press **ENTER**.
This simple procedure modifies the desired step of the program.

Note

If the **ENTER**, ▲ or ▼ key is pressed independently during operation, the instrument input value (V, mA or °C) flashes on the display. To return to normal operation, press the ▲ ▼or **ENTER** key independently again.

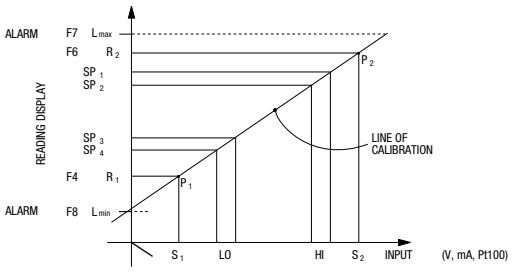
Error signal

The instrument indicates an error signal in the following cases:

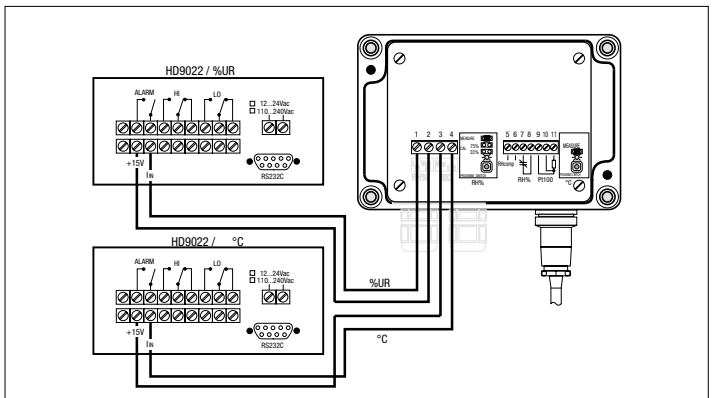
OFL: this appears when the set value of **R max** is exceeded.
-OFL: this appears when the set value of **R min** is exceeded.
E1: this appears when the set points P1 and P2 require a resolution of the A/D converter higher than the one available.
E2: this appears when the values of F7 and F8 are inverted.

THE MAXIMUM RESOLUTION OF THE CONVERTER IS: 0.05 mV/Digit, 1µA/Digit.

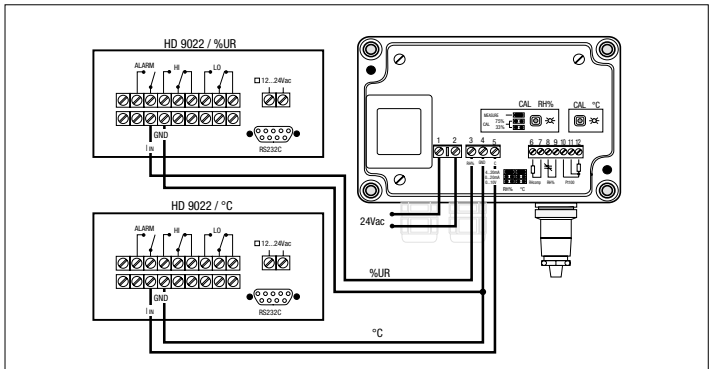
Summary of programming steps of HD 9022



INPUT mA		INPUT V	
0 ÷ 1 mA 0 ÷ 10 mA 0 ÷ 16 mA 0 ÷ 20 mA 0 ÷ 5 mA 0 ÷ 10 mA 0 ÷ 20 mA	Input resistance 25 Ω ± 0,1%	0 ÷ 100 mV 0 ÷ 1 V 0 ÷ 5 V 0 ÷ 10 V 1 ÷ 5 V -10V a +10V	Input inpedance 200K Ω ± 0,1%



Connection examples: HD 4917T... transmitters with HD 9022 panel meter



Examples of connection of the transmitter HD 4817T... with the indicator HD 9022

PROG Programming start. Selects the programming step, F0.
PROG Selects the programming step, **F1**.
PROG Selects the programming step, **F2**.
PROG .....
ENTER Exit program mode.
ENTER Allows modification of the variable.
▲ ▲ Modifies the variable on display.
ENTER Confirms the modification.
PROG Moves to next programming step.

STEP	COMMENT	LIMITS
F0	Press **ENTER** to exit program mode	
F1	Select type of input: Voltage, current, Pt100	*U* - *A* - Pt
F2	Position of the decimal separator	0 - 0.0 - 0.00 - 0.000
F3	Beginning of scale value of the input (Voltage, Current, °C)	0...10,00V, 0...20,00 mA -200,0...+800,0°C
F4	Beginning of scale value of the display	-9999...19999
F5	Full scale value of the input (Voltage, Current, °C)	0...10,00V, 0...20,00 mA -200,0...+800,0°C
F6	Full scale value of the display	-9999...19999
F7	Maximum alarm threshold set point	-9999...19999
F8	Minimum alarm threshold set point	-9999...19999
SP1	ON Threshold of Set-point HI	-9999...19999
SP2	OFF Threshold of Set-point HI	-9999...19999
SP3	ON Threshold of Set-point LO	-9999...19999
SP4	OFF Threshold of set-point LO	-9999...19999
S10	Baud rate	-9999...19999 300, 600, 1200, 2400, 4800, 9600

Serial interface RS-232C

The HD 9022 is equipped with standard serial interface RS-232C which is available on the SUB D male 9-pin connector. The arrangement of the signals on this connector is as follows:

Pin	Signal	Description
2	TD	Datum transmitted by the HD 9022
3	RD	Datum received by the HD 9022
5	GND	Reference logic mass

The transmission parameters with which the instrument is supplied are:
- baud rate 9600 baud
- parity None
- n. bits 8
- stop bit 1

The data transmission speed may be changed by altering the set-up parameter S10 with the keyboard; the possible baud rates are: 9600, 4800, 2400, 1200, 600, 300. The other transmission parameters are fixed.

All the messages reaching and leaving the HD 9022 must be inserted in a "Communication frame" with the following structure:

<Stx><Record><Etx>

Where:

<Stx>	Start of text (ASCII 02)
<Record>	constitutes the message
<Etx>	End of text (ASCII 03)

Host commands

The structure of the command records is as follows:

<Command character><Sub-command><Values>

Where:

<Command character>	is characterized by an alphabetic character indicating the set of commands.
<Sub-command>	is characterized by a character indicating the type of command.
<Values>	is characterized by ASCII characters that depend on the type of command.

The replies provided by the HD 9022 are essentially of two types:
"Information" and "Data"

The former allow information on the status and programming of the HD 9022 to be obtained, as well as the diagnosis of the message received; the latter contain data on the two channels at the moment the request is made.
It is also possible to make use of the serial line for the complete programming of the HD 9022, with the exception of the data transmission speed which may be set only with the keyboard.
The diagnostic replies of the HD 9022 are composed of the following control characters, sent individually (not inserted in the communication frame):

-ack- Command executed (ASCII 06)
-nak- Incorrect command (ASCII 15H)

COMMAND A

Sub-command			Values	Replies
A	Type of terminal		HD 9022	ack/nak
C	Company		DELTA OHM	ack/nak
D	Firmware Version		Vxx Rxx	ack/nak
E	Firmware Date		dd/mm/yy	ack/nak
F	Serial Number	(rd)	xxxxxx	ack/nak
		(wr)	stxAFxxxxxxetx	ack/nak

COMMAND M

Sub-command	Values	Replies
1	Measure Channel 1	ack/nak
2	Measure Channel 2	ack/nak

RESET COMMAND

		Values	Replies
	(wr)	stxRESETetx	ack/nak

CHANNEL 1

C1F01	**x**	Input in	V/A/Pt	ack/nak
C1F02	**x**	Point	0/1/2/3	ack/nak
C1F03	**xxxx**	Start of scale	-9999...19999	ack/nak
C1F04	**xxxx**	V/I Start of scale	0000...10000 (2000 if I)	ack/nak
C1F05	**xxxx**	End of scale	-9999...19999	ack/nak
C1F06	**xxxx**	V/I End of scale	0000...10000 (2000 if I)	ack/nak
C1F07	**xxxx**	Energ. Relay HI	-9999...19999	ack/nak
C1F08	**xxxx**	De-energ. Relay HI	-9999...19999	ack/nak
C1F09	**xxxx**	Energ. Relay LO	-9999...19999	ack/nak
C1F10	**xxxx**	De-energ. Relay LO	-9999...19999	ack/nak
C1F11	**xxxx**	Min Relay Alarm	-9999...19999	ack/nak
C1F12	**xxxx**	Max Relay Alarm	-9999...19999	ack/nak

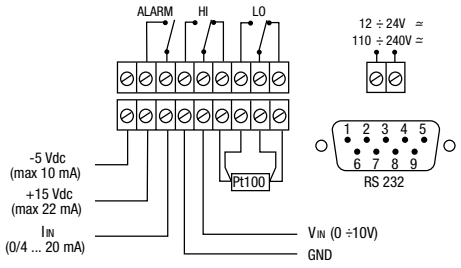
As regards the command just described, a few remarks must be made:
- There is no command character.
- For the other controls of the type C1F01 etc., the present programming status is supplied for the specific command if only the sequence of the sub-command characters is sent.

Ex: StxC1F01Etx Request from Host
StxC1F01:1Etx Reply

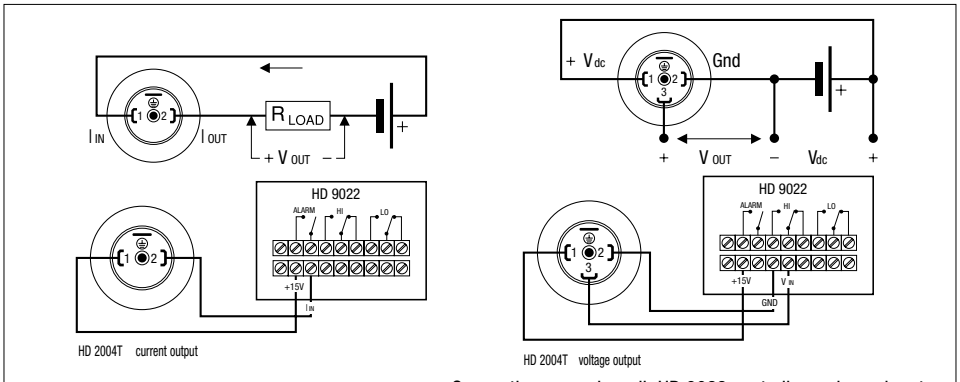
If the sequence of the sub-command characters is followed by a space and then the desired programming value, the programming of the parameter is produced.

Ex: StxC1F01 1Etx Command from Host
ack / nak Reply
StxC1F03 1000Etx Command from Host
ack / nak Reply
StxC1F03-2000Etx Command from Host
ack / nak Reply
StxC1F0512000Etx Command from Host
ack / nak Reply

Note: for programming of the point F03...F12, the value field has fixed length of 5 characters. The first character in the value field may be a space, the minus sign, or the number 1.



Connections

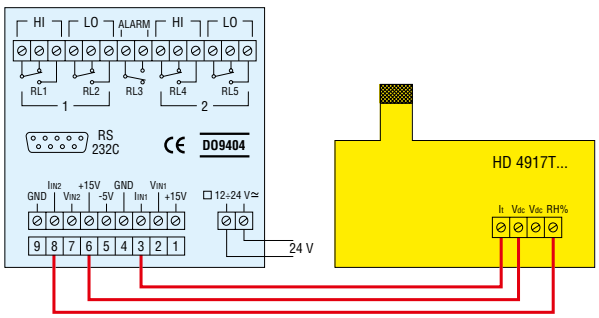


Connection examples wih HD 9022 controller and panel meters

DO 9404

HD 9404
DUAL REGULATING INDICATOR WITH MICROPROCESSOR CONFIGURATION AND TWO INPUTS, FOR VOLTAGE OR CURRENT

The dual regulating indicator DO 9404 is a microprocessor-controlled panel instrument with LED 96x96, with thresholds and alarms that may be programmed and configured by the user. In the two input channels it accepts signals coming from two distinct transmitters or from a double transmitter. The transmitters may be passive with 2 wires or active with 3 wires, in voltage 0÷1 V, 0÷5 V, 0÷10 V or current 0÷20 mA; 4÷20 mA.
For both input channels the configuration possibility is always present in the instrument, no extra cards are needed.
The choice of configurations for the input signals is made on the keyboard located on the front of the instrument.
The DO 9404 is provided with a serial output RS232C, the baud rate may be configured by means of the keyboard, the control is bi-directional and the output connector is a SUB D female 9-pole connector.



Example of connection of a passive transmitter which sends the DO 9404 two current signals (4÷20 mA)

The instrument dimensions are in accordance with DIN 45700, 96x96 mm, depth 120 mm. The operating mode of the DO 9404 is chosen according to the application, configuring the instrument with the keyboard. It is possible to configure the instrument on the field with maximum simplicity to adapt it to changes in the process requirements.
The configuration possibility concerns the inputs, the extent of the scales, the set points, the alarms and the baud rate.

Applications
A typical application of the DO 9404 is the display and regulation of signals arriving from passive 2-wire or active 3-wire transmitters, of any physical quantity: temperature, humidity, pressure, speed, level, etc. for a wide variety of industrial sectors and automation.

Characteristics
- Set point may be configured from -9999 to +19999
- Indication with 1/2" red LEDS
- Separate terminal for each channel for voltage input 0÷10 V and current input 0÷20 mA, 4÷20 mA
- On the terminal board an auxiliary power supply is available at -5 Vdc max. 10 mA and +15 Vdc non-stabilized max. 44 mA for the possible feeding of passive 2-wire transmitters
- Instrument accuracy ±0.1% Rdg ± 1 digit
- A/D converter resolution: 0.05 mV/digit, 1 µA/digit
- Functions: Two relays with insulated HI LO exchange contact for channel 1: RL1, RL2
  Two relays with insulated HI LO exchange contact for channel 2: RL4, RL5
  One relay for the overall maximum and minimum alarms: RL3
  Resistive 3A/230 Vac relay contacts
- Instrument working temperature: (electronic components) -5°C..50°C
- Power supply: 12÷24 ±10% Vac/Vdc.

Error signals
The instrument gives error signals in the following cases:
OFL: appears when the SET value is set higher than the high alarm value (maximum).
-OFL: appears when the SET value is set lower than the low alarm value (minimum).
E1: appears when a resolution of the AD converter has been asked for that is higher than what is available: **THE MAXIMUM AD RESOLUTION IS 0.1mV/digit or 2µA/digit.**
E2: appears when there is an analog value at input that is lower or higher than that of the instrument: voltage 0 V..+10 V, current 0-20 mA.
E3: appears when the values of the alarm thresholds are inverted.
E4: reading/writing mistake on the Eeprom.

Configuration of the regulating indicator DO 9404
1) Supply power to the instrument: 11÷30 Vac; 11÷40 Vdc.
2) The dual display indicates OFL on both channels (1 and 2) at the first programming, or values depending on previous programming operations.
3) When the [PROG] key is pressed, the message FO appears alternately on channel 1 or 2.
4) Select which channel (1 or 2) you want to program, for example channel 1.
5) Press the ▲ key, the message F1 appears; confirm with the [ENTER] key and the symbol A (Ampere = current signal 0÷20 mA, 4÷20 mA) or the symbol *U* (voltage V = voltage signal 0÷10 V) appears; with the ▲ and ▼ keys, prepare the input for the desired signal, current A or voltage; for example, set A current input, confirm with the [ENTER] key, then F1 appears. Press the ▲ key and the message F2 appears.
6) Press the [ENTER] key, four figures *8888* appear with the decimal point placed at random; using the ▲ and ▼ keys, set the decimal point in the desired position, the possible configurations are:

8888
8.8
8.88
8.888

Press the [ENTER] key to confirm, then the message F2 appears; press the ▲ key and the message F3 appears.
7) Press [ENTER], then using the ▲ and ▼ keys set the start of scale value for channel 1, for example -30.0°C; confirm with [ENTER], the message F3 appears, press the ▲ key and the message F4 appears.

8) Press the ENTER, key, then using the ▲ and ▼ keys set the analog value corresponding to the start of scale in voltage or current, depending on the choice made in point 5, for example 4.00 mA; confirm with ENTER, the message F4 appears, press the ▲ key and the message F5 appears.
9) Press ENTER, then using the ▲ and ▼ keys set the full scale value for channel 1, for example 130.0°C; confirm with ENTER, the message F5 appears, press the ▲ key and the message F6 appears.
10) Press the ENTER key, then using the ▲ and ▼ keys set the analog value corresponding to the end of scale in voltage or current, depending on the choice made in point 5, for example 20.00 mA; confirm with ENTER, the message F6 appears, press the ▲ key and the message F7 appears.
11) Press the ENTER key, then using the ▲ and ▼ keys set the SET LO value (closing of contact RL1) for channel 1, for example 0.0°C; confirm with ENTER, the message F7 appears, press the ▲ key and the message F8 appears.
12) Press the ENTER key, then using the ▲ and ▼ keys set the Reset HI value (opening of contact RL1) for channel 1, for example 10.0°C; confirm with ENTER, the message F8 appears, press the ▲ key and the message F9 appears.
13) Press the ENTER key, then using the ▲ and ▼ keys set the SET LO value (closing of contact RL2) for channel 1, for example 20.0°C (control of a refrigerating unit, for example); confirm with ENTER, the message F9 appears, press the ▲ key and the message F10 appears.
14) Press the ENTER key, then using the ▲ and ▼ keys set the Reset HI value (opening of contact RL2) for channel 1, for example 15.0°C (switching off a refrigerating unit, for example); confirm with ENTER, the message F10 appears, press the ▲ key and the message F11 appears.
15) Press the ENTER key, then using the ▲ and ▼ keys set the low ALARM value for the relay RL3, for example -5.0°C; confirm with ENTER, the message F11 appears, press the ▲ key and the message F12 appears.
16) Press the ENTER key, then using the ▲ and ▼ keys set the high ALARM value for the relay RL3, for example 25.0°C; confirm with ENTER, the message F12 appears, press the ▲ key and the message F13 appears.
17) Function F13 is used to select the baud rate for serial transmission; press the ENTER key and a baud rate value appears, then using the ▲ and ▼ keys set the desired rate, choosing one of the following: 300, 600, 1200, 2400, 4800, 9600; the other serial transmission parameters are fixed and cannot be changed; they are:

8 bit
No Parity
1 Stop bit

Note: the baud rate is the same for both channels. Press ENTER to confirm, press the ▼ key until FO appears indicating the end of programming; press the ENTER key. This operation concludes the programming of channel 1 as described up to this point.

- Programming is the same for both channels, 1 and 2; all that has been described for channel 1 also applies to channel 2.
- The function of the set and reset relays (close LO contact, open HI contact), of relays RL1 and RL2 or RL4 and RL5, depends on what the process requires.
- To alter the parameters it is sufficient to enter the program by pressing the ENTER key; when FO appears, choose the channel in which you want to change the parameter, press the ▲ key until the function that you want to change appears, then make the change with the ▲ and ▼ keys; press ENTER to confirm, then return to FO function with the ▼ key, press ENTER thus returning to normal operation.
- In normal operation, pressing one of the ▲ or ▼ keys passes from the measurement of the physical quantity to the voltage or current value corresponding to the measurement in progress; this applies to both channels. When one of the or keys is pressed the instrument returns to normal measuring status.
- The serial interface is active only during normal operation.
- The programming parameters remain in the memory even when the instrument is receiving no power.
- The relays are disconnected during programming.

Serial interface RS-232C

The DO 9404 is equipped with standard serial interface RS-232C which is available on the SUB D female 9-pin connector. The arrangement of the signals on this connector is as follows;

Pin	Signal	Description
2	TD	Datum transmitted by the DO 9404
3	RD	Datum received by the DO 9404
5	GND	Reference logic mass

The transmission parameters with which the instrument is supplied are:

-	baud rate	9600 baud
-	parity	None
-	n. bits	8
-	stop bit	1

The data transmission speed may be changed by altering the set-up parameter F13 with the keyboard; the possible baud rates are: 9600, 4800, 1200, 600, 300. The other transmission parameters are fixed.

All the messages reaching and leaving the DO 9404 must be inserted in a “Communication frame” with the following structure:

<Stx><Record><Etx>

where:

<Stx>	Start of text (ASCII 02)
<Record>	constitutes the message
<Etx>	End of text (ASCII 03)

Host commands

The structure of the command records is as follows:

<Command character><Sub-command><Values>

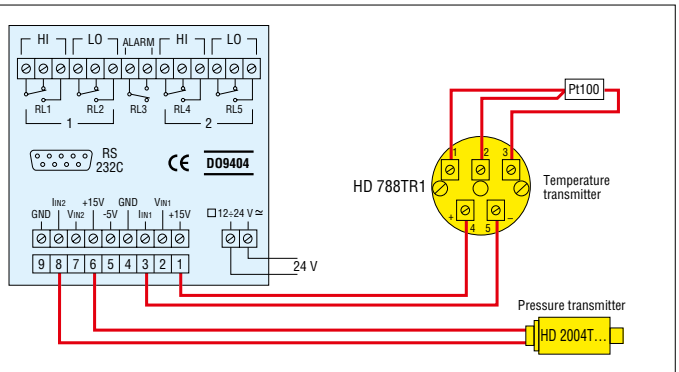
Where:

<Command character>	is characterized by an alphabetic character indicating the set of commands.
<Sub-command>	is characterized by a character indicating the type of command.
<Values>	is characterized by ASCII characters that depend on the type of command.

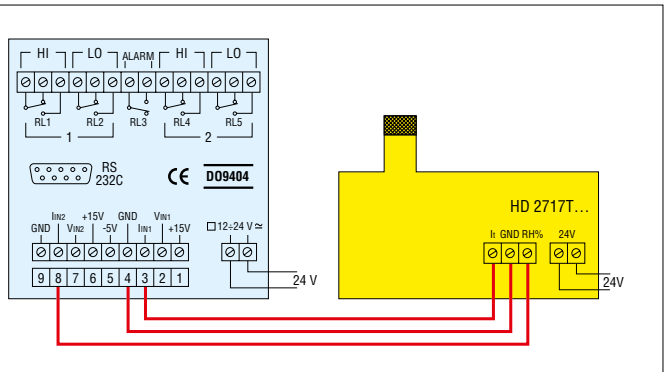
The replies provided by the DO 9404 are essentially of two types:
“Information” and “Data”.

The former allow information on the status and programming of the DO 9404 to be obtained, as well as the diagnosis of the message received; the latter contain data on the two channels at the moment the request is made.
It is also possible to make use of the serial line for the complete programming of the DO 9404, with the exception of the data transmission speed which may be set only with the keyboard.
The diagnostic replies of the DO 9404 are composed of the following control characters, sent individually (not inserted in the communication frame):

-ack-	Command executed (ASCII 06)
-nak-	Incorrect command (ASCII 15H)



Example of connection of transmitters which are connected to the DO 9404:
- a temperature transmitter which sends a current signal (4÷20 mA)
- a pressure transmitter which sends a current signal (4÷20 mA)



Example of connection of a self-powered transmitter which sends the DO 9404 two current signals (4÷20 mA)

COMMAND A

Sub-command		Values	Replies
A Type of terminal			DO 9404
C Company			DELTA OHM
D Firmware Version			Vxx Rxx
E Firmware Date			dd/mm/yy
F Serial number	(rd)		AFxxxxxx
	(wr)	xxxxxx	ack/nak

COMMAND M

Sub-command	Values	Replies
1 Measure Channel 1		Measure Channel 1
2 Measure Channel 2		Measure Channel 2

RESET COMMAND		Vales	Replies
RESET	(wr)		

COMMAND

Sub-command	Values	Replies
1 Set-up Channel 1		Set-up Channel 1
2 Set-up Channel 2		Set-up Channel 2

CHANNEL 1

C1F01	**x**	Input in	V/A	ack/nak
C1F02	**x**	Point	0/1/2/3	ack/nak
C1F03	**xxxx**	Start of scale	-9999...19999	ack/nak
C1F04	**xxxx**	V/I Start of scale	0000...10000 (2000 if I)	ack/nak
C1F05	**xxxx**	End of scale	-9999...19999	ack/nak
C1F06	**xxxx**	V/I End of scale	0000...10000 (2000 if I)	ack/nak
C1F07	**xxxx**	Energ. Relay 1	-9999...19999	ack/nak
C1F08	**xxxx**	De-energ. Relay 1	-9999...19999	ack/nak
C1F09	**xxxx**	Energ. Relay 2	-9999...19999	ack/nak
C1F10	**xxxx**	De-energ. Relay 2	-9999...19999	ack/nak
C1F11	**xxxx**	Min1 Relay 3	-9999...19999	ack/nak
C1F12	**xxxx**	Min1 Relay 3	-9999...19999	ack/nak
C1F12	**xxxx**	Max1 Relay 3	0000-9999	ack/nak

CHANNEL 2

C2F01	**x**	Input in	V/A	ack/nak
C2F02	**x**	Point	0/1/2/3	ack/nak
C2F03	**xxxx**	Start of scale	-9999...19999	ack/nak
C2F04	**xxxx**	V/I Start of scale	0000...10000 (2000 if I)	ack/nak
C2F05	**xxxx**	End of scale	-9999...19999	ack/nak
C2F06	**xxxx**	V/I End of scale	0000...10000 (2000 if I)	ack/nak
C2F07	**xxxx**	Energ. Relay 4	-9999...19999	ack/nak
C2F08	**xxxx**	De-energ. Relay 4	-9999...19999	ack/nak
C2F09	**xxxx**	Energ. Relay 5	-9999...19999	ack/nak
C2F10	**xxxx**	De-energ. Relay 5	-9999...19999	ack/nak
C2F11	**xxxx**	Min2 Relay 3	-9999...19999	ack/nak
C2F12	**xxxx**	Max2 Relay 3	-9999...19999	ack/nak

As regards the command just described, a few remarks must be made:
- There is no command character.
- In the first two cases (Sub-command 1 and 2) the complete set-up of the DO 9404, for Channel 1 and for Channel 2, is made available in the serial line.
- For all the other controls of the type C1F01 etc., the present programming status is supplied for the specific command if only the sequence of the sub-command characters is sent.

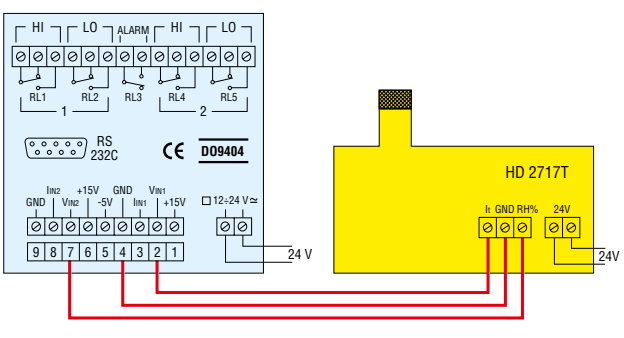
Example: StxC1F01Etx Request from Host
StxC1F01:1Etx Reply

If the sequence of the sub-command characters is followed by a space and then the desired programming value, the programming of the parameter is produced.

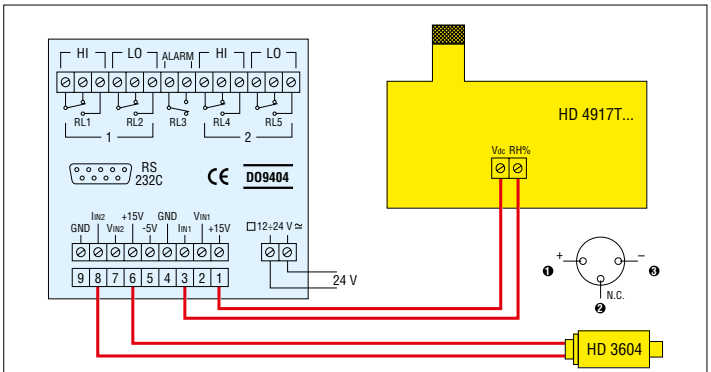
Example: StxC1F01 1Etx Command from Host
ack / nak Reply

Note: for programming of the point F03...F12, the value field has fixed length of 5 characters. The first character in the value field may be a space, the minus sign, or the number one.

StxC1F03 1000Etx Request from Host
ack / nak Reply
StxC1F03-2000Etx Request from Host
ack / nak Reply
StxC1F0512000Etx Request from Host
ack / nak Reply

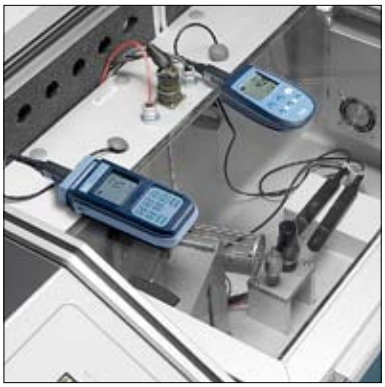


Example of connection of a self-powered transmitter which sends the DO 9404 two voltage signals (0÷10 V)



Example of connection of two transmitters which are connected to the DO 9404:
- a R.H.% transmitter which sends a current signal (4÷20 mA)
- a pressure transmitter which sends a current signal (4÷20 mA)

SIT N° 124 laboratory - Humidity measurements



Calibration Service in Italy

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DELTA OHM s.r.l.
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Telefono: +39 049 89 77 150
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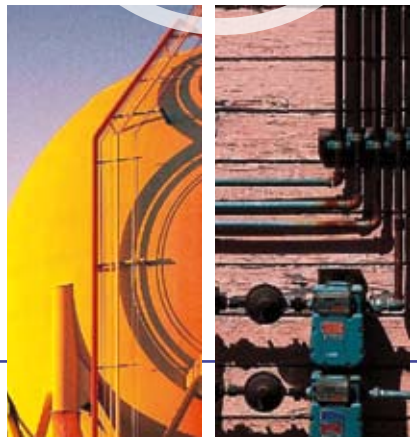
E-mail: deltaohm@tin.it
URL http://www.deltaohm.com

Permanent Laboratory **SIT ACCREDITATION TABLE**

Quantity	Instruments to be calibrated	Measuring range	Uncertainty (*)	Note
Relative humidity	Electrical and mechanical hygrometers and thermo- hygrometers	from 10 to 92 % RH (with air temperature within 0°C…60°C)	from 0,5 to 1,8 %RH	⇦
	Electrical Psycrometers	from 10 to 92 % RH (with air temperature within 0°C…60°C)	from 0,5 to 1,8 %RH	⇦
	Saturated salt solutions	from 10 to 90 % RH (with air temperature within 20°C .. 25°C)	1,4 %RH	
Dew point	Mirror Hygrometers	from -20°C to 60°C	0,16°C	

(*) The measurement uncertainty is expressed at a confidence level of 95%.
⇦ Extended composed uncertainty resulting from the propagation of uncertainties of reference magnitudes (Td and Tair)

N



Pressure

- HD 2124.1, HD 2124.2, HD 2304.0, HD 2114.0, HD 2114.2, HD 2134.0, HD 2134.2, HD 2164.0, HD 2164.2, HD 2114B.0, HD 2114B.2 — pag. 94
  Portable manometers, barometers, thermometers

- DO 9704 — pag. 101
  Portable pressure and temperature meter, datalogger

- HD 3604T…, HD 36V4T… — pag. 105
  Absolute or relative pressures transmitters, with DIN 43650 connectors, stainless steel membrane

- HD 2004T…, HD 20V4T… — pag. 107
  Absolute or relative pressures transmitters, DIN 43650 connectors, aluminia membrane

- HD 408T, HD 4V8T — pag. 109
  Relative or differential pressures transmitters

- HD 404T — pag. 111
  Very low relative or differential pressures transmitters

- HD 9408T BARO, HD 9408TR BARO, HD 9908T BARO — pag. 114
  Barometric (pressure) transmitters

- HD 9408PS 50 — pag. 116
  Static port for barometric measures

• SIT Centre 124 accredited laboratory for Pressure — pag. 118

The qualitative level of our instruments is the result of a continuous evolving of the product itself. This way bring to slight differences between what reported on this manual and the instruments you bought. We can not completely exclude the presence of errors for which we apologise. Data, images and descriptions included in this catalogue can not be enforced legally. We reserve the right to perform any modification and correction at any time without notice.

HD 2124.1
HD 2124.2

HD2124.1 AND HD2124.2
MANOMETER-THERMOMETER

HD2124.1 and **HD2124.2** are **two inputs** portable instruments with a large LCD display. They perform measure of absolute, relative, differential pressure and temperatura. In order to measure the pressure you use the electronic module PP471 that works as an interface between the instrument and Delta Ohm probes series TP704 and TP705. Temperature is measured by means of Pt100 with SICRAM module or direct 4 wires Pt100 probes for immersion, penetration, contact or air. Temperature probes are equipped with SICRAM module and factory calibration data are stored inside so that when the instrument is on it soon recognizes them. The HD2124.2 is a data logger. It stores up to 32.000 samples which can be transferred into a PC connected to the instrument through a multi-standard RS232C serial port and a USB 2.0. It is possible to configure the storage interval, the printing and the baud rate by the menu.
The models HD2124.1 and HD2124.2 are equipped with RS232C serial port and they can transfer the acquired measures, in real time, into a PC or a portable printer. Functions Max, Min and Avg calculate maximum, minimum and average values. Further functions are: REL relative measure, HOLD and automatic switching-off system, excludable.
Instruments have IP67 protection degree.

INSTRUMENT TECHNICAL CHARACTERISTICS

Instrument

Dimensions (Length x Width x Height)	185x90x40mm
Weight	470g (complete with batteries)
Materials	ABS, rubber
Display	2x4½ characters plus symbols Visible area: 52x42mm

Operating conditions

Operating temperature	-5…50°C
Storage temperature	-25…65°C
Working relative humidity	0…90%RH without condensation
Protection degree	**IP67**

Power supply

Batteries	4 1.5V type AA batteries
Autonomy	200 hours with 1800mAh alkaline batteries
Current absorbed with instrument off	20µA
Mains	Output mains adapter 12Vdc / 1000mA

Measuring unit — *°C - °F - Pa - hPa - mbar - bar - atm mmHg - mmH_2O - kgf/cm^2 - PSI - inchHg*

Security of data stored — Unlimited, independently of battery charge conditions

Time

Date and time	Schedule in real time
Precision	1min/month max departure

*Measured values storage - model **HD2124.2***

Type	2000 pages of 16 samples each
Quantity	32,000 pairs of samples
Storage interval	1s…3600s (1hour)

Serial interface RS232C

Type	RS232C electrically isolated
Baud rate	Can be set from 1200 to 38400 baud
Data bit	8
Parity	None
Stop bit	1
Flow Control	Xon/Xoff
Serial cable length	Max 15m
Immediate print interval	1s…3600s (1hour)

*USB interface - model **HD2124.2***

Type	1.1 - 2.0 electrically isolated

Connections

Input module for the probes	2 8-pole male DIN45326 connectors
Serial interface	8-pole MiniDin connector
USB interface - model **HD2124.2**	8-pole MiniDin connector
Mains adapter	2-pole connector (positive at centre)

Measurement of temperature by Instrument

Pt100 measurement range	-200…+650°C
Resolution	0.1°C
Instrument accuracy	±0.1°C
Drift after 1 year	0.1°C/year

TECHNICAL DATA FOR INSTRUMENT EQUIPPED WITH PROBES AND MODULES
Measurement of pressure by module PP471

All TP704 and TP705 series Delta Ohm probes can be connected to the PP471 module. For the technical characteristics of the single probes, see the table below.

Technical characteristics

Accuracy	±0.05% of bottom scale
Peak duration	≥ 5ms
Peak accuracy	±0.5% of bottom scale
Peak dead band	≤ 2% of bottom scale

Pt100 sensor temperature probes with SICRAM module

Model	Type	Application field	Accuracy
TP472I	Immersion	-196°C…+500°C	±0.25°C (-196°C…+350°C) ±0.4°C (+350°C…+500°C)
TP472I.0	Immersion	-50°C…+400°C	±0.25°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP473P	Penetration	-50°C…+400°C	±0.25°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP473P.0	Penetration	-50°C…+400°C	±0.25°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP474C	Contact	-50°C…+400°C	±0.3°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP474C.0	Contact	-50°C…+400°C	±0.3°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP475A.0	Air	-50°C…+250°C	±0.3°C (-50°C…+250°C)
TP472I.5	Immersion	-50°C…+400°C	±0.3°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP472I.10	Immersion	-50°C…+400°C	±0.30°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP49A	Immersion	-70°C…+400°C	±0.25°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP49AC	Contact	-70°C…+400°C	±0.25°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP49AP	Penetration	-70°C…+400°C	±0.25°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP875	Globe-thermometer Ø150mm	-30°C…+120°C	±0.25°C
TP876	Globe-thermometer Ø 50mm	-30°C…+120°C	±0.25°C
TP87	Immersion	-50°C…+200°C	±0.25°C
TP878 TP878.1	Solar panel	+5°C…+80°C	±0.25°C
TP879	For compost	-20°C…+120°C	±0.25°C

Common specifications

Temperature drift @20°C 0.003%/°C

4 wires Pt100 and 2 wires Pt1000 Probes

Model	Type	Application field	Accuracy
TP47.100	4 wires Pt100	-50…+400°C	Class A
TP47.1000	2 wires Pt1000	-50…+400°C	Class A

Common specifications
Temperature drift @20°C
Pt100 0.003%/°C
Pt1000 0.005%/°C

ORDER CODES

HD2124.1: The kit consists of instrument HD2124.1, 4 per 1.5V alkaline batteries, instruction manual, case and DeltaLog9 software. **Probes, PP471 module and cables have to be ordered separately.**

HD2124.2: The kit consists of instrument HD2124.2 data logger, 4 per 1.5V alkaline batteries, instruction manual, case and DeltaLog9 software. **Probes, PP471 module and cables have to be ordered separately.**

HD2110CSNM: 8-pole connection cable MiniDin - Sub D 9-pole female for RS232C.

C.206: Cable for instruments of the series HD21…1 and .2 to connect directly to USB input of PC.

HD2101/USB: Connection cable USB 2.0 connector type A - 8-pole MiniDin.

DeltaLog9: Software for download and management of the data on a PC using Windows 98 to XP and Vista operating systems.

SWD10: Stabilized power supply at 230Vac/12Vdc-300mA-1000mA mains voltage.

HD40.1: Upon request, portable, serial input, 24 column thermal printer, 58mm paper width.

PROBES FOR MASURING PRESSURE
Probes equipped with SICRAM module

PP471: Interfacing SICRAM module between instrument and Delta Ohm probes of the series TP704 and TP705. Cable 2 meters long.

The list of pressure probes is outlined in the technical data table.

PROBES FOR MEASURING TEMPERATURE
Probes equipped with SICRAM module

TP472I: Immersion probe, Pt100sensor. Stem Ø 3 mm, length 300 mm. Cable 2 meters long.

TP472I.0: Immersion probe, Pt100sensor. Stem Ø 3 mm, length 230 mm. Cable 2 meters long.

TP473P: Penetration probe, Pt100sensor. Stem Ø 4mm, length 150 mm. Cable 2 meters long.

TP473P.0: Penetration probe, Pt100sensor. Stem Ø 4mm, length 150 mm. Cable 2 meters long.

TP474C: Contact probe, Pt100sensor. Stem Ø 4mm, length 230mm, contact surface Ø 5mm. Cable 2 meters long.

TP474C.0: Contact probe, Pt100sensor. Stem Ø 4mm, length 230mm, contact surface Ø 5mm. Cable 2 meters long.

TP475A.0: Air probe, Pt100sensor. Stem Ø 4mm, length 230mm. Cable 2 meters long.

TP472I.5: Immersion probe, Pt100sensor. Stem Ø 6mm, length 500 mm. Cable 2 meters long.

TP472I.10: Immersion probe, Pt100sensor. Stem Ø 6mm, length 1,000mm. Cable 2 meters long.

TP49A: Immersion probe, Pt100sensor. Stem Ø 2.7mm, length 150mm. Cable 2 meters long. Aluminium handle.

TP49AC: Contact probe, Pt100sensor. Stem Ø 4 mm, length 150mm. Cable 2 meters long. Aluminium handle.

TP49AP: Penetration probe, Pt100sensor. Stem Ø 2.7mm, length 150mm. Cable 2 meters long. Aluminium handle.

TP875: Globe thermometer Ø 150 mm with handle. Cable 2 meters long.

TP876: Globe thermometer Ø 50 mm with handle. Cable 2 meters long.

TP87: Immersion probe, Pt100sensor. Stem Ø 3 mm, length 70 mm. Cable 2 meters long.

TP878: Contact probe for solar panels. Cable 2 meters long.

TP878.1: Contact probe for solar panels. Cable 5 meters long

TP879: Penetration probe for compost. Stem Ø 8 mm, length 1 meter. Cable 2 meters long.

Temperature probes without SICRAM

TP47.100: Direct 4 wires Pt100 sensor immersion probe. Stem Ø 3 mm, length 230mm. 4 wires connection cable with connector, 2 meters long.

TP47.1000: Pt1000 sensor immersion probe. Stem Ø 3 mm, length 230mm. 2 wires connection cable with connector, 2 meters long.

TP47: Only connector for probe connection: direct 3 and 4 wires Pt100, 2 wires Pt1000.

HD2124.2

HD2101/USB

PRESSURE PROBE TABLE

Bottom scale pressure	Maximum overpressure	Resolution	ORDER CODES			Accuracy From 20 to 25°C	Working temperature	Connection
			Differential pressure	Relative pressure (compared to atmosphere)	Absolute pressure			
			NON insulated membrane	Insulated membrane	Insulated membrane			
10.0 mbar	20.0 mbar	0.01 mbar	• TP705-10MBD			0.5 % FSO	0..60 °C	Tube Ø 5 mm
20.0 mbar	40.0 mbar	0.01 mbar	• TP705-20MBD			0.5 % FSO	0..60 °C	Tube Ø 5 mm
50.0 mbar	100 mbar	0.01 mbar	TP705-50MBD			0.5 % FSO	0..60 °C	Tube Ø 5 mm
100 mbar	200 mbar	0.1 mbar	TP705-100MBD			0.25 % FSO	0..60 °C	Tube Ø 5 mm
				TP704-100MBGI		0.25 % FSO	-10..+80 °C	¼ BSP
200 mbar	400 mbar	0.1 mbar	TP705-200MBD			0.25 % FSO	0..60 °C	Tube Ø 5 mm
				TP704-200MBGI		0.25 % FSO	-10..+80 °C	¼ BSP
400 mbar	1000 mbar	0.1 mbar		TP704-400MBGI		0.25 % FSO	-10..+80 °C	¼ BSP
500 mbar	1000 mbar	0.1 mbar	TP705-500MBD			0.25 % FSO	0..60 °C	Tube Ø 5 mm
600 mbar	1000 mbar	0.1 mbar		TP704-600MBGI		0.25 % FSO	-40..125 °C	¼ BSP
1.00 bar	2.00 bar	1 mbar	TP705-1BD			0.25 % FSO	0..60 °C	Tube Ø 5 mm
					TP705BARO	0.25 % FSO	0..60 °C	Tube Ø 5 mm
						0.25 % FSO	-40..125 °C	¼ BSP
					TP704-1BA	0.25 % FSO	-40..120 °C	¼ BSP
2.00 bar	4.00 bar	1 mbar	TP705-2BD			0.25 % FSO	0..60 °C	Tube Ø 5 mm
				TP704-2BGI		0.25 % FSO	-40..+125 °C	¼ BSP
					TP704-2BAI *	0.25 % FSO	-25..+85 °C	¼ BSP
5.00 bar	10.00 bar	1 mbar		TP704-5BGI		0.25 % FSO	-40..+125 °C	¼ BSP
					TP704-5BAI *	0.25 % FSO	-25..+85 °C	¼ BSP
10.00 bar	20.0 bar	0.01 bar		TP704-10BGI		0.25 % FSO	-40..+125 °C	¼ BSP
					TP704-10BAI *	0.25 % FSO	-25..+85 °C	¼ BSP
20.0 bar	40.0 bar	0.01 bar		TP704-20BGI		0.25 % FSO	-40..+125 °C	¼ BSP
					TP704-20BAI *	0.25 % FSO	-25..+85 °C	¼ BSP
50.0 bar	100.0 bar	0.01 bar		TP704-50BGI		0.25 % FSO	-40..+125 °C	¼ BSP
					TP704-50BAI *	0.25 % FSO	-25..+85 °C	¼ BSP
100 bar	200 bar	0.1 mbar		TP704-100BGI		0.25 % FSO	-40..+125 °C	¼ BSP
					TP704-100BAI *	0.25 % FSO	-25..+85 °C	¼ BSP
200 bar	400 bar	0.1 mbar		TP704-200BGI		0.25 % FSO	-40..+125 °C	¼ BSP
					TP704-200BAI *	0.25 % FSO	-25..+85 °C	¼ BSP
500 bar	1000 bar	0.1 mbar		TP704-500BGI		0.25 % FSO	-40..+125 °C	¼ BSP
	700 bar	0.1 mbar			TP704-500BAI *	0.25 % FSO	-25..+85 °C	¼ BSP

* Ceramic diaphragm
• Only report of calibration, no SIT certificate

HD2304.0
MANOMETER - THERMOMETER

The **HD2304.0** is a portable instrument with a large LCD display. It performs measurements of absolute, relative and differential pressure, and temperature. The PP471 electronic module is used to measure the pressure. The PP471 electronic module works as an interface between the instrument and the TP704 and TP705 series Delta Ohm probes. The temperature is detected with immersion, penetration, contact or air Pt100 probes with SICRAM module or 4 wire direct Pt100 probes. The temperature probes are fitted with SICRAM module and the factory calibration settings are already memorized inside. Upon turning on the instrument automatically detects them. The Max, Min and Avg function calculate the maximum, minimum or average values. Other functions include: the relative measurement REL, the HOLD function, and the automatic turning off that can also be excluded. **The instrument has IP67 protection degree.**

INSTRUMENT TECHNICAL SPECIFICATIONS

Instrument

Dimensions (Length x Width x Height)	140x88x38mm
Weight	160g (complete with batteries)
Materials	ABS
Display	2x4½ characters plus symbols Visible area: 52x42mm

Operating conditions

Operating temperature	-5…50°C
Storage temperature	-25…65°C
Working relative humidity	0…90%RH without condensation
Protection degree	**IP67**

Power

Batteries	3 1.5V type AA batteries
Autonomy	200 hours with 1800mAh alkaline batteries
Power absorbed with instrument off	< 20µA

Measuring unit — *°C - °F - Pa - hPa - kPa - mbar - bar - atm mmHg - mmH_2O - kgf/cm^2 - PSI - inchHg*

Connections

Input module for the probes	8-pole male DIN45326 connector

Measurement of temperature by Instrument

Pt100 measurement range	-200…+650°C
Resolution	0.1°C
Instrument accuracy	±0.1°C
Drift after 1 year	0.1°C/year

TECHNICAL SPECIFICATIONS OF PROBES AND MODULES IN LINE WITH THE INSTRUMENTS

Measurement of pressure by module PP471

All TP704 and TP705 series Delta Ohm probes can be connected to the PP471 module. For the technical specifications of each probe see the table below.

Technical specifications

Accuracy ±0.05% of full scale

Pt100 sensor temperature probes equipped with SICRAM module

Model	Type	Application field	Accuracy
TP472I	Immersion	-196°C…+500°C	±0.25°C (-196°C…+350°C) ±0.4°C (+350°C…+500°C)
TP472I.0	Immersion	-50°C…+400°C	±0.25°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP473P	Penetration	-50°C…+400°C	±0.25°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP473P.0	Penetration	-50°C…+400°C	±0.25°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP474C	Contact	-50°C…+400°C	±0.3°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP474C.0	Contact	-50°C…+400°C	±0.3°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP475A.0	Air	-50°C…+250°C	±0.3°C (-50°C…+250°C)
TP472I.5	Immersion	-50°C…+400°C	±0.3°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP472I.10	Immersion	-50°C…+400°C	±0.30°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP49A	Immersion	-70°C…+400°C	±0.25°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP49AC	Contact	-70°C…+400°C	±0.25°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP49AP	Penetration	-70°C…+400°C	±0.25°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP875	Globe-thermometer Ø150mm	-30°C…+120°C	±0.25°C
TP876	Globe-thermometer Ø 50mm	-30°C…+120°C	±0.25°C
TP87	Immersion	-50°C…+200°C	±0.25°C
TP878 TP878.1	Solar panel	+5°C…+80°C	±0.25°C
TP879	For compost	-20°C…+120°C	±0.25°C

Common characteristics

Temperature drift @20°C 0.003%/°C

HD2304.0

PP471

TP704…

TP705…

4 wire Pt100 and 2 wire Pt1000 probes without SICRAM module

Model	Type	Application range	Accuracy
TP47.100	Pt100 4 wires	-50…+400°C	Class A
TP47.1000	Pt1000 2 wires	-50…+400°C	Class A

Common specifications
Temperature drift @20°C
Pt100 0.003%/°C
Pt1000 0.005%/°C

ORDER CODES

HD2304.0: The kit consists of the instrument HD2304.0, 1 **SICRAM interface module PP471,** 3 1.5V alkaline batteries, operating manual, case. **Probes have to be ordered separately.**

PRESSURE MEASUREMENT PROBES
Probes equipped with SICRAM module

PP471: Interfacing SICRAM module between instrument and Delta Ohm probes of the series TP704 and TP705. Cable 2 meters long.
The list of pressure probes is outlined in the technical data table.

TEMPERATURE MEASUREMENT PROBES
Probes equipped with SICRAM module

TP472I: Immersion probe, Pt100sensor. Stem Ø 3 mm, length 300 mm. Cable 2 meters long.
TP472I.0: Immersion probe, Pt100sensor. Stem Ø 3 mm, length 230 mm. Cable 2 meters long.
TP473P: Penetration probe, Pt100sensor. Stem Ø 4mm, length 150 mm. Cable 2 meters long.
TP473P.0: Penetration probe, Pt100sensor. Stem Ø 4mm, length 150 mm. Cable 2 meters long.
TP474C: Contact probe, Pt100sensor. Stem Ø 4mm, length 230mm, contact surface Ø 5mm. Cable 2 meters long.
TP474C.0: Contact probe, Pt100sensor. Stem Ø 4mm, length 230mm, contact surface Ø 5mm. Cable 2 meters long.
TP475A.0: Air probe, Pt100sensor. Stem Ø 4mm, length 230mm. Cable 2 meters long.
TP472I.5: Immersion probe, Pt100sensor. Stem Ø 6mm, length 500 mm. Cable 2 meters long.
TP472I.10: Immersion probe, Pt100sensor. Stem Ø 6mm, length 1,000mm. Cable 2 meters long.
TP49A: Immersion probe, Pt100sensor. Stem Ø 2.7mm, length 150mm. Cable 2 meters long. Aluminium handle.
TP49AC: Contact probe, Pt100sensor. Stem Ø 4 mm, length 150mm. Cable 2 meters long. Aluminium handle.
TP49AP: Penetration probe, Pt100sensor. Stem Ø 2.7mm, length 150mm. Cable 2 meters long. Aluminium handle.
TP875: Globe thermometer Ø 150 mm with handle. Cable 2 meters long.
TP876: Globe thermometer Ø 50 mm with handle. Cable 2 meters long.
TP87: Immersion probe, Pt100sensor. Stem Ø 3 mm, length 70 mm. Cable 2 meters long.
TP878: Contact probe for solar panels. Cable 2 meters long.
TP878.1: Contact probe for solar panels. Cable 5 meters long
TP879: Penetration probe for compost. Stem Ø 8 mm, length 1 meter. Cable 2 meters long.

Temperature probes without SICRAM

TP47.100: Direct 4 wires Pt100 sensor immersion probe. Stem Ø 3 mm, length 230mm. 4 wires connection cable with connector, 2 meters long.
TP47.1000: Pt1000 sensor immersion probe. Stem Ø 3 mm, length 230mm. 2 wires connection cable with connector, 2 meters long.
TP47: Only connector for probe connection: direct 3 and 4 wires Pt100, 2 wires Pt1000.

PRESSURE PROBE TABLE

Bottom scale pressure	Maximum overpressure	Resolution	ORDER CODES			Accuracy From 20 to 25°C	Working temperature	Connection
			Differential pressure	Relative pressure (compared to atmosphere)	Absolute pressure			
			NON insulated membrane	Insulated membrane	Insulated membrane			
10.0 mbar	20.0 mbar	0.01 mbar	• **TP705-10MBD**			0.5 % FSO	0..60 °C	Tube Ø 5 mm
20.0 mbar	40.0 mbar	0.01 mbar	• **TP705-20MBD**			0.5 % FSO	0..60 °C	Tube Ø 5 mm
50.0 mbar	100 mbar	0.01 mbar	**TP705-50MBD**			0.5 % FSO	0..60 °C	Tube Ø 5 mm
100 mbar	200 mbar	0.1 mbar	**TP705-100MBD**			0.25 % FSO	0..60 °C	Tube Ø 5 mm
				TP704-100MBGI		0.25 % FSO	-10..+80 °C	¼ BSP
200 mbar	400 mbar	0.1 mbar	**TP705-200MBD**			0.25 % FSO	0..60 °C	Tube Ø 5 mm
				TP704-200MBGI		0.25 % FSO	-10..+80 °C	¼ BSP
400 mbar	1000 mbar	0.1 mbar		**TP704-400MBGI**		0.25 % FSO	-10..+80 °C	¼ BSP
500 mbar	1000 mbar	0.1 mbar	**TP705-500MBD**			0.25 % FSO	0..60 °C	Tube Ø 5 mm
600 mbar	1000 mbar	0.1 mbar		**TP704-600MBGI**		0.25 % FSO	-40..125 °C	¼ BSP
1.00 bar	2.00 bar	1 mbar	**TP705-1BD**			0.25 % FSO	0..60 °C	Tube Ø 5 mm
					TP705BARO	0.25 % FSO	0..60 °C	Tube Ø 5 mm
						0.25 % FSO	-40..125 °C	¼ BSP
					TP704-1BA	0.25 % FSO	-40..120 °C	¼ BSP
2.00 bar	4.00 bar	1 mbar	**TP705-2BD**			0.25 % FSO	0..60 °C	Tube Ø 5 mm
				TP704-2BGI		0.25 % FSO	-40..+125 °C	¼ BSP
					TP704-2BAI *	0.25 % FSO	-25..+85 °C	¼ BSP
5.00 bar	10.00 bar	1 mbar		**TP704-5BGI**		0.25 % FSO	-40..+125 °C	¼ BSP
					TP704-5BAI *	0.25 % FSO	-25..+85 °C	¼ BSP
10.00 bar	20.0 bar	0.01 bar		**TP704-10BGI**		0.25 % FSO	-40..+125 °C	¼ BSP
					TP704-10BAI *	0.25 % FSO	-25..+85 °C	¼ BSP
20.0 bar	40.0 bar	0.01 bar		**TP704-20BGI**		0.25 % FSO	-40..+125 °C	¼ BSP
					TP704-20BAI *	0.25 % FSO	-25..+85 °C	¼ BSP
50.0 bar	100.0 bar	0.01 bar		**TP704-50BGI**		0.25 % FSO	-40..+125 °C	¼ BSP
					TP704-50BAI *	0.25 % FSO	-25..+85 °C	¼ BSP
100 bar	200 bar	0.1 mbar		**TP704-100BGI**		0.25 % FSO	-40..+125 °C	¼ BSP
					TP704-100BAI *	0.25 % FSO	-25..+85 °C	¼ BSP
200 bar	400 bar	0.1 mbar		**TP704-200BGI**		0.25 % FSO	-40..+125 °C	¼ BSP
					TP704-200BAI *	0.25 % FSO	-25..+85 °C	¼ BSP
500 bar	1000 bar	0.1 mbar		**TP704-500BGI**		0.25 % FSO	-40..+125 °C	¼ BSP
	700 bar	0.1 mbar			**TP704-500BAI ***	0.25 % FSO	-25..+85 °C	¼ BSP

* Ceramic diaphragm
• Only report of calibration, no SIT certificate

HD2114.0
HD2114.2
HD2134.0
HD2134.2
HD2164.0
HD2164.2
HD2114B.0
HD2114B.2

HD2114.0, HD2114.2, HD2134.0, HD2134.2, HD2164.0 HD2164.2 MANOMETER - THERMOMETER HD2114B.0, HD2114B.2 BAROMATRIC - THERMOMETER

These are portable instruments with a large LCD display. They measure absolute, relative and differential pressure, as well as temperature.
Pressure is measured using an internal module which is differential with respect to the atmosphere with fixed full scale. With the PP471 module acting as an interface, the instrument can use all the TP704 and TP705 series Delta Ohm probes to perform the measurements. **The HD2114B.0 and HD2114B.2 internal module measures the barometric pressure.**
The temperature is detected using immersion, penetration, contact or air probes, with SICRAM module or direct 4 wire probes. The sensor can be a Pt100 or Pt1000. Temperature probes are equipped with SICRAM module and factory calibration data are stored inside so that when the instrument is on it soon recognizes them.
The HD2114.2, HD2134.2, HD2164.2 and HD2114B.2 instruments are **dataloggers**. They store up to 36,000 samples which can be transferred in to a PC via the multi-standard RS232C serial port and USB 2.0. The storing interval, printing, and baud rate can be configured using the menu. They are also fitted with an RS232C serial port and can transfer the acquired measurements to a PC or to a portable printer in real time.
The *Max, Min* and *Avg* function calculates the maximum, minimum or average values. **The Peak function can be activated with external probes connected to the module PP471** and detects the presence of pressure peaks. Other functions include: the relative measurement REL, the HOLD function, and the automatic turning off which can also be excluded.
The instruments have IP67 protection degree.

INSTRUMENT TECHNICAL CHARACTERISTICS

Instrument

Dimensions (Length x Width x Height)	185x90x40mm
Weight	470g (complete with batteries)
Materials	ABS, rubber
Display	2x4½ digits plus symbols Visible area: 52x42mm

Operating conditions

Working temperature	-5…50°C
Storage temperature	-25…65°C
Working relative humidity	0…90%RH without condensation
Protection degree	**IP67**

Power supply

Batteries	4 1.5V type AA batteries
Autonomy	200 hours with 1800mAh alkaline batteries
Power absorbed with instrument off	20µA
Mains - models **HD21...4.2**	Output mains adapter 9Vdc / 250mA

Measuring unit	*°C - °F - Pa - hPa - kPa - mbar - bar atm - mmHg - mmH_2O - kgf/cm^2 - PSI inchHg*
Security of logged data	Unlimited, independent of battery charge conditions

Time

Date and time	Schedule in real time
Accuracy	1min/month max departure

*Measured values storage - models **HD21...4.2***

Type	2000 pages containing 18 samples each
Quantity	36000 samples (pressure - temperature)
Storage interval	1s…3600s (1hour)

*Serial interface RS232C - models **HD21...4.2***

Type	RS232C electrically isolated
Baud rate	Can be set from 1200 to 38400 baud
Data bit	8
Parity	None
Stop bit	1
Flow Control	Xon/Xoff
Serial cable length	Max 15m
Immediate print interval	1s…3600s (1hour)

*USB interface - models **HD21...4.2***

Type	1.1 - 2.0 electrically isolated

Connections

Input modules for the probes	2 quick couplings Ø 5mm
Serial and USB interface models **HD21...4.2**	8-pole MiniDin connector
Mains adapter - models **HD21...4.2**	2-pole connector (positive at centre)

HD2114.2

PP471

	HD2114.0	HD2134.0	HD2164.0	HD2114B.0	HD2114.2	HD2134.2	HD2164.2	HD2114B.2
Full scale	±20mbar	±200mbar	±2000mbar	600..1100mbar	±20mbar	±200mbar	±2000mbar	600..1100 mbar
Barometer	-	-	-	SI	-	-	-	SI
Datalogger	-	-	-	-	SI	SI	SI	SI
RS232C-USB	-	-	-	-	SI	SI	SI	SI
External power supply	-	-	-	-	SI	SI	SI	SI

Measurement of pressure using the internal sensor

	HD2114.0 HD2114.2	HD2134.0 HD2134.2	HD2164.0 HD2164.2	HD2114B.0 HD2114B.2
Full scale	±20mbar	±200mbar	±2000mbar	600..1100mbar
Maximum overpressure	±300mbar	±1bar	±6bar	3bar
Resolution	0.001mbar	0.01mbar	0.1mbar	0.1mbar
Accuracy @23°C	±0.3%f.s.	±(0.1%f.s.+0.1% measurement)		±0.3mbar
Working temperature	0…60°C			
Connection	quick couplings Ø5mm			
Compensation temperature	0…60°C			
Drift on zero	±1%f.s.	±0.5%f.s.	±0.5%f.s.	±0.3%f.s.
Drift on span	±1%f.s.	±0.5%f.s.	±0.5%f.s.	±0.3%f.s.
Fluid contacting the membrane	non corrosive air and gas			

Measurement of temperature by Instrument

Pt100 measurement range	-200…+650°C
Pt1000 measurement range	-200…+650°C
Resolution	0.1°C
Instrument accuracy	±0.1°C
Drift after 1 year	0.1°C/year

TECHNICAL SPECIFICATIONS OF PROBES AND MODULES IN LINE WITH THE INSTRUMENT

Pressure measurement by module PP471

All TP704 and TP705 series Delta Ohm probes can be connected to the PP471 module. See the table below for the technical specifications of the individual probes.

Technical specifications of the PP471 module

Accuracy	±0.05% of full scale
Peak duration	≥ 5ms
Peak accuracy	±0.5% of full scale
Peak dead band	≤ 2% of full scale

Pt100 sensor temperature probes using SICRAM module

Modell	Type	Application range	Accuracy
TP472I	Immersion	-196°C…+500°C	±0.25°C (-196°C…+350°C) ±0.4°C (+350°C…+500°C)
TP472I.0	Immersion	-50°C…+400°C	±0.25°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP473P	Penetration	-50°C…+400°C	±0.25°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP473P.0	Penetration	-50°C…+400°C	±0.25°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP474C	Contact	-50°C…+400°C	±0.3°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP474C.0	Contact	-50°C…+400°C	±0.3°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP475A.0	Air	-50°C…+250°C	±0.3°C (-50°C…+250°C)
TP472I.5	Immersion	-50°C…+400°C	±0.3°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP472I.10	Immersion	-50°C…+400°C	±0.30°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP49A	Immersion	-70°C…+400°C	±0.25°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP49AC	Contact	-70°C…+400°C	±0.25°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP49AP	Penetration	-70°C…+400°C	±0.25°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP875	Globothermometer Ø 150mm	-30°C…+120°C	±0.25°C
TP876	Globothermometer Ø 50mm	-30°C…+120°C	±0.25°C
TP87	Immersion	-50°C…+200°C	±0.25°C
TP878 TP878.1	Solar pannels	+5°C…+80°C	±0.25°C
TP879	Per compost	-20°C…+120°C	±0.25°C

Common characteristics

Temperature drift @20°C 0.003%/°C

4 wire Pt100 and 2 wire Pt1000 probes without SICRAM module

Model	Type	Application range	Accuracy
TP47.100	Pt100 4 wires	-50…+400°C	Class A
TP47.1000	Pt1000 2 wires	-50…+400°C	Class A

Common characteristics

Temperature drift @20°C

Pt100	0.003%/°C
Pt1000	0.005%/°C

ORDER CODES

HD2114.0: The kit consits of the HD2114.0 **with built-in 20mbar full scale probe**, 4 1.5V alkaline batteries, operating manual, case. **Other probes and cables have to be ordered separately.**

HD2114.2: The kit consits of the HD2114.2 **datalogger with built-in 20mbar full scale probe**, 4 1.5V alkaline batteries, operating manual, case and DeltaLog9 software. **Other probes and cables have to be ordered separately.**

HD2134.0: The kit consits of the HD2134.0 **with built-in 200mbar full scale probe**, 4 1.5V alkaline batteries, operating manual, case. **Other probes and cables have to be ordered separately.**

HD2134.2: The kit consits of the HD2134.2 **datalogger with built-in 200mbar full scale probe**, 4 1.5V alkaline batteries, operating manual, case and DeltaLog9 software. **Other probes and cables have to be ordered separately.**

HD2164.0: The kit consits of the HD2164.0 **with built-in 2000mbar full scale probe**, 4 1.5V alkaline batteries, operating manual, case. **Other probes and cables have to be ordered separately.**

HD2164.2: The kit consits of the HD2164.2 **datalogger with built-in 2000mbar full scale probe**, 4 1.5V alkaline batteries, operating manual, case and DeltaLog9 software. **Other probes and cables have to be ordered separately.**

HD2114B.0: The kit consits of the HD2114B.0 **with 600…1100mbar range barometric sensor**, 4 1.5V alkaline batteries, operating manual, case. **Other probes and cables have to be ordered separately.**

HD2114B.2: The kit consits of the HD2114B.2 **datalogger with 600…1100mbar range barometric sensor**, 4 1.5V alkaline batteries, operating manual, case and DeltaLog9 software. **Other probes and cables have to be ordered separately.**

HD2110CSNM: 8-pole connection cable MiniDin - Sub D 9-pole female for RS232C.

C.206: Cable for instruments of the series HD21…1 and .2 to connect directly to USB input of PC.
HD2101/USB: Connection cable USB 2.0 connector type A - 8-pole MiniDin.
DeltaLog9: Software for download and manage of the data on PC by using Windows 98 to Vista operating systems.
SWD10: Stabilized power supply at 230Vac/12Vdc-1000mA mains voltage.
HD40.1: Upon request, portable, serial input, 24 column thermal printer, 58mm paper width.

PRESSURE MEASUREMENT PROBES

PP471: SICRAM interface module between instrument and TP704 and TP705 series Delta Ohm probes. Cable length 2 metres. **The list of pressure probes is outlined in the PP471 module technical data table.**

TEMPERATURE PROBES EQUIPPED WITH SICRAM MODULE

TP472I: Immersion probe, Pt100sensor. Stem Ø 3 mm, length 300 mm. Cable 2 meters long.
TP472I.0: Immersion probe, Pt100sensor. Stem Ø 3 mm, length 230 mm. Cable 2 meters long.
TP473P: Penetration probe, Pt100sensor. Stem Ø 4mm, length 150 mm. Cable 2 meters long.
TP473P.0: Penetration probe, Pt100sensor. Stem Ø 4mm, length 150 mm. Cable 2 meters long.
TP474C: Contact probe, Pt100sensor. Stem Ø 4mm, length 230mm, contact surface Ø 5mm. Cable 2 meters long.
TP474C.0: Contact probe, Pt100sensor. Stem Ø 4mm, length 230mm, contact surface Ø 5mm. Cable 2 meters long.
TP475A.0: Air probe, Pt100sensor. Stem Ø 4mm, length 230mm. Cable 2 meters long.
TP472I.5: Immersion probe, Pt100sensor. Stem Ø 6mm, length 500 mm. Cable 2 meters long.
TP472I.10: Immersion probe, Pt100sensor. Stem Ø 6mm, length 1,000mm. Cable 2 meters long.
TP49A: Immersion probe, Pt100sensor. Stem Ø 2.7mm, length 150mm. Cable 2 meters long. Aluminium handle.
TP49AC: Contact probe, Pt100sensor. Stem Ø 4 mm, length 150mm. Cable 2 meters long. Aluminium handle.
TP49AP: Penetration probe, Pt100sensor. Stem Ø 2.7mm, length 150mm. Cable 2 meters long. Aluminium handle.
TP875: Globe thermometer Ø 150 mm with handle. Cable 2 meters long.
TP876: Globe thermometer Ø 50 mm with handle. Cable 2 meters long.
TP87: Immersion probe, Pt100sensor. Stem Ø 3 mm, length 70 mm. Cable 2 meters long.
TP878: Contact probe for solar panels. Cable 2 meters long.
TP878.1: Contact probe for solar panels. Cable 5 meters long
TP879: Penetration probe for compost. Stem Ø 8 mm, length 1 meter. Cable 2 meters long.

TEMPERATURE PROBES WITHOUT SICRAM MODULE

TP47.100: Direct 4 wire Pt100 sensor immersion probe. Probe's stem Ø 3mm, length 230mm. 4 wire connection cable with connector, length 2 metres.
TP47.1000: Pt1000 sensor immersion probe. Probe's stem Ø 3mm, length 230mm. 2 wire connection cable with connector, length 2 metres.
TP47: Only connector for probe connection: direct 3, 4 wire Pt100, 2 wire Pt1000 .

HD40.1

HD2110CSNM

PRESSURE PROBE TABLE

Bottom scale pressure	Maximum overpressure	Resolution	ORDER CODES			Accuracy From 20 to 25°C	Working temperature	Connection
			Differential pressure	Relative pressure (compared to atmosphere)	Absolute pressure			
			NON insulated membrane	Insulated membrane	Insulated membrane			
10.0 mbar	20.0 mbar	0.01 mbar	• TP705-10MBD			0.5 % FSO	0..60 °C	Tube Ø 5 mm
20.0 mbar	40.0 mbar	0.01 mbar	• TP705-20MBD			0.5 % FSO	0..60 °C	Tube Ø 5 mm
50.0 mbar	100 mbar	0.01 mbar	TP705-50MBD			0.5 % FSO	0..60 °C	Tube Ø 5 mm
100 mbar	200 mbar	0.1 mbar	TP705-100MBD			0.25 % FSO	0..60 °C	Tube Ø 5 mm
				TP704-100MBGI		0.25 % FSO	-10..+80 °C	¼ BSP
200 mbar	400 mbar	0.1 mbar	TP705-200MBD			0.25 % FSO	0..60 °C	Tube Ø 5 mm
				TP704-200MBGI		0.25 % FSO	-10..+80 °C	¼ BSP
400 mbar	1000 mbar	0.1 mbar		TP704-400MBGI		0.25 % FSO	-10..+80 °C	¼ BSP
500 mbar	1000 mbar	0.1 mbar	TP705-500MBD			0.25 % FSO	0..60 °C	Tube Ø 5 mm
600 mbar	1000 mbar	0.1 mbar		TP704-600MBGI		0.25 % FSO	-40..125 °C	¼ BSP
1.00 bar	2.00 bar	1 mbar	TP705-1BD			0.25 % FSO	0..60 °C	Tube Ø 5 mm
					TP705BARO	0.25 % FSO	0..60 °C	Tube Ø 5 mm
						0.25 % FSO	-40..125 °C	¼ BSP
					TP704-1BA	0.25 % FSO	-40..120 °C	¼ BSP
2.00 bar	4.00 bar	1 mbar	TP705-2BD			0.25 % FSO	0..60 °C	Tube Ø 5 mm
				TP704-2BGI		0.25 % FSO	-40..+125 °C	¼ BSP
					TP704-2BAI *	0.25 % FSO	-25..+85 °C	¼ BSP
5.00 bar	10.00 bar	1 mbar		TP704-5BGI		0.25 % FSO	-40..+125 °C	¼ BSP
					TP704-5BAI *	0.25 % FSO	-25..+85 °C	¼ BSP
10.00 bar	20.0 bar	0.01 bar		TP704-10BGI		0.25 % FSO	-40..+125 °C	¼ BSP
					TP704-10BAI *	0.25 % FSO	-25..+85 °C	¼ BSP
20.0 bar	40.0 bar	0.01 bar		TP704-20BGI		0.25 % FSO	-40..+125 °C	¼ BSP
					TP704-20BAI *	0.25 % FSO	-25..+85 °C	¼ BSP
50.0 bar	100.0 bar	0.01 bar		TP704-50BGI		0.25 % FSO	-40..+125 °C	¼ BSP
					TP704-50BAI *	0.25 % FSO	-25..+85 °C	¼ BSP
100 bar	200 bar	0.1 mbar		TP704-100BGI		0.25 % FSO	-40..+125 °C	¼ BSP
					TP704-100BAI *	0.25 % FSO	-25..+85 °C	¼ BSP
200 bar	400 bar	0.1 mbar		TP704-200BGI		0.25 % FSO	-40..+125 °C	¼ BSP
					TP704-200BAI *	0.25 % FSO	-25..+85 °C	¼ BSP
500 bar	1000 bar	0.1 mbar		TP704-500BGI		0.25 % FSO	-40..+125 °C	¼ BSP
	700 bar	0.1 mbar			TP704-500BAI *	0.25 % FSO	-25..+85 °C	¼ BSP

* Ceramic diaphragm
• Only report of calibration, no SIT certificate

DO 9704
PRESSURE AND TEMPERATURE DATALOGGER

The Delta Ohm **DO 9704** pressure gauge and data logger has been designed for detecting pressure, flow rate and temperature, physical values which are very important in industrial and chemical processes.
The instrument has two inputs and automatically recognises the probes connected, whether they be pressure or temperature probes or turbines for measuring flow rate.
As the probes are interchangeable, it is possible to choose the most suitable combination for all applications without having to recalibrate the instrument.
The operating principle of the pressure sensor is based on the deflection of a membrane in a sealed chamber in contact with the stream you want to measure the pressure. The flow may be liquid or gas. The flow rate measurement is based on the number of impulses or the frequency of a small fan. The DO 9704 is able to measure the following:

Pressure:
- differential or relative pressure from 10 mbar to 2 bar for air or non corrosive gases;
- absolute and relative pressure from 0.2 bar to 1000 bar for measurements in contact with liquids or gases.
- The measurement units are: bar, kPa, atm, mmHg, mmH_2O and psi.
- The instrument is able to detect peaks of around 5 milliseconds.

Temperature:
interchangeable probes are available with amplified Pt100 elements of the TP 870 series; the measurement can be in °C or °F.

Flow rate:
Flow rate can be measured with a turbine in the range from 2 to 2000 litres per minute in the measurement units LPM (litres per minute) or IPGM (Imperial Gallons per Minute).

MAIN CHARACTERISTICS AND APPLICATIONS
- RECORD function with display of the peak, minimum and mean value.
- Input A-B measurement function for pseudo differential measurements, pressure drops or flow rate with calibrated flanges.
- Relative measurement function with respect to a given instant.
- Zero correction function, especially useful for low pressures.
- Stores up to 30,000 measurements with date and time of measurement and programmable interval from 1 sec. to 12 hours.
- Double display for simultaneous viewing of the two inputs.
- RS 232C serial output for a printer or for unloading data onto a PC.

Typical applications for this instrument are in the following sectors:
- Hydraulics - Fluidodynamics - Chemical plants and process controls - Compressors
- Pumping plants - Flow rate measurements - Chimney draught - Moulding and presses for plastics and thermosetting materials - Level measurements

INSTRUMENT TECHNICAL DATA

Inputs/type of measurement	2 / pressure, flow rate or temperature
Connector	DIN 45326 8-pole
No. conversions per second	2
Working temperature	-5...+50°C
Working relative humidity	0...90% R.H. no condensation
Serial output	RS 232C, 300...19200 baud (galvanically insulated)
Display	Double LCD 12.5 mm
Functions	Auto Power Off, Autorange, Hold, Record, Peak (5ms), Minimum, Mean, Relative, A-B (differential)
Memory	512kB (FLASH) corr. To 30000 measurements
Power supply	9V dc alkaline battery
Autonomy	Approx. 50 hours (continuous duty)
Weight/dimensions	20 gr. / 215x73x38 mm

INSTRUMENT ACCURACY

	Amb. T. 18 to 25°C	Amb. T. -5...18 or 25...50°C	measures
Pressure measurements	0.1% FS + 0.1% RDG	0.1% FS + 0.1% RGD + 100ppm/°C	RDG = measured value
Flow rate measurements	0.2% FS + 0.5% RDG	0.2% FS + 0.5% RDG + 100ppm/°C	
Temperatre measurements	0.4°C 0.2°C 3°C	0.4°C + 0.01°C/°C 0.2°C + 0.01°C/°C 3°C + 0.01°C/°C	-200...-50°C -50...+200°C +200...+800°C

CLASSIFICATION OF PRESSURE MEASUREMENTS
Pressure measurements are always relative to a reference pressure; there are four distinguish types that allow you to immediately define the reference pressure.
- **Absolute pressure** (**A**=absolute) - Pressure with respect to absolute zero, ideal vacuum reference; the measured pressure is always higher than the reference pressure.
- **Overpressure** (**G**=gauge) - Pressure measured with respect to the atmospheric pressure, environment pressure reference; the measured pressure is always higher than the reference pressure.
- **Depression** (**V**=vacuum) - Pressure with respect to the atmospheric pressure, environment pressure reference; the measured pressure is always lower than the reference pressure.
- **Differential pressure** (**D**=differential) - Pressure measured with respect to any reference pressure; the measured pressure may be higher or lower than the reference pressure.

ORDER CODES

DO9704: Pressure gauge, thermometer, data logger. The kit consists of instrument DO9407, carrying case, 9V batteries, DeltaLog1 software and user's manual. CPA cable, 9CPRS232 cable for dowonload data, pressure probes, temperaure probes, **fittings and gaskets have to be ordered separately.**

ACCESSORIES

9CPRS232: Sub D 9-pole extension cable female/female for RS232 (null modem).

CPA: Connection cable L=1,5m, to connect the pressure probes to the instruments.

DeltaLog-1: DeltaLog1 software for PC data download and PC data manager.

KIT 2104: Set of ¼ BSPP fittings and gaskets for TP704 series of probes.

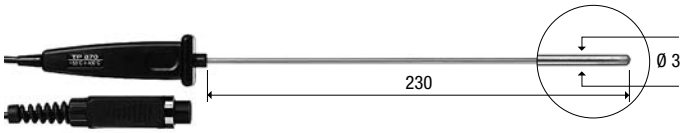
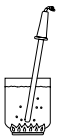
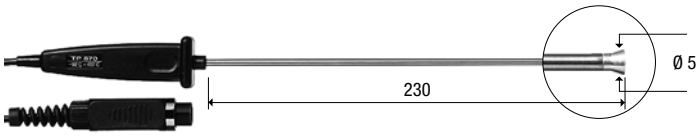
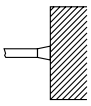
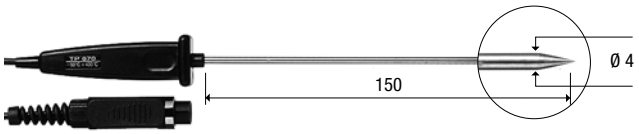
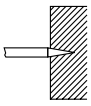
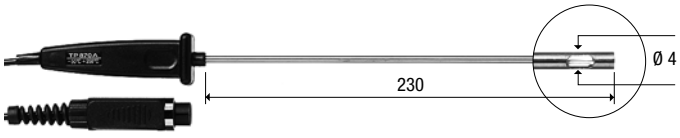
TP 870: Immersion temperature probe, Pt100 sensor, diam. 3x230 mm measuring range -50…+400°C.

TP 870/C: Contact temperature probe, Pt100 sensor, diam. 4x230 mm, measuring range -50…+400°C.

TP 870/P: Penetration temperature probe, Pt100 sensor, diam. 4x150 mm, range -50…+400°C.

TP 870/A: Air temperature probe, Pt100 sensor, diam. 4x230 mm, measuring range -50…+250°C.

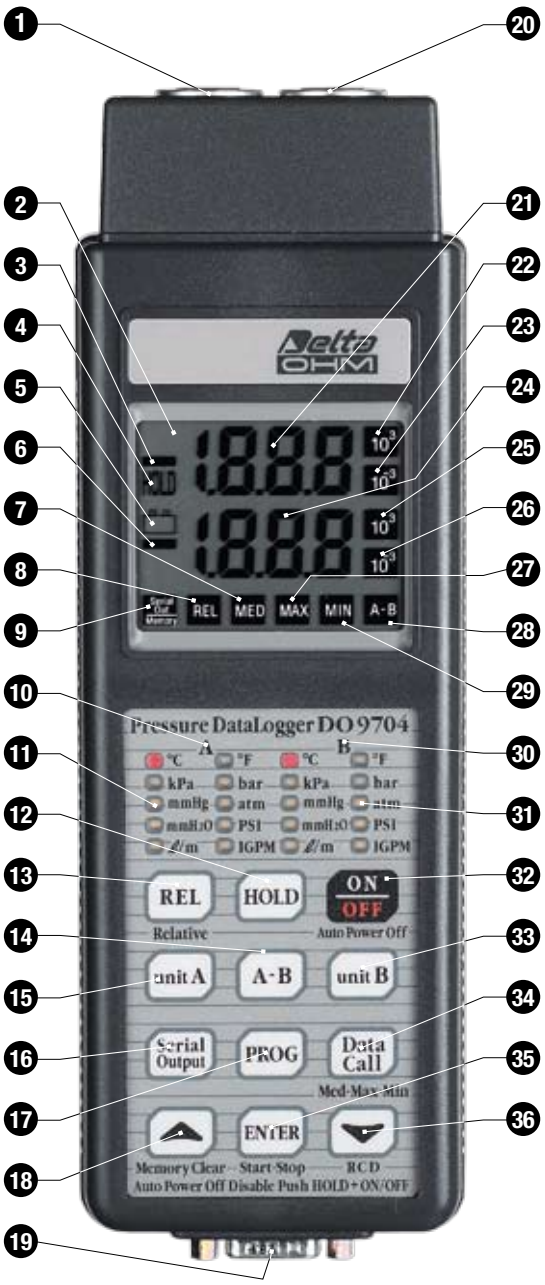
TEMPERATURE PROBES

CODE	°C max	τ s	DIMENSIONS	USE
TP 870	-50 +400	3s		
TP 870 C	-50 +400	5s		
TP 870 P	-50 +400	5s		
TP 870 A	-50 +250	12s		

PRESSURE PROBES

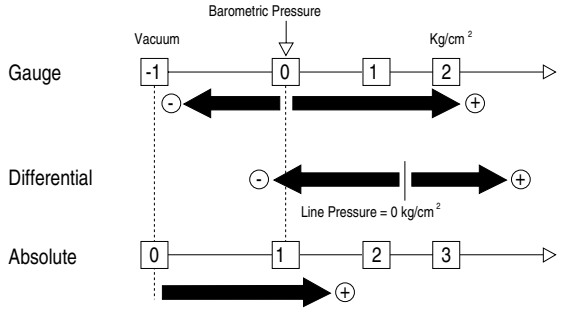
Bottom scale pressure	Maximum overpressure	Resolution	ORDER CODES			Accuracy From 20 to 25°C	Working temperature	Connection
			Differential pressure	Relative pressure (compared to atmosphere)	Absolute pressure			
			NON insulated membrane	Insulated membrane	Insulated membrane			
10.0 mbar	20.0 mbar	0.01 mbar	• **TP705-10MBD**			0.5 % FSO	0..60 °C	Tube Ø 5 mm
20.0 mbar	40.0 mbar	0.01 mbar	• **TP705-20MBD**			0.5 % FSO	0..60 °C	Tube Ø 5 mm
50.0 mbar	100 mbar	0.01 mbar	**TP705-50MBD**			0.5 % FSO	0..60 °C	Tube Ø 5 mm
100 mbar	200 mbar	0.1 mbar	**TP705-100MBD**			0.25 % FSO	0..60 °C	Tube Ø 5 mm
				TP704-100MBGI		0.25 % FSO	-10..+80 °C	¼ BSP
200 mbar	400 mbar	0.1 mbar	**TP705-200MBD**			0.25 % FSO	0..60 °C	Tube Ø 5 mm
				TP704-200MBGI		0.25 % FSO	-10..+80 °C	¼ BSP
400 mbar	1000 mbar	0.1 mbar		**TP704-400MBGI**		0.25 % FSO	-10..+80 °C	¼ BSP
500 mbar	1000 mbar	0.1 mbar	**TP705-500MBD**			0.25 % FSO	0..60 °C	Tube Ø 5 mm
600 mbar	1000 mbar	0.1 mbar		**TP704-600MBGI**		0.25 % FSO	-40..125 °C	¼ BSP
1.00 bar	2.00 bar	1 mbar	**TP705-1BD**			0.25 % FSO	0..60 °C	Tube Ø 5 mm
					TP705BARO	0.25 % FSO	0..60 °C	Tube Ø 5 mm
						0.25 % FSO	-40..125 °C	¼ BSP
					TP704-1BA	0.25 % FSO	-40..120 °C	¼ BSP
2.00 bar	4.00 bar	1 mbar	**TP705-2BD**			0.25 % FSO	0..60 °C	Tube Ø 5 mm
				TP704-2BGI		0.25 % FSO	-40..+125 °C	¼ BSP
					TP704-2BAI *	0.25 % FSO	-25..+85 °C	¼ BSP
5.00 bar	10.00 bar	1 mbar		**TP704-5BGI**		0.25 % FSO	-40..+125 °C	¼ BSP
					TP704-5BAI *	0.25 % FSO	-25..+85 °C	¼ BSP
10.00 bar	20.0 bar	0.01 bar		**TP704-10BGI**		0.25 % FSO	-40..+125 °C	¼ BSP
					TP704-10BAI *	0.25 % FSO	-25..+85 °C	¼ BSP
20.0 bar	40.0 bar	0.01 bar		**TP704-20BGI**		0.25 % FSO	-40..+125 °C	¼ BSP
					TP704-20BAI *	0.25 % FSO	-25..+85 °C	¼ BSP
50.0 bar	100.0 bar	0.01 bar		**TP704-50BGI**		0.25 % FSO	-40..+125 °C	¼ BSP
					TP704-50BAI *	0.25 % FSO	-25..+85 °C	¼ BSP
100 bar	200 bar	0.1 mbar		**TP704-100BGI**		0.25 % FSO	-40..+125 °C	¼ BSP
					TP704-100BAI *	0.25 % FSO	-25..+85 °C	¼ BSP
200 bar	400 bar	0.1 mbar		**TP704-200BGI**		0.25 % FSO	-40..+125 °C	¼ BSP
					TP704-200BAI *	0.25 % FSO	-25..+85 °C	¼ BSP
500 bar	1000 bar	0.1 mbar		**TP704-500BGI**		0.25 % FSO	-40..+125 °C	¼ BSP
	700 bar	0.1 mbar			**TP704-500BAI ***	0.25 % FSO	-25..+85 °C	¼ BSP

* Ceramic diaphragm
• Only report of calibration, no SIT certificate



1 Input A, DIN 8-pole connector for pressure, flow rate or temperature.
2 Display.
3 Negative symbol input A.
4 HOLD symbol.
5 H symbol, flashes during RECORD function, permanently lit if the battery is running low.
6 Negative symbol input B.
7 The display shows the mean values.
8 REL symbol, indicates that the instrument is making a relative measurement.
9 Memory / Serial Out. Fixed symbol: the instrument is storing. Flashing symbol: serial output is enabled.
10 Measurement units that may be selected at input A.
11 Measurement unit selected at input A.
12 HOLD key for blocking the reading.
13 REL key, the value shown is relative with respect to the moment in which the REL key was pressed.
14 A-B key. The instrument displays the difference between the inputs.
15 Unit A. Key for selecting the measurement unit for input A.
16 Serial Out: enables unloading of data at the RS 232C serial output.
17 Prog: this key is pressed to enter the routine for programming the various functions of the instrument.
18 ▲ key. When enabled, this key increases the displayed parameter.
19 Output for RS 232C (SUB D male 9-pole).
20 Input B, DIN 8-pole connector for pressure, flow rate or temperature.
21 Input A indication.
22 Multiplication channel for channel A 103.
23 Multiplication channel for channel A 10–3.
24 Input B indication.
25 Multiplication channel for channel B 103.
26 Multiplication channel for channel B 10–3.
27 The display shows the Maximum values.
28 The display shows the difference in value between inputs A or B.
29 The display shows the Minimum values.
30 Measurement units that may be selected at input B.
31 Measurement unit selected at input B.
32 Key for switching the instrument on and off.
33 Unit B. Key for selecting the measurement unit for input B.
34 When pressed in sequence, the display indicates the Maximum peak value, the Minimum value and the Mean value.
35 The key has various functions: it starts and stops storage, conforms the set parameters.
36 ▼ key. When enabled, this key decreases the displayed values, starts and stops the RECORD function.

PRESSURE REFERENCES



HD3604T…
HD36V4T…

HD3604T…, HD36V4T…
RELATIVE PRESSURE TRANSMITTERS

HD3604T... and HD36V4T... are pressure transmitters with microprocessor and current (4...20mA) or voltage (0...5V, 1...5V or 0...10V) output, respectively. The sensor, piezoresistive, is insulated and allows gas and liquid pressure measurement over a wide range of temperatures.
The measured pressure is relative to atmosphere. The different models cover the scales from 100mbar to 600bar.
The case is in stainless steel 20mm diam. and encloses sensor and electronics: in order to connect it to a pressurized system, it is supplied with a ¼" BSP threaded connection with a 22mm hex fastening ring.
For electrical connections, three different solutions are provided:

- A male connector DIN 43650A,
- A male connector DIN 43650C,
- A circular male connector DIN 41524.

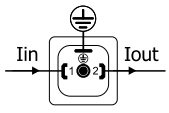
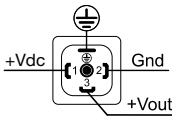
The connectors are fitted with a three or four pole free female socket with fairlead (according to the models).

All transmitters are factory calibrated at three points. The use of a microprocessor circuit allows memorizing the sensor response curve and correcting any possible non linearity.
No calibration is requested to the user.

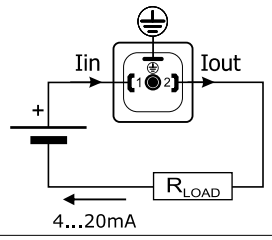
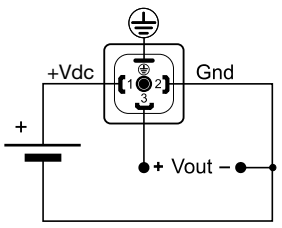
Technical characteristics		Notes
Output signal	4 …20mA	HD3604TxBG models
	0 …5V	HD36V4TxBG**1** models
	1 …5V	HD36V4TxBG**2** models
	0 …10V	HD36V4TxBG**3** models
Bottom scale pressure range	100, 200, 400, 600 mbar 1, 2,5 bar 4, 6, 10, 16, 25, 40, 60, 100, 160, 250, 400 and 600 bar relative	
Overpressure limit	Twice the nominal value	
Sensor	Piezoresistive	
Surface in contact with fluid	Steel 17-4PH	
Fluid in contact with membrane	Gas or liquid	
Operating temperature	-40 … +125°C	
Power supply voltage	10…30Vdc	
	15…30Vdc	HD36V4TxBG**3** models with 0…10Vdc output
Absorption	< 4mA	In the models with voltage output
Accuracy	≤ ±0.25%F.S.	
Temperature effects	±1% span ±1% offset	For a variation of 100°C
Mechanical stability	< 0.1%F.S.	After 10^6 cycles 0...f.s.
Response time	<5ms	
Connection to the system under pressure	¼"BSP male	
Electric connection	Male connector 3 or 4 poles DIN 43650A + female connector DIN 46350A	HD3604TxBG and HD-36V4TxBG models
	Male connector 3 or 4 poles DIN 43650C + female connector DIN 46350C	HD3604T**A**xBG and HD-36V4T**A**xBG models
	Male connector 3 or 4 poles DIN 41524 + female connector DIN 41524	HD3604T**B**xBG and HD-36V4T**B**xBG models
Case material	Stainless steel AISI 304	
Dimensions	Ø 20x95mm	Connector included
Weight	80g	
Load resistance	R_{Lmax} = 636Ω a 24Vdc $R_{Lmax} = \frac{(Vdc - 10)}{22mA}$	For the models with current output 4...20mA HD3604T… (see fig.1)
	$R_L \geq 10K\Omega$	For the models with voltage output HD36V4T …
Protection degree	IP65	With connector correctly engaged.

Installation and connections

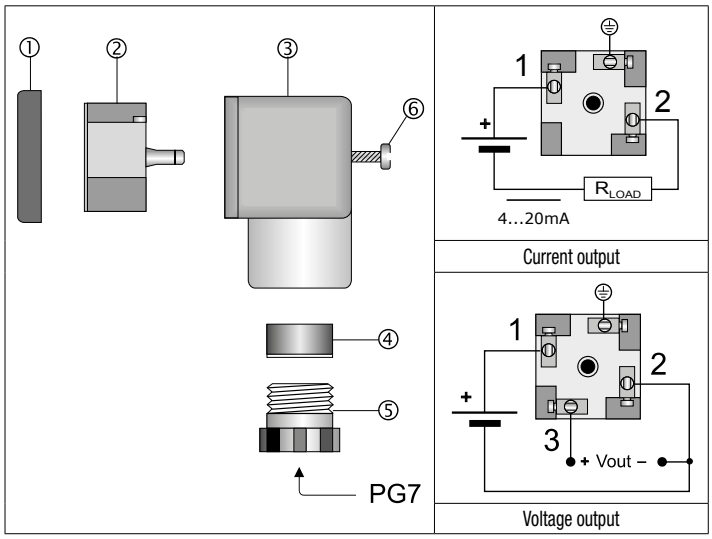
The HD3604T… and HD36V4T… transmitters can be installed in any position.
Make the electrical connection to the free female connector as indicated in the diagrams of the following table.

Transmitter model	Connection diagram of the transmitter pin (front view)	Notes
HD3604TxBG HD3604T**A**xBG		If the connection cable is shielded, connect the shield to pin ⏚
HD36V4TxBG… HD36V4T**A**xBG…		Use a shielded connection cable and connect the shield to the pin ⏚

Pressure

In the models with a 4...20mA current output, use the following connections:	In the models with a voltage output, use the following connection:
	
HD3604TxBG e HD3604TAxBG	**HD36V4TxBG... e HD36V4TAxBG...**

DIN 43650A and DIN 43650C connectors
To make the electrical connections you need to open the female connector.



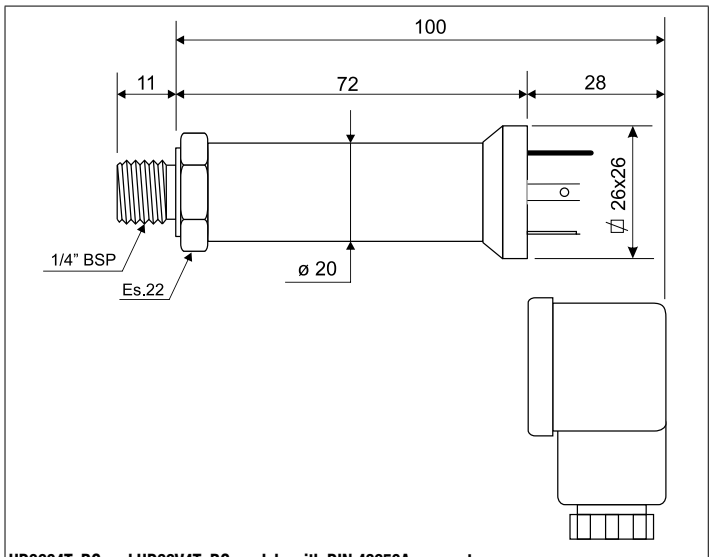
Remove the gasket ①. Unscrew the fairlead ⑤ and take off the gasket ④. Use a screwdriver to pry and take off the connecting terminal ②. Make the connections as shown in the figure: if present, the shielded cable braid must be connected to the earth terminal. Once the connections are made, close the connector.

Transmitter calibration
The transmitters are calibrated at three points; no calibration is requested to the user.

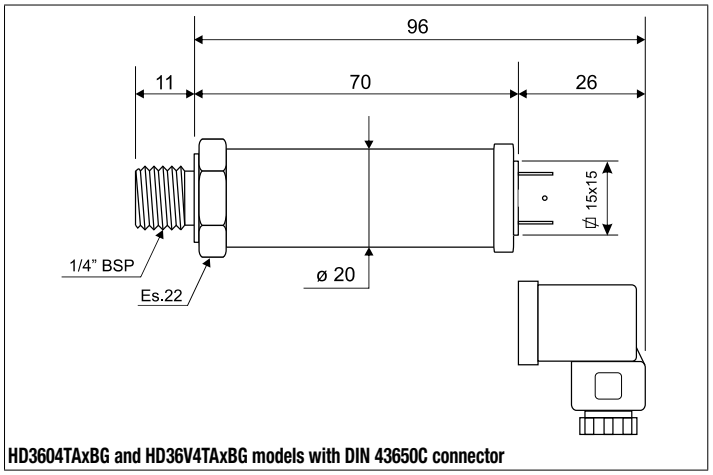
Warnings
The pressure transmitter has a male threaded ¼" BSP. During installation, take special care to the pressure resistance of the junction. Use any appropriate seals.

Great attention must be placed in the installation of transmitters in the pressure vessel or piping. Attention must be paid to the choice of full scale flow rate for an error, in addition to permanently damage the transmitter, can cause personal injuries and property also severe. Always insert, before the first transmitter, a key stop and make sure that the plant will not occur abnormal and unexpected peaks or surges of fluid under pressure.

Mechanical Dimensions

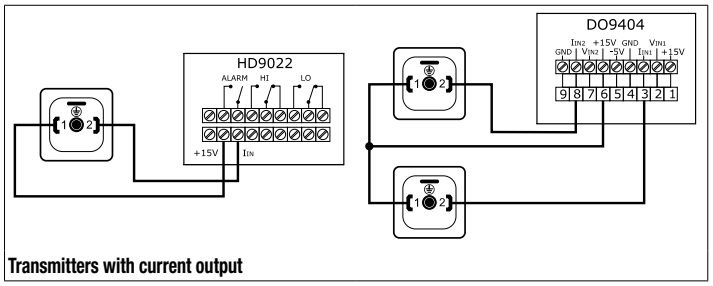


HD3604TxBG and HD36V4TxBG models with DIN 43650A connector

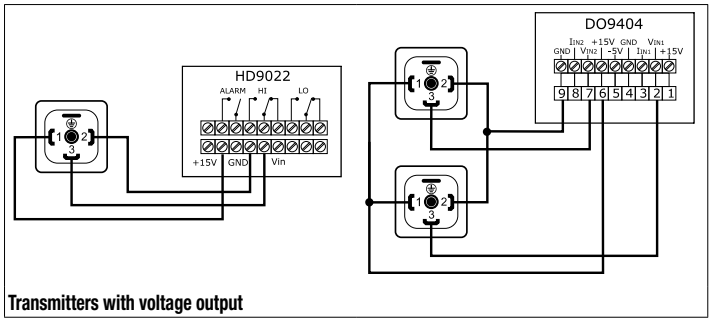


HD3604TAxBG and HD36V4TAxBG models with DIN 43650C connector

Examples of connections with the HD9022 and DO9404 indicators/regulators



Transmitters with current output



Transmitters with voltage output

Order codes:

HD36 X 4T X X BG X

1 = Voltage analog output 0...5Vdc
2 = Voltage analog output 1...5Vdc
3 = Voltage analog output 0...10Vdc

MB = mbar
B = Bar
G = Gauge (relative pressure)

Electrical Connection
No sign = Male connector DIN 43650A
A = Male connector DIN 43650C

Nominal bottom scale (bar)
100 - 200 - 400 - 600 mbar - 1 - 2,5 relative bar
4 - 6 - 10 - 16 - 25 - 40 - 60 - 100 - 160 - 200 - 250
400 - 600 - relative bar

O = Analog output 4…20mA
V = Voltage analog output

HD 2004T…
HD 20V4T…

HD 2004T…, HD 20V4T…
PASSIVE PRESSURE TRANSMITTERS WITH DIN 43650 CONNECTOR

HD 2004T and **HD 20V4T** are microprocessor pressure transmitters, with current output (4÷20 mA) the first and voltage output (0÷5V, 1÷5V or 0÷10V).
The sensitive element consists of a jumper of piezoresistive resistors deposited on a ceramic membrane. At the variation of pressure, the bending of this membrane causes a linear and proportional variation of the bridge resistances.
The stainless steel case (30 mm diam.) includes both the sensor and the electronics. For the connection to the pressure there will be a part threaded ¼ "BSP and a tax on container for a key 27 mm. For the electrical connection is present on the side, a male connector pin Faston three or four (depending on model) with the corresponding female socket and PG7 cable gland to DIN 43650.

Technical Specifications

Output Signal	Current	4...20 mA (HD 2004T...)
	Voltage	0...5V (HD 20V4T... 1), 1...5V (HD 20V4T... 2), 0...10V (HD 20V4T... 3)
Pressure range		200, 400, 600 relative mbars 1, 2.5, 4, 6, 10, 16, 25, 40, 60, 100, 160, 250, 400 and 600 absolute bars 1, 2.5, 4, 6, 10, 16, 25, 40, 60 relative bars
Overpressure limit	Up to 250 bars	Twice the rated value
	400 nominal bars	750 bars
	600 nominal bars	750 bars
Sensor		Piezoresistive
Material in contact with the measuring fluid		Alumina
Fluid in contact with the diaphragm		Gas or liquids
Operating temperature		-30...+80°C
Power supply voltage		10...30Vdc (15...30Vdc for models having 0...10Vdc output)
Accuracy (linearity, hysteresis and repeatability)		≤ ±0.25%F.S.
Gain sensitivity to temperature changes (@ 25°C)		≤ ±0.008%F.S. between 0 and 70°C ≤ ±0.012%F.S. between -30°C and 0°C and between 70°C and 80°C
Zero sensitivity to temperature changes (@ 25°C)		≤ ±0.04%F.S.
Connection to plant under pressure		¼"BSP male
Electrical connection		3/4 -pole faston male connector + DIN 43650 female connector (outlet)
Housing		AISI 304 stainless steel
Size		Ø 30x90 mm (included DIN 43650 connector)
Weight		190 g
Load resistance for HD 2004T models... (see Fig.2)		R_{Lmax} = 636 Ω a 24 Vdc $R_{Lmax} = \frac{(Vdc - 10)}{22mA}$
Load resistance for HD 20V4T models...		$R_L \geq 10K$
Response time		1 sec. (Time required to achieve the 63% of the final variation)
Protection class		IP54

Installation and connections
HD 2004T... and HD 20V4T... transmitters can be installed in any position. Open the female connector to make the electrical connections (see fig.3).

Transmitter Calibration
The transmitter output is factory-calibrated, thus no user's operation is generally requested. Current output transmitters supply 4 mA on the upper scale and 20 mA at full scale;
0...5V, 1...5V and 0...10V voltage output transmitters generate 0V or 1V at upper scale pressure and 5V or 10V at full scale pressure.

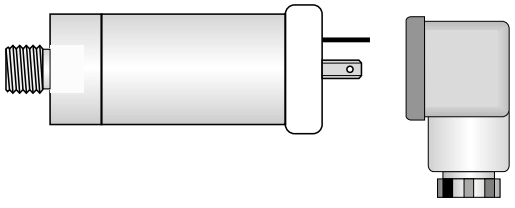


Fig.1 HD 2004T transmitter with DIN 43650 connector.

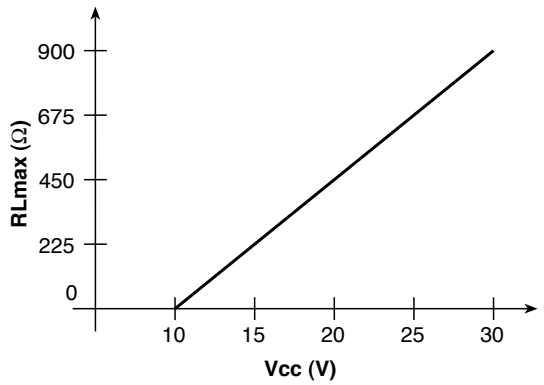


Fig.2 4...20 mA output load resistance according to the power supply voltage.

HD 2004T... and HD 20V4T... series pressure transmitters can be connected to Delta Ohm HD 9022 single input configurable indicators / regulators or with DO 9404 double input ones.

Warnings

The pressure transmitter has a male threaded ¼" BSP. During installation, take special care to the pressure resistance of the junction. Use any appropriate seals.

Great attention must be placed in the installation of transmitters in the pressure vessel or piping. Attention must be paid to the choice of full scale flow rate for an error, in addition to permanently damage the transmitter, can cause personal injuries and property also severe. Always insert, before the first transmitter, a key stop and make sure that the plant will not occur abnormal and unexpected peaks or surges of fluid under pressure.

FULL SCALE	RELATIVE Ref.: atmospheric pressure	ABSOLUTE Ref.: vacuum	ABSOLUTE Ref.: 1 bar s.g.
1 bar	HD 20...4T- 1 BG...	HD 20...4T- 1 BA...	
2.5 bar	HD 20...4T- 2 B5G...	HD 20...4T- 2 B5A...	
4 bar	HD 20...4T- 4 BG...	HD 20...4T- 4 BA...	
6 bar	HD 20...4T- 6 BG...	HD 20...4T- 6 BA...	
10 bar	HD 20...4T- 10 BG...	HD 20...4T- 10 BA...	
16 bar	HD 20...4T- 16 BG...	HD 20...4T- 16 BA...	
25 bar	HD 20...4T- 25 BG...	HD 20...4T- 25 BA...	
40 bar	HD 20...4T- 40 BG...	HD 20...4T- 40 BA...	
60 bar	HD 20...4T- 60 BG...	HD 20...4T- 60 BA...	
100 bar			HD 20...4T- 100 BA...
160 bar			HD 20...4T- 160 BA...
250 bar			HD 20...4T- 250 BA...
400 bar			HD 20...4T- 400 BA...
600 bar			HD 20...4T- 600 BA...

ORDER CODES

H D 2 0 0 4 T - 1 B G 1

Output:
1 = 0...5V
2 = 1...5V
3 = 0...10V
none = 4...20 mA

A = Absolute pressure
G = Relative pressure

B = bar
MB = mbar

Nominal full scale (bar)
200-400-600 relative mbar
1-2.5-4-6-10-16-25-40-60 relative or absolute bar
100-160-250-400-600 absolute bar

Type of output
0 = Current
V = Voltage

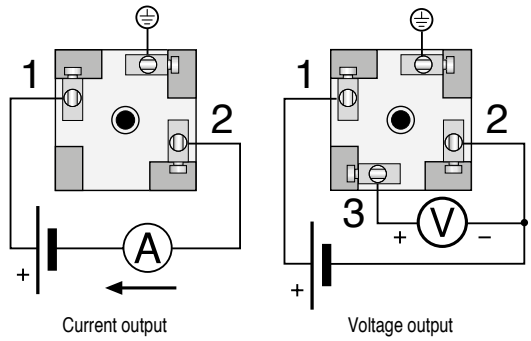
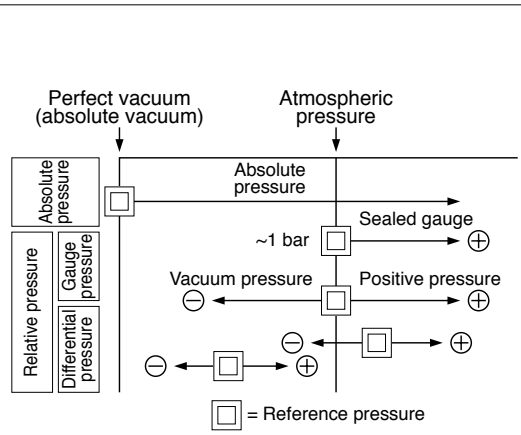


Fig.7



Types of pressure

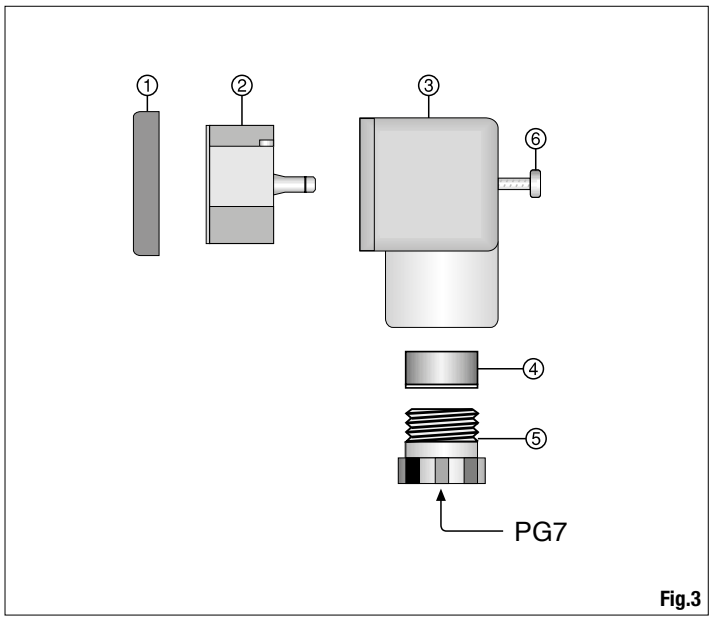


Fig.3

Remove the gasket **1**. Unscrew the cable gland **5** and take the gasket **4** away. Using a screwdriver, lever and remove the terminal carrier **2**. Follow the indications shown on figure 4 to make the connections: the ground terminal has to be connected with the braid of the screened cable. After carrying out the connections, close again the connector. Mount the HD 2004T... or the HD 20V4T... : the transmitters have a 1/4" BSP male threaded connection. By mounting, take care that the fitting is properly pressure-sealed and, if necessary, use adequate seals. Apply the connector to the transmitter and fix it with the provided **6** screw.

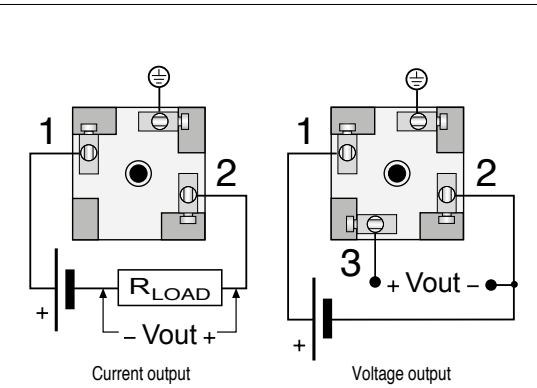
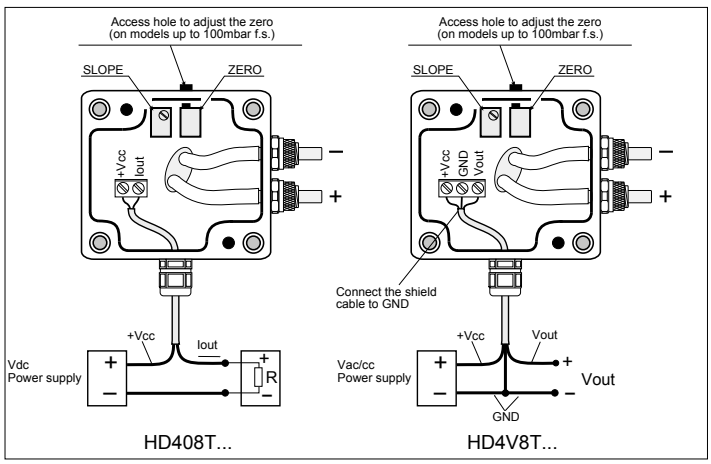


Fig.4 DIN 43650 connector: electrical connections.

HD 408T
HD 4V8T

HD 408T…, HD 4V8T…
RELATIVE OR DIFFERENTIAL ATMOSPHERIC PRESSURE TRANSMITTERS

The HD408T, HD4V8T are analog output relative or differential atmospheric pressure transmitters; they are used in all those applications where non corrosive air or gas need to be monitored, with pressure fields from 10 mbar to 2000 mbar. The piezoresistive sensor gives extremely precise and stable measurements of the applied differential pressure, with excellent repeatability, low hysteresis, and very good temperature stability.
The output signal of the sensor is conditioned to provide a voltage or a current output (model HD408T) or a voltage output (model HD4V8T) linearly proportional to the applied differential pressure.
The transmitters are ready to use as they have been calibrated at the factory. They are used to monitor clean room barometric pressure, to control filters, to measure flows (employment with the Pitot tube), for packing and packaging machines, and to control ventilation.



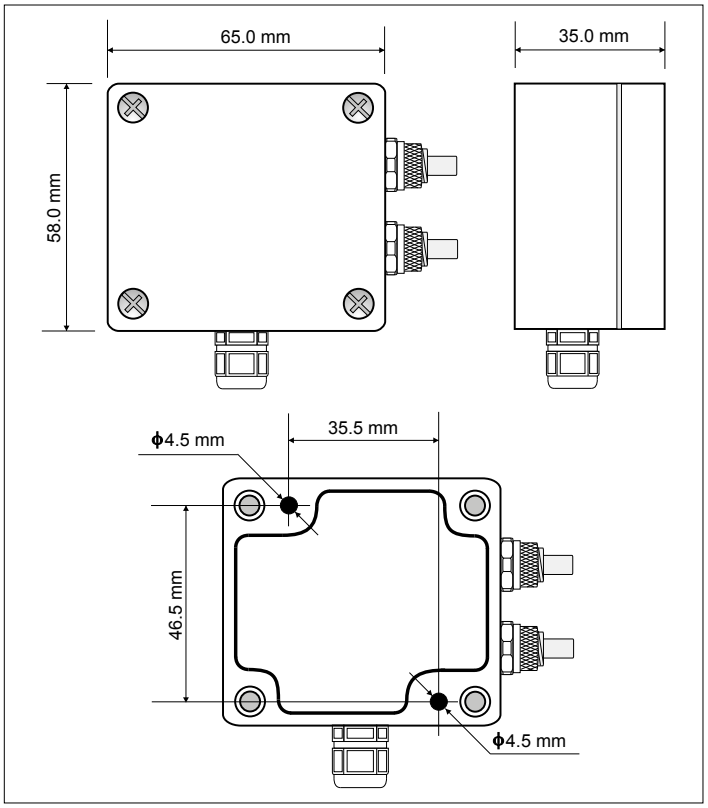
TECHNICAL INFORMATION @ 20°C AND 24Vdc

	HD408T	HD4V8T
Sensor	Piezoresistive	
Measurement range	10, 20, 50, 100, 200, 500, 1000, 2000 mbar ±10, ±20, ±50, ±100, ±200, ±500, ±1000, ±2000 mbar	
Output signal	4 … 20 mA	0 … 10 Vdc standard; 0 … 5 Vdc, 1 … 5 Vdc on request
Precision	±0.5 % F.S. @ 20°C	
Resolution	Infinite	
Temperature effects	< 1% F.S., zero; <1% F.S., span from –20°C to +60°C (from -4° to 140°F)	
Time stability	< 1 % F.S. over 6 months at 20°C	
Startup time	1 sec. at 99% of bottom scale reading	
Response time	< 10 m sec. until it reaches the stated precision by applying a pressure level	
Power	8 … 30 Vdc	16 … 40 Vdc or 24 Vac with output 0 … 10 Vdc 10 … 40 Vdc or 24 Vac with outputs 0 … 5 Vdc, 1 … 5 Vdc
Absorption	< 4 mA	20 mA @ 20°C, 24 Vdc
Load resistance	R_{Lmax} = 727 Ω a 24Vcc $R_{Lmax} = \frac{Vdc-8}{22\ mA}$	Minimum input resistance 10kΩ
Operating temperature	-20 ... +60°C	
Storage temperature	-20 ... +80°C	
Compatible elements	**air and dry gases only**	
Overpressure limit	350mbar for the models 10, 20, 50, 100 mbar 3X F.S. for all the other models	
Pressure connection	With Ø 5mm flexible tube	
Electric connection	Screw terminal box	
Case	MACROLON	
Case size	64x58x34	
Protection degree	IP67	

INSTALLATION

In all models the sensor and electronic parts are housed in a robust case in MACROLON with IP67 degree of protection. Opening the cover, the holes that allow to secure the transmitter's base directly to a panel or a wall, become available. HD408T, HD4V8T can be mounted in any position, the deviation of the zero due to the mounting position is in the worst case (10 mbar range) less than 1% F.S. and can be corrected with an appropriate regulating potentiometer, that can be accessed from outside, for pressures up to 100mbar.

MECHANICAL DIMENSIONS



ORDER CODES

H D 4 0 8 T - 1 B G

Output:
1 = 0...5Vdc
2 = 1...5Vdc
3 = 0...10Vdc
not indicated = 4…20mA

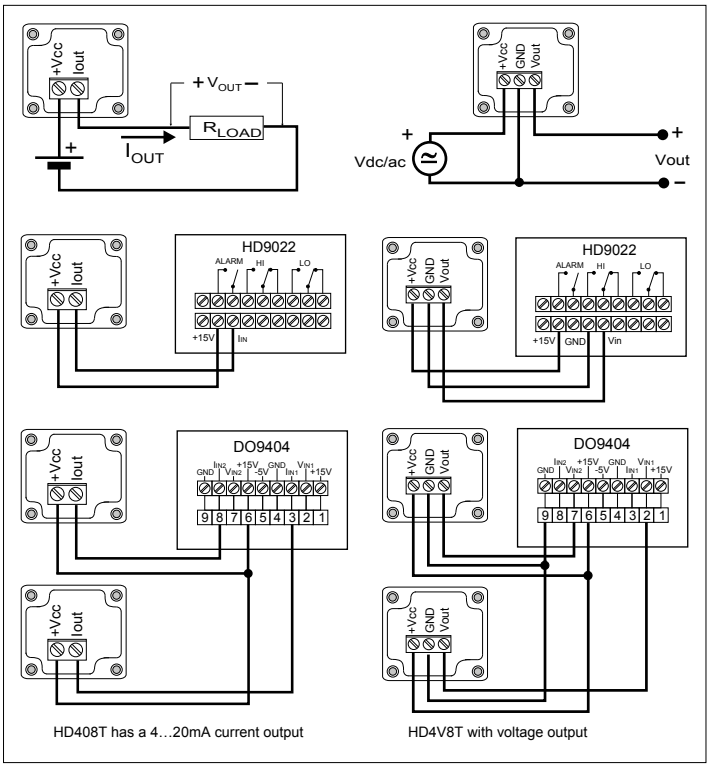
D = Differential pressure -f.s … +f.s
with regard to the atmosphere
G = Relative pressure 0… +f.s
with regard to the atmosphere

B = bar
MB = mbar

Nominale full scale
10 - 20 - 50 - 100 - 200 - 500 mbar (MB)
1 - 2bar (B)

Output Type: **0** = Current
V = Voltage

Examples of connections with the HD9022 and DO9404 indicators/regulators



HD408T has a 4…20mA current output

HD4V8T with voltage output

	RANGE	OUTPUT 4…20mA	OUTPUT 0…10Vdc	OUTPUT 0…5Vdc	OUTPUT 1…5Vdc
RELATIVE	0...10mbar	HD408T-10MBG	HD4V8T-10MBG3	HD4V8T-10MBG1	HD4V8T-10MBG2
	0...20mbar	HD408T-20MBG	HD4V8T-20MBG3	HD4V8T-20MBG1	HD4V8T-20MBG2
	0...50mbar	HD408T-50MBG	HD4V8T-50MBG3	HD4V8T-50MBG1	HD4V8T-50MBG2
	0...100mbar	HD408T-100MBG	HD4V8T-100MBG3	HD4V8T-100MBG1	HD4V8T-100MBG2
	0...200mbar	HD408T-200MBG	HD4V8T-200MBG3	HD4V8T-200MBG1	HD4V8T-200MBG2
	0...500mbar	HD408T-500MBG	HD4V8T-500MBG3	HD4V8T-500MBG1	HD4V8T-500MBG2
	0...1000mbar	HD408T-1BG	HD4V8T-1BG3	HD4V8T-1BG1	HD4V8T-1BG2
	0…2000mbar	HD408T-2BG	HD4V8T-2BG3	HD4V8T-2BG1	HD4V8T-2BG2
DIFFERENTIAL	-10...10mbar	HD408T-10MBD	HD4V8T-10MBD3	HD4V8T-10MBD1	HD4V8T-10MBD2
	-20...20mbar	HD408T-20MBD	HD4V8T-20MBD3	HD4V8T-20MBD1	HD4V8T-20MBD2
	-50...50mbar	HD408T-50MBD	HD4V8T-50MBD3	HD4V8T-50MBD1	HD4V8T-50MBD2
	-100...100mbar	HD408T-100MBD	HD4V8T-100MBD3	HD4V8T-100MBD1	HD4V8T-100MBD2
	-200...200mbar	HD408T-200MBD	HD4V8T-200MBD3	HD4V8T-200MBD1	HD4V8T-200MBD2
	-500...500mbar	HD408T-500MBD	HD4V8T-500MBD3	HD4V8T-500MBD1	HD4V8T-500MBD2
	-1000...1000mbar	HD408T-1BD	HD4V8T-1BD3	HD4V8T-1BD1	HD4V8T-1BD2
	-2000… 2000mbar	HD408T-2BD	HD4V8T-2BD3	HD4V8T-2BD1	HD4V8T-2BD2

HD 404T
VERY LOW PRESSURE TRANSMITTER

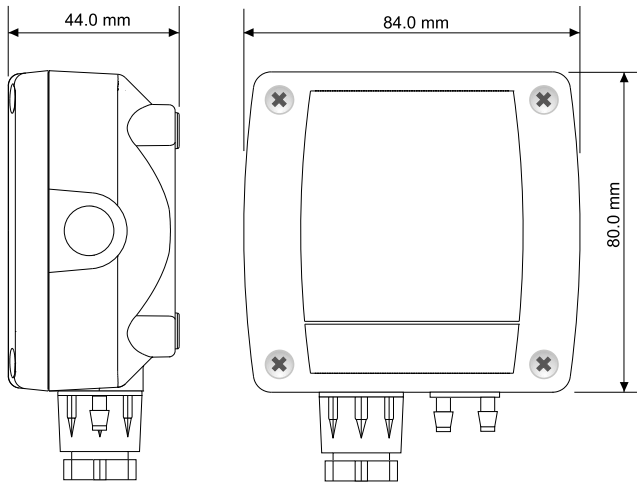
The series of HD404T transmitters is able to measure relative pressures with reference to the atmosphere or differential in their range from 50 to 1000 Pa (0.2" H_2O to 5" H_2O). HD404T transmitters use a silicon "micro-machined" type sensor compensated in temperature that has an excellent linearity, repeatability and stability over time. The output signal from the sensor is amplified and converted into a standard analogical output in current (4-20mA) and in one in voltage (0-10V), which, then, can be transmitted over long distances with a high immunity to noise.
In each model it's possible to choose, via a dip switch, between two measurement ranges in order to select the optimum scale optimal for each application.
Usually the low pressure transmitters are susceptible to the guidance by which they are mounted. In HD404T series there is available a special auto-zero circuit, which periodically equalize the differential pressure at the input sensor and corrects the offset; the transmitters, provided with this circuit, are insensitive to the mounting position. In addition, The circuit compensates autozero aging and the deviation of the zero of the sensor to temperature changes: virtually eliminates maintenance. It's available the **(L)** "display" option, in which the pressure is visualized on a display with 4 digits in the selected measurement unit.
The **(SR)** "square root" is especially useful if the transmitter is connected to a pitot tube, as the output is directly proportional to the speed of airflow.
The transmitters are ready to use and are supplied calibrated at 3 points by the manufacturer. Typical applications for HD404T series are clean room monitoring, filters' control, flow measures (matched with the Pitot tube), the air conditioning control and the ventilation one.

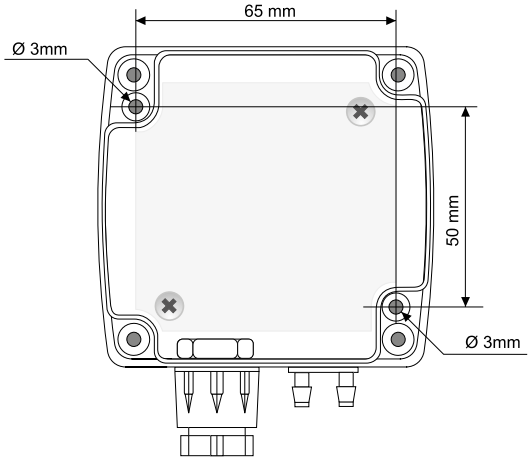
HD404T1PG-AZ-L

TECHNICAL COMMON FEATURES @ 20°C and 24Vdc

Sensor	Piezoresistive
Measurement range	from 0…50 Pa (0…0,2" H_2O) to 0…1000 Pa (0…4" H_2O) relative and differential (look at the table downwards)
Signal output	0 … 10 Vdc, R_L > 10kΩ and 4…20 mA, R_L < 500Ω
Precision	It depends on the model (look at the table)
Response time	1sec. (slow) or 4sec. (fast) selectable through wire bridge
Overpressure limit	25 kPa
Compatible means	Only air and no aggressive gas
Power Supply	24 Vac ±10% or 16…40Vdc
Absorption	< 1W
Fit on pressure	With Ø 5mm flexible cable
Electrical connections	Terminal board with screw, max 1,5mm², PG9 conduit with input cable
Working conditions	-10 ... +60°C (-5…+50°C for models with auto-zero AZ), 0…95% RH
Storage temperature	-20 ... +70°C
Case sizes	80x84x44
Degree of electronic protection	IP67

INSTALLATION
In all the models, the sensor and the electronic are contained in a sturdy plastic case with an IP67 protection degree. Opening the lid are available 3 mm diameter holes that let you set the base of the transmitter directly to a panel or a wall.

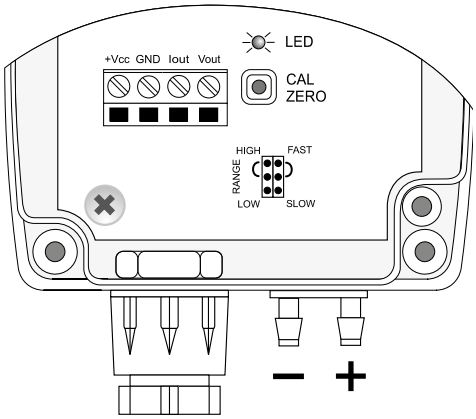




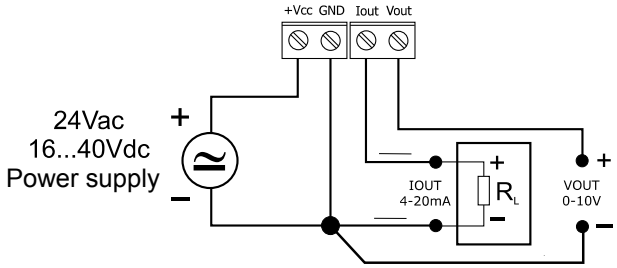
HD404T can be mounted in any position, but typically on a vertical wall with the pressure facing downwards. The gap from zero due to the mounting position can be compensated by using CAL ZERO button. The procedure to follow for manual calibration of zero is the following one:

- Make sure that the transmitter is powered by at least 1 hour;
- Disconnect both tubes taken from the + and – pressure;
- Press CAL ZERO button until the red LED starts to flash;
- When the red led turns off, the reset procedure is completed and you can reconnect the tubes to pressure fits.

We suggest you to perform the auto-zero procedure at least once a year under normal working conditions. In models with auto-zero circuit (AZ option), this procedure is regularly performed every 15 minutes without disconnecting the hoses from pressure taps. During the reset, which takes about 4 seconds, the analogical outputs and the display will remain frozen at the measured value. Models with auto-zero have virtually no need for maintenance.



CAL ZERO button and configuration bridge wires



Electrical connections

CONFIGURATION

Setting the output range: jumper named RANGE allows you to choose one of this output ranges: with LOW you choose the low range, with HIGH the extended range.

Response time setting: the FAST SLOW small jumper let you choose the response time of the transmitter: in FAST position the measurement is integrated over 1 sec., while SLOW position is integrated over 4 sec. SLOW position is recommended if there are conditions of turbulence or disruption of air flow.

DISPLAY

Models with **L** suffix are provided with a LCD display with 4 digits.

Visualization resolution:

50, 100, 250, 500 Pa → 0.5 Pa
1000 Pa → 1 Pa
5, 10, 25, 50 mmH_2O → 0.05 mmH_2O
100 mmH_2O → 0.1 mmH_2O
0.2, 0.4, 1, 2, 4 $inchH_2O$ → 0.002 $inchH_2O$

Default reporting:

Undr → it appears if the measured value is smaller than the minimum value that you can measure
OvEr → it appears if the measured value surpasses the maximum value that you can measure
CAL Error → it appears when the zero calibration is finished if the maximum offset value is surpassed that you can correct

SUMMARY TABLE OF MODELS AND PRECISION

MODEL	RANGE		PRECISION %FS RANGE2 (0..+50°C)	LONG TERM STABILITY (1 YEAR)	
	LOW	HIGH		-AZ	NO AZ
	Pa				
HD404T1PG-AZ(-L-SR)	0...50 Pa	0...100 Pa	±3%	≤±1Pa	
HD404T2PG-AZ(-L-SR)	0...100 Pa	0...250 Pa	±1,5%	≤±1Pa	
HD404T3PG(-AZ-L-SR)	0...250 Pa	0...500 Pa	±1%	≤±1Pa	≤±8Pa
HD404T4PG(-AZ-L-SR)	0...500 Pa	0...1000 Pa	±1%	≤±1Pa	≤±8Pa
HD404T1PD-AZ(-L)	-50...+50 Pa	-100...+100 Pa	±1,5%	≤±1Pa	
HD404T2PD-AZ(-L)	-100...+100 Pa	-250...+250 Pa	±1%	≤±1Pa	
HD404T3PD(-AZ-L)	-250...+250 Pa	-500...+500 Pa	±1%	≤±1Pa	≤±8Pa
HD404T4PD(-AZ-L)	-500...+500 Pa	-1000...+1000 Pa	±1%	≤±1Pa	≤±8Pa
	mmH_2O				
HD404T1MG-AZ(-L-SR)	0...5 mmH_2O	0...10 mmH_2O	±3%	≤±0,1 mmH_2O	.
HD404T2MG-AZ(-L-SR)	0...10 mmH_2O	0...25 mmH_2O	±1,5%	≤±0,1 mmH_2O	
HD404T3MG(-AZ-L-SR)	0...25 mmH_2O	0...50 mmH_2O	±1%	≤±0,1 mmH_2O	≤±0,8 $inchH_2O$
HD404T4MG(-AZ-L-SR)	0...50 mmH_2O	0...100 mmH_2O	±1%	≤±0,1 mmH_2O	≤±0,8 $inchH_2O$
HD404T1MD-AZ(-L)	-5...+5 mmH_2O	-10...+10 mmH_2O	±1%	≤±0,1 mmH_2O	
HD404T2MD-AZ(-L)	-10...+10 mmH_2O	-25...+25 mmH_2O	±1%	≤±0,1 mmH_2O	
HD404T3MD(-AZ-L)	-25...+25 mmH_2O	-50...+50 mmH_2O	±1%	≤±0,1 mmH_2O	≤±0,8 $inchH_2O$
HD404T4MD(-AZ-L)	-50...+50 mmH_2O	-100...+100 mmH_2O	±1%	≤±0,1 mmH_2O	≤±0,8 $inchH_2O$
	$inchH_2O$				
HD404T1IG-AZ(-L-SR)	0...0.2 $inchH_2O$	0...0.4 $inchH_2O$	±3%	≤±0,04 $inchH_2O$	
HD404T2IG-AZ(-L-SR)	0...0.4 $inchH_2O$	0...0.8 $inchH_2O$	±1,5%	≤±0,04 $inchH_2O$	
HD404T3IG(-AZ-L-SR)	0...1 $inchH_2O$	0...2 $inchH_2O$	±1,5%	≤±0,04 $inchH_2O$	≤±0,04 $inchH_2O$
HD404T4IG(-AZ-L-SR)	0...2 $inchH_2O$	0...4 $inchH_2O$	±1,5%	≤±0,04 $inchH_2O$	≤±0,04 $inchH_2O$
HD404T1ID-AZ(-L)	-0.2...0.2 $inchH_2O$	-0.4...0.4 $inchH_2O$	±3%	≤±0,04 $inchH_2O$	
HD404T2ID-AZ(-L)	-0.4...0.4 $inchH_2O$	-1…+1 $inchH_2O$	±3%	≤±0,04 $inchH_2O$	
HD404T3ID(-AZ-L)	-1...+1 $inchH_2O$	-2...+2 $inchH_2O$	±3%	≤±0,04 $inchH_2O$	≤±0,04 $inchH_2O$
HD404T4ID(-AZ-L)	-2...+2 $inchH_2O$	-4...+4 $inchH_2O$	±3%	≤±0,04 $inchH_2O$	≤±0,04 $inchH_2O$

CODES FOR PURCHASE ORDER

HD404T [1P] - [G] - [AZ] - [L] - [SR]

- **SR** = with square root output **(not available for type D versions)**
- **L** = with LCD display
- **AZ** = with auto-zero circuit
- **D** = differential pressure –f.s…+f.s.
  G = relative pressure with reference to the atmosphere 0…+f.s.
- **Nominal scale bottom (f.s.):**
  1P = 100Pa, **2P** = 250Pa, **3P** = 500Pa, **4P** = 1000Pa
  1M = 10mmH_2O, **2M** = 25mmH_2O, **3M** = 50mmH_2O, **4M** = 100mmH_2O
  1I= 0.4inchH_2O, **2I** = 0.8inchH_2O, **3I** = 2inchH_2O, **4I** = 4inchH_2O

MODEL	RANGE	
	LOW	HIGH
	Pa	
HD404T1PG-AZ(-L-SR)	0...50 Pa	0...100 Pa
HD404T2PG-AZ(-L-SR)	0...100 Pa	0...250 Pa
HD404T3PG(-AZ-L-SR)	0...250 Pa	0...500 Pa
HD404T4PG(-AZ-L-SR)	0...500 Pa	0...1000 Pa
HD404T1PD-AZ(-L)	-50...+50 Pa	-100...+100 Pa
HD404T2PD-AZ(-L)	-100...+100 Pa	-250...+250 Pa
HD404T3PD(-AZ-L)	-250...+250 Pa	-500...+500 Pa
HD404T4PD(-AZ-L)	-500...+500 Pa	-1000...+1000 Pa
	mmH_2O	
HD404T1MG-AZ(-L-SR)	0...5 mmH_2O	0...10 mmH_2O
HD404T2MG-AZ(-L-SR)	0...10 mmH_2O	0...25 mmH_2O
HD404T3MG(-AZ-L-SR)	0...25 mmH_2O	0...50 mmH_2O
HD404T4MG(-AZ-L-SR)	0...50 mmH_2O	0...100 mmH_2O
HD404T1MD-AZ(-L)	-5...+5 mmH_2O	-10...+10 mmH_2O
HD404T2MD-AZ(-L)	-10...+10 mmH_2O	-25...+25 mmH_2O
HD404T3MD(-AZ-L)	-25...+25 mmH_2O	-50...+50 mmH_2O
HD404T4MD(-AZ-L)	-50...+50 mmH_2O	-100...+100 mmH_2O
	inchH_2O	
HD404T1IG-AZ(-L-SR)	0...0.2 inchH_2O	0...0.4 inchH_2O
HD404T2IG-AZ(-L-SR)	0...0.4 inchH_2O	0...0.8 inchH_2O
HD404T3IG(-AZ-L-SR)	0...1 inchH_2O	0...2 inchH_2O
HD404T4IG(-AZ-L-SR)	0...2 inchH_2O	0...4 inchH_2O
HD404T1ID-AZ(-L)	-0.2...0.2 inchH_2O	-0.4...0.4 inchH_2O
HD404T2ID-AZ(-L)	-0.4...0.4 inchH_2O	-1…+1 inchH_2O
HD404T3ID(-AZ-L)	-1...+1 inchH_2O	-2...+2 inchH_2O
HD404T4ID(-AZ-L)	-2...+2 inchH_2O	-4...+4 inchH_2O

ACCESSORIES

Supplied:

- N°1 piece of ∅3.2/∅6.4 silicone tube 2m long
- N°2 HD434T.5 plastic fittings.

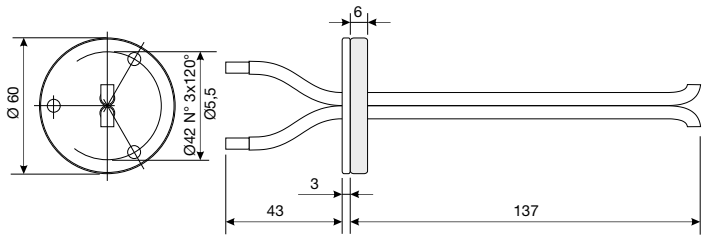
Under request:

AP3719: Flow offtake for square or cylindrical channel. Two pieces of ∅3.2/∅6.4 tube 1m long.

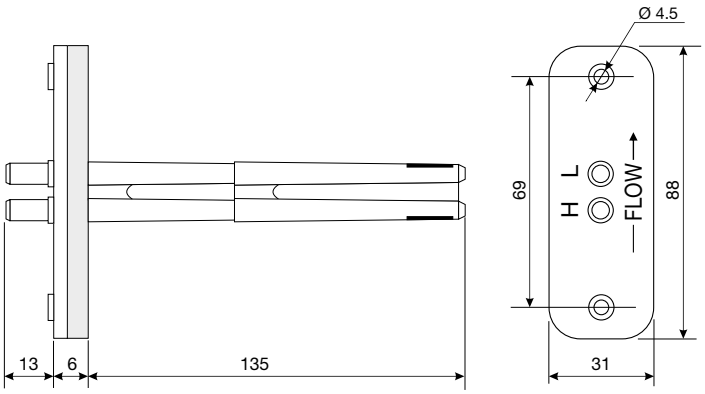
AP3721: Flow offtake for plastic material cylindrical channel. Two pieces of ∅3.2/∅6.4 tube 1m long.

Pitot Tube: see list and dimensions on pag. 130

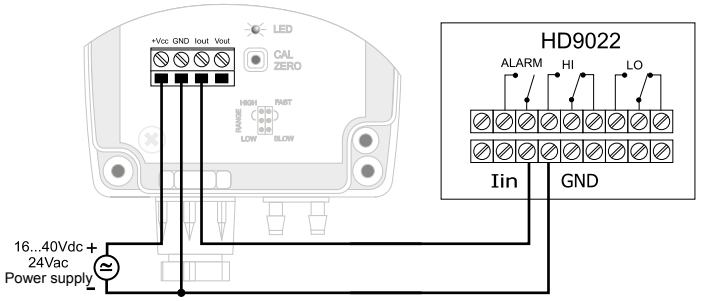
AP3719 channel probe



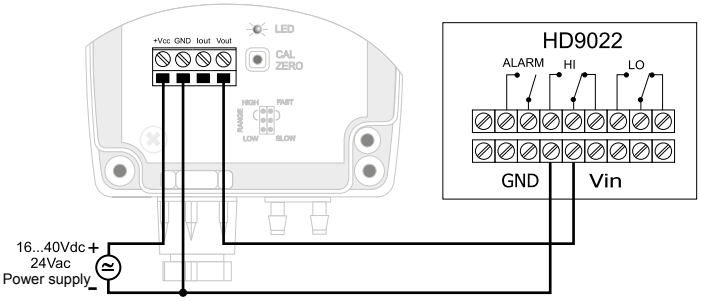
AP3721 channel probe



Examples of connection with HD9022 indicator regulator



Current output 4…20mA



Voltage output 0…10Vdc

HD404T3PD

HD 9408T BARO
HD 9408TR BARO
HD 9908T BARO

HD 9408T BARO, HD 9408TR BARO, HD 9908T BARO BAROMETRIC TRANSMITTERS

HD 9408T BARO, HD 9408TR BARO and **HD 9908T BARO** are analog output electronic barometers. They use a piezoresistive sensor element which gives extremely accurate and stable measurement of the atmospheric pressure and assures excellent repeatability, low hysteresis and very good temperature stability. The output signal of the sensor is conditioned to provide a voltage or a current output linearly proportional to the barometric pressure. The transmitters are ready as they have been calibrated at the factory. A zero adjustments potentiometer is available for offset to station elevation.
HD9408T BARO requires a continuous dc power supply, its low power consumption (< 4 mA) makes it ideal for portable and remote battery or solar powered applications. It is available in different kinds of analog output: 0-1 Vdc, 0-5 Vdc (1-5 Vdc, 1-6 Vdc on request) or 4-20 mA (two wires).
HD 9408TR BARO offers superior temperature performance: the internal circuitry allows the sensor to work at constant temperature so that it achieves accurate temperature compensation over the whole range from -40°C to +60°C.
HD 9408TR BARO requires a continuous dc power supply and a differential cabling connection to achieve best results. It is available in different output versions: 0÷1 Vdc, 0÷5 Vdc (1÷5 Vdc, 1÷6 Vdc on request).
HD 9908T BARO, unlike the other models, is equipped with a display showing the pressure measurements, an analog output 0÷20 mA, 4÷20 mA, 0÷1 V and 0÷5 V (0÷10 V on request) configurable by the customer and with an ON/OFF relay output with programmable alarm threshold.
HD 9908T BARO requires a 24 Vac (or 220 Vac on request) power supply.

HD 9408T BARO, HD 9408TR BARO and **HD 9908T BARO** are low cost and excellent performance solutions for meteorological applications, environmental monitoring systems, metrological and environmental data logging, altitude applications, barometric pressure compensation in the performance of internal combustion engine, cleanroom barometric pressure compensation, testing of vehicle emissions.

HOUSING AND INSTALLATION

In all models the sensor electronics are housed in a sturdy MACROLON with IP67 protection. Opening the lid holes are available that allow you to secure the base of the transmitter directly to a panel or a wall. The measurement accuracy is independent of the position of the transmitter. However, it is advisable to mount the transmitter so that the sensor is facing down to reduce dust and dirt on the filter. If the installation is in an open environment is recommended to use a special static port to minimize errors caused by the wind flow on the input pressure.

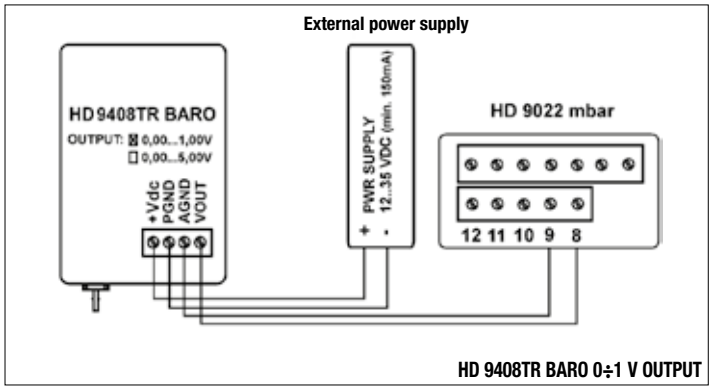
CONNECTION DIAGRAM AND OPERATION

- Make the power connections for the HD 9908T BARO.
- Make the connections for the relay output, the relay contact is free.
- Select the analog output 0÷20 mA, 4÷20 mA, 0÷1 V, 0÷5 V by means of the jumper.
- Switch on the instrument, press the PUSH button and turn the SET trimmer to set the desired threshold value between 800 and 1100 mbar; the set value is shown on the LCD display.
- Using the trimmer i ⎍, set the desired HYS (=hysteresis) value between 5 and 50 mbar.
- The instrument will now indicate the barometric pressure; HI led, LO led or ALARM led and ALARM relay will switch on if one the following cases occurs (see table 1).

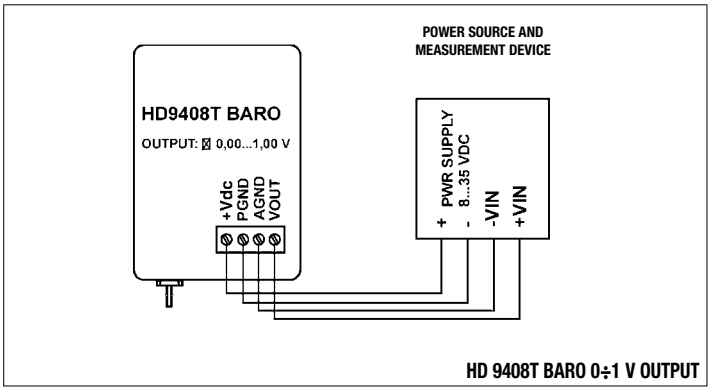
NOTE: the ALARM led comes on to indicate that the relay is energized and the contact is closed.

- **Once installation is completed, check that the cover is tightly closed; the same applies to the grommets.**

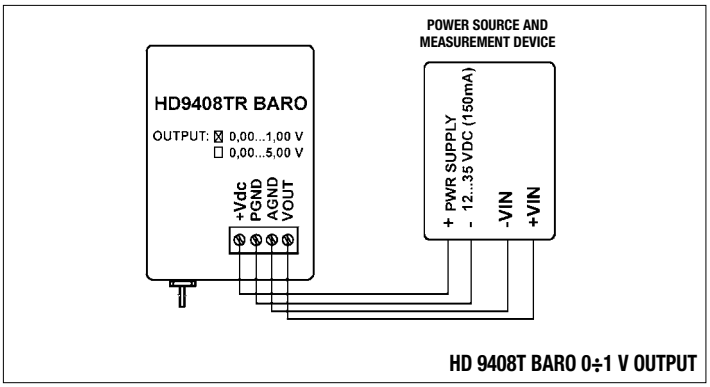
TABLE 1	HI	LO	ALARME LED
MISURA > SET, MISURA < SET + HYS	ON	OFF	OFF
MISURA > SET, MISURA > SET + HYS	ON	OFF	ON
MISURA < SET, MISURA > SET - HYS	OFF	ON	OFF
MISURA < SET, MISURA < SET - HYS	OFF	ON	ON



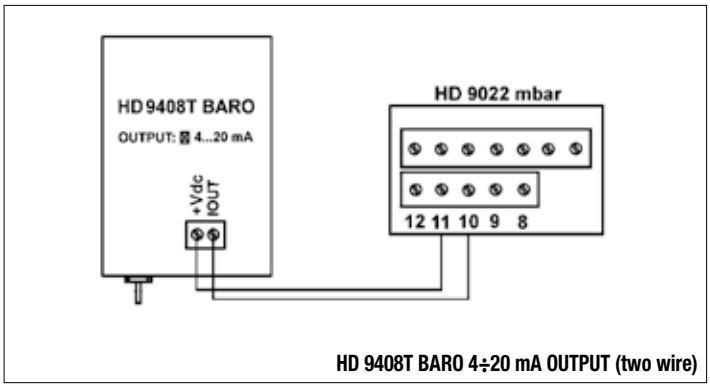
HD 9408TR BARO 0÷1 V OUTPUT



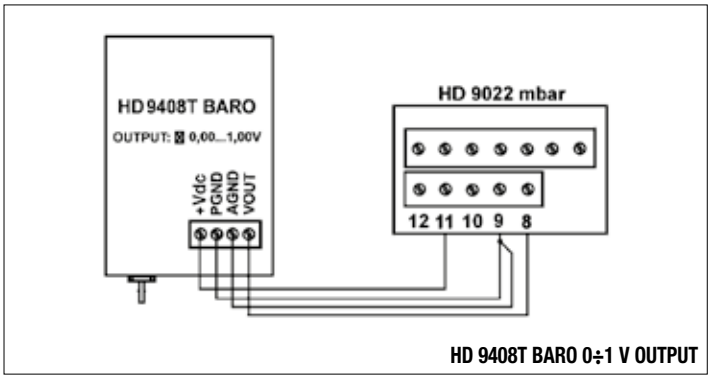
HD 9408T BARO 0÷1 V OUTPUT



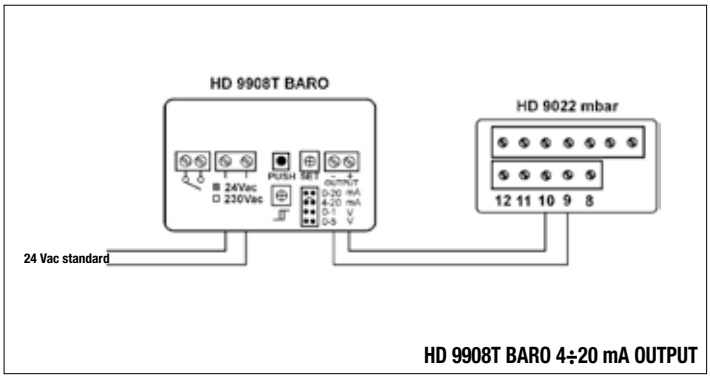
HD 9408T BARO 0÷1 V OUTPUT



HD 9408T BARO 4÷20 mA OUTPUT (two wire)



HD 9408T BARO 0÷1 V OUTPUT



HD 9908T BARO 4÷20 mA OUTPUT

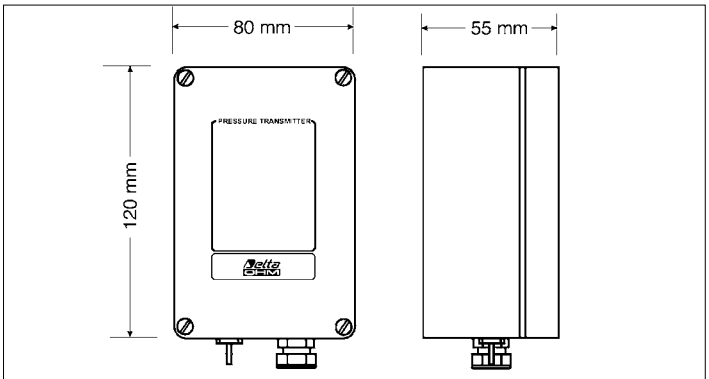
	HD9408T BARO	HD9408TR BARO	HD9908T BARO
Sensor type	Piezoresistive diaphragm		
Measuring range	800 ÷ 1100 mbar / 600 ÷ 1100 mbar on request		
Analog output	0 ÷ 1 Vdc standard; 0 ÷ 5 Vdc, 1 ÷ 5 Vdc, 1 ÷ 6 Vdc and 4 ÷ 20 mA (two wires) on request	0 ÷ 1 Vdc standard; 0 ÷ 5 Vdc, 1 ÷ 5 Vdc and 1 ÷ 6 Vdc on request	0 ÷ 20 mA, 4 ÷ 20 mA, 0 ÷ 1 V and 0 ÷ 5 V (0 ÷ 10 V on request), configurable by means of a jumper.
Accuracy	± 0.5 mbar, @ 20°C	± 0.5 mbar, @ 20°C	Display: ± 1 mbar, @20°C Analog output: ± 0,8 mbar, @ 20°C
Resolution	Infinite	Infinite	Display: Analog output: 1 mbar Infinite
Thermal effects	< 1% F.S., zero; <1% F.S., span over –20°C to +60°C (-4° to 140°F)	± 0.8 mbar over –40°C to +60°C (-40° to 40°F)	< 1% F.S. zero, <1% F.S. span over –20°C to +60°C (-4° to 140°F)
Long term stability	< 0.25 % F.S. over 6 months at 20°C	< 0.2 % F.S. over 6 months at 20°C	< 0.25 % F.S. over 6 months at 20°C
Turn on time	1 sec. to 99% of full scale reading	5 min @ 24 Vdc supply to 99% of full scale reading	5 sec. to 99% of full scale reading
Response time	< 200 msec. to reach full accuracy after a pressure step		
Relay contact output	Absent	Absent	3A/220 Vac resistive load
Set point	Absent	Absent	Configurable from 800 to 1100 mbar
Supply Voltage	8 ÷ 35 Vdc	12 ÷ 35 Vdc	24 Vac ±10% (230 Vac on request)
Supply current	< 4 mA	25 mA @ 20°C, 24 Vdc (warm-up 120 mA)	1VA
Operating Temperature	-30 ÷ +60°C	-40 ÷ +60°C	-20 ÷ +60°C
Media ompatibility	Air and dry gases only		
Overload pressure	30 psi		

ORDERING CODE

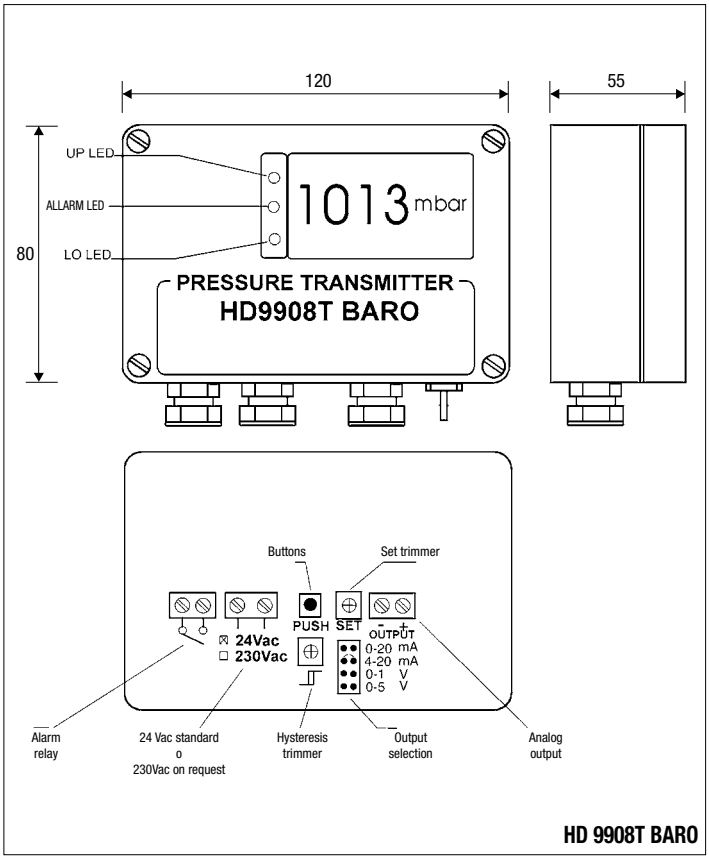
HD9408T BARO 800÷1100mbar barometric transmitter output 0÷1Vdc. Upon request output: 0÷5Vdc, 1÷5Vdc, 1÷6Vdc, 4÷20mA. Working temperature range -30°C ÷ +60°C.

HD9408TR BARO 800÷1100mbar barometric transmitter output 0÷1Vdc. Upon request output 0÷5Vdc, 1÷5Vdc. Temperature working range –40°C ÷ +60°C, heaters sensor

HD9908T BARO 800÷1100mbar digital barometric transmitter with LCD indication. Outputs: 0÷20mA, 4÷20mA, 0÷1Vdc, 0÷5Vdc. Working temperature range -20°C ÷ +60°C.

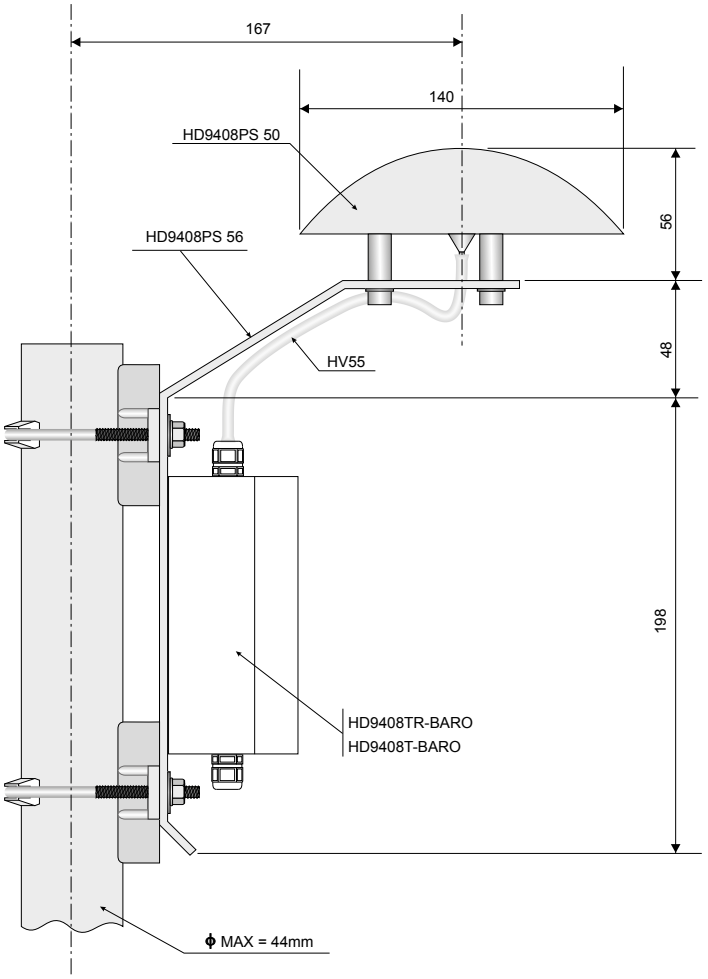


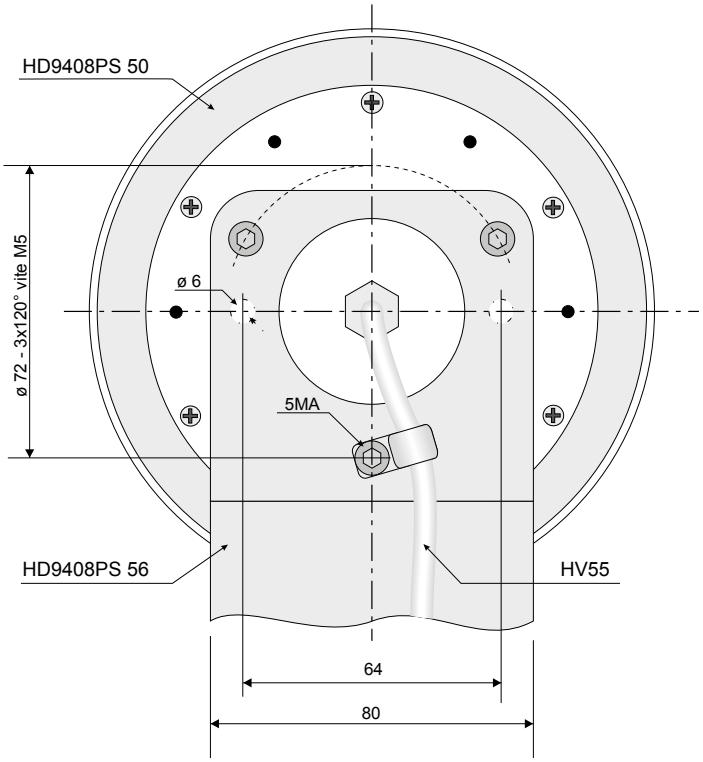
HD 9408T BARO, HD 9408TR BARO



HD 9908T BARO

HD9408PS 50





HD9408PS 50
STATIC PORT FOR BAROMETRIC MEASUREMENTS

The measurement of the barometric pressure in free field can give incorrect values of hundred pascal fluctuation and wind direction. With the static port for barometric measurements, HD9408PS 50 can minimize these errors because, in addition to act as a filter (brake) against the dynamic pressure of the wind, the barometer can operate correctly even in the presence of snow or ice and comply with the recommendations of the WMO (World Meteorological Organization). The materials used for the construction of the static are UV resistant and can operate in temperatures between -40°C and +80°C.

INSTALLATION AND CONNECTION

Installation is simple: it must be installed away from buildings, trees or any other source which can disrupt the flow of wind. To install the bracket is available HD9408PS 56 and three stainless steel screws M5x16 Acc. The connection of the static to the barometer, for example, HD9408T or HD9408TR, is made with a special tube HV55 (internal diameter of 3mm, 6mm outer diameter) and UV resistant to climate changes. Maintenance or cleaning is minimal. The plastic parts are manufactured by BASF LURAN S777K. Clean using non aggressive detergents compatible with the material.

TECHNICAL SPECIFICATIONS

According to reccomendations the of WMO, the deviation allowed measurement of wind speed 20meters/second is equal to 0.3mbar, corresponding to 300 Pascal. The HD9408PS 50 static port for barometric measurements falls within that value. The following tables show the values obtained from the tests performed in the wind tunnel.

Error due to the dynamic pressure	Lower than 0.3mbar @20°C
Working temperature	-40°C… +80°C
Connection pipe (for a tube with inside ø : 3mm, outside ø: 6mm)	Ø 3.4 mm
Weight of the static port. - Weight of the static port equipped with the bracket	200 gr, 570 gr
Total weight and static port and bracket	570 gr

ORDERING CODE

HD9408PS 50K Kit consits of static port, pole mounting bracket and HV55 tube

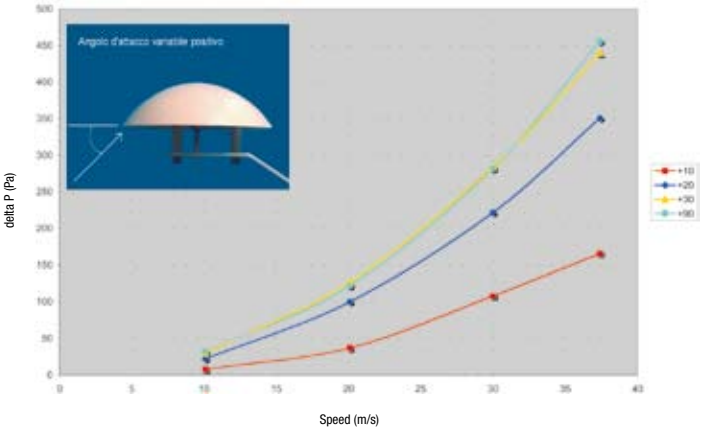
HD9408PS 50 Static port for barometric measurements equipped with the HV55 tube

HD9408PS 56 Mounting bracket for static port, barometer fastening, pole anchor

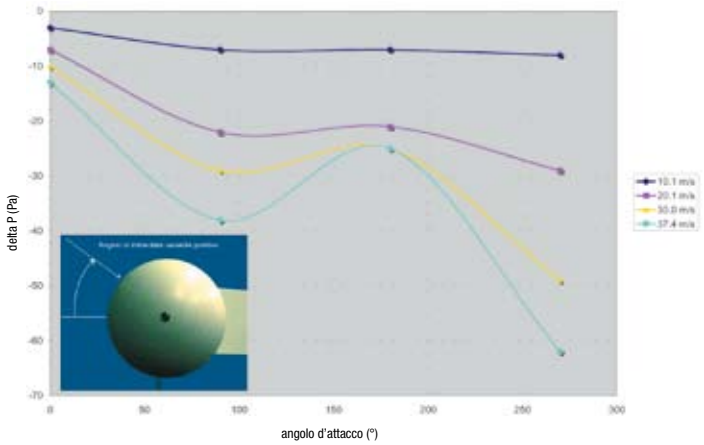
HV55 HV55 UV- and temperature-resistant silicone tube, inside Ø : 3mm, outside Ø : 6mm, L=400mm

TESTS MADE IN THE WIND TUNNEL

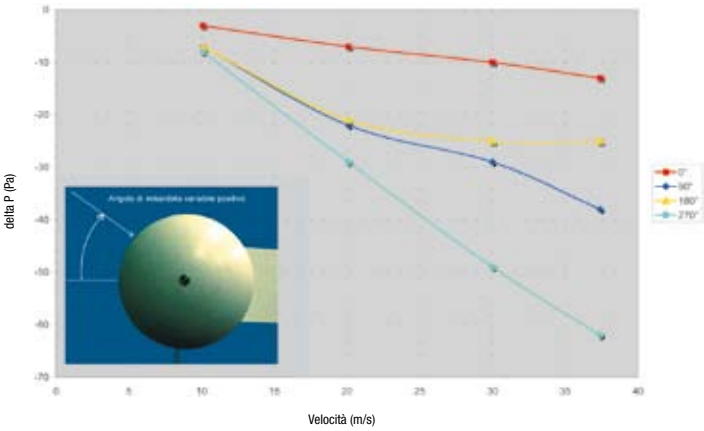
Static port put in front of the wind tunnel



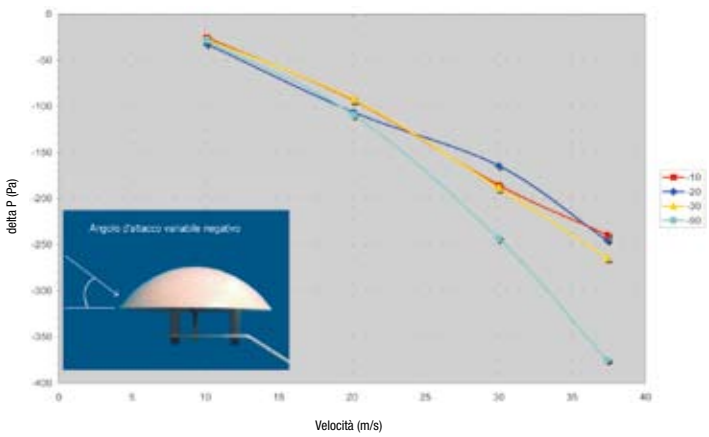
ΔP according to the yaw angle β (join angle α = 0°)



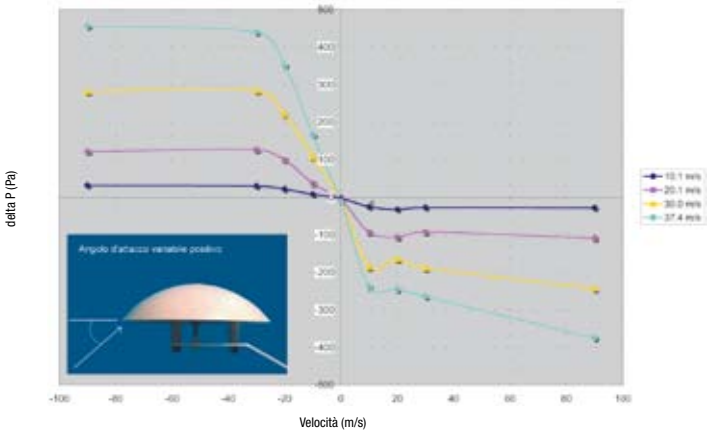
ΔP according to the join angle α (yaw angle β = 0°)



ΔP according to the α join angle (yaw angle β = 0°)



ΔP according to the β yaw angle



ΔP according to the α join angle

SIT N° 124 Laboratory - pressure measurements

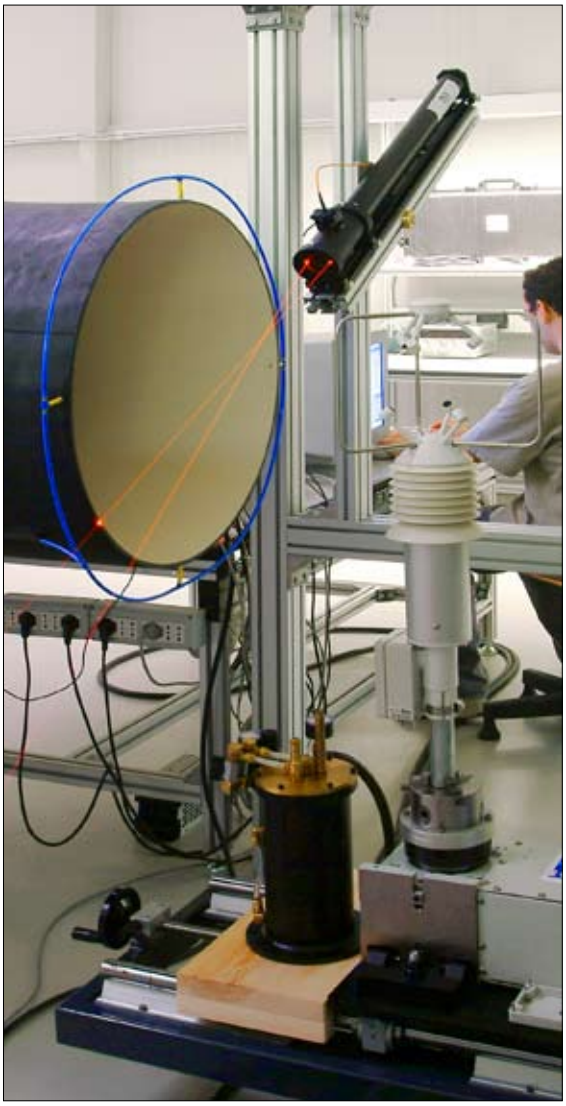
Italian calibration service

SIT centre n° 124:
DELTA OHM s.r.l.
Via G. Marconi, 5
35030 CASELLE DI SELVAZZANO (PD) - ITALIA
Telefono: +39 049 89 77 150
Telefax: +39 049 63 55 96
E-mail: deltaohm@tin.it
URL http://www.deltaohm.com

Permanent Laboratory **SIT ACCREDITATION TABLE**

Magnitude	Instrument under calibration	Measuring range	Uncertainty (*)	Note
Pressure	Secondary pressure transducer:			
	- in liquid medium relative condition	from 0,075 MPa to 100 MPa	0,01 %	
	- in gas medium relative condition	from 1, 4 kPa to 12 MPa	0,01 %	
	- in gas medium absolute condition	1,4 KPa to 6,9 MPa	0,01 %	

(*) Measuring uncertainty is expressed at the 95% of confidence level.



Air speed

- HD 2103.1, HD 2103.2, HD 2303.0 pag. 122
  Handheld Thermo-Anemometers

- DO 2003 pag. 127
  Handheld meter for flow rate, temperature, temperature-humidity, pressure

- HD 2114P.0, HD 2114P.2, HD 2134P0, HD 2134P.2 pag. 131
  Handheld Micro-Manometers using Pitot tubes, thermometers for thermocouple probes

- HD 2903T…, HD 2937T…, HD 29371T… pag. 144
  Handheld Micro-Manometers using Pitot tubes, thermometers for thermocouple probes

- HD 403TS… pag. 148
  Transmitters for air speed, temperature, and humidity

- HD 103T.0 pag. 150
  Hot-wire air speed transmitters

- HD 2003, HD 2003.1 pag. 151
  Three axis ultrasonic transmitters

• Accredited laboratory SIT Centre 124 in Air speed. pag. 154

The qualitative level of our instruments is the result of a continuous evolving of the product itself. This way bring to slight differences between what reported on this manual and the instruments you bought. We can not completely exclude the presence of errors for which we apologise. Data, images and descriptions included in this catalogue can not be enforced legally. We reserve the right to perform any modification and correction at any time without notice.

HD 2103.1
HD 2103.2

HD 2103.1 HD 2103.2
THERMO-ANEMOMETERS

The **HD2103.1** and **HD2103.2** are portable instruments with a large LCD display. They are designed for use in the fields of air conditioning, heating, ventilation and environmental comfort. They use hot-wire or vane probes to measure air speed, flow rate, and temperature inside pipelines and vents. Temperature only is measured by immersion, penetration or air contact probes. The temperature sensor used can be chosen from the Pt100, Pt1000.
The probes are equipped with the SICRAM module, with the factory calibration data are stored inside.
The HD2103.2 instrument is a **datalogger**. It stores up to 38,000 samples which can be transferred from the instrument to a PC connected via the multi-standard RS232C serial port and USB 2.0. The storing interval, printing, and baud rate can be configured using the menu.
The HD2103.1 and HD2103.2 models are equipped with an RS232C serial port and can transfer the acquired measurements in real time to a PC or to a portable printer. The *Max, Min* and *Avg* function calculate the maximum, minimum or average values. Other functions include: the relative measurement REL, the HOLD function, and the automatic turning off that can also be excluded.
The instruments have IP67 protection degree.

HD2101/USB

INSTRUMENT TECHNICAL CHARACTERISTICS

Instrument

Dimensions (Length x Width x Height)	185x90x40mm
Weight	470g (complete with batteries)
Materials	ABS, rubber
Display	2x4½ digits plus symbols Visible area: 52x42mm

Operating conditions

Operating temperature	-5…50°C
Storage temperature	-25…65°C
Working relative humidity	0…90%RH without condensation
Protection degree	**IP67**

Power supply

Batteries	4 1.5V type AA batteries
Autonomy (*)	200 hours with 1800mAh alkaline batteries
Power absorbed with instrument off	20µA
Mains	Output mains adapter 12Vdc / 1000mA

Measuring units	*°C - °F - m/s - km/h - ft/min - mph - knot - l/s - m^3/s - m^3/min - m^3/h - ft^3/s - ft^3/min WCT*
Security data stored	Unlimited, independent of battery charge conditions

Time

Date and time	Schedule in real time
Accuracy	1min/month max drift

Measured values memorization - model HD2103.2

Type	2000 pages containing 19 samples each
Quantity	Total of 38000 samples
Storage interval	1s…3600s (1hour)

Serial interface RS232C

Type	RS232C electrically isolated
Baud rate	Can be set from 1200 to 38400 baud
Data bit	8
Parity	None
Stop bit	1
Flow Control	Xon/Xoff
Serial cable length	Max 15m
Immediate print interval	1s…3600s (1hour)

USB interface - model HD2103.2

Type	1.1 - 2.0 electrically isolated

Connections

Input module for the probes	8-pole male DIN45326 connector
Serial interface and USB	8-pole MiniDin connector
Mains adapter	2-pole connector (positive at centre)

Measurement of temperature by Instrument

Pt100 measurement range	-200…+650°C
Pt1000 measurement range	-200…+650°C
Resolution	0.1°C
Accuracy	±0.1°C
Drift after 1 year	0.1°C/year

(*) It's referred to all the probes except the hot wire ones, which autonomy is stated in the next pages

PROBES AND MODULES TECHNICAL DATA EQUIPPED WITH INSTRUMENT
Wind speed measurement probes

Hot-wire probes: AP471 S1 - AP471 S2 - AP471 S3 - AP471 S4 - AP471 S5

	AP471 S1 - AP471 S3	AP471 S2	AP471 S4 AP471 S5
Type of measure	Air speed, calculated flow rate, air temperature		
Type of sensor			
Speed	NTC thermistor	Omnidirectional NTC thermistor	
Temperature	NTC thermistor	NTC thermistor	
Measurement range			
Speed	0,1…40m/s	0,1…5m/s	
Temperature	-25…+80°C	-25…+80°C	0…80°C
Measurement resolution:			
Speed	0.01 m/s 0.1 km/h 1 ft/min 0.1 mph 0.1 knot		
Temperature	0.1°C		
Measurement accuracy:			
Speed	±0.1 m/s (0…0.99 m/s)	±0.05m/s (0…0.99 m/s)	
	±0.3 m/s (1.00…9.99 m/s)	±0.15m/s (1.00…5.00 m/s)	
	±0.8 m/s (10.00…40.0 m/s)		
Temperature	±0.8°C (-10…+80°C)	±0.8°C (-10…+80°C)	
Minimum speed	0.1 m/s		
Air temperature compensation	0…80°C		
Sensor working conditions	Clean air, RH<80%		
Battery life	Approx. 20 hours @ 20 m/s with alkaline batteries	Approx. 30 hours @ 5 m/s with alkaline batteries	
Unit of Measurement			
Speed	m/s – km/h – ft/min – mph – knot		
Flow rate	l/s - m^3/s - m^3/min - m^3/h - ft^3/s - ft^3/min		
Pipeline section for flow rate calculation	0.0001…1.9999 m^2		
Cable length	~2m		

Vane probes: AP472 S1… - AP472 S2 - AP472 S4…

	AP472 S1…	AP472 S2	AP472 S4…			
			L	LT	H	HT
Type of measure	Air speed, calculated flow rate, air temperature	Air speed, calculated flow rate	Air speed, calculated flow rate.	Air speed, calculated flow rate, air temperature.	Air speed, calculated flow rate.	Air speed, calculated flow rate, air temperature.
Diameter	100mm	60mm	16mm			
Type of measurement						
Speed	Vane	Vane	Vane			
Temperature	K thermocouple	----	----	K thermo couple	----	K thermo couple
Measurement range						
Speed (m/s)	0.6…25	0.5…20	0.8…20		10…40	
Temperature (°C)	-25…+80 (*)		-25...+80 (*)			
Resolution						
Speed	0.01 m/s 0.1 km/h 1 ft/min 0.1 mph 0.1 knot					
Temperature	0.1°C	----	----	0.1°C	----	0.1°C
Accuracy						
Speed	±(0.3 m/s +1.5%f.s.)	±(0.3m/s +1.5%f.s.)	±(0.4 m/s +1.5%f.s.)			
Temperature	±0.8°C	----	----	±0.8°C	----	±0.8°C
Minimum speed	0.6m/s	0.5m/s	0.8m/s		10m/s	
Unit of Measurement						
Speed	m/s – km/h – ft/min – mph – knot					
Flow rate	l/s - m^3/s - m^3/min - m^3/h - ft^3/s - ft^3/min					
Pipeline section for flow rate calculation	0.0001…1.9999 m^2					
Cable length	~2m					

(*) The indicated value refers to the vane's working range.

Temperature probes Pt100 sensor using SICRAM module

Model	Type	Application range	Accuracy
TP472I	Immersion	-196°C…+500°C	±0.25°C (-196°C…+350°C) ±0.4°C (+350°C…+500°C)
TP472I.0	Immersion	-50°C…+400°C	±0.25°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP473P	Penetration	-50°C…+400°C	±0.25°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP473P.0	Penetration	-50°C…+400°C	±0.25°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP474C	Contact	-50°C…+400°C	±0.3°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP474C.0	Contact	-50°C…+400°C	±0.3°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP475A.0	Air	-50°C…+250°C	±0.3°C (-50°C…+250°C)
TP472I.5	Immersion	-50°C…+400°C	±0.3°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP472I.10	Immersion	-50°C…+400°C	±0.30°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP49A	Immersion	-70°C…+400°C	±0.25°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP49AC	Contact	-70°C…+400°C	±0.25°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP49AP	Penetration	-70°C…+400°C	±0.25°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP875	Globe thermometer Ø 150mm	-30°C…+120°C	±0.25°C
TP876	Globe thermometer Ø 50mm	-30°C…+120°C	±0.25°C
TP87	Immersion	-50°C…+200°C	±0.25°C
TP878 TP878.1	For solar panels	+5°C…+80°C	±0.25°C
TP879	For compost	-20°C…+120°C	±0.25°C

Common characteristics
Temperature drift @ 20°C 0.003%/°C

4 wire Pt100 and 2 wire Pt1000 Probes

Model	Type	Application range	Accuracy
TP47.100	Pt100 4 wires	-50…+400°C	Class A
TP47.1000	Pt1000 2 wires	-50…+400°C	Class A

Common characteristics
Temperature drift @ 20°C
Pt100 0.003%/°C
Pt1000 0.005%/°C

ORDER CODES

HD2103.1: The kit consists of the instrument HD2103.1, 4 1.5V alkaline batteries, operating manual, case and DeltaLog9 software. **Probes and cables must be ordered separately.**

HD2103.2: The kit consists of the HD2103.2 **datalogger,** 4 1.5V alkaline batteries, operating manual, case and DeltaLog9 software. **Probes and cables must be ordered separately.**

HD2110CSNM: 8-pole connection cable MiniDin - Sub D 9-pole female for RS232C.

C.206: Cable to connect the instruments HD21…1 and .2 directly to the USB port of the PC.

HD2101/USB: Connection cable USB 2.0 connector type A - 8-pole MiniDin.

DeltaLog9: Software for download and management of the data on PC using Windows 98 to Vista operating systems.

SWD10: Stabilized power supply at 230Vac/12Vdc-1000mA mains voltage.

HD40.1: On request, portable, serial input, 24 column thermal printer, 58mm paper width.

Probes complete with SICRAM module
AIR speed measurement probes

Hot-wire PROBES:

AP471 S1: Hot-wire telescopic probe, measuring range: 0.1…40m/s. Cable 2 metres long.

AP471 S2: Omnidirectional hot-wire probe, measuring range: 0.1…5m/s. Cable 2 metres long.

AP471 S3: Hot-wire telescopic probe with terminal tip for easy position, measuring range: 0.1…40m/s. Cable 2 metres long.

AP471 S4: Omnidirectional hot-wire telescopic probe with base, measuring range: 0.1…5m/s. Cable 2 metres long.

AP471 S5: Omnidirectional hot-wire telescopic probe, measuring range: 0.1…5m/s. Cable 2 metres long.

Vane probes:

AP472 S1L: Vane probe with thermocouple, Ø 100mm. Speed from 0.6 to 25m/s; temperature from -25 to 80°C. Cable 2 metres long.

AP472 S2: Vane probe, Ø 60mm. Measurement range: 0.5…20m/s. Cable 2 metres long.

AP472 S4L: Vane probe, Ø 16mm. speed from 0.8 to 20m/s. Cable 2 metres long.

AP472 S4LT: Vane probe with thermocouple, Ø 16mm, speed from 0.8 to 20m/s. Temperature from -25 to 80°C with thermocouple K sensor. Cable 2 metres long.

AP472 S4H: Vane probe, Ø 16mm speed from 10 to 40m/s. Cable 2 metres long.

AP472 S4HT: Vane probe with thermocouple, Ø 16mm speed from 10 to 50m/s. Temperature from -25 to 80°C with thermocouple K sensor(*). Cable length 2 metres long.

Temperature PROBES complete with SICRAM module

TP472I: Immersion probe, sensor Pt100. Stem Ø 3 mm, length 300 mm. Cable 2 metres long.

TP472I.0: Immersion probe, sensor Pt100. Stem Ø 3 mm, length 230 mm. Cable 2 metres long.

TP473P: Penetration probe, sensor Pt100. Stem Ø 4mm, length 150 mm. Cable 2 metres long.

TP473P.0: Penetration probe, sensor Pt100. Stem Ø 4mm, length 150 mm. Cable 2 metres long.

TP474C: Contact probe, sensor Pt100. Stem Ø 4mm, length 230mm, contact surface Ø 5mm. Cable 2 metres long.

TP474C.0: Contact probe, sensor Pt100. Stem Ø 4mm, length 230mm, contact surface Ø 5mm. Cable 2 metres long.

TP475A.0: Air probe, Pt100 sensor. Stem Ø 4mm, length 230mm. Cable 2 metres long.

TP472I.5: Immersion probe, Pt100 sensor. Stem Ø 6mm, length 500 mm. Cable 2 metres long.

TP472I.10: Immersion probe, Pt100 sensor. Stem Ø 6mm, length 1000mm. Cable 2 metres long.

TP875: Globe thermometer Ø 150mm with handle, cable 2 metres long.

TP876: Globe thermometer Ø 50mm with handle. Cable 2 metres long.

TP87: Immersion probe, Pt100sensor. Stem Ø 3mm, length 70mm. Cable 2 metres long.

TP878: Contact probe for solar panels. Cable 2 metres long.

TP878.1: Contact probe for solar panels. Cable 5 metres long.

TP879: Penetration probe for compost. Stem Ø 8 mm, Length 1 m. Cable 2 meters long.

Temperature probes without SICRAM module

TP47.100: 4 wire direct Pt100 sensor immersion probe,. Probe's stem Ø 3mm, length 230mm. Connection cable 4 wires with connector, length 2 metres.

TP47.1000: Pt1000 sensor immersion probe. Probe's stem Ø 3mm, length 230mm. Connection cable 2 wires with connector, length 2 metres.

TP47: Only connector for probe connection: direct 4 wires Pt100 and 2 wires Pt1000.

SWD10

HD40.1

HD 2303.0

HD 2303.0
THERMO-ANEMOMETER

The **HD2303.0** is a portable instrument with a large LCD display. It is designed for use in the fields of air conditioning, heating, ventilation and environmental comfort. It uses hot-wire or vane probes to measure air speed, flow rate, and temperature inside pipelines and vents. Temperature only is measured by immersion, penetration or air contact probes. The temperature sensor used can be chosen from the Pt100, Pt1000.
The probes are equipped with the SICRAM module, with the factory calibration data stored inside. The *Max, Min* and *Avg* function calculate the maximum, minimum or average values. Other functions include: the relative measurement REL, the HOLD function, and the automatic turning off that can also be excluded.
The instruments have IP67 protection degree.

INSTRUMENT TECHNICAL CHARACTERISTICS

Instrument

Dimensions (Length x Width x Height)	140x88x38mm
Weight	160g (complete with batteries)
Materials	ABS
Display	2x4½ digits plus symbols Visible area: 52x42mm

Operating conditions

Operating temperature	-5…50°C
Storage temperature	-25…65°C
Working relative humidity	0…90%RH without condensation
Protection degree	**IP67**

Power supply

Batteries	3 1.5V type AA batteries
Autonomy (*)	200 hours with 1800mAh alkaline batteries
Power absorbed with instrument off	< 20µA

Measuring unit — *°C - °F - m/s - km/h - ft/min - mph - knot - l/s - m³/min - m³/h - ft³/s - ft³/min*

Connections

Input module for the probes	8-pole male DIN45326 connector

Measurement of temperature by Instrument

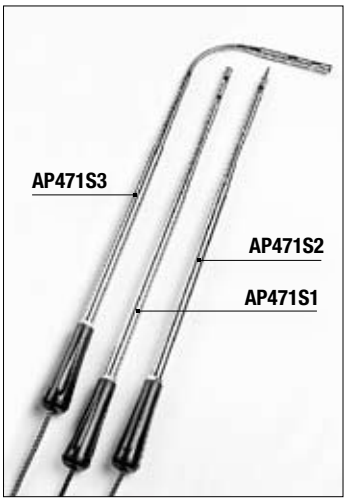
Pt100 measurement range	-200…+650°C
Pt1000 measurement range	-200…+650°C
Resolution	0.1°C
Accuracy	±0.1°C
Drift after 1 year	0.1°C/year

PROBES AND MODULES TECHNICAL DATA EQUIPPED WITH INSTRUMENT
Wind speed measurement probes

Hot-wire probes: AP471 S1 - AP471 S2 - AP471 S3 - AP471 S4 - AP471 S5

	AP471 S1 - AP471 S3	AP471 S2	AP471 S4 AP471 S5
Type of measure	Air speed, calculated flow rate, air temperature		
Type of sensor			
Speed	NTC thermistor	Omnidirectional NTC thermistor	
Temperature	NTC thermistor	NTC thermistor	
Measurement range			
Speed	0.1…40m/s	0.1…5m/s	
Temperature	-25…+80°C	-25…+80°C	0…80°C
Measurement resolution:			
Speed	0.01 m/s 0.1 km/h 1 ft/min 0.1 mph 0.1 knot		
Temperature	0.1°C		
Measurement accuracy:			
Speed	±0.1 m/s (0…0.99 m/s)	±0.05m/s (0…0.99 m/s)	
	±0.3 m/s (1.00…9.99 m/s)	±0.15m/s (1.00…5.00 m/s)	
	±0.8 m/s (10.00…40.0 m/s)		
Temperature	±0.8°C (-10…+80°C)	±0.8°C (-10…+80°C)	
Minimum speed	0,1 m/s		
Air temperature compensation	0…80°C		
Sensor working conditions	Clean air, RH<80%		
Battery life	Approx. 20 hours @ 20 m/s with alkaline batteries	Approx. 30 hours @ 5 m/s with alkaline batteries	
Unit of Measurement			
Speed	m/s – km/h – ft/min – mph – knot		
Flow rate	l/s - m³/s - m³/min - m³/h - ft³/s - ft³/min		
Pipeline section for flow rate calculation	0.0001…1.9999 m²		
Cable length	~2m		

(*) It's referred to all the probes except the hot wire ones, which autonomy is stated in the next pages



Vane probes: AP472 S1… - AP472 S2 - AP472 S4…

	AP472 S1…	AP472 S2	AP472 S4…			
			L	LT	H	HT
Type of measure	Air speed, calculated flow rate, air temperature	Air speed, calculated flow rate	Air speed, calculated flow rate.	Air speed, calculated flow rate, air temperature.	Air speed, calculated flow rate.	Air speed, calculated flow rate, air temperature.
Diameter	100mm	60mm	16mm			
Type of measurement						
Speed	Vane	Vane	Vane			
Temperature	K thermocouple	----	----	K thermo couple	----	K thermo couple
Measurement range						
Speed (m/s)	0.6…25	0.5…20	0.8…20		10…40	
Temperature (°C)	-25…+80 (*)		-25...+80 (*)			
Resolution						
Speed	0.01 m/s 0.1 km/h 1 ft/min 0.1 mph 0.1 knot					
Temperature	0.1°C	----	----	0.1°C	----	0.1°C
Accuracy						
Speed	±(0.3 m/s +1.5%f.s.)	±(0.3m/s +1.5%f.s.)	±(0.4 m/s +1.5%f.s.)			
Temperature	±0.8°C	----	----	±0.8°C	----	±0.8°C
Minimum speed	0.6m/s	0.5m/s	0.8m/s		10m/s	
Unit of Measurement						
Speed	m/s – km/h – ft/min – mph – knot					
Flow rate	l/s - m^3/s - m^3/min - m^3/h - ft^3/s - ft^3/min					
Pipeline section for flow rate calculation	0.0001…1.9999 m^2					
Cable length	~2m					

(*) The indicated value refers to the vane's working range.

Temperature probes Pt100 sensor using SICRAM module

Model	Type	Application range	Accuracy
TP472I	Immersion	-196°C…+500°C	±0.25°C (-196°C…+350°C) ±0.4°C (+350°C…+500°C)
TP472I.0	Immersion	-50°C…+400°C	±0.25°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP473P	Penetration	-50°C…+400°C	±0.25°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP473P.0	Penetration	-50°C…+400°C	±0.25°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP474C	Contact	-50°C…+400°C	±0.3°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP474C.0	Contact	-50°C…+400°C	±0.3°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP475A.0	Air	-50°C…+250°C	±0.3°C (-50°C…+250°C)
TP472I.5	Immersion	-50°C…+400°C	±0.3°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP472I.10	Immersion	-50°C…+400°C	±0.30°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP49A	Immersion	-70°C…+400°C	±0.25°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP49AC	Contact	-70°C…+400°C	±0.25°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP49AP	Penetration	-70°C…+400°C	±0.25°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP875	Globe thermometer Ø 150mm	-30°C…+120°C	±0.25°C
TP876	Globe thermometer Ø 50mm	-30°C…+120°C	±0.25°C
TP87	Immersion	-50°C…+200°C	±0.25°C
TP878 TP878.1	For solar panels	+5°C…+80°C	±0.25°C
TP879	For compost	-20°C…+120°C	±0.25°C

Common characteristics
Temperature drift @ 20°C 0.003%/°C

4 wire Pt100 and 2 wire Pt1000 Probes

Model	Type	Application range	Accuracy
TP47.100	Pt100 4 wires	-50…+400°C	Class A
TP47.1000	Pt1000 2 wires	-50…+400°C	Class A

Common characteristics
Temperature drift @ 20°C
Pt100 0.003%/°C
Pt1000 0.005%/°C

ORDER CODES

HD2303.0: The kit consists of the instrument HD2303.0, 3 1.5V alkaline batteries, operating manual, case. **Probes must be ordered separately.**

Probes complete with SICRAM module
AIR speed measurement probes

Hot-wire PROBES:

AP471 S1: Hot-wire telescopic probe, measuring range: 0.1…40m/s. Cable 2 metres long.
AP471 S2: Omnidirectional hot-wire probe, measuring range: 0.1…5m/s. Cable 2 metres long.
AP471 S3: Hot-wire telescopic probe with terminal tip for easy position, measuring range: 0.1…40m/s. Cable 2 metres long.
AP471 S4: Omnidirectional hot-wire telescopic probe with base, measuring range: 0.1…5m/s. Cable 2 metres long.
AP471 S5: Omnidirectional hot-wire telescopic probe, measuring range: 0.1…5m/s. Cable 2 metres long.

Vane probes:

AP472 S1L: Vane probe with thermocouple, Ø 100mm. Speed from 0.6 to 25m/s; temperature from -25 to 80°C. Cable 2 metres. long
AP472 S2: Vane probe, Ø 60mm. Measurement range: 0.5…20m/s. Cable 2 metres long.
AP472 S4L: Vane probe, Ø 16mm. speed from 0.8 to 20m/s. Cable 2 metres long.
AP472 S4LT: Vane probe with thermocouple, Ø 16mm, speed from 0.8 to 20m/s. Temperature from -25 to 80°C with thermocouple K sensor. Cable 2 metres.
AP472 S4H: Vane probe, Ø 16mm speed from 10 to 40m/s. Cable 2 metres long.
AP472 S4HT: Vane probe with thermocouple, Ø 16mm speed from 10 to 40m/s. Temperature from -25 to 80°C with thermocouple K sensor(*). Cable 2 metres long.

Temperature PROBES complete with SICRAM module

TP472I: Immersion probe, sensor Pt100. Stem Ø 3 mm, length 300 mm. Cable 2 metres long.
TP472I.0: Immersion probe, sensor Pt100. Stem Ø 3 mm, length 230 mm. Cable 2 metres long.
TP473P: Penetration probe, sensor Pt100. Stem Ø 4mm, length 150 mm. Cable 2 metres long.
TP473P.0: Penetration probe, sensor Pt100. Stem Ø 4mm, length 150 mm. Cable 2 metres long.
TP474C: Contact probe, sensor Pt100. Stem Ø 4mm, length 230mm, contact surface Ø 5mm. Cable 2 metres long.
TP474C.0: Contact probe, sensor Pt100. Stem Ø 4mm, length 230mm, contact surface Ø 5mm. Cable 2 metres long.
TP475A.0: Air probe, Pt100 sensor. Stem Ø 4mm, length 230mm. Cable 2 metres long.
TP472I.5: Immersion probe, Pt100 sensor. Stem Ø 6mm, length 500 mm. Cable 2 metres long.
TP472I.10: Immersion probe, Pt100 sensor. Stem Ø 6mm, length 1000mm. Cable 2 metres long.
TP875: Globe thermometer Ø 150mm with handle, cable 2 metres long.
TP876: Globe thermometer Ø 50mm with handle. Cable 2 metres long.
TP87: Immersion probe, Pt100sensor. Stem Ø 3mm, length 70mm. Cable 2 metres long.
TP878: Contact probe for solar panels. Cable 2 metres long.
TP878.1: Contact probe for solar panels. Cable 5 metres long.
TP879: Penetration probe for compost. Stem Ø 8 mm, Length 1 m. Cable 2 meters long.

Temperature probes without SICRAM module

TP47.100: 4 wire direct Pt100 sensor immersion probe,. Probe's stem Ø 3mm, length 230mm. Connection cable 4 wires with connector, length 2 metres.
TP47.1000: Pt1000 sensor immersion probe. Probe's stem Ø 3mm, length 230mm. Connection cable 2 wires with connector, length 2 metres.
TP47: Only connector for probe connection: direct 4 wires Pt100 and 2 wires Pt1000.

DO 2003
HVAC Datalogger

DO2003
AIR SPEED AND FLOW RATE • TEMPERATURE • TEMPERATURE/RELATIVE HUMIDITY • PRESSURE

DO2003 is a **datalogger** portable instrument, specifically designed to perform measurements in air-conditioning, heating, ventilation, environmental comfort, energy saving both for industrial and residential application by means of a complete series of probes dedicated. It measures:

- Air speed and flow rate inside pipeline with hot-wire probes, vane probes or Pitot tube probes
- relative humidity and temperature with combined probes
- differential pressure up to 2000 mbar and barometric pressure
- temperature with immersion, pointed or contact probes.

This datalogger stores up to 12.000 readings which can be downloaded to a PC connected to the instrument through RS232C serial port. Storage interval, printing, baud rate can be configurated on the menu.
"Record" (RCD) function calculates maximum, average and minimum values.
A big size dual display and a led series make the reading of data easy.
The instrument is provided also with these further functions: relative measurement, Hold function, zero correction for differential pressure probes and hot-wire probes.

CHARACTERISTICS OF THE INSTRUMENT
Display: 3½ digit, dual LCD, figure height 12,5 mm. Unit of measure and other additional information are supplied with a led series.
No. 2 inputs: **input A** for air speed and pressure probes, **input B** only for combined temperature/humidity probes.
Storage capacity: 12.000 readings.
Storage interval and printing can be configured between 1 second and 1 hour.
Safety of stored data and battery charge situation unrelated.
Automatic switch-off after 8 minutes can be disabled.
Operating conditions:
Working temperature: -5°C..50°C.
Relative humidity 0-90% RH. not condensing.
Storage temperature: -20°C..+60°C.
Power supply: four 1.5V alkaline AA batteries, , operating time with alkaline batteries 100 hours approx.
Probes input: 2 circular 8 pole DIN 45326 male connectors.
9 pole SUB D male RS232C serial output. Baud rate from 300 to 38400 baud.
housing: ABS.
Dimensions and weight: 72x210x40 mm - 320gr.

CHARACTERISTICS OF PROBES FOR DO2003 EQUIPPED WITH SICRAM MODULE
Probes for air speed measurement

A filo caldo: AP471 S1 - AP471 S2 - AP471 S3 - AP471-S4

	AP471 S1 - AP471 S3	AP471 S2	AP471 S4
Kind of measure	Air speed, calculated flow, air temperature		
Working range			
Speed	0.1…40m/s	0.1…5m/s	
Temperature	-25…+80°C	-25…+80°C	0…+80°C
Resolution			
Speed	0.01m/s (0…19.99) - 0.1m/s above 0.1 km/h 1 ft/min (0…1999) - 10ft/min above 0.1 mph	0.01 m/s (0…5 m/s) 0.1 km/h 1 ft/min 0.1 mph	
Temperature	0.1°C (-25…+80°C)	0.1°C (-25…+80°C)	
Accuracy			
Speed	±0.1 m/s (0…0.99 m/s)	±0.05m/s (0…0.99 m/s)	
	±0.3 m/s (1.00…9.99 m/s)	±0.15m/s (1.00…5.00 m/s)	
	±0.8 m/s (10.00…40.0 m/s)		
Temperature	±0.8°C (-10…+80°C)	±0.8°C(-10…+80°C)	
Minimum speed	0.1 m/s		
Air temperature Compensation	0…80°C		
Sensor working conditions	Clean air, RH<80%		
Unit of measurement			
Speed	m/s – km/h – ft/min – mph		
Flow rate	l/s – m^3/h – cfm		
Duct section for flow calculation	0.001…1.999 m^2		
Cable length	~2m		

AP471S4

Vane probe: AP472 S1… - AP472 S2 - AP472 S4…

	AP472 S1…	AP472 S2	AP472 S4 …			
			L	LT	H	HT
Type of measurements	Air speed, calculated flow, air temperature	Air speed, calculated flow	Air speed, calculated flow	Air speed, calculated flow, air temperature	Air speed, calculated flow	Air speed, calculated flow, air temperature
Diameter	100 mm	60 mm	16 mm			
Type of measurement						
Speed	Vane	Vane	Vane			
Temperature	Tc K	----	----	Tc K	----	Tc K
Measuring range						
Speed	0.6…25	0.5…20	0.8…20		10…40	
Temperature (*)	-25…+80	-25…+80 (*)	-25...+80 (*)		-25...+80 (*)	
Resolution						
Speed	0.01 m/s - 0.1 km/h - 1 ft/min - 0.1 mph - 0.1 knots 0.01 m/s (up to 19.99 m/s), 0.1 m/s above 0.1 k/h - 1 ft/min. (up to 1999), 0.01·10³ ft/min. above					
Temperature	0.1°C	----	----	0.1°C	----	0.1°C
Accuracy						
Speed	±(0.3 m/s +1.5%f.s.)	±(0.3 m/s +1.5%f.s.)	±(0.4 m/s +1.5%f.s.)			
Temperature	±0.8°C	----	----	±0.8°C	----	±0.8°C
Min. speed	0.6m/s	0.5m/s	0.8m/s		10m/s	
Unit of measurement						
Speed	m/s - km/h - ft/min - mph					
Flow	l/s - m³/s - cfm					
Duct section for flow calculation	0.001 - 1.999 m²					
Cable length	~2m					

(*) The indicated value refers to the vane working range.

Pitot tube probes: AP473 S1 - AP473 S2 - AP473 S3 - AP473 S4

	AP473 S1	AP473 S2	AP473 S3	AP473 S4
Kind of measurement	Air speed, calculated flow, differential pressure, Air temperature			
Working range				
Diff. pressure	10 mbar f.s.	20mbar f.s.	50mbar f.s.	100mbar f.s.
Speed (*)	2 … 40m/s	2 … 55m/s	2 … 90m/s	2 … 130m/s
Temperature	-200…+460°C	-200…+460°C	-200…+460°C	-200…+460°C
Resolution				
Speed m/s	0.1			
km/h	1			
ft/min	0,01·10³			
mph	1			
Temperature	0.1°C			
Accuracy				
Speed	±0.4%f.s. of pressure		±0.3%f.s. of pressure	
Temperature	±0.8°C		±0.8°C	
Minimum speed	2 m/s			
Air temperature compensation	-200…+460°C (if K thermocouple is connected to the module)			
Unit of measurement				
Speed	m/s – km/h – ft/min – mph			
Flow rate	l/s – m³/h – cfm			
Duct section for flow calculation	.001…1.999 m²			

(*) At 20°C, 1013mbar and Ps negligible.

Temperature probes Pt100 sensor using SICRAM module

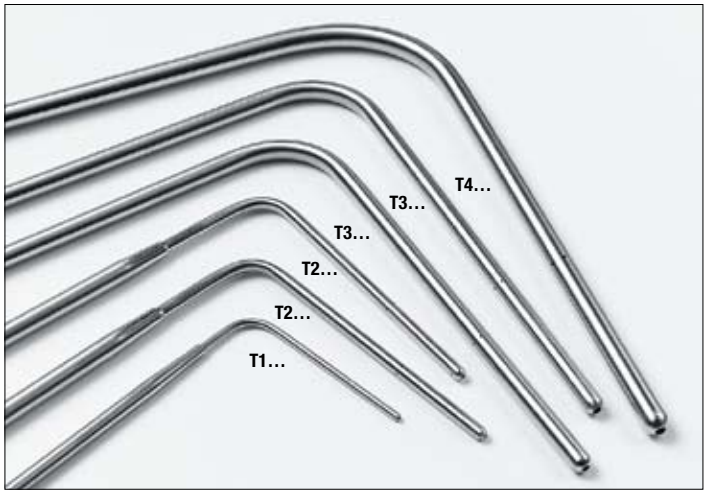
Model	Type	Application range	Accuracy
TP472I	Immersion	-196°C…+500°C	±0.25°C (-196°C…+350°C) ±0.4°C (+350°C…+500°C)
TP472I.0	Immersion	-50°C…+400°C	±0.25°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP473P	Penetration	-50°C…+400°C	±0.25°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP473P.0	Penetration	-50°C…+400°C	±0.25°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP474C	Contact	-50°C…+400°C	±0.3°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP474C.0	Contact	-50°C…+400°C	±0.3°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP475A.0	Air	-50°C…+250°C	±0.3°C (-50°C…+250°C)
TP472I.5	Immersion	-50°C…+400°C	±0.3°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP472I.10	Immersion	-50°C…+400°C	±0.30°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP49A	Immersion	-70°C…+400°C	±0.25°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP49AC	Contact	-70°C…+400°C	±0.25°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP49AP	Penetration	-70°C…+400°C	±0.25°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP875	Globe thermometer Ø 150mm	-30°C…+120°C	±0.25°C
TP876	Globe thermometer Ø 50mm	-30°C…+120°C	±0.25°C
TP87	Immersion	-50°C…+200°C	±0.25°C
TP878 TP878.1	For solar panels	+5°C…+80°C	±0.25°C
TP879	For compost	-20°C…+120°C	±0.25°C

Relative humidity and temperature probes

Typical characteristics **of module** of relative humidity and temperature probes

Temperature

Temperature sensor	Pt100 (100Ω @ 0°C)
Working range	-50°C…+200°C.
Accuracy	±0.1°C
Resolution	0.1°C
Temperature drift @20°C	0.003%/°C
Temperature sensor (**HP572AC**)	K Thermocouple
Working range	-50°C…+200°C.
Accuracy	±0.5°C
Resolution	0.1°C
Temperature drift @20°C	0.02%/°C



Relative humidity

Sensor	Capacitive
Temperature working range	-40°C…+150°C
Working range	0 … 100%R.H.
Accuracy	±2%RH in the range 10…90%RH ±2.5%RH in the remainig range
Resolution	0.1%RH
Temperature drift @20°C	0.02%RH/°C
%RH response time at constant temperature	10sec (10→80%RH; air speed=2m/s)

Temperature and relative humidity probes with SICRAM module

Model	Temperature sensor	Application range		Accuracy	
		%RH	Temperature	%RH	Temp
HP472ACR	Pt100	0…100%RH	-20°C…+80°C	±2%RH (5…90%RH) ±2,5%RH (remaining range)	±0.3°C
HP572ACR	Thermocouple K	0…100%RH	-20°C…+80°C		±0.5°C
HP473ACR	Pt100	0…100%RH	-20°C…+80°C		±0.3°C
HP474ACR	Pt100	0…100%RH	-40°C…+150°C	-40°C…150°C (180°C) ±(1,5+0,02 times the displayed value)	±0.3°C
HP475ACR	Pt100	0…100%RH	-40°C…+150°C		±0.3°C
HP475AC1R	Pt100	0…100%RH	-40°C…+150°C		±0.3°C
HP477DCR	Pt100	0…100%RH	-40°C…+150°C		±0.3°C
HP478ACR	Pt100	0…100%RH	-40°C…+150°C		±0.3°C

Pressure probes

PP472 Probe for measuring barometric pressure.
Working range: 600 … 1100mbar Resolution: 1mbar
Accuracy @ 20°C: ±1mbar Temperature range: -10 … +60°C

PP473 S1…S8 Differential pressure probes

Working range	**S1**=f.s.10mbar, **S4**=f.s.100mbar, **S7**=f.s.1bar,	**S2**=f.s.20mbar, **S5**=f.s.200mbar, **S8**=f.s.2bar	**S3**=f.s.50mbar, **S6**=f.s.500mbar,
Maximum overpressure	**S1,S2,S3**=200mbar **S7**=3bar	**S4**=300mbar **S8**=6bar	**S5,S6**=1bar
Accuracy @ 25°C	±0.5%f.s. (10, 20, 50mbar)	±0.25%f.s. (100mbar)	±0.12% f.s. (200, 500, 1000, 2000mbar)
Temperature range	-10 … +60°C		
Fluid in contact with the membrane	non-corrosive dry gas or air		
Connection	tube Ø 5mm		

Purchasing codes

DO 2003: The kit consists of instrument, 4 1.5V alkaline batteries, instructions manual, carrying case and software Deltalog3. **Probes and cable have to be ordered separately.**

9CPRS232: Female/female 9 pole sub D extension cable for RS232C (null modem).

DeltaLog3: (vers.4.0 and following ones) Software for downloading and PC data management.

PROBES FOR AIR SPEED MEASUREMENTS
Probes equipped with SICRAM modules

HOT-WIRE PROBES

AP471 S1: Hot-wire telescopic probe, measuring range: 0.1…40m/s.

AP471 S2: Omni-directional hot-wire probe, measuring range: 0.1…5m/s.

AP471 S3: Hot-wire telescopic probe with terminal tip for easy position, measuring range: 0.1…40m/s.

AP471 S4: Omnidirectional hot-wire telescopic probe with base, measuring range: 0.1…5m/s. Cable 2 metres long.

Vane probes:

AP472 S1: Vane probe with thermocouple, Ø 100mm. Speed from 0.6 to 25m/s; temperature from -25 to 80°C. Cable 2 metres long.

AP472 S2: Vane probe, Ø 60mm. Measurement range: 0.5…20m/s. Cable 2 metres long.

AP472 S4L: Vane probe, Ø 16mm. speed from 0.8 to 20m/s. Cable length 2 metres.

AP472 S4LT: Vane probe with thermocouple, Ø 16mm, speed from 0.8 to 20m/s. Temperature from -25 to 80°C with thermocouple K sensor(*). Cable 2 metres long.

AP472 S4H: Vane probe, Ø 16mm speed from 10 to 40m/s. Cable 2 metres long.

AP472 S4HT: Vane probe with thermocouple, Ø 16mm speed from 10 to 40m/s. Temperature from -25 to 80°C with thermocouple K sensor(*). Cable 2 metres long.

MODULES FOR PITOT TUBES

AP473 S1: Pitot tube probe, differential pressure 10mbar f.s. Air speed from 2 to 40m/s. The Pitot tube has to be ordered separately.

AP473 S2: Pitot tube probe**,** differential pressure 20mbar f.s. Air speed from 2 to 55m/s. The Pitot tube has to be ordered separately.

AP473 S3: Pitot tube probe, differential pressure 50mbar f.s. Air speed from 2 to 90m/s. The Pitot tube has to be ordered separately.

AP473 S4: Pitot tube probe**,** differential pressure 100mbar f.s. Air speed from 2 to 130m/s. The Pitot tube has to be ordered separately.

PW: Connection cable between AP473S… module and **Pitot tube**.

TEMPERATURE PROBES COMPLETE WITH SICRAM MODULE

TP472I: Immersion probe, sensor Pt100. Stem Ø 3 mm, length 300 mm. Cable 2 metres long.

TP472I.0: Immersion probe, sensor Pt100. Stem Ø 3 mm, length 230 mm. Cable 2 metres long.

TP473P: Penetration probe, sensor Pt100. Stem Ø 4mm, length 150 mm. Cable 2 metres long.

TP473P.0: Penetration probe, sensor Pt100. Stem Ø 4mm, length 150 mm. Cable 2 metres long.

TP474C: Contact probe, sensor Pt100. Stem Ø 4mm, length 230mm, contact surface Ø 5mm. Cable 2 metres long.

TP474C.0: Contact probe, sensor Pt100. Stem Ø 4mm, length 230mm, contact surface Ø 5mm. Cable 2 metres long.

TP475A.0: Air probe, Pt100 sensor. Stem Ø 4mm, length 230mm. Cable 2 metres long.

TP472I.5: Immersion probe, Pt100 sensor. Stem Ø 6mm, length 500 mm. Cable 2 metres long.

TP472I.10: Immersion probe, Pt100 sensor. Stem Ø 6mm, length 1000mm. Cable 2 metres long.

TP875: Globe thermometer Ø 150mm with handle, cable 2 metres long.

TP876: Globe thermometer Ø 50mm with handle. Cable 2 metres long.

TP87: Immersion probe, Pt100sensor. Stem Ø 3mm, length 70mm. Cable 2 metres long.

TP878: Contact probe for solar panels. Cable 2 metres long.

TP878.1: Contact probe for solar panels. Cable 5 metres long.

TP879: Penetration probe for compost. Stem Ø 8 mm, Length 1 m. Cable 2 meters long.

RELATIVE HUMIDITY AND TEMPERATURE PROBES COMPLETE WITH SICRAM MODULE

HP472ACR: %RH and temperature combined probe, dimensions Ø 26x170 mm. 2 m connecting cable.

HP572ACR: %RH and temperature combined probe, **K thermocouple sensor**. Dimensions Ø 26x170 mm. 2 m connecting cable.

HP473ACR: %RH and temperature combined probe. Dimensions: handle Ø 26x130 mm, probe Ø 14x110 mm. 2m connecting cable.

HP474ACR: %RH and temperature combined probe. Dimensions: handle Ø 26x130 mm, probe Ø 14x210 mm. 2m connecting cable.

HP475ACR: %RH and temperature combined probe. 2 m connecting cable. Handle Ø 26x110 mm. Stainless-steel tube Ø 12x560 mm. Terminal tip Ø 13.5x75 mm.

HP475AC1R: %RH and temperature combined probe. 2 m connection cable. Handle Ø 26x110 mm. Stainless steel stern Ø 14x480 mm.

HP477DCR: %RH and temperature combined sword probe. 2 m connecting cable. Handle Ø 26x110 mm. Probe tube 18x4 mm, length 520 mm.
HP478ACR: %RH and temperature combined probe. Dimensions Ø 14x130 mm. 5m connection cable.

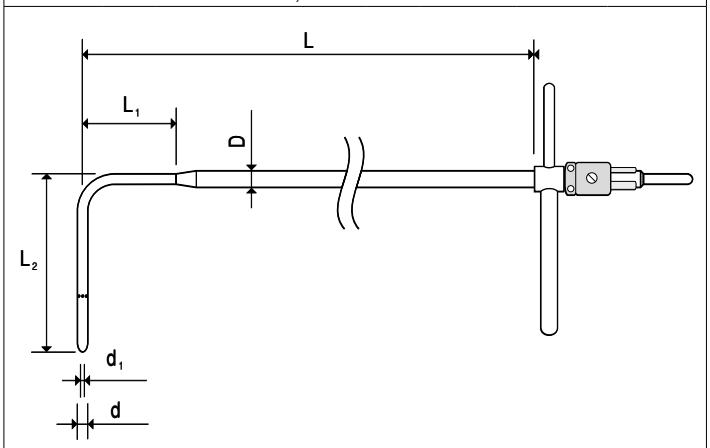
Protection for humidity probes HP472AC, HP572AC (M24x1,5)
P1: Stainless steel grid protection for probes Ø 26 mm.
P2: 20µ sintered polyethylene PE protection for probes Ø 26 mm.
P3: 20µ sintered bronze protection for probes Ø 26 mm.
P4: 20µ sintered PE complete cap for probes Ø 26 mm.

Protection for humidity probes HP473AC, HP474AC, HP475AC (M12x1)
P5: Stainless steel grid protection for probes Ø 14 mm.
P6: 20µm sintered complete protection made of stainless steel for probes Ø 14 mm.
P7: 10µm sintered complete protection made of PTFE for probes Ø 14 mm.
P8: Stainless steel grid and Pocan protection for probes Ø 14 mm.

PRESSURE PROBES
PP472: Barometric probe, working range 600…1100mbar.
PP473 S1: Differential pressure probe, full scale 10mbar.
PP473 S2: Differential pressure probe, full scale 20mbar.
PP473 S3: Differential pressure probe, full scale 50mbar.
PP473 S4: Differential pressure probe, full scale 100mbar.
PP473 S5: Differential pressure probe, full scale 200mbar.
PP473 S6: Differential pressure probe, full scale 500mbar.
PP473 S7: Differential pressure probe, full scale 1bar.
PP473 S8: Differential pressure probe, full scale 2bar.

PITOT TUBES

Stainless steel Pitot tubes to measure air speed and temperature for models provided with 'K' thermocouple. They can be connected to the SICRAM modules AP473S1, AP473S2, AP473S3 and AP473S4



	d mm	d_1 mm	D mm	L mm	L_1 mm	L_2 mm	Temp.°C	Thermo-couple K	Material
T1-300	3	1	6	300	30	72		---	
T2-400	5	2	8	400	45	120		---	
T2-600	5	2	8	600	45	120		---	
T3-500	8	3.2	8	500	---	192		---	
T3-800	8	3.2	8	800	---	192		---	
T3-800TC	8	3.2	8	800	---	192	0…600°C	TC	AISI 316
T4-500	10	4.0	10	500	---	240		---	
T4-800	10	4.0	10	800	---	240		---	
T4-800TC	10	4.0	10	800	---	240		TC	
T4-1000	10	4.0	10	1000	---	240		---	
T4-1000TC	10	4.0	10	1000	---	240		TC	

HD 2114P.0
HD 2114P.2
HD 2134P.0
HD 2134P.2

HD 2114P.0, HD 2114P.2, HD 2134P.0, HD 2134P.2 PORTABLE MICRO MANOMETER - THERMOMETER FOR PITO TUBES

The **HD2114P.0** and **HD2114P.2**, **HD2134P.0** and **HD2134P.2** are portable micromanometers for Pitot tubes with large LCD display. They are used to perform measurements in air conditioning, heating and ventilation.
They measure the differential pressure measured by Pitot tube connected to the inputs of the instrument and achieve the speed and air flow in ducts or vents; also measure temperature with thermocouple K probe.
The instruments can be used as thermometers and can be employed with any kind of thermocouple K sensor if a standard miniature connector is used.
The HD2114P.2 and HD2134P.2 instruments are **dataloggers**. They store up to 36,000 samples which can be transferred from the instrument to a PC connected via the multi-standard RS232C serial port and USB 2.0. The storing interval, printing, and baud rate can be configured using the menu.
They are also equipped with an RS232C serial port which can transfer in real time the acquired measurements to a PC or to a portable printer.
The *Max, Min* and *Avg* function calculates the maximum, minimum or average values. Other functions include: the relative measurement REL, the HOLD function, and the automatic turning off which can also be excluded. **The instruments have IP67 protection degree.**

TECHNICAL SPECIFICATIONS OF THE INSTRUMENTS

Instrument

Dimensions (Length x Width x Height)	185x90x40mm
Weight	470g (complete with batteries)
Materials	ABS, rubber
Display	2x4½ digits plus symbols Visible area: 52x42mm

Operating conditions

Operating temperature	-5…50°C
Storage temperature	-25…65°C
Working relative humidity	0…90%RH without condensation
Protection degree	**IP67**

Power supply

Batteries	4 1.5V type AA batteries
Autonomy	200 hours with 1800mAh alkaline batteries
Power absorbed with instrument off	20µA
Mains - models **HD2114P.2** and **HD2134P.2**	Output mains adapter 12Vdc / 1000mA

Measuring unit	*°C - °F - Pa - mbar - mmH_2O - PSI - m/s km/h - ft/m - mph - knot - l/s - m^3/h - cfm*
Security of memorized data	Unlimited, independent of battery charge conditions

Time

Date and time	Schedule in real time
Accuracy	1min/month max drift

Measured values storage - models HD2114P.2 and HD2134P.2

Type	2000 pages containing 18 samples each
Quantity	36000 samples
Storage interval	1s…3600s (1hour)

Serial interface RS232C - models HD2114P.2 and HD2134P.2

Type	RS232C electrically isolated
Baud rate	Can be set from 1200 to 38400 baud
Data bit	8
Parity	None
Stop bit	1
Flow Control	Xon/Xoff
Serial cable length	Max 15m
Immediate print interval	1s…3600s (1hour)

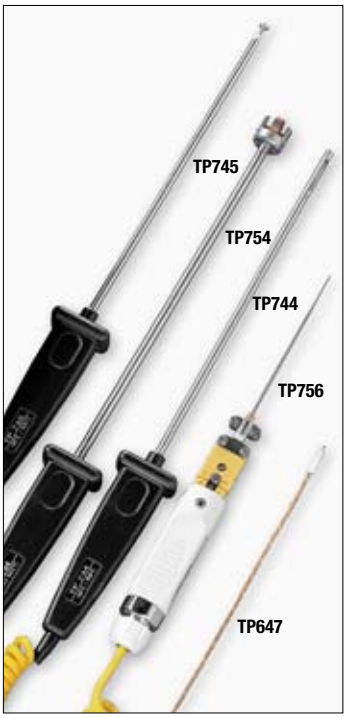
USB interface - models HD2114P.2 and HD2134P.2

Type	1.1 - 2.0 electrically isolated

Connections

Pressure inputs	2 quick couplings Ø 5mm
TC type K Temperature input	2-pole female polarized standard miniature connector
Serial and USB interface - models **HD2114P.2** and **HD2134P.2**	8-pole MiniDin connector
Mains adapter - models **HD2114P.2** and **HD2134P.2**	2-pole connector (positive at centre)

HD2101/USB



Measurement of pressure, wind speed and flow rate calculated by the internal sensor, and temperature measured using thermocouple K

	HD2114P.0 HD2114P.2	HD2134P.0 HD2134P.2
Measurement range		
Differential pressure	±20mbar	±200mbar
Speed (*)	2 … 55m/s	2 … 180m/s
Temperature using thermocouple K	-200…+1370°C	-200…+1370°C
Temperature using Pitot tube	-200…+400°C	-200…+400°C
Maximum overpressure	±300mbar	±1bar
Resolution		
Differential pressure	0.005mbar - 0.5Pa	0.01mbar - 1Pa
Speed	0.1 m/s - 1 km/h - 1 ft/min - 1 mph - 1 knots	
Flow rate	1l/s - 0.01·10^{3}m^3/h - 0.01·10^{3}cfm	
Temperature	0.1°C	
Accuracy		
Differential pressure	±0.4%f.s.	±0.3%f.s.
Speed	±(2% reading+0.1m/s)	±(2% reading +0.3m/s)
Temperature (**)	±0.1°C	±0.1°C
Minimum speed	2 m/s	3 m/s
Automatic air temperature compensation	-200…+600°C	
Manual air temperature compensation	-200…+600°C	
Unit of Measurement		
Differential pressure	Pa - mbar - mmH_2O - PSI	
Speed	m/s – km/h – ft/min – mph - knots	
Flow rate	l/s – m^3/h – cfm	
Temperature	°C / °F	
Pipeline section for flow rate calculation	0.0001…1.9999 m^2	
Fluid contacting the membrane	non corrosive air and gas	

(*) At 20°C, 1013mbar and Ps negligible.
(**) The accuracy only refers to the instrument. The error due to the thermocouple or to the cold junction reference sensor is not included.

Temperature drift @20°C	0.02%/°C
Drift after 1 year	0.1°C/year

Type K Thermocouple probes

Thermocouple probes accuracy:
Tolerance of a type of thermocouple corresponds to the maximum acceptable shift from the e.m.f. of any thermocouple of that type, with reference junction at 0°C. The tolerance is expressed in degrees Celsius, preceded by the sign. The percentage tolerance is given by the ratio between the tolerance expressed in degrees Celsius and the measurement junction temperature, multiplied by one hundred.

Tolerance classes for thermocouples (reference junction at 0°C)

Type of thermocouple	Tolerance Class 1	Tolerance Class 2	Tolerance Class 3 (1)
Type T Temperature interval Tolerance Temperature interval Tolerance	from -40 to +125°C ± 0.5°C from 125 to 350°C ± 0.004 · ltr	from -40 to +133°C ± 1°C from 133 to 350°C ± 0.0075 · ltr	from -67 to+40°C ± 1°C from -200 to -67°C ± 0.015 · ltr
Type E Temperature interval Tolerance Temperature interval Tolerance	from -40 to +375°C ± 1.5°C from 375 to 800°C ± 0.004 · ltr	from -40 to +333°C ± 2.5°C from 333 to 900°C ± 0.0075 · ltr	from -167 to +40°C ± 2.5°C from -200 to -167°C ± 0.015 · ltr
Type J Temperature interval Tolerance Temperature interval Tolerance	from -40 to +375°C ± 1.5°C from 375 to 750°C ± 0.004 · ltr	from -40 to +333°C ± 2.5°C from 333 to 750°C ± 0.0075 · ltr	- - - -
Type K, type N Temperature interval Tolerance Temperature interval Tolerance	from -40 to +375°C ± 1.5°C from 375 to 1000°C ± 0.004 · ltr	from 40 to +333°C ± 2.5°C from 333 to 1200°C ± 0.0075 · ltr	from -167 to+40°C ± 2.5°C from -200 to -167°C ± 0.015 · ltr

(1) The materials used for thermocouples are generally supplied so to comply with the production tolerances specified in the table for temperatures over -40°C. Nevertheless, these materials may not comply with the production tolerances for low temperatures reported under Class 3, for T, E, K and N thermocouples when the thermocouples have to comply at the same time with the limits of Class 3 and those of Class 1 and/or Class 2.

ORDER CODES

HD2114P.0: The kit consists of the HD2114P.0 **with 20mbar full scale** and thermocouple K input, 4 1.5V alkaline batteries, operating manual, case. **The Pitot tubes have to be ordered separately.**

HD2114P.2: The kit consists of the HD2114P.2 **datalogger with 20mbar full scale** and thermocouple K input, 4 1.5V alkaline batteries, operating manual, case and DeltaLog9 software. **The Pitot tubes and cables have to be ordered separately.**

HD2134P.0: The kit consists of the HD2134P.0 **with 200mbar full scale** and thermocouple K input, 4 1.5V alkaline batteries, operating manual, case. **The Pitot tubes have to be ordered separately.**

HD2134P.2: The kit consists of the HD2134P.2 **datalogger with 200mbar full scale** and thermocouple K input, 4 1.5V alkaline batteries, operating manual, case and DeltaLog9 software. **The Pitot tubes and cables have to be ordered separately.**

HD2110CSNM: 8-pole connection cable MiniDin - Sub D 9-pole female for RS232C.

C.206: Cable to connect the instruments HD21…1 and .2 directly to the USB port of the PC.

HD2101/USB: Connection cable USB 2.0 connector type A - 8-pole MiniDin.

DeltaLog9: Software for download and management of the data on PC using Windows 98 to Vista operating systems.

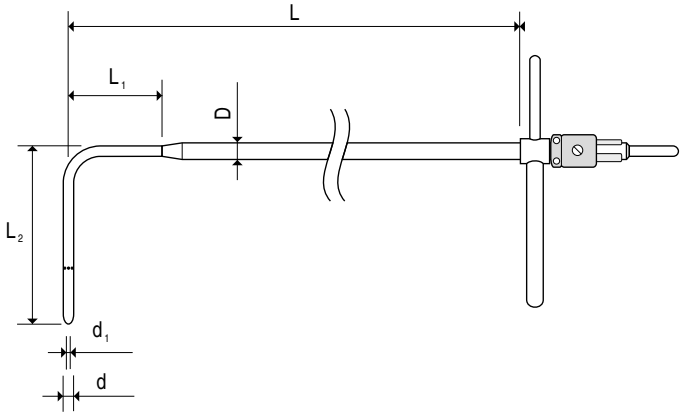
PW: Extension with male-female standard miniature connectors to connect the Pitot tube's thermocouple K to the instrument, length 2m.

SWD10: Stabilized power supply at 230Vac/12Vdc-1000mA mains voltage.

HD40.1: On request, portable, serial input, 24 column thermal printer, 58mm paper width.

PITOT TUBES

Stainless steel Pitot tubes to measure air speed and temperature for models provided with 'K' thermocouple. They can be connected to the SICRAM modules AP473S1, AP473S2, AP473S3 and AP473S4

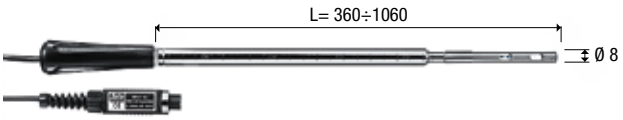


	d mm	d_1 mm	D mm	L mm	L_1 mm	L_2 mm	Temp.°C	Thermo-couple K	Material
T1-300	3	1	6	300	30	72	0…600°C	---	AISI 316
T2-400	5	2	8	400	45	120		---	
T2-600	5	2	8	600	45	120		---	
T3-500	8	3.2	8	500	---	192		---	
T3-800	8	3.2	8	800	---	192		---	
T3-800TC	8	3.2	8	800	---	192		TC	
T4-500	10	4.0	10	500	---	240		---	
T4-800	10	4.0	10	800	---	240		---	
T4-800TC	10	4.0	10	800	---	240		TC	
T4-1000	10	4.0	10	1000	---	240		---	
T4-1000TC	10	4.0	10	1000	---	240		TC	

Thermocouple K probes

All **thermocouple probes of type K** can be connected to the instruments by using the standard miniature connector, which can be found in the price list.
See page 137 for further details

AIR SPEED PROBES WITH SICRAM MODULE FOR PORTABLE INSTRUMENTS

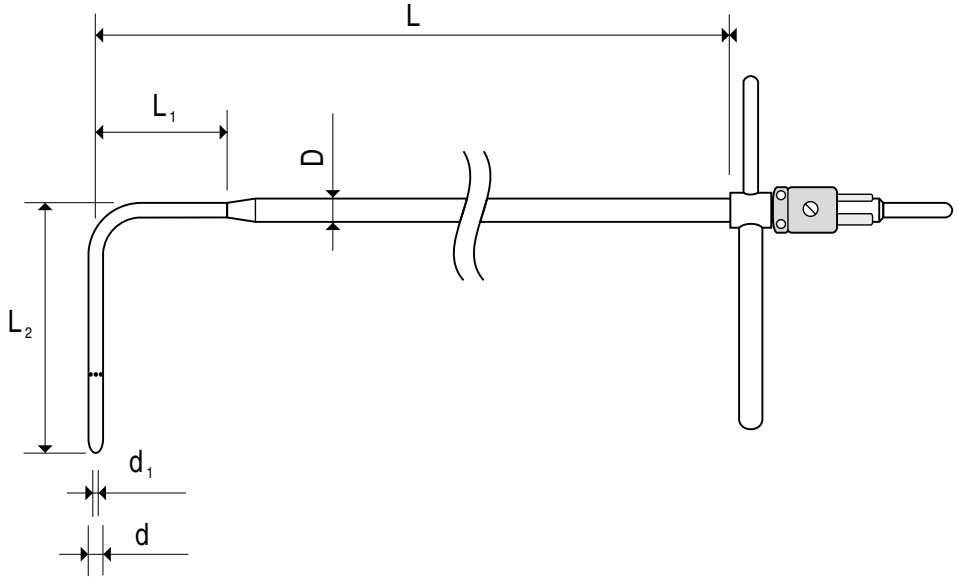
Code	Range m/s	Range Temp. °C	
HOT-WIRE			
AP471S1	0.1÷40	-25÷80	
AP471S2	0.1÷5		
AP471S3	0.1÷40		
AP471S4	0.1÷5	0÷80	**AP471S4**
VANE			
AP472S1	0.6÷25	-25÷80	
AP472S2	0.5÷20		
AP472S4L	0.8÷20		
AP472S4LT			
AP472S4H	10÷40		
AP472S4HT			
AST1	Telescopic shaft min. length 220 mm Telescopic shaft max. length 870 mm		

MODULES FOR PITOT TUBES

Code	Range Press. Diff. mbar	Range Speed m/s	
AP473S1	10 f.s.	2÷40	
AP473S2	20 f.s.	2÷55	
AP473S3	50 f.s.	2÷90	
AP473S4	100 f.s.	2÷130	
PW	Connection cable between module AP473S… and Pitot tube provided with TC		

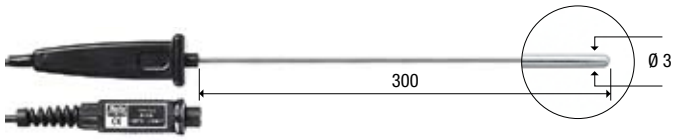
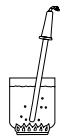
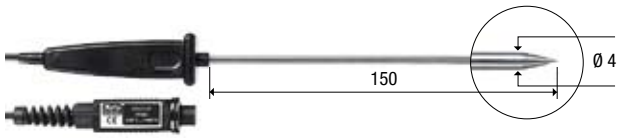
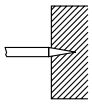
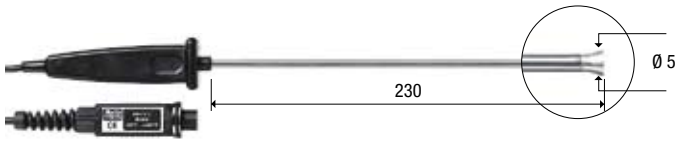
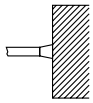
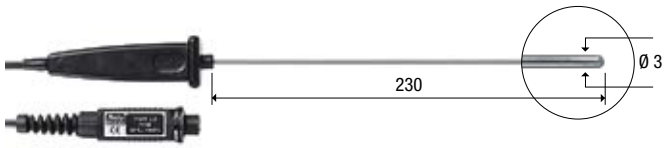
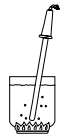
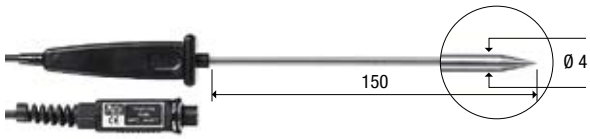
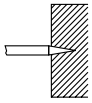
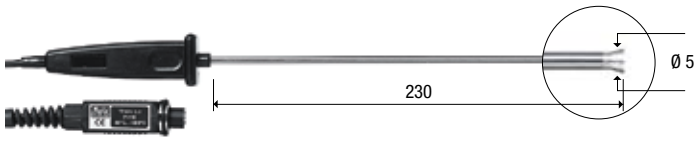
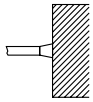
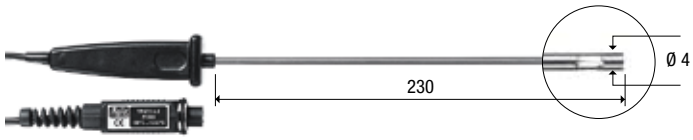
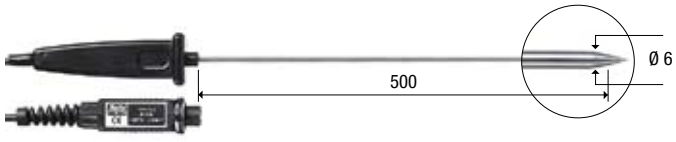
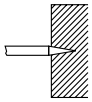
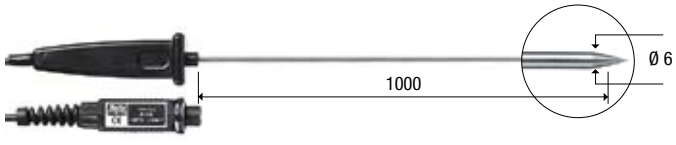
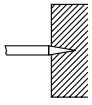
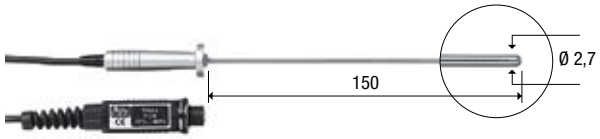
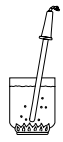
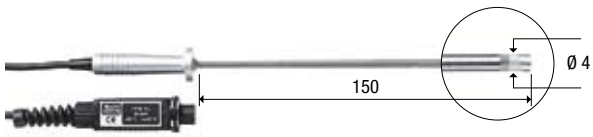
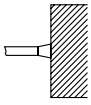
PITOT TUBES

Stainless steel Pitot tubes to measure air speed and temperature for models provided with 'K' thermocouple.
They can be connected to the SICRAM modules AP473S1, AP473S2, AP473S3 and AP473S4

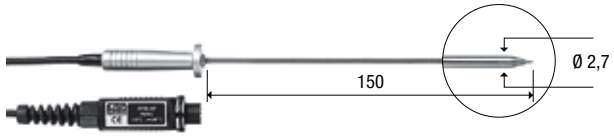
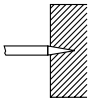
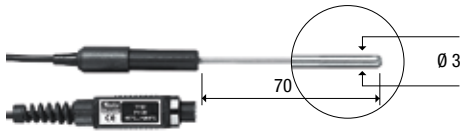
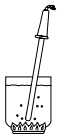
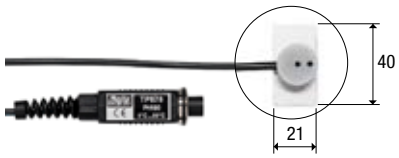
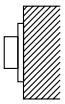
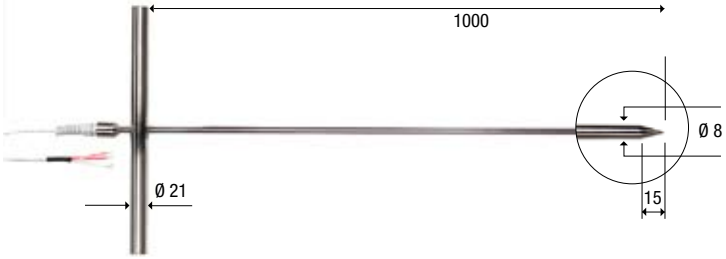
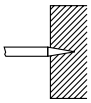


	d mm	d_1 mm	D mm	L mm	L_1 mm	L_2 mm	Temp. °C	Thermocouple K	Material
T1-300	3	1	6	300	30	72		---	
T2-400	5	2	8	400	45	120		---	
T2-600	5	2	8	600	45	120		---	
T3-500	8	3.2	8	500	---	192		---	
T3-800	8	3.2	8	800	---	192		---	
T3-800TC	8	3.2	8	800	---	192	0…600°C	TC	AISI 316
T4-500	10	4.0	10	500	---	240		---	
T4-800	10	4.0	10	800	---	240		---	
T4-800TC	10	4.0	10	800	---	240		TC	
T4-1000	10	4.0	10	1000	---	240		---	
T4-1000TC	10	4.0	10	1000	---	240		TC	

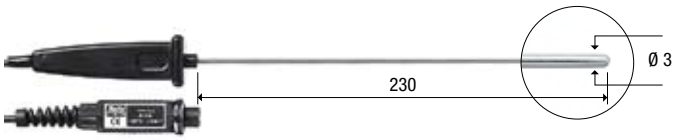
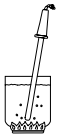
PT100 PROBES WITH SICRAM MODULE FOR PORTABLE INSTRUMENTS

CODE	°C max	τ s	DIMENSIONS	USE
TP 472 I	-196 +500	3s		
TP 473 P	-50 +400	5s		
TP 474 C	-50 +400	5s		
TP 472 I.0	-50 +400	3s		
TP 473 P.0	-50 +400	5s		
TP 474 C.0	-50 +400	5s		
TP 475 A.0	-50 +250	12s		
TP 472 I.5	-50 +400	3s		
TP 472 I.10	-50 +400	3s		
TP 49 A	-70 +400	3,5s		
TP 49 AC	-70 +400	5,5s		

PT100 PROBES WITH SICRAM MODULE FOR PORTABLE INSTRUMENTS

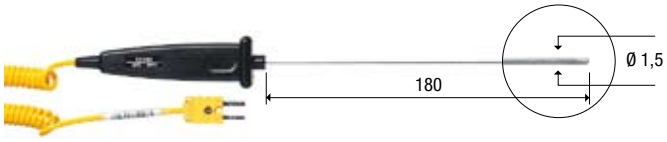
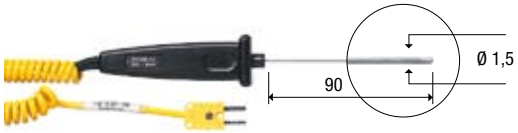
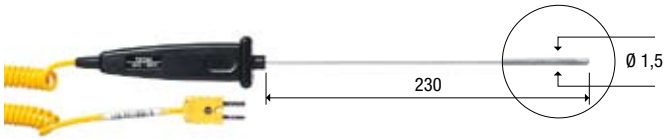
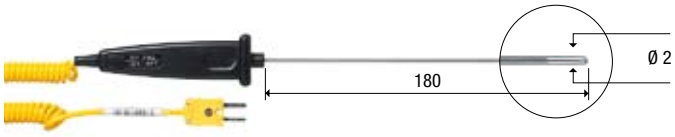
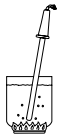
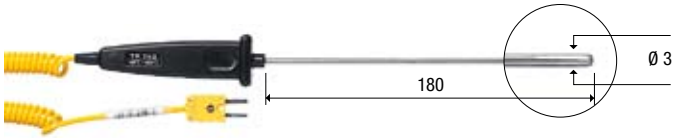
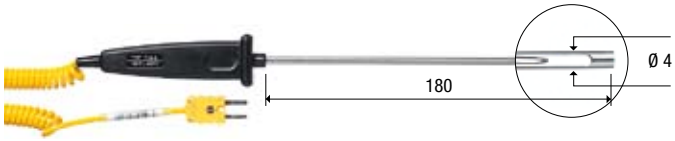
COD.	°C max	τ s	DIMENSIONS	USE
TP 49 AP	-70 +400	4s		
TP 87	-50 +200	3s		
TP 878	+5 +80	60s	Contact probe for solar panels. Cable L = 2m.	
TP 878.1	+5 +80	60s	Contact probe for solar panels. Cable L = 5m.	
TP879	-20 +120	60s	Penetration probe for compost. Cable L = 2m	 
TP 875	-30 +120	15s	Globe-thermometer probe for measuring radiant heat ø150 mm. (ISO7243, ISO7726). 4 wires Pt100 Sensor cable L=2m. **Equipped with SICRAM module.**	
TP 876	-10 +100	15s	Globe-thermometer probe for measuring radiant heat ø50 mm. (ISO7243, ISO7726). 4 wires Pt100 Sensor cable L=2m. **Equipped with SICRAM module.**	

Pt100 / Pt1000 SENSOR PROBES WITH TP 47 MODULE

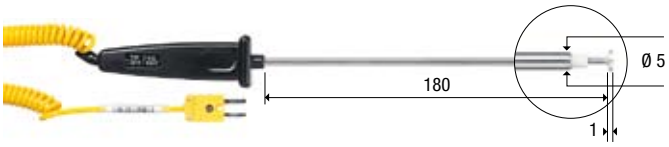
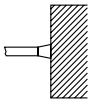
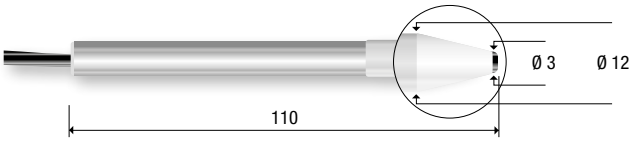
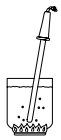
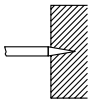
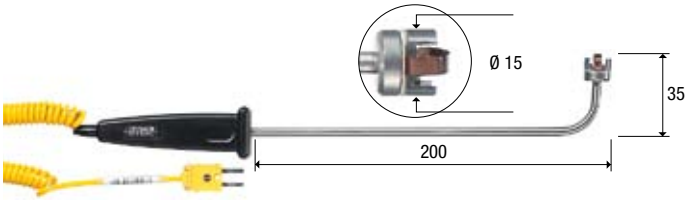
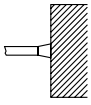
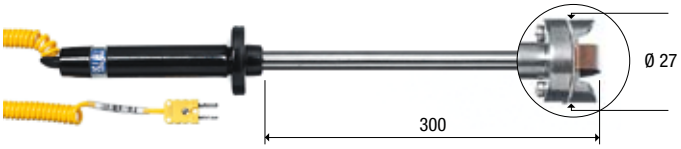
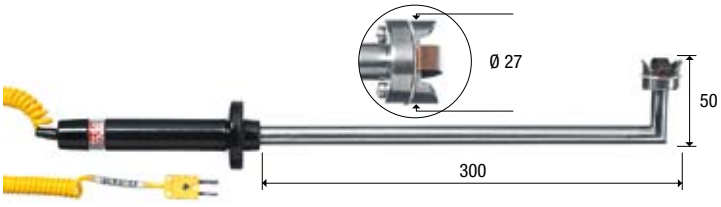
COD.	°C max	τ s	DIMENSIONS	USE
TP 47.100 (Pt100) **TP 47.1000 (Pt1000)**	-50 +400	3s		
TP 47	Only connector for connection of probes without SICRAM module: direct 3 and 4 wires Pt100, 2 wires Pt1000.			

THERMOCOUPLE PROBES FOR PORTABLE INSTRUMENTS

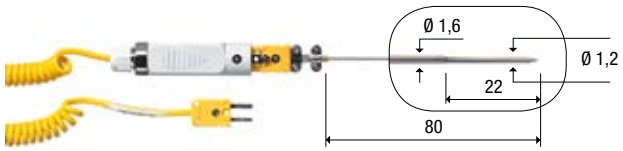
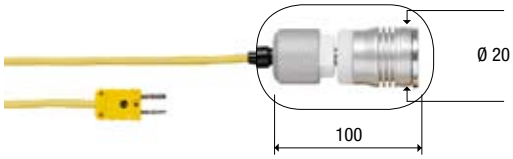
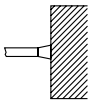
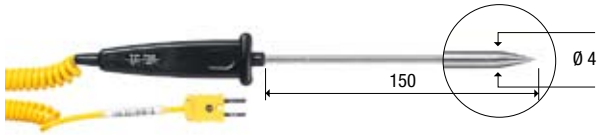
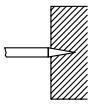
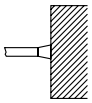
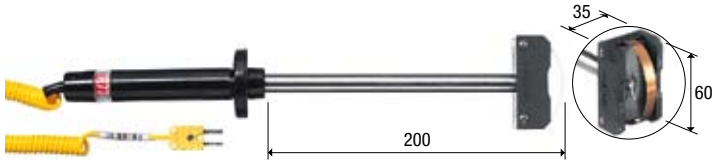
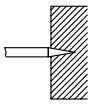
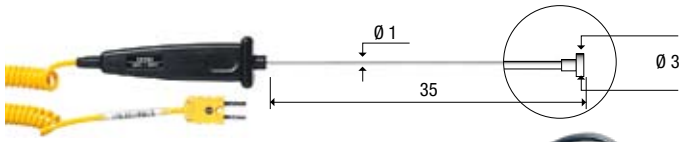
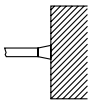
TYPE “K” (CHROMEL - ALUMEL) THERMOCOUPLE PROBES

CODE	°C max	τ s	DIMENSIONS	USE
TP 741	800	2s		
TP 741/1	400	2s		
TP 741/2	800	2s		
TP 742	800	2s		
TP 742/1	400	2s		
TP 742/2	800	2s		
TP 743	800	3s		
TP 744	400	4s		

TYPE “K” (CHROMEL - ALUMEL) THERMOCOUPLE PROBES

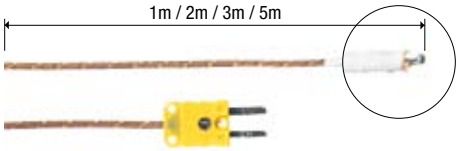
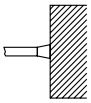
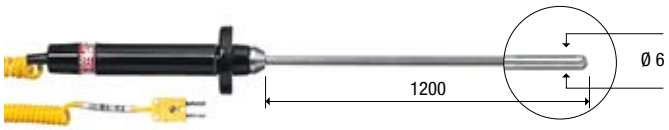
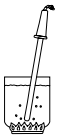
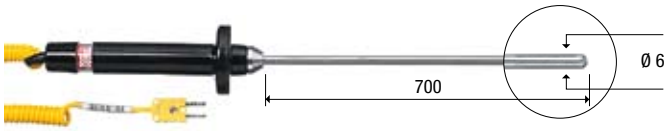
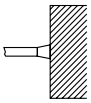
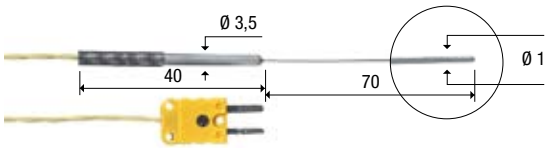
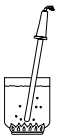
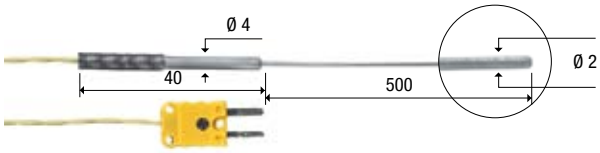
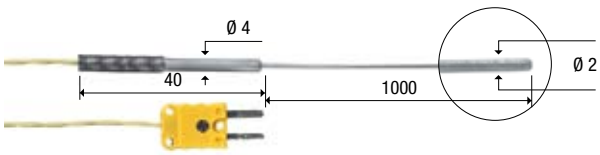
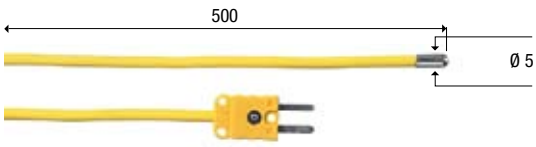
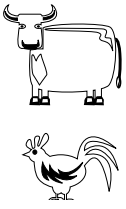
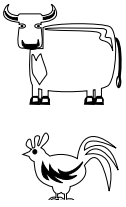
CODE	°C max	τ s	DIMENSIONS	USE
TP 745	500	5s		
TP 746	250	2s		
TP 750	1000	3s		
TP 750.0	800	3s		
TP 751	200	2s		
TP 754	500	2s		
TP 754/9	500	2s		
TP 755	800	2s		
TP 755/9	800	2s		

TYPE “K” (CHROMEL - ALUMEL) THERMOCOUPLE PROBES

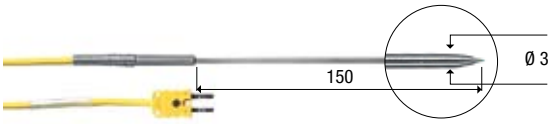
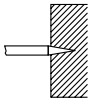
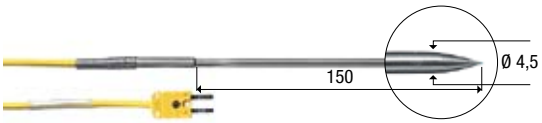
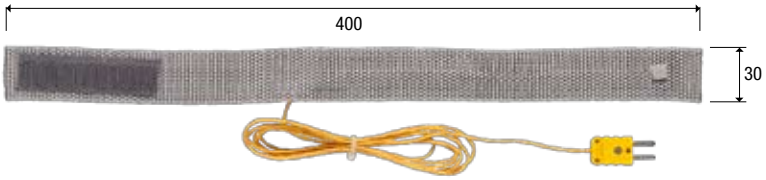
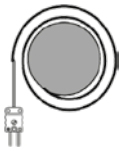
CODE	°C max	τ s	DIMENSIONS	USE
TP 756	200	2s		
TP 757	180	30s	MAGNETIC PROBE FOR CONTACT MEASURE ON MAGNETIC METALLIC SURFACES 	
TP 758	400	4s		
TP 758.1	400	4s		
TP 772	400	3s		
TP 774	250	2s		
TP 776	200	2s		
TP 777	200	3s		

Air speed

TYPE “K” (CHROMEL - ALUMEL) THERMOCOUPLE PROBES

CODE	°C max	τ s	DIMENSIONS	USE
TP 647 **TP 647/2** **TP 647/3** **TP 647/5**	300 300 300 300	2s 2s 2s 2s	For SIT calibration up to 300°C. 	
TP 651	1200	6s		
TP 652	1200	6s		
TP 655	180	2s		
TP 656	200	1s		
TP 656/1	1000	1s		
TP 656/2	1000	1s		
TP 657/1	100	5s		
TP 658	100	2s		

TYPE “K” (CHROMEL - ALUMEL) THERMOCOUPLE PROBES

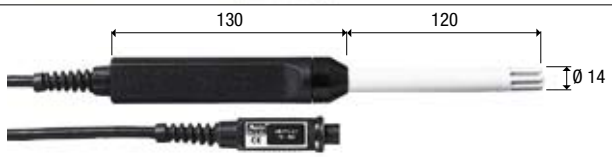
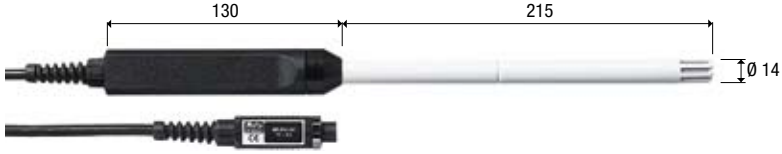
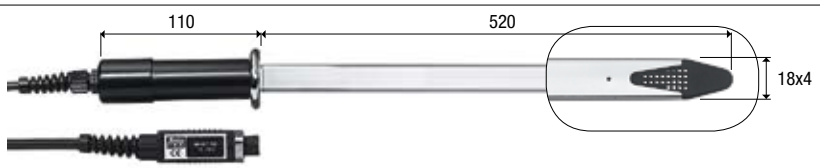
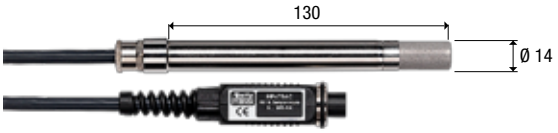
CODE	°C max	τ s	DIMENSIONS	USE
TP 659	400	3s		
TP 660	400	4s		
TP 661	-60 +50	30s		
TP 662	110	120s	PROBE WITH VELCRO TAPE FOR MEASURES ON PIPES MAX 110 DIAM. 	
CM **CS**	“K” “K”			
PW	“K”			

Response time for a 63% variation ($\tau_{0.63}$)

The response time τ **s** is the reaction time of the sensor to a temperature variation, with a signal variation when measuring that corresponds to a given percentage (63%) of the variation.
Response times are referred to:

Immersion probes when into water at 100°C.
Contact probes when in contact with a metallic surface at 200°C.
Air probes at air temperature of 100°C.

RELATIVE HUMIDITY AND TEMPERATURE PROBES FOR PORTABLE INSTRUMENTS - ACCESSORIES

CODE	Sensors	Range RH - Temp.	USE
HP472ACR	RH Pt100	5 ÷ 98% RH -20°C…+80°C	
HP572ACR	RH TC.K		
HP473ACR	RH Pt100		
HP474ACR		5 ÷ 98% RH -40°C…+150°C	
HP475ACR			
HP475AC1R			
HP477DCR			
HP478ACR			

SATURATED SOLUTIONS AND PROTECTIONS

CODE			USE
HD75 HD33 HD11	**Probe fixing adapter 24x1,5 Probe fixing adapter 12x1**		
P1 P2 P3 P4	Ø 26	M 24x1,5	**P1** **P2** **P3** **P4**
P5 P6 P7 P8	Ø 14	M 12x1	**P5** **P6** **P7** **P8**

PRESSURE PROBES: RELATIVE, ABSOLUTE, DIFFERENTIAL, FOR PORTABLE INSTRUMENTS

CODE	Differential pressure f.s.	Max. overpressure	
PP472 Barometric	600÷1100 mbar absolute	3 bar	
PP473S1	10 mbar	200 mbar	
PP473S2	20 mbar		
PP473S3	50 mbar		
PP473S4	100 mbar	300 mbar	
PP473S5	200 mbar	1 bar	
PP473S6	500 mbar		
PP473S7	1000 mbar	3 bar	
PP473S8	2000 mbar	6 bar	

HD2903T…
HD29V3T…
HD2937T…
HD29V37T…
HD29371T…
HD29V371T…

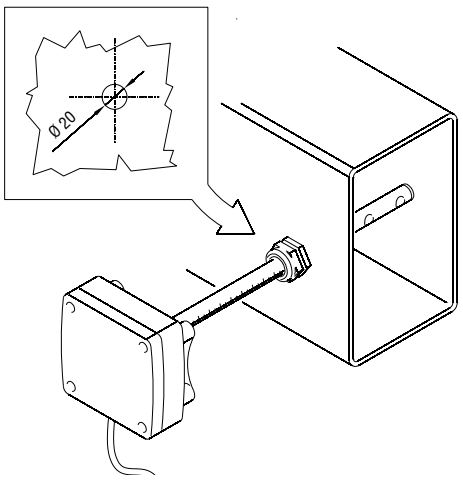
HD 2903T…, HD 29V3T…, HD 2937T…, HD 29V37T… HD 29371T…, HD 29V371T… TEMPERATURE, RELATIVE HUMIDITY AND AIR SPEED TRANSMITTERS

The family of transmitters series HD29 ... are employed in the control of air speed in the air conditioning and ventilation (HVAC / BEMS) in the pharmaceutical, museum, clean rooms, ventilation ducts, industrial sectors and households, crowded places, cafeterias, auditoriums, gymnasiums or on farms with large numbers of animals. The sensors in combination with an accurate electronics guarantee precise and reliable measurements in the time.
The sensor for the air speed is thin film, the probe sheath is AISI304, the filter relative humidity of 20µ wire mesh, materials that allow the use in hostile areas.
There are two possible installations: in the TO version, the horizontal probe is joined to the electronics enclosure while in the TC version the probe is connected to the electronics through a cable.
In the TO version, the duct probe is fixed to the electronics enclosure and it is available in three different lengths. To fix the probe to the duct, you can use, for example, the HD9008.31 flange, a 3/8" universal biconical connection or a PG16 metal cable gland (∅10…14mm).
In the TC version, the probe together with the sensors is equipped with a cable which can be 2, 5 or 10 meters long. The probes are available in three different lengths.

Common technical specifications		Notes
Air speed Measuring range	0.05…1m/s 0.1…2m/s 0.20…10m/s 0.20…20m/s	The measuring range can be selected by dip-switch.
Air speed Accuracy range 0…1m/s range 0…2m/s range 0…10m/s range 0…20m/s	 ±(0.06m/s+2% of measurement) ±(0.06m/s+2% of measurement) ±(0.4m/s+3% of measurement) ±(0.4m/s+3% of measurement)	at 50%RH and 1013hPa
Temperature Measuring range	-10…+60°C	HD2937, HD29V37, HD29371 and HD29V371 models
Temperature Accuracy	±0.3°C	
Relative Humidity Measuring range	5…98%RH	HD29371 and HD29V371 models
Relative Humidity Accuracy	±2.5% (5..90%RH), ±3.5% remaining range	
Relative Humidity Output Range	0…100%RH	
Output (according to the models)	4…20mA 0…10Vdc	R_L < 500Ω R_L > 10kΩ
Power supply	16…40Vdc or 12…24Vac±10%	
Response time (selected by jumper)	0.2s 2.0s	Fast Slow
Operating temperature electronics probe	 0…+60°C -10…+80°C	
Compensation temperature	0…+80°C	
Storage temperature	-10…+70°C	
Electronics protection class	IP67	
Sensor working conditions	Clean air, RH<80%	
Case dimensions	80x84x44	Without probe

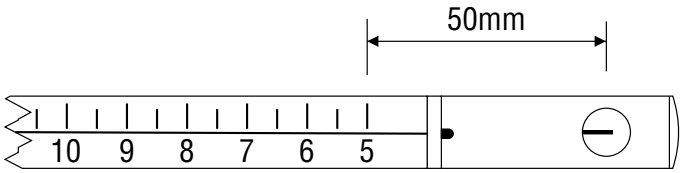
Model description

Model	Output		Measured parameters		
	4…20mA	0…10Vdc	Air speed	Temperature	Relative Humidity
HD2903T...	✓		✓		
HD29V3T...		✓	✓		
HD2937T...	✓		✓	✓	
HD29V37T...		✓	✓	✓	
HD29371T...	✓		✓	✓	✓
HD29V371T...		✓	✓	✓	✓

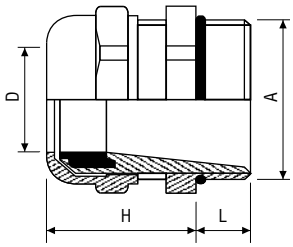
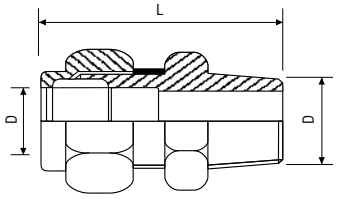


Installation notes

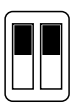
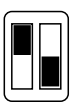
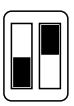
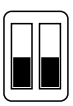
- The window of the sensor (or of the sensors) must be oriented in the direction of flow. To facilitate the proper positioning of the probe, eg. inside of a pipe, a graduated scale, engraved along the stem, indicates the depth of introduction of the window speed sensor in the channel. To properly orient the sensor to the flow, once introduced into the channel, the air speed window and line on the base of the scale are on the same axis.



- To fix the probe inside a ventilation duct, a pipe , etc. you can use, for example, HD9008.31 flange, a PG16 metal cable gland (∅10…14mm) or a 3/8" universal biconical connection.

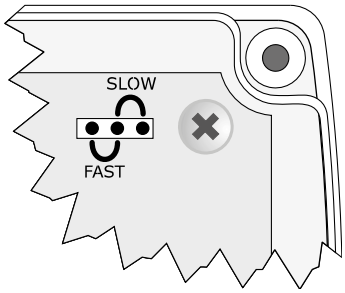
	HD9008.31 Flange
	**PG16 metal cable gland** D = 10…14mm L = 6.5mm H = 23mm A = PG16
	**Universal biconical connector** L = 35mm D = 14mm A = 3/8"

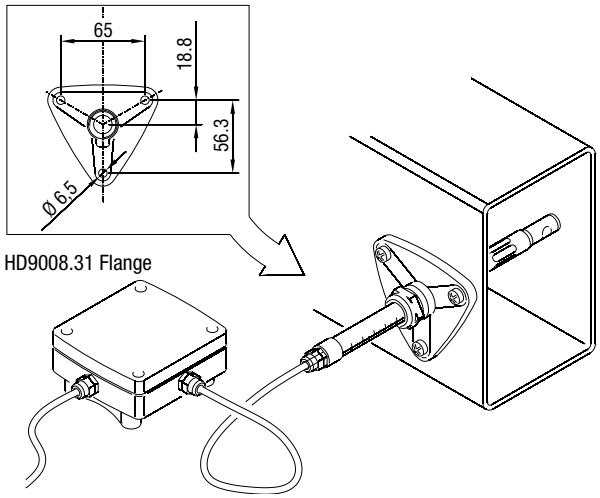
- The transmitters are factory calibrated and no further adjustments are required.
- To select the air speed **output range** by using the dual dip-switch on the board, please see the chart below:

Output range	0…1m/s	0…2m/s	0…10m/s	0…20m/s
Dip-switch position				

- Dip-switch should always be at the end of its final limit in both directions.

- The jumper on the board selects an **integrated response time in 0.2s in the FAST position and in 2s in the SLOW position. Please set the integration time at SLOW in case of turbulence, otherwise please select the FAST position.**





HD9008.31 Flange

Electrical connections

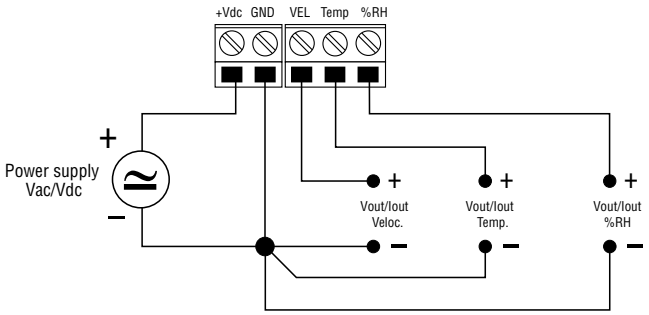
Power supply

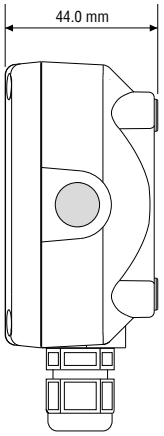
Power the instrument at the voltage shown in the electrical specifications: power supply terminals are marked as +Vdc and GND.

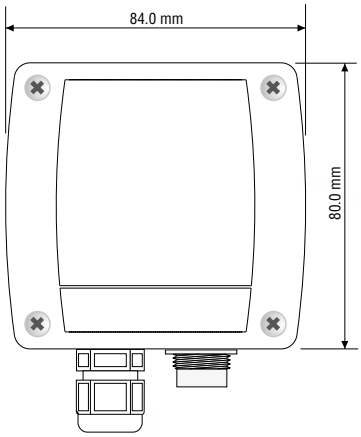
Analogue output

According to the model, the output signal comes from:

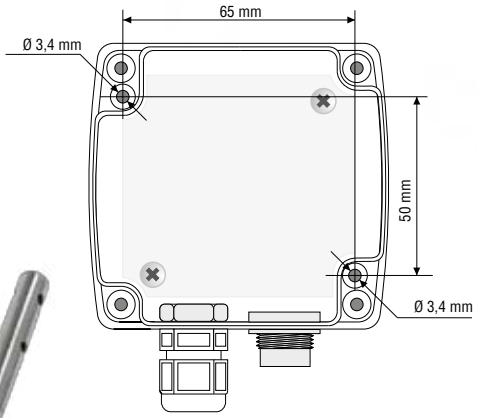
- VEL and GND terminals for air speed transmitters,
- VEL and GND, Temp and GND terminals for temperature / air speed transmitters,
- VEL and GND, Temp and GND, %RH and GND terminals for temperature / relative humidity / air speed transmitters.







Template



HD2903T… and HD29V3T… ORDERING CODES

HD2903T…: Active transmitter for measuring air speed in ducts, 4…20mA output. AISI 304 steel probe, diameter 12mm, compact unit HD2903TO… version with probe joined to the electronics enclosure, HD2903TC… version with probe connected to the electronics through a cable. Air speed range 0.05…1m/s - 0.1…2m/s 0.20…10m/s - 0.20…20m/s selected by jumper. Power supply 16...40Vdc or 12…24Vac. Air probe operating temperature -10+80°C.

HD29V3T…: Active transmitter for measuring air speed in ducts, 0…10Vdc output. AISI 304 steel probe, diameter 12mm, compact unit HD29V3TO… version with probe joined to the electronics enclosure, HD29V3TC… version with probe connected to the electronics through a cable. Air speed range 0.05…1m/s 0.1…2m/s - 0.20…10m/s - 0.20…20m/s selected by jumper. Power supply 16...40Vdc or 12…24Vac. Air probe operating temperature -10+80°C.

H D 2 9 3 T

Cable length (… TC … models only)
2 = 2m
5 = 5m
10 = 10m

Probe length
T01 = 150mm
T02 = 200mm
T03 = 300mm
TC1 = 210mm
TC2 = 410mm
TC3 = 560mm

3 = Air speed

No sign = 4…20mA analogue output
V = 0…10Vdc analogue output

HD2937T… and HD29V37T… ORDERING CODES

HD2937T…: Active transmitter for measuring air speed and temperature in ducts, 4…20mA outputs. AISI 304 steel probe, diameter 12mm, compact unit HD2937TO…version with probe joined to the electronics enclosure, HD2937TC…version with probe connected to the electronics through a cable. Air speed range 0.05…1m/s - 0.1…2m/s - 0.20…10m/s - 0.20…20m/s selected by jumper, fixed temperature range -10…+60°C. Power supply 16...40Vdc or 12…24Vac. Air probe operating temperature -10+80°C.

HD29V37T…: Active transmitter for measuring air speed and temperature in ducts, 0…10Vdc outputs. AISI 304 steel probe, diameter 12mm, compact unit HD29V37TO…version with probe joined to the electronics enclosure, HD29V37TC… version with probe connected to the electronics through a cable. Air speed range 0.05…1m/s - 0.1…2m/s - 0.20…10m/s - 0.20…20m/s selected by jumper, fixed temperature range -10…+60°C. Power supply 16...40Vdc or 12…24Vac. Air probe operating temperature -10+80°C.

H D 2 9 3 7 T

Cable length (… TC … models only)
2 = 2m
5 = 5m
10 = 10m

Probe length
T01 = 200mm
T02 = 400mm
T03 = 550mm
TC1 = 210mm
TC2 = 410mm
TC3 = 560mm

7 = Temperature output
3 = Air speed

No sign = 4…20mA analogue output
V = 0…10Vdc analogue output

HD29371T… and HD29V371T… ORDERING CODES

HD29371T…: Active transmitter for measuring air speed, temperature and relative humidity in ducts, 4…20mA outputs. AISI 304 steel probe, diameter 14mm, compact unit HD29371TO version… with probe joined to the electronics enclosure, HD29371TC… version with probe connected to the electronics through a cable. Air speed range 0.05…1m/s - 0.1…2m/s - 0.20…10m/s - 0.20…20m/s selected by jumper, fixed temperature range -10…+60°C, relative humidity range 0…100%RH. Power supply 16...40Vdc or 12…24Vac. Air probe operating temperature -10+80°C.

HD29V371T…: Active transmitter for measuring air speed, temperature and relative humidity in ducts, 0…10Vdc outputs. AISI 304 steel probe, diameter 14mm, compact unit HD29V371TO…version with probe joined to the electronics enclosure, HD29V371TC… version with probe connected to the electronics through a cable. Air speed range 0.05…1m/s - 0.1…2m/s - 0.20…10m/s - 0.20…20m/s selected by jumper, fixed temperature range -10…+60°C, relative humidity range 0…100%RH. Power supply 16...40Vdc or 12…24Vac. Air probe operating temperature -10+80°C.

H D 2 9 3 7 1 T

Cable length (… TC … models only)
2 = 2m
5 = 5m
10 = 10m

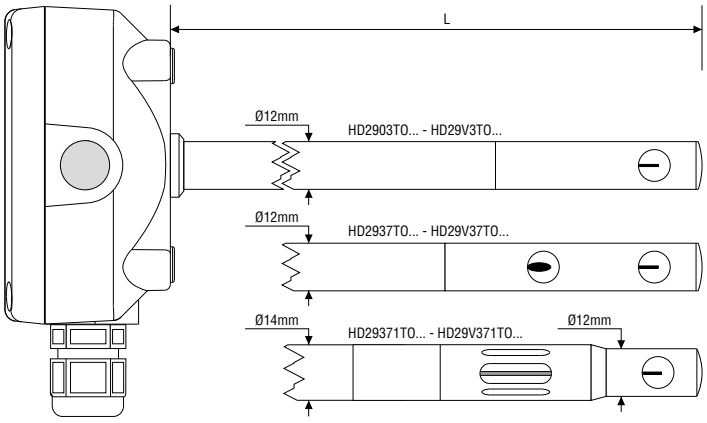
Probe length
T01 = 180mm
T02 = 280mm
T03 = 380mm
TC1 = 185mm
TC2 = 285mm
TC3 = 385mm

1 = %RH output
7 = Temperature output
3 = Air speed

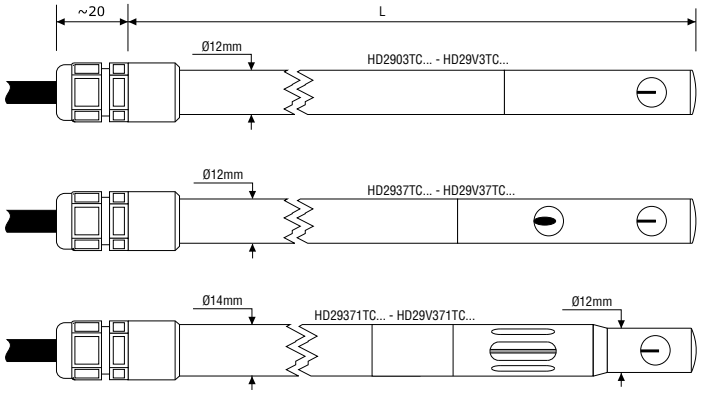
No sign = 4…20mA analogue output
V = 0…10Vdc analogue output

Probe dimensions:

TO series



TC series



HD403TS…
HD4V3TS…

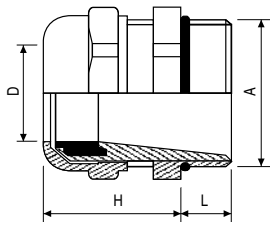
HD 403TS… E HD 4V3TS…
ACTIVE HOTWIRE AIR SPEED TRANSMITTERS

The **HD403TS**… series of hotwire air speed transmitters are used for measuring and controlling air speed in ventilation ducts, clean rooms, extractor fans, as well as monitoring air quality (IAQ), etc. These transmitters are equipped with a hotwire sensor, in the directional or omnidirectional version. The HD403TS… series of transmitters have a 4…20mA output, while the HD4V3TS… series have a 0…10Vdc output.
Two measuring ranges are available: 0.20…40m/s for …S1 and …S3 models with directional probe and 0.08…5.00m/s for …S2 and…S4 models with omnidirectional probe.

Technical specifications		Notes
Air speed Standard measuring range	0.08…5.00m/s 0.20…40.0m/s	…S2 and …S4 models …S1 and …S3 models
Measurement accuracy	±(0.2m/s+3%f.s.)	
Response time (integration) selected by jumper	0.2s 2.0s	Fast Slow
Operating temperature electronics probe	 0…+60°C 0…+80°C	
Compensation temperature	0…+80°C	
Storage temperature	-10…+70°C	
Electronics protection class	IP67	
Sensor working conditions	Clean air, RH<80%	
Case dimensions	58x65x35	Without probe
Standard cable length	2m	

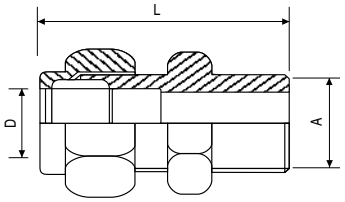
Model	Output	Power supply	Load resistance
HD403TS...	4…20mA	12…40Vdc or 24Vac	R_L < 500Ω
HD4V3TS...	0…10Vdc	16…40Vdc or 24Vac	R_L > 10kΩ

Installation notes
- The probe must be used with clean air only and humidity below 80%.
- In …S1 and …S3 directional probes, the sensor hole must be oriented in the same direction as the flow: turn the probe so that the displayed speed will be the highest, at constant flow.
- To fix the probe of …S1, …S2 and …S3 models inside a ventilation duct, a pipe ,etc. use a PG9 or PG11 metal cable gland according to the shape or a connection equipped with a ¼" rubber ring.



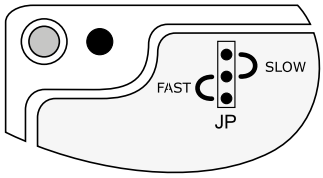
PG9
D = 4…8mm
L = 6mm
H = 20mm
A = PG9

PG11
D = 5…10mm
L = 6mm
H = 21mm
A = PG11

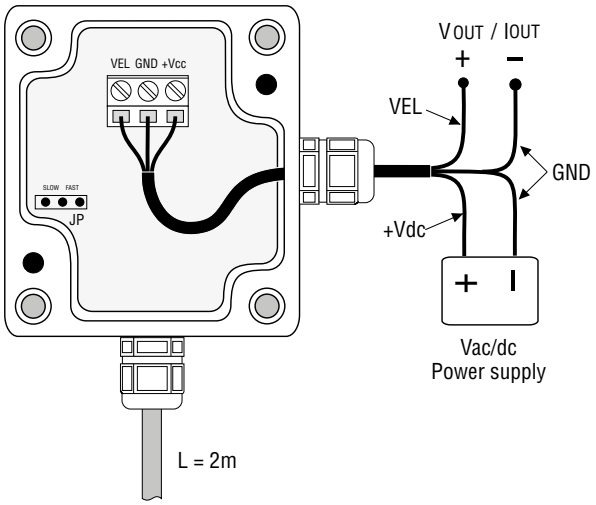


L = 30.5mm
D = 8mm
A = ¼"

- The transmitters are factory calibrated and no further adjustments are required.
- Select the **response time** by using the JP jumper: in the FAST position, the response time is 0.2s, in the SLOW position is 2s. Set the jumper on SLOW in case of turbulence, otherwise please select the FAST position.

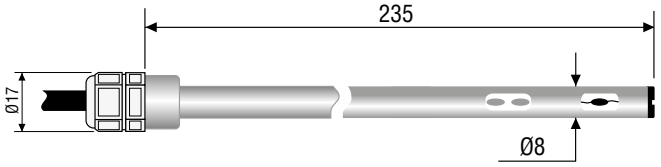


Electrical connections
Power supply and output
Power the instrument at the voltage shown in the electrical specifications: power supply terminals are marked as +Vcc and GND. The output signal comes from VEL and GND terminals. To make the connection, please use a three-wire cable as shown in the drawing below.

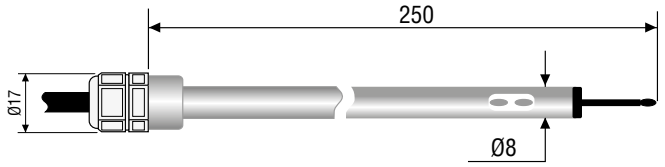


Probe dimensions

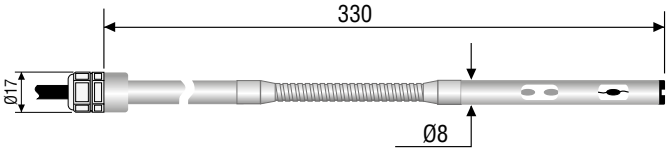
AP403S1 Directional probe for HD4…3TS1



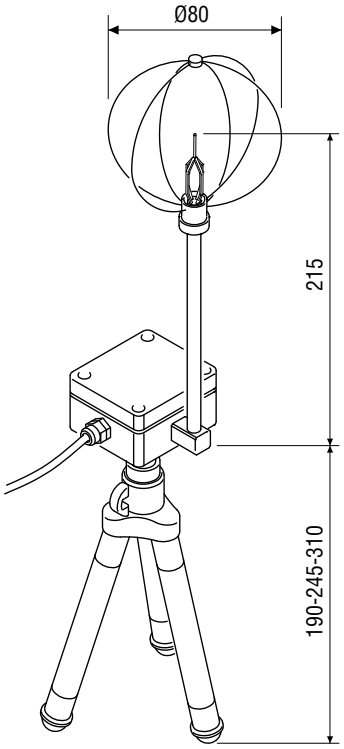
AP403S2 Omnidirectional probe for HD4…3TS2



AP403S3 Flexible directional probe for HD4…3TS3



AP403S4 Omnidirectional probe for HD4…3TS4



PURCHASING CODES

HD403TS1: Active hotwire air speed transmitter with 4…20mA output. Measuring range: 0.20…40m/s. Directional probe ∅=8mm, cable L=2m.

HD4V3TS1: Active hotwire air speed transmitter with 0…10Vdc output. Measuring range: 0.20…40m/s. Directional probe ∅=8mm, cable L=2m.

HD403TS2: Active hotwire air speed transmitter with 4…20mA output. Measuring range: 0.08…5.00m/s. Omnidirectional probe ∅=8mm, cable L=2m.

HD4V3TS2: Active hotwire air speed transmitter with 0…10Vdc output. Measuring range: 0.08…5.00m/s. Omnidirectional probe ∅=8mm, cable L=2m.

HD403TS3: Active hotwire air speed transmitter with 4…20mA output. Measuring range: 0.20…40m/s. Flexible directional probe, ∅=8mm, cable L=2m.

HD4V3TS3: Active hotwire air speed transmitter with 0…10Vdc output. Measuring range: 0.20…40m/s. Flexible directional probe, ∅=8mm, cable L=2m.

HD403TS4: Active hotwire air speed transmitter with 4…20mA output. Measuring range: 0.08…5.00m/s. Omnidirectional probe with wired protective cover ∅=80mm. Equipped with tripod.

HD4V3TS4: Active hotwire air speed transmitter with 0…10Vdc output. Measuring range: 0.08…5.00m/s. Omnidirectional probe with wired protective cover ∅=80mm. Equipped with tripod.

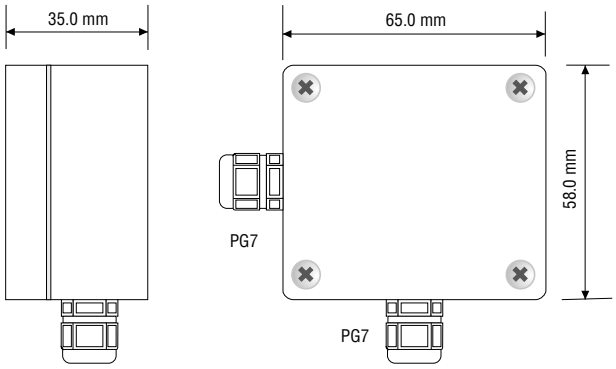
How to compose your purchasing code

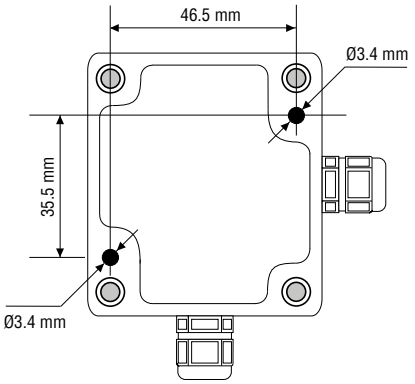
HD4 □ **3TS** □

- **1** = Directional probe
- **2** = Omnidirectional probe
- **3** = Flexible directional probe
- **4** = Omnidirectional probe with tripod

- **0** = 4…20mA signal output
- **V** = 0…10Vdc signal output

Dimensions



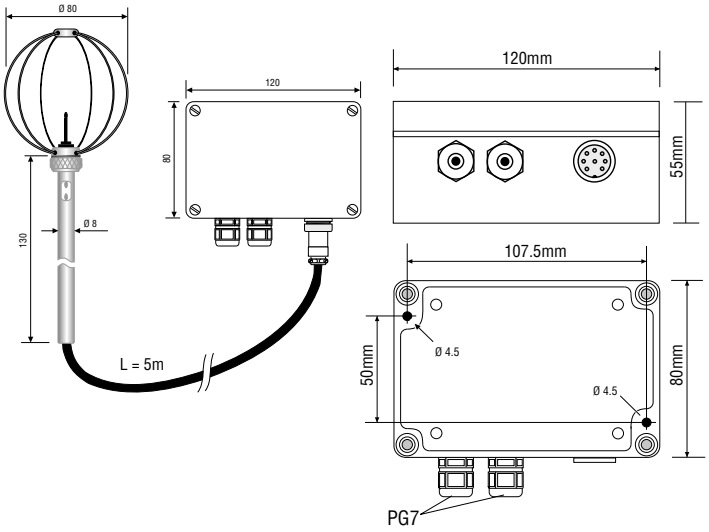


Template

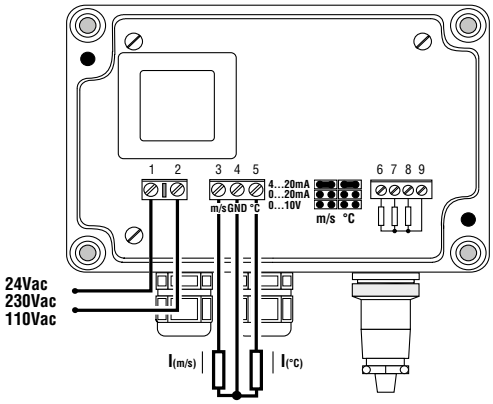
HD103T.0

HD 103T.0
ACTIVE AIR SPEED TRANSMITTER

The HD103T.0 measures air speed by using an omnidirectional hotwire probe. It has three configurable analogue outputs: 4…20mA and 0…20mA current outputs and 0…10Vdc voltage output (0…1Vdc or 0…5Vdc outputs can be supplied on request). The output can be chosen by using the jumpers inside the instrument.
The sensor set at the top of the probe is very delicate and must be protected with the special protection provided with the instrument. During transport, the sensor is enclosed in a cylinder screwed on the top of the probe; during installation, remove the protection and apply the protective cover in its place.



Technical specifications		Notes
Air speed Measuring range	0.08…5m/s	
Air speed Accuracy range 0…0.99m/s range 1…5m/s	 ±0.06m/s ±0.3m/s	at 50%RH and 1013hPa
Temperature measuring range	-10…+80°C	
Temperature Accuracy range 0…70°C remaining range	 ±0.3°C ±0.4°C	
Output (for both temperature and air speed)	4…20mA 0…20mA 0…10Vdc	0…5Vdc and 0…1Vdc outputs on request
Load resistance	R_L < 500Ω R_L > 100kΩ	for current outputs for voltage outputs
Power supply	24Vac ±10%, 50…60Hz	110Vac or 230Vac on request
Operating temperature electronics probe	 -5…+50°C -20…+80°C	5÷80%RH
Compensation temperature	0…+80°C	
Storage temperature	-10…+80°C	
Electronics protection class	IP67	
Sensor working conditions	Clean air, RH<80%	
Case dimensions	120 x 80 x 55	Without probe
Probe cable length	L=5m	



Installation notes
- Select the type of air speed and temperature **output** by using the jumpers placed on the board.
- The probe must be used with clean air only and humidity below 80%.
- The transmitters are factory calibrated and no further adjustments are required.
- Each instrument is calibrated with its own probe. Don't mix up probes and instruments: the calibration will have to be repeated.

Electrical connections
Power supply
Power the instrument at the voltage shown in the electrical specifications.
Analogue output
The output signal comes from m/s and *GND* terminals for air speed, from *°C* and *GND* for temperature.

PURCHASING CODES
HD103T.0: Active air speed and temperature transmitter. Analogue outputs: 4…20mA, 0...20mA and 0...10Vdc selected by jumper. Omnidirectional probe with wired protective cover ∅=80mm connected to the electronics through a 5-metre cable. Air speed range 0…5m/s. Temperature output range -20...+80°C. Power supply 24Vac (115 and 230Vac on request). Probe operating temperature -10...+80°C, electronics operating temperature -5...+50°C.

HD 2003
HD 2003.1

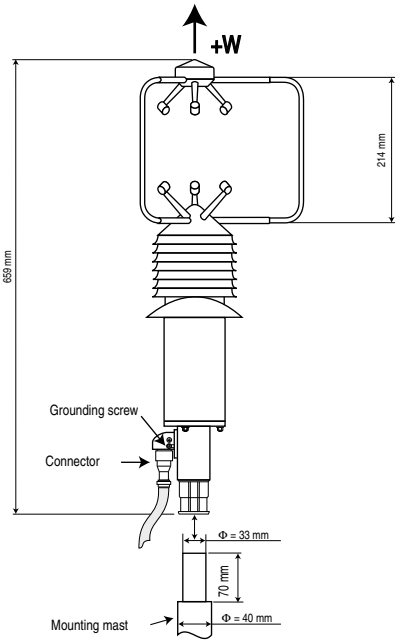
HD 2003, HD 2003.1
THREE AXIS ULTRASONIC ANEMOMETER

HD2003 and HD2003.1 are three axis ultrasonic anemometers, they measure the speed and direction of wind, the U-V-W Cartesian components of speed, sound speed and sonic temperature.
The HD2003 allows also to detect temperature and relative humidity of the air and barometric pressure.

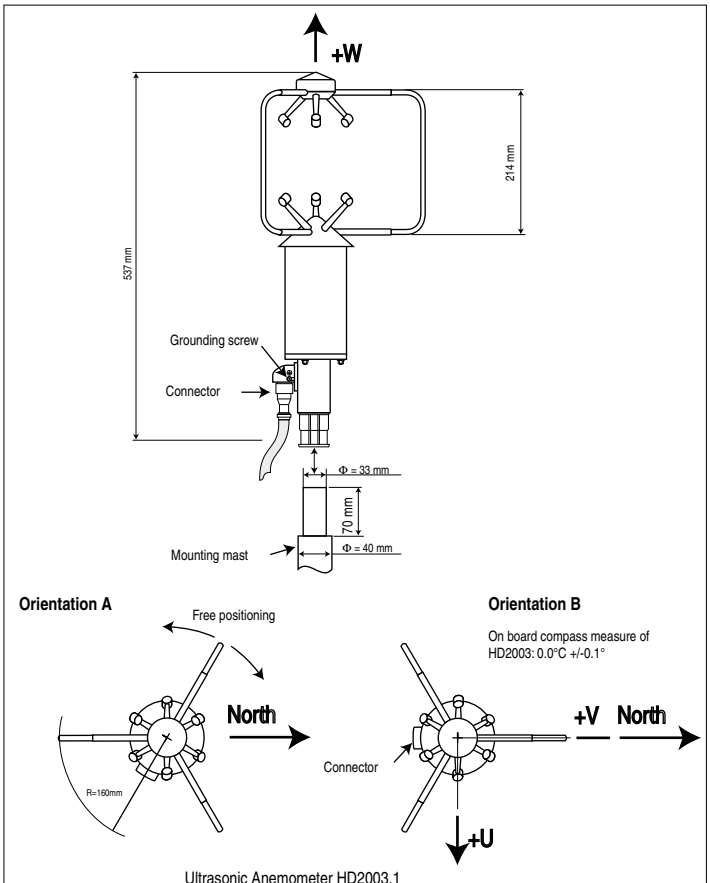
The HD2003 main features are:
- Determination of the anemometric quantities represented in diverse measurement units: wind speed and direction, U-V-W Cartesian components of speed, sound speed, sonic temperature.
- **(HD2003 Model)** additional output quantities: Temperature, Relative Humidity and Pressure.
- 5 analogue voltage or current outputs, with different measuring ranges.
- RS232 and Multidrop RS485 Serial Communication interfaces.
- Configurable output rate of digital output data string.
- Configurable average periods 1÷60sec and 1÷60min. for all output quantities.
- Processing algorithms and validation of the raw measurement signals to provide a measure of greatness anemometer with ± 1%.
- Digital high frequency data acquisition mode with 50Hz data output.
- Self diagnostics with error checking and report.
- Reliability and accuracy throughout the measuring range without further calibration.
- Flexible, easy-to use **demo software**, configurable according to the user's needs through Computer interface.
- User interface for managing the setup and software upgrade via RS232 or RS485.
- Compass magneto sensor for automatic alignment to magnetic north.
- No moving parts, maintenance costs and reduced service.
- Robust construction, suitable to operate continuously in harsh conditions.
- Low power consumption.
- **(On request)** Heating Option: built-in heating device of sonic transducers, to prevent ice and snow formation. Assures correct measurements even in presence of sleet or snow.

Typical applications:
- Meteorology
- Aviation and Navigation
- Tunnels, Highways
- Climatology
- Sport and winter stations
- Safety in yards
- Industrial buildings

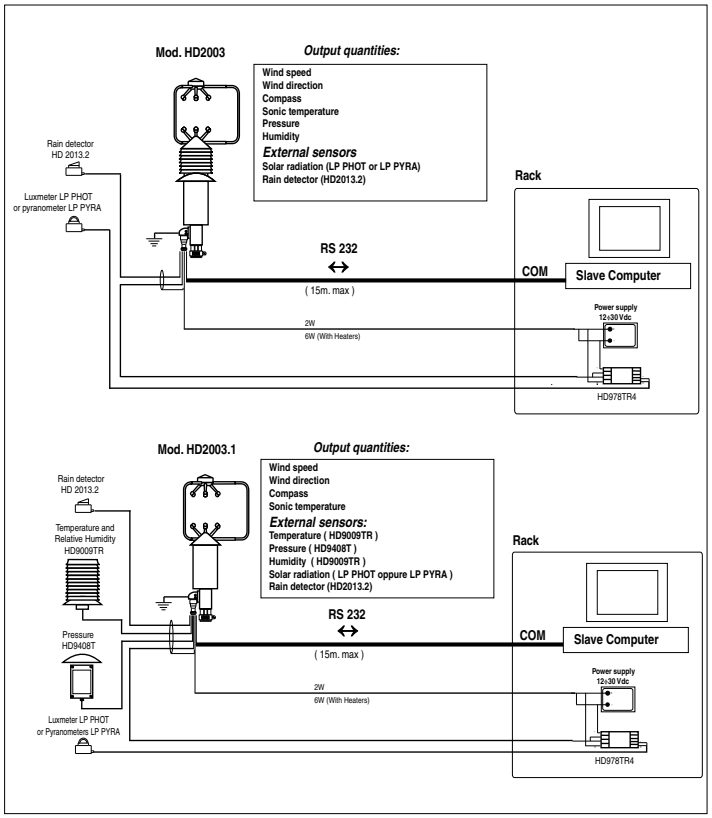
Technical specifications
Output quantities
- Anemometric parameters — Wind speed and direction, Sound Speed, Sonic Temperature, U-V-W Components
- Meteorological parameters — **(Model HD2003)** Pressure, Temperature, Relative Humidity
- Heading — Compass with magnetic Azimuth
- Moving Averages — 1÷60 sec./ 1 ÷ 60 min.
- Output rate — 1÷3600 sec. or 1/50 sec. (RS232 or RS485)

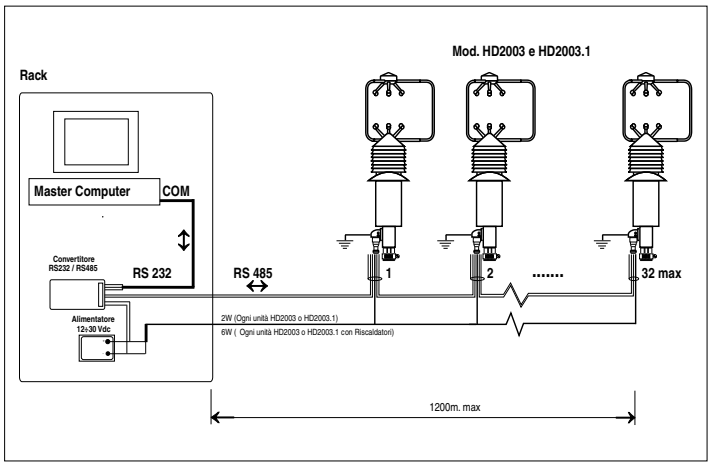


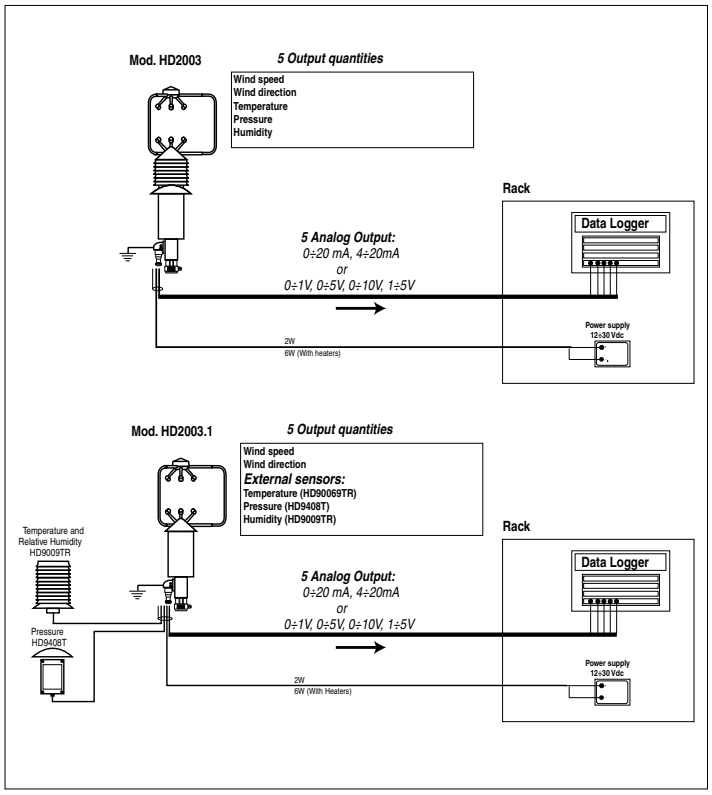
Ultrasonic Anemometer HD2003



Ultrasonic Anemometer HD2003.1







Wind Speed

• Measuring unit	m/s, cm/s, km/h, knots, mph
• Range	0÷65 m/s (234 km/h)
• Resolution	0.01 m/s
• Accuracy	± 1% of reading

Wind Direction

• Range	Azimuth: 0÷360° Elevation: ± 60°
• Resolution	0. 1°
• Accuracy	± 1°

Sound speed

• Range	300 ÷ 380 m/s
• Resolution	0.01 m/s
• Accuracy	± 1% of reading

Sonic Temperature

• Range	-40 + 60°C
• Resolution	0.1 °C
• Accuracy	± 1°C

Compass

• Range	0 ÷ 360°
• Resolution	0.1 °
• Accuracy	± 1°

Digital Outputs

• Communications	RS-232 full duplex, Multidrop RS-485 half duplex
• Baud Rate	9600 ÷ 115200 bit/sec.
• Output Rate	Normal functioning mode: 1 ÷ 3600 sec Digital high frequency: 1/50 sec
• Measured data	Digital string of anemometric quantities and compass **(Model HD2003)** Pressure, temperature, relative humidity

Analog Outputs

• Number	5 freely, selectable output of all sizes available
• Range	0÷20mA, 4÷20mA, 0÷1V, 0÷5V, 1÷5V, 0÷10V
• Resolution	14 bit max

Power supply

• Range	12 ÷ 30 VDC
• Power	<2W (typically 110mA @ 15Vdc) <6W Models with heaters and environment temperature not lower than -10°C

Heaters (On request at the time of placing the order)
Heating with automatic temperature control on sonic transducers, to prevent ice and snow formation.

Temperature, Relative Humidity, and Pressure Sensors (Model 2003)

Temperature
Pt100 sensor
Analog output 0÷20mA, 4÷20mA, 0÷1V, 0÷5V, 1÷5V, 0÷10V
Range: -40 + 60°C
Resolution 0.1°C
Accuracy ± 0.2°C, ± 0.15°C of reading

Relative Humidity
Capacitive sensor
Analog output (0 ÷ 100% RH): 0÷20mA, 4÷20mA, 0÷1V, 0÷5V, 1÷5V, 0÷10V
Range: 0 ÷ 100% RH
Resolution 0.1 % RH
Accuracy ± 2% RH @ 23°C in the range 5÷90%RH, 2.5% in the remaining range.

Pressure
Piezoresistive sensor
Analog output: 0÷20mA, 4÷20mA, 0÷1V, 0÷5V, 1÷5V, 0÷10V
Range 800 ÷ 1100 mbar (On request: 600 ÷ 1100 mbar)
Resolution 0.1mbar
Accuracy ± 0.4mbar @ 20°C
Thermic effects ± 0.8mbar from -40°C up to +60°C
Long-term stability < 0.2% f.s. in 6 months @ 20°C

Order codes:

HD2003: Static anemometer for measuring the speed and direction of wind, air temperature, relative humidity and barometric pressure. Wind speed and direction, U-V-W Cartesian Components of speed, sound speed, sonic temperature. Five different analogue voltage or current outputs for different ranges. Communication software for bi-directional links for net connection of different anemometers, interfaces available RS-232 and RS-485. Different measuring units and average periods are available. Ultrasonic transducers heating as optional. 12..30 Vdc power supply, 120mA consumption at 15Vdc. To be mounted on a mast diam.33mm. Flying connector included.

HD2003R: Transducers heating option for HD 2003 against ice or snow.

HD2003.1: Static anemometer for measuring the speed and direction of wind. Wind speed and direction, U-V-W Cartesian Components of speed, sound speed, sonic temperature.

Five different analogue voltage or current outputs for different ranges. Communication software for bi-directional links for net connection of different anemometers, interfaces available RS-232 and RS-485. Different measuring units and average periods are available. Transducers heating as optional. 12..30 Vdc power supply, 120mA consumption at 15Vdc. To be mounted on a mast diam.33mm. Flying connector included.

HD200.1R: Transducers heating option for HD 2003.1 against ice or snow.

CP2003/5: 26-pole shielded cable diam. 8mm, length 5m. complete with watertight connector at one side and free at the other end.

CP2003/10: 26-pole shielded cable diam. 8mm, length 10m. complete with watertight connector at one side and free at the other end.

CP2003/C: Watertight 26-pole connector Tyco 62IN- 16A – 16 – 265 – 4 0445

HD2003.77: Clamping for mast ∅ 40mm

HD2003.77C: 2 crossed sleeves for tube ∅ 40mm

HD2003.1.14: Crossed clamping for mast ∅ 40mm with 6 inputs ∅ 16mm

HD2003.2.17: Support rod for sensors ∅ 16mm, length 500mm

HD2003.71K: Mast kit ∅ 40mm, height 2m, in two pieces, ∅ 33mm tapered tip (HD2003.71, HD2003.72, HD2003.73)

HD2003.74: Clamping with bubble level for ∅ 40mm mast with 3 bracing tie rods

HD2003.75: Flange for ∅ 40mm mast with grounding rod.

HD2003.75K: Accessories kit for bracing the mast, to fix on the ground (HD2003.80, HD2003.82 - stainless steel strings). 2m fixing diameter.

HD2003.78: Flange plate for ∅ 40mm mast to fasten on the floor

HD2003.78K: Accessories kit for bracing the mast, to fasten on the floor (HD2003.81, HD2003.82- stainless steel strings). 2m fixing diameter.

HD2003.79K: Fixing kit to mount pyranometers on clamping ∅ 40mm (HD2003.77 – HD2003.79)

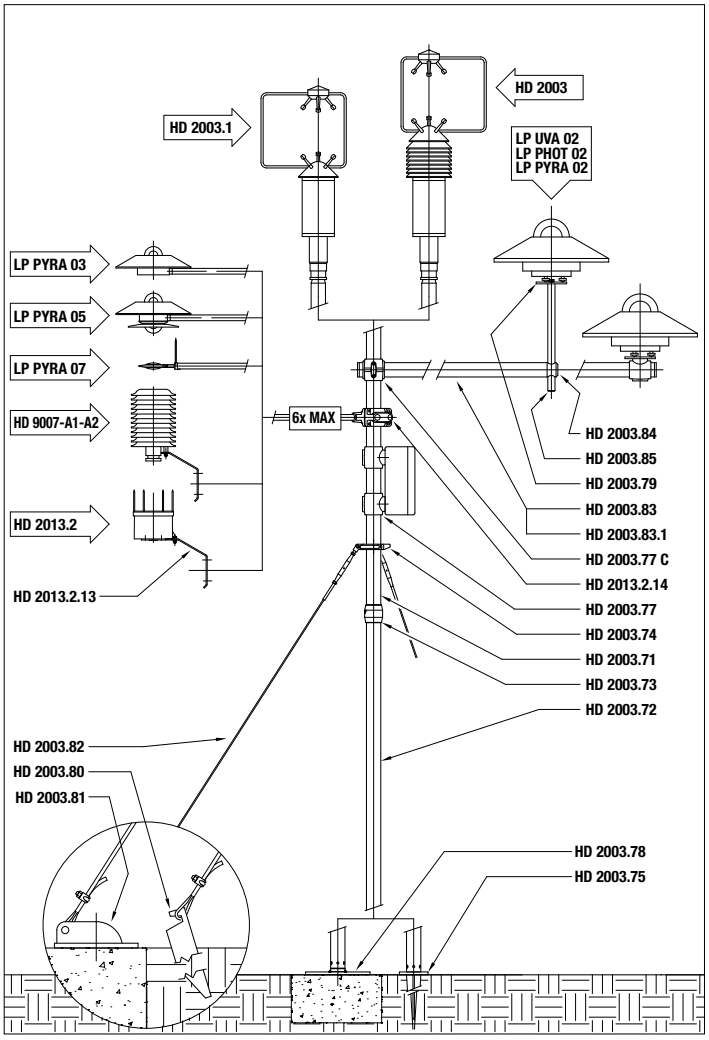
HD2003.83: Transverse mast L=150 cm

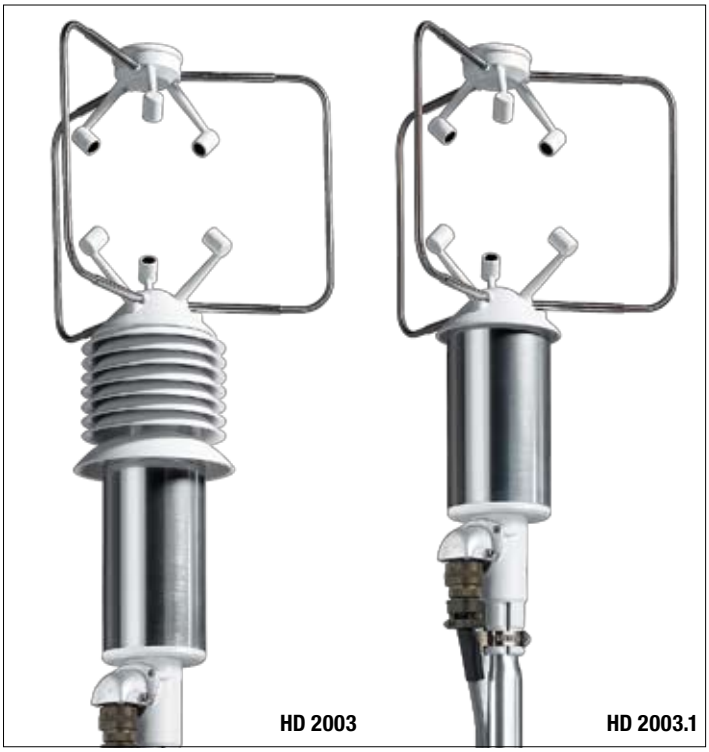
HD2003.83.1: Transverse mast L=75 cm

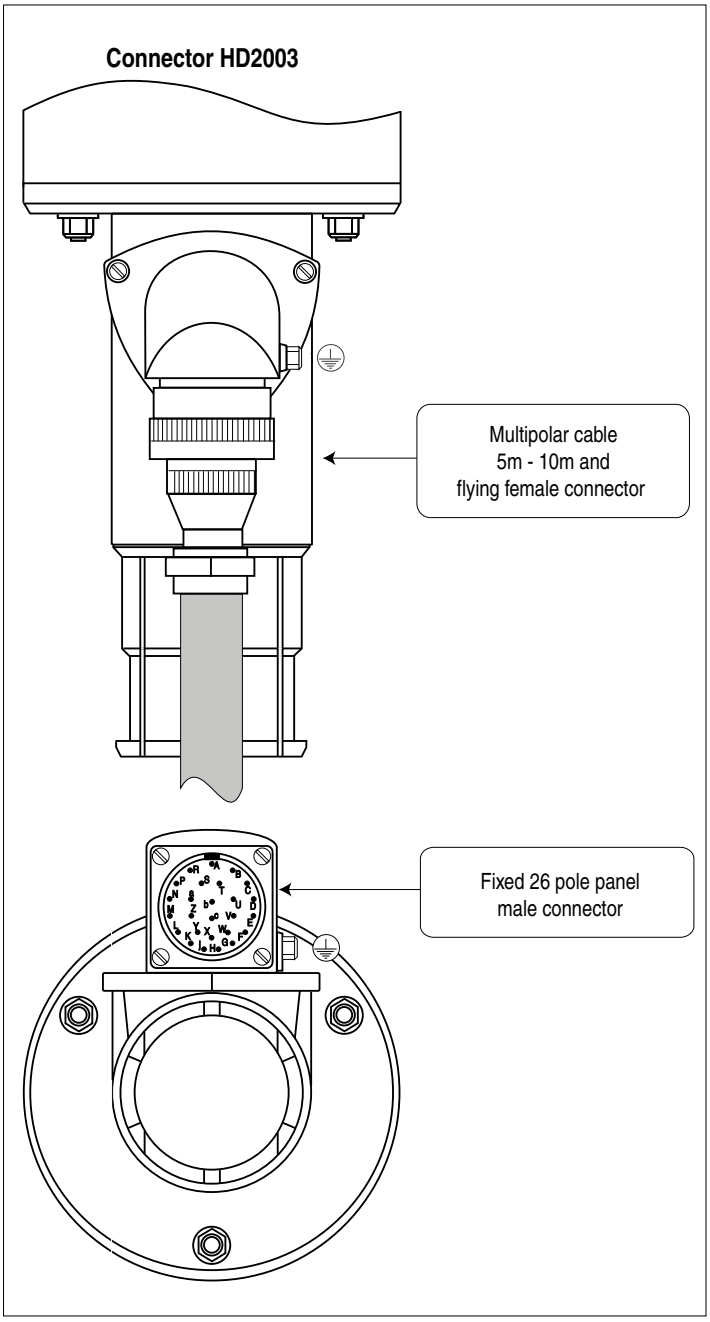
HD2003.85K: Fixing kit with adjustable height to mount pyranometers on ∅ 40mm mast (HD2003.84 – HD2003.85 – HD2003.79)

Please specify also the following:

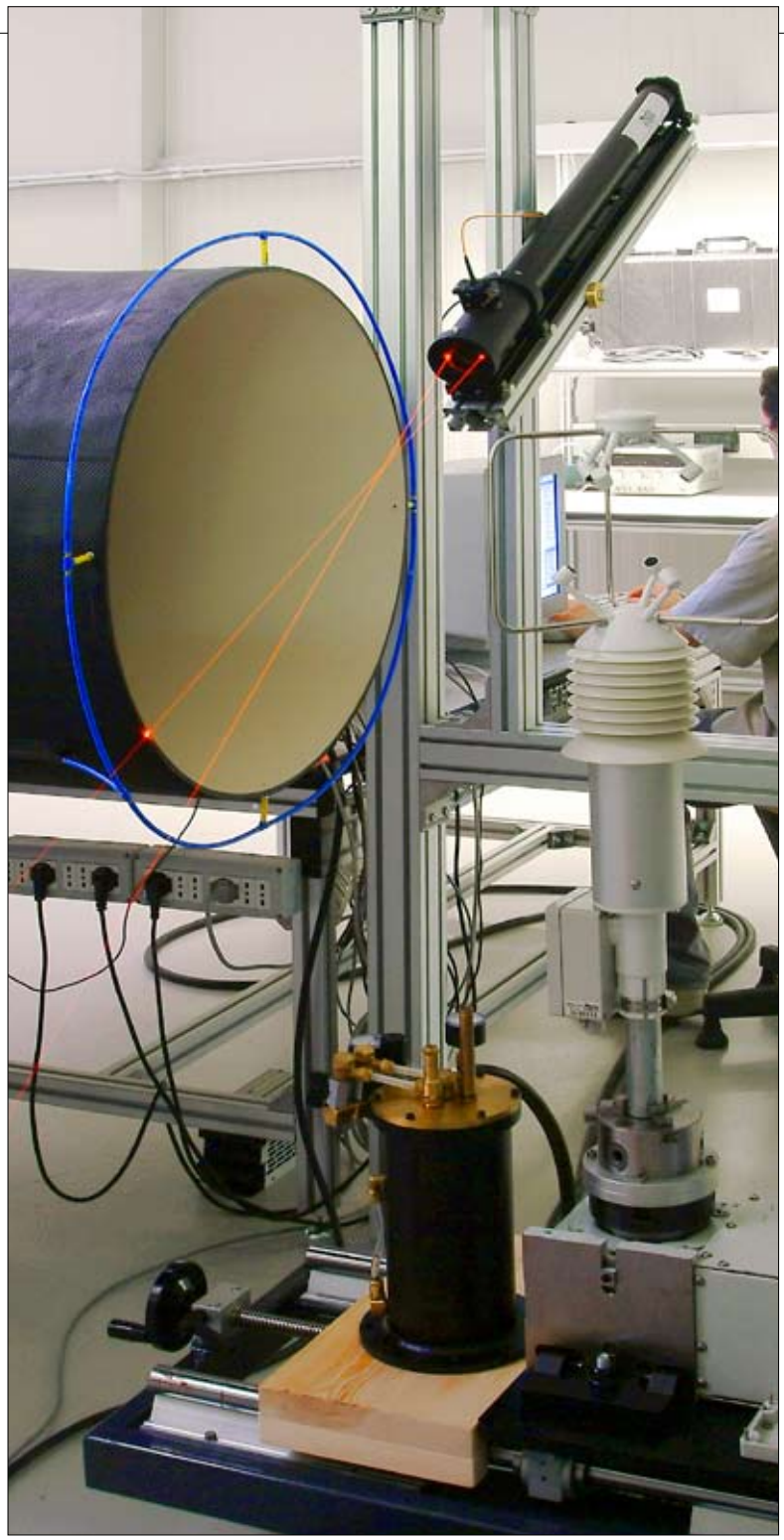
- **Model HD2003**: optional range of pressure sensor 600 ÷ 1100 mbar (Factory Default = 800 ÷ 1100 mbar)
- **Model HD2003**: if you need to employ additional output quantities, by external sensors with **analog output 0÷1V**. In order to linearize their range on the scale **0÷1V**, it is necessary to specify in this case the number of sensors that you intend to employ (max. two), and their physical range.
- **Model HD2003.1**: if you need to employ additional external sensors with **analog output 0÷1V**. In order to linearize their range on the scale **0÷1V**, it is necessary to specify in this case the number of sensors that you intend to employ (max. five), and their physical range.

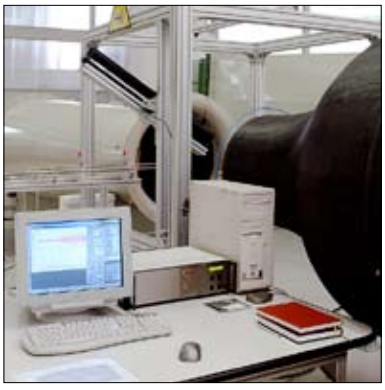


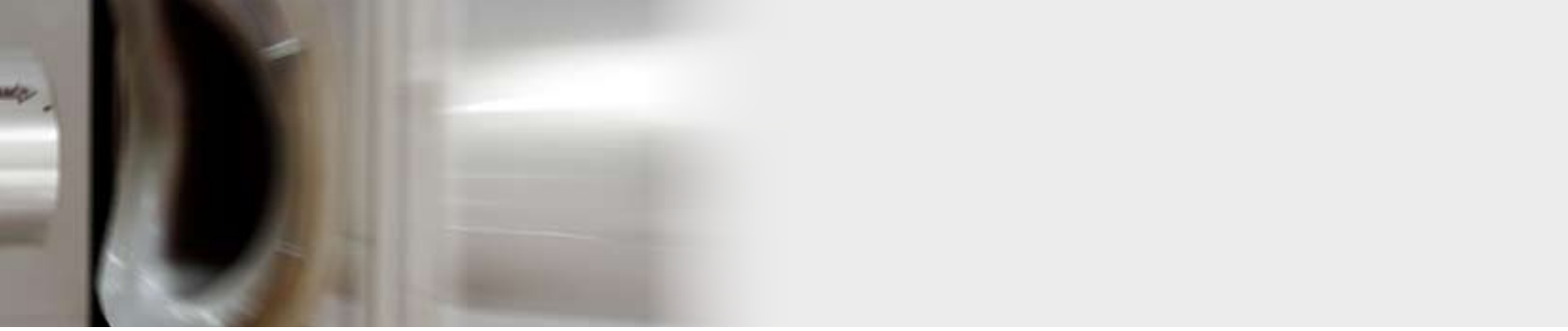




SIT N° 124 laboratory - Air speed







Italian calibration service

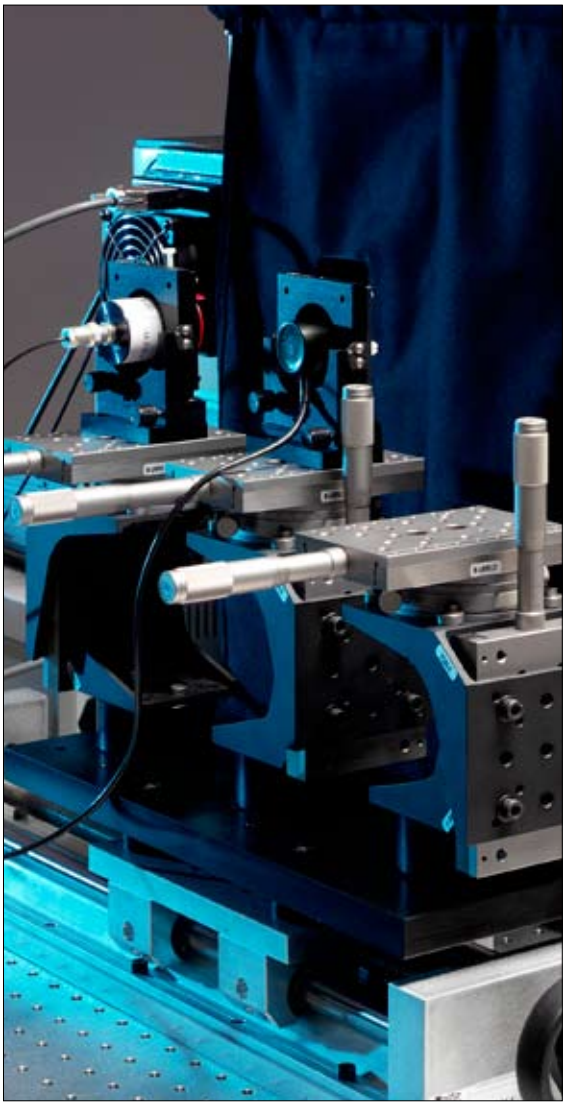
SIT centre n° 124:
DELTA OHM s.r.l.
Via G. Marconi, 5
35030 CASELLE DI SELVAZZANO (PD) - ITALIA
Telefono: +39 049 89 77 150
Telefax: +39 049 63 55 96
E-mail: deltaohm@tin.it
URL http://www.deltaohm.com

Permanent Laboratory **SIT ACCREDITATION TABLE**

Quantity	Instruments to be calibrated	Measuring range	Uncertainty (*)		Note
			↙	←	
Air speed	Anemometers	0,5 m/s	3,6 %		
		1 m/s	1,8 %	4,2 %	
		2,5 m/s	1,6 %	2,7 %	
		5 m/s	1,8 %	2,6 %	
		7,5 m/s	1,8 %	1,5 %	
		10 m/s	2,0 %	1,4 %	
		15 m/s	2,2 %	1,3 %	
		20 m/s	2,0 %	1,5 %	
		25 m/s	2,3 %	2,8 %	
		30 m/s	2,2 %	2,0 %	
		35 m/s	2,5 %	2,2 %	
		40 m/s		2,2 %	
		50 m/s		2,2 %	
		60 m/s		2,4 %	

(*) The uncertainty is expressed on a confidence level of approximately 95%.

↙ Type of instrument: hot wire, vane (diameter ≤ 60mm)
← Type of instrument: Cup anemometer, ultrasonic, Pitot tube, vane (diameter > 60mm)



Light

- HD 2102.1, HD 2102.2, HD 2302.0 pag. 158
  Portable photo-radiometers

- DO 9721 pag. 165
  Portable quantum photo-radiometer and thermometer

- LP PHOT 01, LP RAD 01, LP PAR 01, LP UVA 01, LP UVB 01, LP UVC 01 pag. 168
  Photo-radiometric probes for indoors, output signal 4÷20mA, 0÷10V, mV

- LP PHOT 03, LP RAD 03, LP PAR 03, LP UVA 03, LP UVB 03 pag. 170
  Photo-radiometric probes for outdoors, output signal 4÷20mA, 0÷10V, mV

- LP PHOT 02 pag. 176
  Photometric probe for weather stations, output signal 4÷20mA, 0÷10V, mV

- LP UVA 02 pag. 179
  Radiometric probe for weather stations, output signal 4÷20mA, 0÷10V, mV

- LP UVB 02 pag. 182
  Radiometric probe for weather stations, typical sensitivity 5V/(W/m²)

- HD 2021T pag. 185
  Transmitters for the measurement of illuminance and irradiance

- HD 2021T7, HD 2021T6 pag. 187
  Probes for the measurement of the equivalent veiling luminance and luminance

• Accredited SIT calibration laboratory for photo-radiometric measures. pag. 190

The qualitative level of our instruments is the result of a continuous evolving of the product itself. This may bring to slight differences between what written in the following manual and the instrument you bought. We cannot completely exclude the presence of errors inside the manual, which we apologise for. Data, images and descriptions included in this manual cannot be enforced legally. We reserve the right to perform modifications and corrections at any time without notice.

HD 2102.1
HD 2102.2

HD2102.1 AND HD2102.2
PHOTO-RADIOMETERS

The **HD2102.1** and **HD2102.2** are portable instruments with a large LCD display. They measure **illuminance**, **luminance, PAR** and **irradiance** (across VIS-NIR, UVA, UVB and UVC spectral regions or measurement of irradiance effective according to the UV action curve).
The probes are fitted with the SICRAM automatic detection module: in addition to detection, the unit of measurement selection is also automatic. The factory calibration data are already stored inside the instruments.
In addition to instantaneous measurement the instruments calculate the acquired measurements time integral Q(t). Some thresholds can be associated with the integrated measurement and with the integration time, which can be set in the menu. When exceeded these thresholds cause the instrument to stop the integral calculation. The HD2102.2 instrument is a **datalogger**. It stores up to 38,000 samples which can be transferred from the instrument connected to a PC via the multi-standard RS232C serial port and USB 2.0. The storing interval, printing, and baud rate can be configured using the menu.
The HD2102.1 and HD2102.2 models are fitted with an RS232C serial port and can transfer the acquired measurements in real time to a PC or to a portable printer. *The Max, Min* and *Avg* function calculate the maximum, minimum or average values. Other functions include: the relative measurement REL, the HOLD function, and the automatic turning off that can also be excluded.
The instruments have IP67 protection degree.

HD40.1

SWD10

INSTRUMENT TECHNICAL CHARACTERISTICS

Instrument

Dimensions (Length x Width x Height)	185x90x40mm
Weight	470g (complete with batteries)
Materials	ABS, rubber
Display	2x4½ digits plus symbols - 52x42mm Visible area: 52x42mm

Operating conditions

Operating temperature	-5…50°C
Storage temperature	-25…65°C
Working relative humidity	0…90%RH without condensation
Protection degree	**IP67**

Power

Batteries	4 1.5V type AA batteries
Autonomy	200 hours with 1800mAh alkaline batteries
Power absorbed with instrument off	20µA
Mains	Output mains adapter 12Vdc / 1000mA

Measuring unit	*lux - fcd - lux/s - cd/s - W/m² - µW/cm²* *J/m² - µJ/cm² - µmol(m²·s) - µmol/m² - cd/m²*
Security of memorized data	Unlimited, independent of battery charge conditions

Time

Date and time	Schedule in real time
Accuracy	1min/month max drift

*Measured values storage - model **HD2102.2***

Type	2000 pages containing 19 samples each
Quantity	Total of 38000 samples
Storage interval	1s…3600s (1hour)

Serial interface RS232C

Type	RS232C electrically isolated
Baud rate	Can be set from 1200 to 38400 baud
Data bit	8
Parity	None
Stop bit	1
Flow Control	Xon/Xoff
Serial cable length	Max 15m
Immediate print interval	1s…3600s (1hour)

*USB interface - model **HD2102.2***

Type	1.1 - 2.0 electrically isolated

Connections

Input module for the probes	8-pole male DIN45326 connector
Serial interface and USB	8-pole MiniDin connector
Mains adapter	2-pole connector (positive at centre)

Technical characteristics of photometric and radiometric probes complete with SICRAM module equipped with the instruments

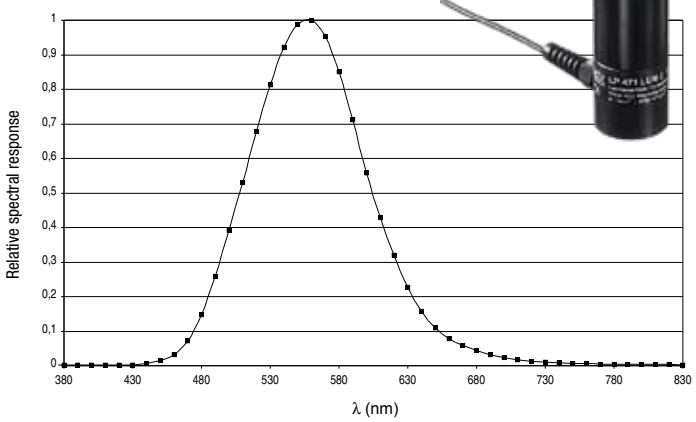
ILLUMINANCE measurement probe LP 471 PHOT				
Measurement range (lux):	0.01…199.99	…1999.9	…19999	…199.99·10³
Resolution (lux):	0.01	0.1	1	0.01·10³
Spectral range:	in agreement with standard photopic curve V(λ)			
Class	C (B on request)			
Calibration uncertainty:	<4%			
f'1 (in agreement with photopic response V(λ)):	<8%			
f_2 (response according to the cosine law):	<3%			
f_3 (linearity):	<1%			
f_4 (instrument reading error):	<0.5%			
f_5 (fatigue):	<0.5%			
α (temp. coefficient) f_6 (T)	<0.05%K			
Drift after 1 year:	<1%			
Functioning temperature:	0…50°C			
Reference Standards	CIE n.69 - UNI 11142			

Photometric probe for **ILLUMINANCE** measurement, spectral response in agreement with standard photopic vision, diffuser for cosine correction.
Measurement range: 0.01 lux…200·10³ lux.
CIE69, UNI11142

LUMINANCE measurement probe LP 471 LUM 2				
Measurement range (cd/m²):	0.1…1999.9	…19999	…199.99·10³	…1999.9·10³
Resolution (cd/m²):	0.1	1	0.01·10³	0.1·10³
Optical angle:	2°			
Spectral range:	in agreement with standard photopic curve V(λ)			
Class	C			
Calibration uncertainty:	<5%			
f'1 (in agreement with photopic response V(λ)):	<8%			
f_3 (linearity):	<1%			
f_4 (instrument reading error):	<0.5%			
f_5 (fatigue):	<0.5%			
α (temp. coefficient) f_6 (T)	<0.05%K			
Drift after 1 year:	<1%			
Functioning temperature:	0…50°C			
Reference Standards	CIE n.69 - UNI 11142			

Photometric probe for **LUMINANCE** measurement, spectral response in agreement with standard photopic vision, vision angle 2°. Measurement range: 0.1 cd/m²…2000·10³ cd/m².

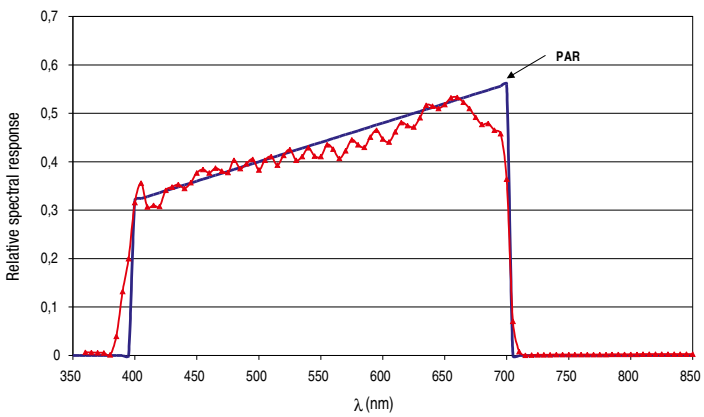
Typical response curve: LP 471 PHOT and LP 471 LUM2



Quantum radiometric probe for the measurement of the photon flow across the chlorophyll range PAR LP 471 PAR			
Measurement range (µmol/m⁻²s⁻¹):	0.01… 199.99	200.0…1999.9	2000…10000
Resolution (µmol/m⁻²s⁻¹):	0.01	0.1	1
Spectral range:	400nm…700nm		
Calibration uncertainty:	<5%		
f_3 (linearity):	<1%		
f_4 (instrument reading error):	±1digit		
f_5 (fatigue):	<0.5%		
Drift after 1 year:	<1%		
Working temperature:	0…50°C		

Quantum radiometric probe for the measurement of the photon flow across the chlorophyll range **PAR** (Photosynthetically Active Radiation 400nm…700nm), measurement in µmol/m²s. Measurement range: 0.01µmol/m⁻²s⁻¹…10·10³µmol/m⁻²s⁻¹.

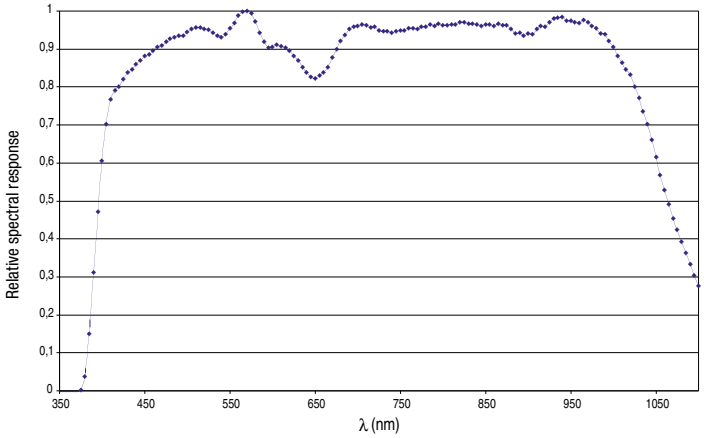
Typical response curve: LP 471 PAR



IRRADIANCE measurement probe LP 471 RAD				
Measurement range (W/m²):	0.1·10⁻³ … 999.9·10⁻³	1.000 …19.999	20.00 …199.99	200.0 …1999.9
Resolution (W/m²):	0.1·10⁻³	0.001	0.01	0.1
Spectral range:	400nm…1050nm			
Calibration uncertainty:	<5%			
f_3 (linearity):	<1%			
f_4 (instrument reading error):	±1digit			
f_5 (fatigue):	<0.5%			
Drift after 1 year:	<1%			
Working temperature:	0…50°C			

Radiometric probe for **IRRADIANCE** measurement in the spectral range 400nm…1050nm, diffuser for cosine correction. Measurement range: 0.1·10⁻³W/m² …2000 W/m².

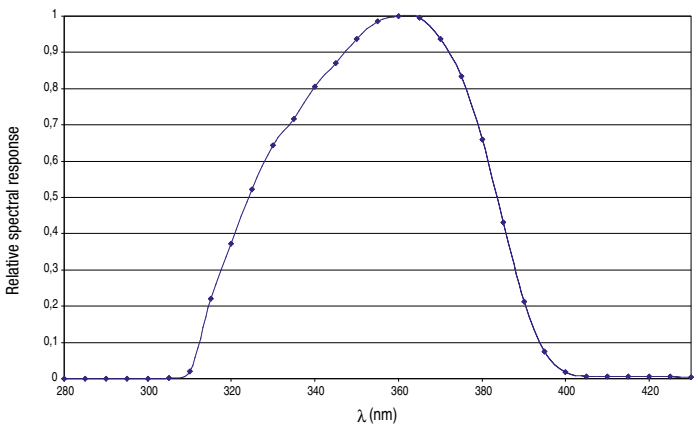
Typical response curve: LP 471 RAD



IRRADIANCE measurement probe LP 471 UVA				
Measurement range (W/m²):	0.1·10⁻³ … 999.9·10⁻³	1.000 …19.999	20.00 …199.99	200.0 …1999.9
Resolution (W/m²):	0.1·10⁻³	0.001	0.01	0.1
Spectral range:	315nm…400nm (Peak 360nm)			
Calibration uncertainty:	<5%			
f_3 (linearity):	<1%			
f_4 (instrument reading error):	±1digit			
f_5 (fatigue):	<0.5%			
Drift after 1 year:	<2%			
Working temperature:	0…50°C			

Radiometric probe for **IRRADIANCE** measurement, in the 315nm…400nm, peak 360nm, **UVA** spectral range. Measurement range: 0.1·10⁻³W/m²…2000 W/m².

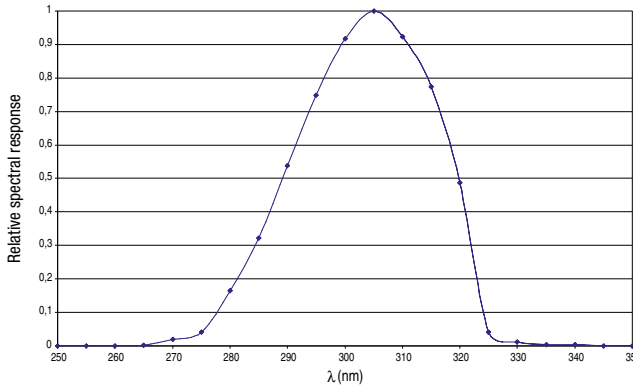
Typical response curve: LP 471 UVA



IRRADIANCE measurement probe LP 471 UVB				
Measurement range (W/m²):	0.1·10⁻³ … 999.9·10⁻³	1.000 …19.999	20.00 …199.99	200.0 …1999.9
Resolution (W/m²):	0.1·10⁻³	0.001	0.01	0.1
Spectral range:	280nm…315nm (Peak 305nm)			
Calibration uncertainty:	<5%			
f_3 (linearity):	<2%			
f_4 (instrument reading error):	±1digit			
f_5 (fatigue):	<0.5%			
Drift after 1 year:	<2%			
Working temperature:	0…50°C			

Radiometric probe for **IRRADIANCE** measurement, in the spectral range 280nm…315nm, peak 305nm, **UVB.** Measurement range: 0.1·10⁻³W/m²…2000 W/m².

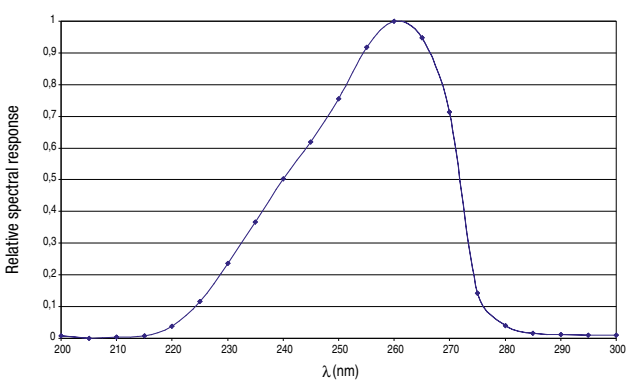
Typical response curve: LP 471 UVB



IRRADIANCE measurement probe LP 471 UVC				
Measurement range (W/m²):	0.1·10⁻³ … 999.9·10⁻³	1.000 …19.999	20.00 …199.99	200.0 …1999.9
Resolution (W/m²):	0.1·10⁻³	0.001	0.01	0.1
Spectral range:	220nm…280nm (Peak 260nm)			
Calibration uncertainty:	<5%			
f_3 (linearity):	<1%			
f_4 (instrument reading error):	±1digit			
f_5 (fatigue):	<0.5%			
Drift after 1 year:	<2%			
Working temperature:	0…50°C			

Radiometric probe for **IRRADIANCE** measurement, in the spectral range 220nm…280nm, peak 260nm, **UVC**. Measurement range: 0.1·10⁻³W/m²…2000 W/m².

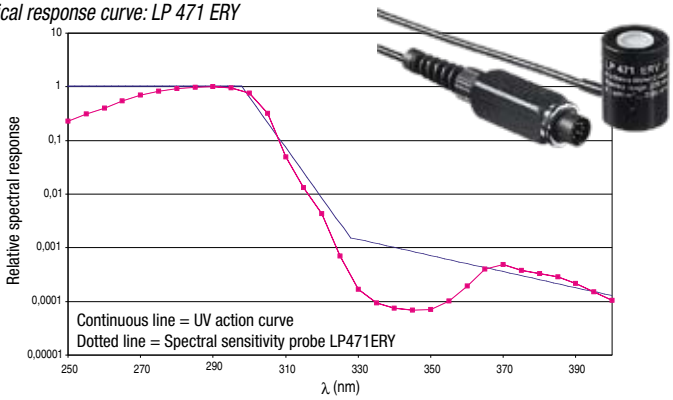
Typical response curve: LP 471 UVC



Measurement probe LP 471ERY of TOTAL EFFECTIVE IRRADIANCE (W/m²) according to the UV action curve UV (CEI EN 60335-2-27)				
Measurement range (W_{eff}/m²):	0.1·10⁻³ … 999.9·10⁻³	1.000 …19.999	20.00 …199.99	200.0 …1999.9
Resolution (W_{eff}/m²):	0.1·10⁻³	0.001	0.01	0.1
Spectral range:	UV action curve for erythema measurement (250nm…400nm)			
Calibration uncertainty:	<15%			
f_3 (linearity):	<3%			
f_4 (instrument reading error	±1digit			
f_5 (fatigue):	<0.5%			
Drift after 1 year	<2%			
Working temperature:	0…50°C			
Reference standard	CEI EN 60335-2-27			

Radiometric probe for **EFFECTIVE TOTAL IRRADIANCE** (W_{eff}/m²) according to the UV action curve (CIE EN 60335-2-27). Spectral range: 250 nm…400 nm, Measurement range: 0.1·10⁻³W_{eff} /m² … 2000 W_{eff} /m²

Typical response curve: LP 471 ERY



The probe LP 471 ERY measures the effective total irradiance (W_{eff}/m²) according to the UV action curve (CEI EN 60335-2-27). A particular type of photodiode and a combination of special filters bring the spectral response closer to the UV action curve. CEI EN 60335-2-27 standards estabilish a maximum allowable dose of 100J/m² for first-time exposure and an annual dose of 15000J/m². The typical spectral response curve of LP 471 ERY is shown in the Figure together with the UV action curve. The good accordance between the two curves enables the instrument to take reliable measurements of different types of lamps (and filters) used at present for tonning machines.

PURCHASING CODES

HD2102.1: The kit consists of the instrument HD2102.1, 4 1.5V alkaline batteries, operating manual, case and DeltaLog9 software. **Probes and cable must be ordered separately.**

HD2102.2: The kit consists of the HD2102.2 **datalogger**, 4 1.5V alkaline batteries, operating manual, case and DeltaLog9 software. **Probes and cable must be ordered separately.**

HD2110CSNM: 8-pole connection cable MiniDin - Sub D 9-pole female for RS232C.

HD2101/USB: Connection cable USB 2.0 connector type A - 8-pole MiniDin.

DeltaLog9: Software for download and management of the data on PC using Windows 98 to Vista operating systems.

SWD10: Stabilized power supply at 230Vac/12Vdc-1000mA mains voltage.

HD40.1: On request, portable, serial input, 24 column thermal printer, 58mm paper width.

Probes complete with SICRAM module

LP 471 PHOT: Photometric probe for **ILLUMINANCE** measurement complete with SICRAM module, spectral response in agreement with standard photopic vision, diffuser for cosine correction. Measurement range: 0.01 lux…200·10³ lux.

LP 471 LUM 2: Photometric probe for **LUMINANCE** measurement complete with SICRAM module, spectral response in agreement with standard photopic vision, vision angle 2°. Measurement range: 0.1 cd/m²…2000·10³ cd/m².

LP 471 PAR: Quantum radiometric probe for the measurement of the photon flow across the chlorophyll range **PAR** (Photosynthetically Active Radiation 400nm…700nm) complete with SICRAM, measurement in µmol/m⁻²s⁻¹, diffuser for cosine correction. Measurement range: 0.01µmol/m⁻²s⁻¹…10·10³µmol/m⁻²s⁻¹.

LP 471 RAD: Radiometric probe for **IRRADIANCE** measurement complete with SICRAM module; in the 400nm…1050nm spectral range, diffuser for cosine correction. Measurement range: 0.1·10⁻³W/m² …2000 W/m².

LP 471 UVA: Radiometric probe for **IRRADIANCE** measurement complete with SICRAM module; in the 315nm…400nm, peak 360nm, **UVA** spectral range, quartz diffuser for cosine correction. Measurement range: 0.1·10⁻³W/m²…2000 W/m².

LP 471 UVB: Radiometric probe for **IRRADIANCE** measurement complete with SICRAM module, in the 280nm…315nm, peak 305nm, **UVB** spectral range, quartz diffuser for cosine correction. Measurement range: 0.1·10⁻³W/m²…2000 W/m².

LP 471 UVC: Radiometric probe for **IRRADIANCE** measurement complete with SICRAM module, in the 220nm…280nm, peak 260nm, **UVC** spectral range, quartz diffuser for cosine correction. Measurement range: 0.1·10⁻³W/m²…2000 W/m².

LP 471 ERY: Radiometric probe for **EFFECTIVE TOTAL IRRADIANCE** (W_{eff}/m²) according to the UV action curve (CEI EN 60335-2-27) complete with SICRAM module. Spectral range: 250 nm…400 nm, quartz diffuser for cosine correction. Measurement range: 0.1·10⁻³W_{eff} /m² … 2000 W_{eff} /m².

LP BL: Base with levelling device (except LP 471 LUM 2).

HD2302.0
PHOTO-RADIOMETER

The **HD2302.0** is a portable instrument with a large LCD display. It measures **illuminance**, **luminance, PAR** and **irradiance** (across VIS-NIR, UVA, UVB and UVC spectral regions or measurement of irradiance effective according to the UV action curve). The probes are equipped with the SICRAM automatic detection module: in addition to detection, the unit of measurement selection is also automatic. The factory calibration data are already memorized inside the instruments. The *Max, Min* and *Avg* function calculate the maximum, minimum or average values. Other functions include: the relative measurement REL, the HOLD function, and the automatic turning off that can also be excluded. **The instruments have IP67 protection degree.**

INSTRUMENT TECHNICAL CHARACTERISTICS

Instrument

Dimensions (Length x Width x Height)	140x88x38mm
Weight	160g (complete with batteries)
Materials	ABS
Display	2x4½ digits plus symbols - 52x42mm Visible area: 52x42mm

Operating conditions

Operating temperature	-5…50°C
Storage temperature	-25…65°C
Working relative humidity	0…90%RH without condensation
Protection degree	**IP67**

Power

Batteries	3 1.5V type AA batteries
Autonomy	200 hours with 1800mAh alkaline batteries
Power absorbed with instrument off	20µA

Measuring unit — *lux - fcd - µmol/m²·s - cd/m² - W/m² - µW/cm²*

Connections

Input module for the probes	8-pole male DIN45326 connector

Technical characteristics of photometric and radiometric probes complete with SICRAM module equipped with the instruments

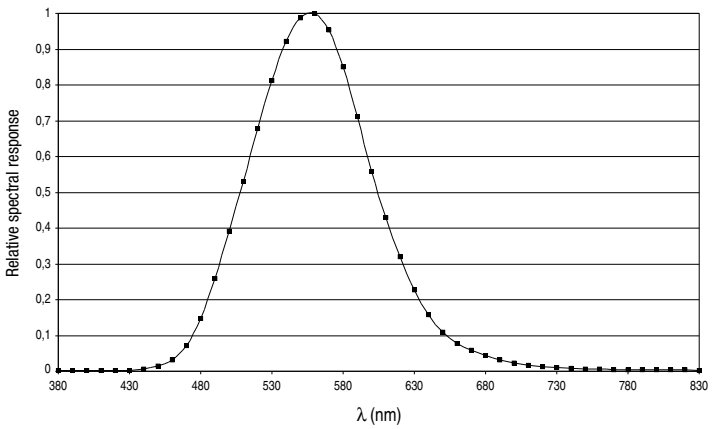
ILLUMINANCE measurement probe LP 471 PHOT				
Measurement range (lux):	0.01…199.99	…1999.9	…19999	…199.99·10³
Resolution (lux):	0.01	0.1	1	0.01·10³
Spectral range:	in agreement with standard photopic curve V(λ)			
Class	C			
Calibration uncertainty:	<4%			
f'1 (in agreement with photopic response V(λ)):	<8%			
f_2 (response according to the cosine law):	<3%			
f_3 (linearity):	<1%			
f_4 (instrument reading error):	<0.5%			
f_5 (fatigue):	<0.5%			
α (temp. coefficient) f_6 (T)	<0.05%K			
Drift after 1 year:	<1%			
Functioning temperature:	0…50°C			
Reference Standards	CIE n.69 - UNI 11142			

Photometric probe for **ILLUMINANCE** measurement, spectral response in agreement with standard photopic vision, diffuser for cosine correction. Measurement range: 0.01 lux…200·10³ lux.

LUMINANCE measurement probe LP 471 LUM 2				
Measurement range (cd/m²):	0.1…1999.9	…19999	…199.99·10³	…1999.9·10³
Resolution (cd/m²):	0.1	1	0.01·10³	0.1·10³
Optical angle:	2°			
Spectral range:	in agreement with standard photopic curve V(λ)			
Class	C			
Calibration uncertainty:	<5%			
f'1 (in agreement with photopic response V(λ)):	<8%			
f_3 (linearity):	<1%			
f_4 (instrument reading error):	<0.5%			
f_5 (fatigue):	<0.5%			
α (temp. coefficient) f_6 (T)	<0.05%K			
Drift after 1 year:	<1%			
Functioning temperature:	0…50°C			
Reference Standards	CIE n.69 - UNI 11142			

Photometric probe for **LUMINANCE** measurement, spectral response in agreement with standard photopic vision, vision angle 2°. Measurement range: 0.1 cd/m²…2000·10³ cd/m².

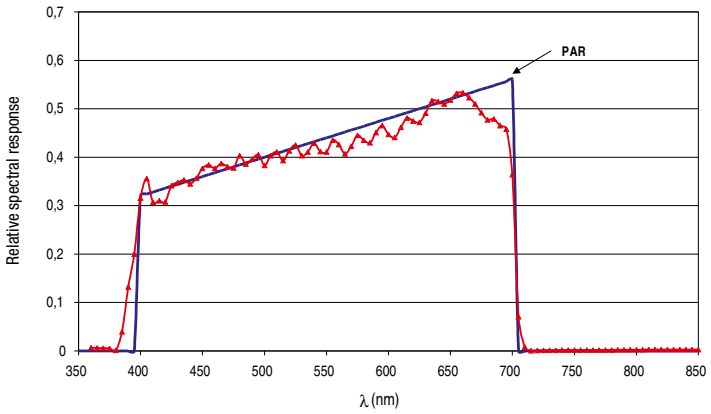
Typical response curve: probe LP 471 PHOT, LP 471 LUM2



Quantum radiometric probe for the measurement of the photon flow across the chlorophyll range PAR LP 471 PAR			
Measurement range (µmol/m^{-2}s^{-1}):	0.01… 199.99	200.0…1999.9	2000…10000
Resolution (µmol/m^{-2}s^{-1}):	0.01	0.1	1
Spectral range:	400nm…700nm		
Calibration uncertainty:	<5%		
f_3 (linearity):	<1%		
f_4 (instrument reading error):	±1digit		
f_5 (fatigue):	<0.5%		
Drift after 1 year:	<1%		
Working temperature:	0…50°C		

Quantum radiometric probe for the measurement of the photon flow across the chlorophyll range **PAR** (Photosynthetically Active Radiation 400nm…700nm), measurement in µmol/m^{-2}s^{-1}. Measurement range: 0.01µmol/m^{2}s^{-1}…10·10^{3}µmol/m^{2}s.

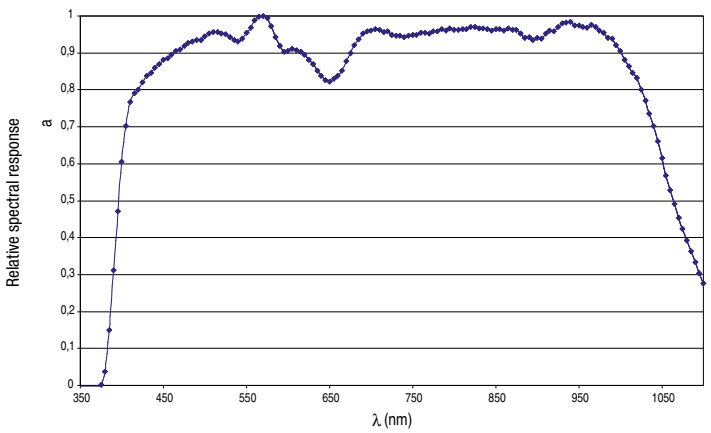
Typical response curve: probe LP 471 PAR



IRRADIANCE measurement probe LP 471 RAD				
Measurement range (W/m^2):	0.1·10^{-3} … 999.9·10^{-3}	1.000 …19.999	20.00 …199.99	200.0 …1999.9
Resolution (W/m^2):	0.1·10^{-3}	0.001	0.01	0.1
Spectral range:	400nm…1050nm			
Calibration uncertainty:	<5%			
f_3 (linearity):	<1%			
f_4 (instrument reading error):	±1digit			
f_5 (fatigue):	<0.5%			
Drift after 1 year:	<1%			
Working temperature:	0…50°C			

Radiometric probe for **IRRADIANCE** measurement in the spectral range 400nm…1050nm, diffuser for cosine correction. Measurement range: 0.1·10^{-3}W/m^2 …2000 W/m^2.

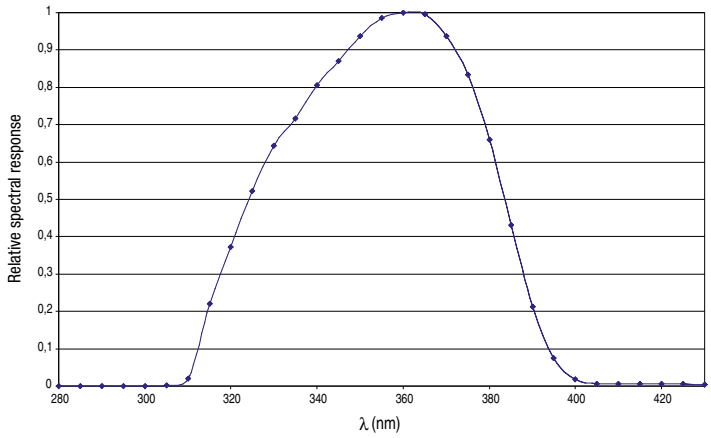
Typical response curve: probe LP 471 RAD



IRRADIANCE measurement probe LP 471 UVA				
Measurement range (W/m^2):	0.1·10^{-3} … 999.9·10^{-3}	1.000 …19.999	20.00 …199.99	200.0 …1999.9
Resolution (W/m^2):	0.1·10^{-3}	0.001	0.01	0.1
Spectral range:	315nm…400nm (Peak 360nm)			
Calibration uncertainty:	<5%			
f_3 (linearity):	<1%			
f_4 (instrument reading error):	±1digit			
f_5 (fatigue):	<0.5%			
Drift after 1 year:	<2%			
Working temperature:	0…50°C			

Radiometric probe for **IRRADIANCE** measurement, in the 315nm…400nm, peak 360nm, **UVA** spectral range. Measurement range: 0.1·10^{-3}W/m^2…2000 W/m^2.

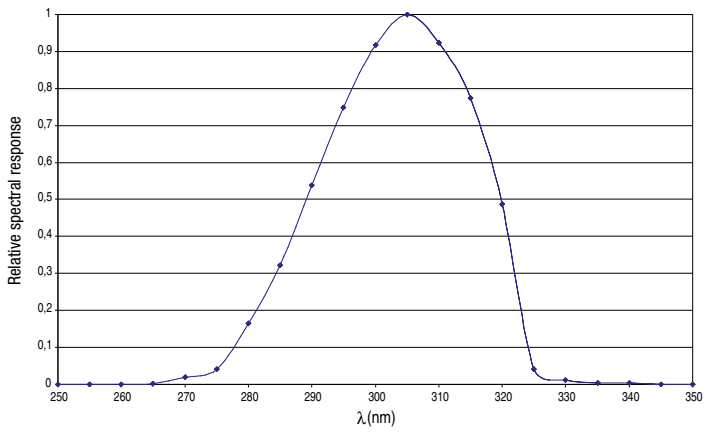
Typical response curve: probe LP 471 UVA



IRRADIANCE measurement probe LP 471 UVB				
Measurement range (W/m^2):	0.1·10^{-3} … 999.9·10^{-3}	1.000 …19.999	20.00 …199.99	200.0 …1999.9
Resolution (W/m^2):	0.1·10^{-3}	0.001	0.01	0.1
Spectral range:	280nm…315nm (Peak 305nm)			
Calibration uncertainty:	<5%			
f_3 (linearity):	<2%			
f_4 (instrument reading error):	±1digit			
f_5 (fatigue):	<0.5%			
Drift after 1 year:	<2%			
Working temperature:	0…50°C			

Radiometric probe for **IRRADIANCE** measurement, in the spectral range 280nm…315nm, peak 305nm, **UVB.** Measurement range: 0.1·10^{-3}W/m^2…2000 W/m^2.

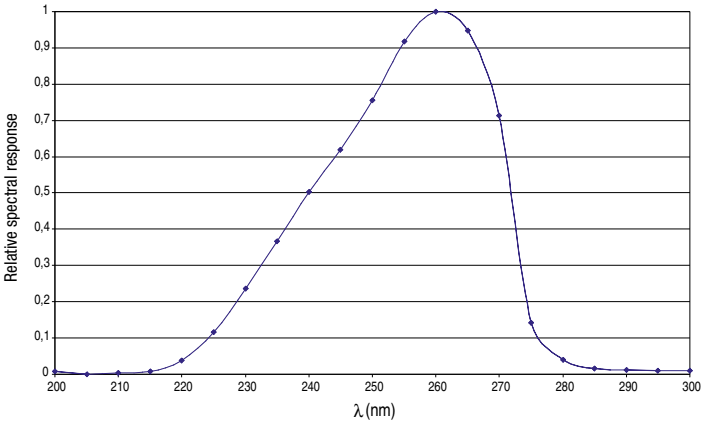
Typical response curve: probe LP 471 UVB



IRRADIANCE measurement probe LP 471 UVC				
Measurement range (W/m²):	$0.1 \cdot 10^{-3}$ … $999.9 \cdot 10^{-3}$	1.000 …19.999	20.00 …199.99	200.0 …1999.9
Resolution (W/m²):	$0.1 \cdot 10^{-3}$	0.001	0.01	0.1
Spectral range:	220nm…280nm (Peak 260nm)			
Calibration uncertainty:	<5%			
f_3 (linearity):	<1%			
f_4 (instrument reading error):	±1digit			
f_5 (fatigue):	<0.5%			
Drift after 1 year:	<2%			
Working temperature:	0…50°C			

Radiometric probe for **IRRADIANCE** measurement, in the spectral range 220nm…280nm, peak 260nm, **UVC**. Measurement range: $0.1 \cdot 10^{-3}$W/m²…2000 W/m².

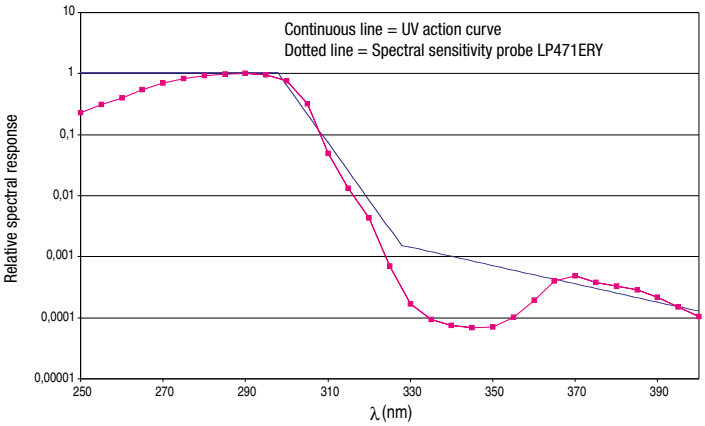
Typical response curve: probe LP 471 UVC



Measurement probe LP 471ERY of TOTAL EFFECTIVE IRRADIANCE (W/m²) according to the UV action curve UV (CEI EN 60335-2-27)				
Measurement range (W_{eff}/m²):	$0.1 \cdot 10^{-3}$ … $999.9 \cdot 10^{-3}$	1.000 …19.999	20.00 …199.99	200.0 …1999.9
Resolution (W_{eff}/m²):	$0.1 \cdot 10^{-3}$	0.001	0.01	0.1
Spectral range:	UV action curve for erythema measurement (250nm…400nm)			
Calibration uncertainty:	<15%			
f_3 (linearity):	<3%			
f_4 (instrument reading error	±1digit			
f_5 (fatigue):	<0.5%			
Drift after 1 year	<2%			
Working temperature:	0…50°C			
Reference standard	CEI EN 60335-2-27			

Radiometric probe for **EFFECTIVE TOTAL IRRADIANCE** (W_{eff}/m²) according to the UV action curve (CIE EN 60335-2-27). Spectral range: 250 nm…400 nm, Measurement range: $0.1 \cdot 10^{-3}W_{eff}$ /m² … 2000 W_{eff} /m²

Typical response curve:
TOTAL EFFECTIVE IRRADIANCE probe LP 471 ERY



The probe LP 471 ERY measures the total effective irradiance (W_{eff}/m²) according to the UV action curve (CEI EN 60335-2-27). A particular type of photodiode and a combination of special filters bring the spectral response closer to the UV action curve.
CEI EN 60335-2-27 standards estabilish a maximum allowable dose of 100J/m² for first-time exposure and an annual dose of 15000J/m².
The typical spectral response curve of LP 471 ERY is shown in the Figure together with the UV action curve.
The good accordance between the two curves enables the instrument to take reliable measurements of different types of lamps (and filters) used at present for tanning machines.
Calibration is performed at 290nm using a SIT calibrated photodiode as reference.

ORDER CODES

HD2302.0: The kit consists of the instrument HD2302.0, 3 1.5V alkaline batteries, operating manual, case. **The probes must be ordered separately.**

Probes equipped with SICRAM module

LP 471 PHOT: Photometric probe for **ILLUMINANCE** measurement complete with SICRAM module, spectral response in agreement with standard photopic vision, diffuser for cosine correction. Measurement range: 0.01 lux…$200 \cdot 10^3$ lux.

LP 471 LUM 2: Photometric probe for **LUMINANCE** measurement complete with SICRAM module, spectral response in agreement with standard photopic vision, vision angle 2°. Measurement range: 0.1 cd/m²…$2000 \cdot 10^3$ cd/m².

LP 471 PAR: Quantum radiometric probe for the measurement of the photon flow across the chlorophyll range **PAR** (Photosynthetically Active Radiation 400nm…700nm) complete with SICRAM, measurement in µmol/m⁻²s⁻¹, diffuser for cosine correction. Measurement range: 0.01µmol/m⁻²s⁻¹…$10 \cdot 10^3$µmol/m⁻²s⁻¹.

LP 471 RAD: Radiometric probe for **IRRADIANCE** measurement complete with SICRAM module; in the 400nm…1050nm spectral range, diffuser for cosine correction. Measurement range: $0.1 \cdot 10^{-3}$W/m² …2000 W/m².

LP 471 UVA: Radiometric probe for **IRRADIANCE** measurement complete with SICRAM module; in the 315nm…400nm, peak 360nm, **UVA** spectral range, quartz diffuser for cosine correction. Measurement range: $0.1 \cdot 10^{-3}$W/m²…2000 W/m².

LP 471 UVB: Radiometric probe for **IRRADIANCE** measurement complete with SICRAM module, in the 280nm…315nm, peak 305nm, **UVB** spectral range, quartz diffuser for cosine correction. Measurement range: $0.1 \cdot 10^{-3}$W/m²…2000 W/m².

LP 471 UVC: Radiometric probe for **IRRADIANCE** measurement complete with SICRAM module, in the 220nm…280nm, peak 260nm, **UVC** spectral range, quartz diffuser for cosine correction. Measurement range: $0.1 \cdot 10^{-3}$W/m²…2000 W/m².

LP 471 ERY: Radiometric probe for **TOTAL EFFECTIVE IRRADIANCE** (W_{eff}/m²) according to the UV action curve (CEI EN 60335-2-27) complete with SICRAM module. Spectral range: 250 nm…400 nm, quartz diffuser for cosine correction. Measurement range: $0.1 \cdot 10^{-3}W_{eff}$ /m² … 2000 W_{eff} /m².

LP BL: Base with levelling device for the probes (except LP 471 LUM 2).

PHOTOMETRIC AND RADIOMETRIC PROBES FOR PORTABLE INSTRUMENTS

Code	Description	
LP471PHOT	Photometric probe for **ILLUMINANCE** measurement, spectral response in agreement with standard photopic vision, diffuser for cosine correction. Measurement range: 0.01 lux…200·10^3 lux. CIE69, UNI11142	
LP471LUM2	Photometric probe for **LUMINANCE** measurement, spectral response in agreement with standard photopic vision, vision angle 2°. Measurement range: 0.1 cd/m^2…2000·10^3 cd/m^2.	
LP471PAR	Quantum radiometric probe for the measurement of the photon flow across the chlorophyll range **PAR** (Photosynthetically Active Radiation 400nm…700nm), measurement in µmol/m^{-2}s^{-1}. Measurement range: 0.01µmol/m^{-2}s^{-1}…10·10^{3}µmol/m^{-2}s^{-1}.	
LP471RAD	Radiometric probe for **IRRADIANCE** measurement in the spectral range 400nm…1050nm, diffuser for cosine correction. Measurement range: 0.1·10^{-3}W/m^2 …2000 W/m^2.	
LP471UVA	Radiometric probe for **IRRADIANCE** measurement, in the 315nm…400nm, peak 360nm, **UVA** spectral range. Measurement range: 0.1·10^{-3}W/m^2…2000 W/m^2.	
LP471UVB	Radiometric probe for **IRRADIANCE** measurement, in the spectral range 280nm…315nm, peak 305nm, **UVB.** Measurement range: 0.1·10^{-3}W/m^2…2000 W/m^2.	
LP471UVC	Radiometric probe for **IRRADIANCE** measurement, in the spectral range 220nm…280nm, peak 260nm, **UVC**. Measurement range: 0.1·10^{-3}W/m^2…2000 W/m^2.	
LP471ERY	Radiometric probe for **EFFECTIVE TOTAL IRRADIANCE** (W_{eff}/m^2) according to the UV action curve (CIE EN 60335-2-27). Spectral range: 250 nm…400 nm, Measurement range: 0.1·10^{-3}W_{eff} /m^2 … 2000 W_{eff} /m^2	
LP BL	Base with levelling device. On request for assembly with the probes at the time of order. (not for LUM probes)	

DO 9721

DO9721
QUANTUM PHOTO-RADIOMETER AND THERMOMETER DATA-LOGGER

The **DO 9721** quantum photo-radiometer and thermometer data logger has been designed for measuring illuminance, irradiance, luminance and temperature.
The instrument has two inputs, A and B, and automatically detects the sensors, whether illuminance, irradiance, luminance or temperature and can provide a view of the difference between the two inputs. As the probes are interchangeable, it is possible to choose the most suitable combination for all applications without having to recalibrate the instrument. The **DO 9721** is able to take illuminance measurements in lux and in fcd (foot-candle), irradiance measurements in W/m^2, in µW/cm^2 e in µmol/m^{-2}s^{-1}, luminance measurements in cd/m^2 and temperature measurements in °C or °F. The function of the instrument data logger stores up to 30,000 readings with selectable sampling interval from 1 second to 12 hours. The data acquired can then be downloaded to a Personal Computer or a printer by means of the opto-insulated serial line RS232C. For each value stored the date and time of acquisition are indicated; each acquisition block is ended with a report which provides the maximum, minimum and mean values. With the Serial Output function it is possible to obtain the instantaneous values measured by the instrument at the output of the serial line RS232C, in order to send them to a printer or a computer. Other functions such as Hold (which blocks the display), Rel (for taking relative measurements), Record (for storing the maximum, minimum and mean values) and Q (integration in time of the measurements with alarm threshold) further enrich the instrument's performance. Thanks to its versatility and to its storage capacity, the instrument is suitable for a wide variety of applications, both in the field and in the laboratory.

PROBE CONNECTION

The instrument **DO 9721** has two circular DIN 45326 8-pole connectors (A and B) which allow the connection of Delta Ohm probes for measuring temperature, type TP 870, and probes for measuring the photometric and radiometric intensity, type LP 9021. The probe model should be chosen according to the specific application; see the section on accessories.

INSTRUMENT TECHNICAL DATA

Inputs / type of measurement 2:	photometric / radiometric or temperature
Connector	DIN 45326 8-pole
Measuring range	
Photometric measurements	0...200.000 lux 0...20.000 fcd 0...2.000.000 cd/m^2
Radiometric measurements	0...2000 W/m^2 0...200.000 µW/cm^2 0...200.000 µmol/m^{-2}s^{-1}
Q energy	depends on the active measurements unit
Integration time	19 hours, 59 minutes, 59 seconds
No. conversions per second	2
Working temperature	-5...+50°C
Working relative humidity	0...90% R.H. (no condensation)
Serial output	RS232C 300...19200 baud (galvanically insulated)
Display	Double LCD 12.5 mm
Functions	Auto power off / Autorange / Hold / Record / Maximum / Minimum / Mean / Relative / A-B / Energy
Memory	512kB (FLASH) corr. to 30,000 measurements
Power supply	9Vdc alkaline battery
Autonomy	Approx. 30 hours (continuous duty)
Weight / dimensions	320 gr. / 215x73x38 mm

ORDER CODES

DO 9721: Basic instrument kit, diplomatic carrying case, instrument, CP RS232C serial connecting cable, 9V battery. **The probes and cables must be ordered separately**.

LP 9021 PHOT: Photometric probe for measuring light, **ILLUMINANCE**, photopic filter complying with CIE, diffuser for correction according to the cosine law.

LP 9021 RAD: Radiometric probe for measuring the **IRRADIANCE** of artificial light sources, irradiance of the sun.

LP 9021 PAR: Radiometric probe for measuring **IRRADIANCE** in the region of PAR radiations (Photosynthetically Active Radiation); it works in the field of the chlorophyll process following a special response curve.

LP 9021 UVA: Radiometric probe for measuring **IRRADIANCE** in the ultraviolet field. Suitable for measuring radiation in the ultraviolet region **A**.

LP 9021 UVB: Radiometric probe for measuring **IRRADIANCE** in the ultraviolet field. Suitable for measuring radiation in the ultraviolet region **B**.

LP 9021 UVC: Radiometric probe for measuring **IRRADIANCE** in the ultraviolet field. Suitable for measuring radiation in the ultraviolet region **C**.

LP 9021 LUM6: Probe for measuring **LUMINANCE**, measuring range from 1 to 1999 x 10^3 candles/ m^2. Measuring angle 2°. CIE filter for correction of the response according to the human eye, CIE n°69-UNI11142

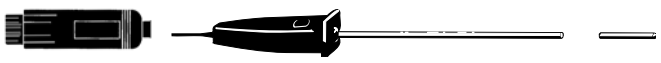
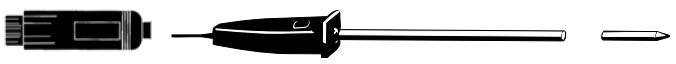
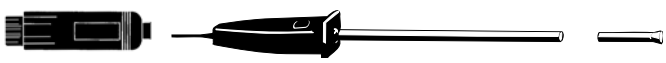
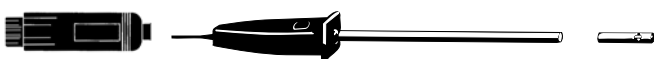
LP 9021 ERY: Radiometric probe for **TOTAL EFFECTIVE IRRADIANCE** (W_{eff}/m^2) according to the UV action curve (CEI EN 60335-2-27) complete with SICRAM module. Spectral range: 250 nm…400 nm, quartz diffuser for cosine correction. Measurement range: $0.1 \cdot 10^{-3} W_{eff}$ /m^2 … 2000 W_{eff} /m^2.

LP BL: Stand for supporting and levelling probes, eccept for LP 9021 LUM6.
TP 870: Immersion temperature probe, Pt100 sensor, diam. 3x230 mm, measuring range -50...+400°C.
TP 870/C: Contact temperature probe, Pt100 sensor, diam. 4x230 mm, measuring range -50...+400°C.
TP 870/P: Penetration temperature probe, Pt100 sensor, diam. 4x150 mm, measuring range -50...+400°C.
TP 870/A: Air temperature probe, Pt100 sensor, diam. 4x230 mm, measuring range -50...+250°C.

LP BL

Probe types	Measuring range	Spectral range	Calibration uncertainty
LP 9021 PHOT	0.1÷200000 LUX	CIE N°69 Classe C	<4%
LP 9021 RAD	1 mW/m^2÷2000 W/m^2	450÷950 nm	<5%
LP 9021 PAR	0.1 µmol $m^{-2}s^{-1}$÷20000 µmol $m^{-2}s^{-1}$	400÷700 nm	<5%
LP 9021 UVA	1 mW/m^2÷2000 W/m^2	315÷400 nm	<5%
LP 9021 UVB	1 mW/m^2÷2000 W/m^2	280÷315 nm	<5%
LP 9021 UVC	1 mW/m^2÷2000 W/m^2	200÷280 nm	<5%
LP 9021 LUM6	1÷2 x 10^6 cd/m^2	CIE N°69 Classe C	<5%
LP 9021 ERY	$0.1 \cdot 10^{-3}$ W_{eff}/m^2 2000 W_{eff}/m^2	250 mm÷400 mm	<15%

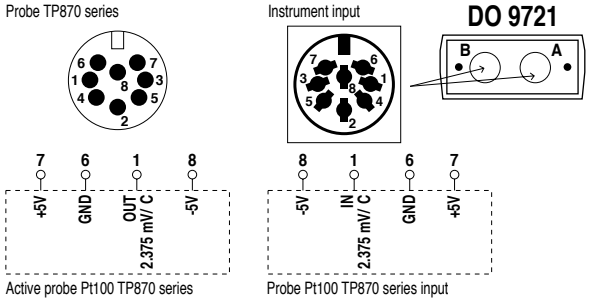
ACCURACY INSTRUMENT			
	at 25°C +/-	**from -5°C till 50°C +/-**	**Measuring range +/-**
Uncertainty of the instrument	0.1% + 1 digit	0.2% + 1 digit	
Temperature measurement instrument in line with probe	0.6°C 0.4°C 2°C	0.6°C + 0.01°C/°C 0.4°C + 0.01°C/°C 2°C + 0.01°C/°C	-50 ... +50°C +50 ... +200°C +200 ... +400°C

TEMPERATURE PROBES TP870				
CODE	Description	Drawing	τ Sec.	Temp/°C
TP 870	Immersion probe Ø 3 x 230 mm		3"A	-50/+400
TP 870/P	Penetration probe Ø 4 x 150 mm		3"A	-50/+400
TP 870/C	Contact probe Ø 4 x 230 mm		12"C	-50/+400
TP 870/A	Air probe Ø 4 x 230 mm		3"B	-50/+250

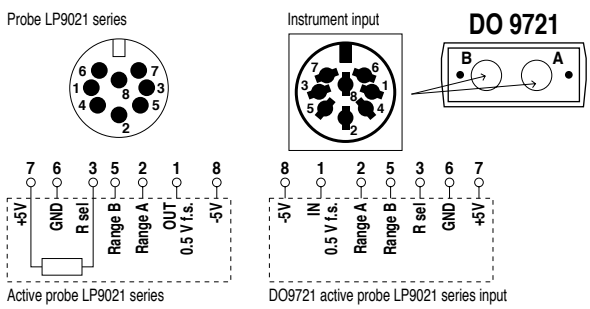
A) Time constant in water at 100°C / **B)** Time constant observed with metal surface at 200°C / **C)** Time constant in air at 100°C
Note: The time constant is the time needed to respond to 63% of the temperature changes.

1 Input A, DIN 45326 8-pole connector.
2 HOLD symbol, the measurement refers to the moment in which the HOLD key was pressed.
3 Battery symbol: flashes during RECORD function, permanently lit if the battery is running low.
4 REL symbol, indicates that the instrument is making a relative measurement.
5 Serial Out/Memory. Fixed symbol: the instrument is storing. Flashing symbol: serial output is enabled.
6 MED symbol: the display shows the mean values found during RCD function.
7 Q: instrument in Q-energy function, flashes when it has reached the limit.
8 Time: the display indicates the integration time, if flashing it has reached the time programmed for integration.
9 Lux: the led indicates that the measurement is in lux.
10 µW/cm^2: the led indicates that the measurement is in µW/cm^2.
11 µmol/m^{-2}s^{-1}: the led indicates that the measurement is in µmol m^{-2}s^{-1}.
12 REL key: shows the difference between the current value and the value stored when the REL key is pressed.
13 HOLD key for blocking the reading.
14 Unit A key: for selecting the measurement unit for input A, depending on the probe fitted. When turned to P0 mode, it sets the Q-energy and Time limits for input A.
15 Serial Output: activates data transmission at the RS232C serial output.
16 ▲ (Memory clear): increases the parameters in programming mode; when held down it erases the "RCD" memory; when pressed with P1, it erases the permanent memory.
17 PROG key: activates the programs P0... P1... P... of the different instrument functions.
18 Connector for RS232C (SUB D male 9 pole).
19 Input B, DIN 45326 8-pole connector.
20 Symbol 10^3: indicates multiplication factor 10^3 for the respective channel.
21 Symbols A and B: for magnitudes Q and T indicate the channel selected.
22 A-B: the bottom display shows the difference between A and B. The top display shows A.
23 MIN symbol: the display shows the minimum values found during RCD function.
24 MAX symbol: the display shows the maximum values found during RCD function.
25 °C: the led indicates that the temperature measurement is in degrees centigrade.
26 °F: the led indicates that the temperature measurement is in degrees Fahrenheit.
27 fcd: the led indicates that the measurement is in fcd (foot-candle).
28 W/m^2: the led indicates that the measurement is in W/m^2.
29 cd/m^2: the led indicates that the measurement is in cd/m^2.
30 On/Off key: for switching the instrument on or off.
31 Unit B key: for selecting the measurement unit for input B, depending on the probe fitted. When turned to P0 mode, it sets the Q-energy and Time limits for input B.
32 A-B key: shows the difference between the inputs.
33 Data Call key (Max-Min-Med-Q-Time): recalls on the display the maximum, mean, minimum, Q and Time values of each input.
34 ▼ (RCD): starts and stops the RECORD function, in programming mode it decreases the parameter shown.
35 ENTER key: starts and stops storage, confirms the parameters set during programming.

A) Amplified temperature probe with Pt100 platinum-sensitive element



B) Probes for photometric and radiometric measurements



LP PHOT 01
LP PAR 01
LP RAD 01
LP UVA 01
LP UVB 01
LP UVC 01

LP PHOT 01, LP RAD 01, LP PAR 01, LP UVA 01, LP UVB 01, LP UVC 01 PHOTOMETRIC/RADIOMETRIC PROBES WITH mV SIGNAL OUTPUT

The LP…01 series allows measurement of Photometric and Radiometric quantities such as illuminance (lux), irradiance (W/m^2) across VIS-NIR, UVA, UVB, UVC spectral regions, as well as the number of photons received per unit time on a unit area, in the Photosynthetical Active Radiation (PAR) wavelength range from 400nm - 700nm.
In LP….01 probes, there is no need for external power supply. Output signal in mV is given through a resistor shunting the photodiode ends. Photocurrent generated by the photodiode when hit by light, is converted to a potential difference, which is read by a voltmeter. Once the DDP (Potential Difference) has been read, the measured value can be calculated through the calibration factor. **All probes are individually calibrated and the calibration factor is shown both on the probe housing and on the user manual and is specific to that probe.** LP…01 probes are equipped with cosine corrected diffuser. In probes for UV measurements the diffuser is made of sanded quartz, for the other probes, the diffuser is commonly made of acrylic material or teflon® (LP PHOT 01). LP ... .01 probes **are suitable for applications in-door** which requires the constant monitoring of the quantities specified. The output signal can be amplified or converted into a 4÷20mA or 0÷10Vdc signal by using a converter of the series HD978TR3 (4÷20mA) and HD978TR4 (0÷10Vdc) for DIN rail attachment, or the wall mounting types HD978TR5 (4÷20mA) and HD978TR6 (0÷10Vdc).

Installing the probes

Once you have chosen where to install the probe, you must provide the connections between the probe and the voltmeter; the volmeter must have proper scales of measurement. The connection diagram of the probe output cables is shown in the user manual. For measurements in weather and agriculture stations or in nursery-gardening systems, the probe reference plane should be mounted parallel to the ground; in this case, the probe shall be mounted on a LP BL (optional) support provided with bubble level.

PROBE DESCRIPTION

LP PHOT 01:

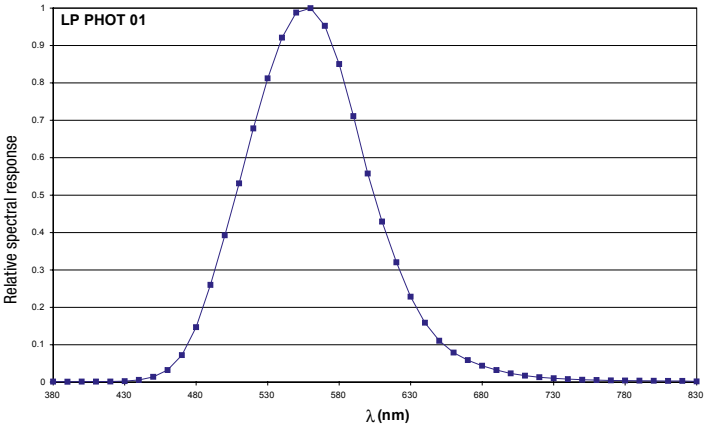
LP PHOT 01 probe measures illuminance (lux) defined as the ratio between the luminous flux (lumen) passing through a surface and the surface area (m^2).
The spectral response curve of a photometric probe is similar to the human eye curve, known as standard photopic curve V(λ). The difference in spectral response between LP PHOT 01 and the standard photopic curve V(λ) is calculated by means of the error f_1'. Calibration is carried out by comparison with a luxmeter, calibrated by a Primary Metrological Institute. Calibration procedures follow CIE publication No 69 (1987) "Method of Characterizing Illuminance Meters and Luminance Meteres". **The measurement is carried out by illuminating the probe with a standard illuminant A.**

TECHNICAL SPECIFICATIONS

Typical sensitivity:	0.5 ÷1.5 mV/klux
Spectral range:	V(λ)
Calibration accuracy:	<4%
f'_1 (V(λ) match error):	<8%
f_2 (cosine response/directional error):	<3%
f_3 (linearity'):	<1%
f_5 (fatigue):	<0.5%
Operating temperature:	0-50°C
Output impedance:	0.5 ÷1 kΩ

Typical spectral response LP PHOT 01

LP RAD 01:

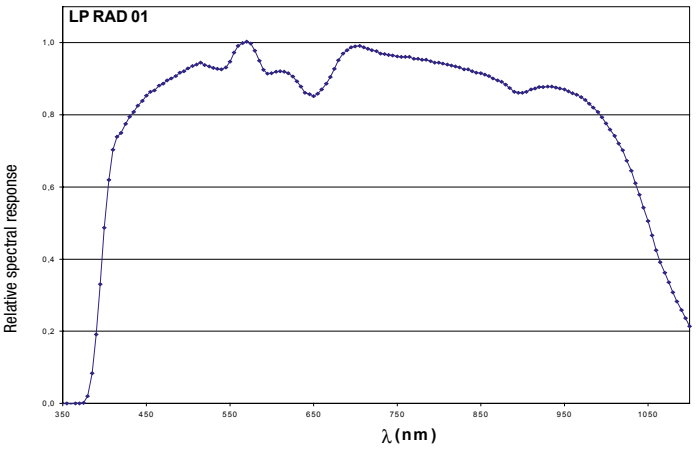


LP RAD 01 probe measures irradiance (W/m^2) defined as the ratio between the radiant flux (W) passing through a surface and the surface area (m^2) in the VIS-NIR (400nm-1050nm) spectral range. These particular features apply to an instrument suitable for measurements in visible and near infrared fields. **Probe calibration is carried out by using 577/579 nm lines** of a Xe-Hg lamp, filtered through a special interferential filter.

TECHNICAL SPECIFICATIONS

Typical sensitivity:	2.6 µV/(µW/cm^2)
Measuring range:	0-200 mW/cm^2
Spectral range:	≈400nm ÷≈1050nm
Calibration accuracy:	<6%
f_2 (cosine response/directional error):	<7%
Operating temperature:	0-50°C
Output impedance:	1 kΩ

Typical spectral response LP RAD 01



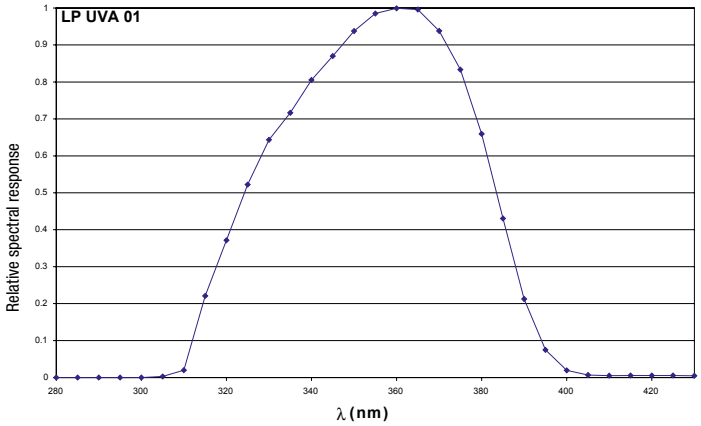
LP UVA 01:

LP UVA 01 probe measures irradiance (W/m^2) defined as the ratio between the radiant flux (W) passing through a surface and the surface area (m^2) in the UVA (315 nm ÷ 400 nm) spectral range. Thanks to a new type of photodiode, LP UVA 01 is blind to visible and infrared light.
Probe calibration is carried out by using a 365 nm line of a Xe-Hg lamp, filtered through a special interferential filter. Measurement is carried out by comparison with the primary standards, assigned to Delta Ohm Metrological Laboratory.
This probe can be used in all processes where ultraviolet lamp emission needs to be monitored: resins and adhesives polymerization, as well as tanning lamps.

TECHNICAL SPECIFICATIONS

Typical sensitivity:	2.6 µV/(µW/cm²)
Measuring range:	0-200 mW/cm²
Typical spectral range:	peak at ≈360 nm and FWHM 60 nm
Calibration accuracy:	<6%
Working temperature:	0-50°C
Output impedance:	1 kΩ

Typical spectral response LP UVA 01

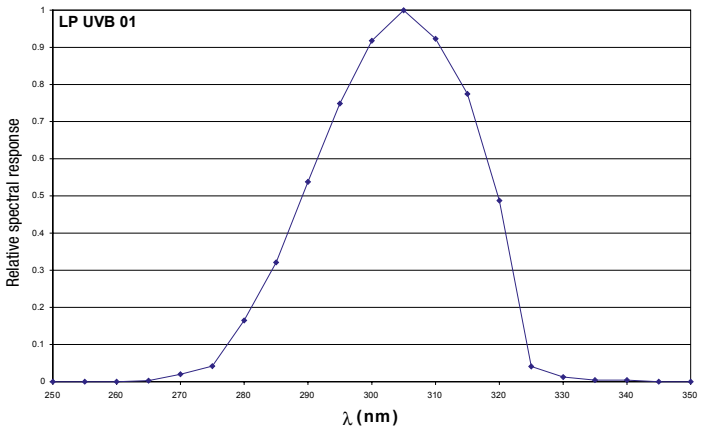


LP UVB 01:
LP UVB 01 probe measures irradiance (W/m²) defined as the ratio between the radiant flux (W) passing through a surface and the surface area (m²) in the UVB (280 nm –315 nm) spectral range. Thanks to a new type of photodiode, LP UVB 01 is blind to visible and infrared light.
Probe calibration is carried out by using a 313 nm line of a Xe-Hg lamp, filtered through a special interferential filter. Measurement is carried out by comparison with the primary standards, assigned to Delta Ohm Metrological Laboratory.

TECHNICAL SPECIFICATIONS

Typical sensitivity:	0.19 µV/(µW/cm²)
Measuring range:	0-200 mW/cm²
Typical spectral range:	peak at ≈ 305 nm and FWHM 31 nm
Calibration accuracy:	<8%
Working temperature:	0-50°C
Output impedance:	2 kΩ

Typical spectral response LP UVB 01

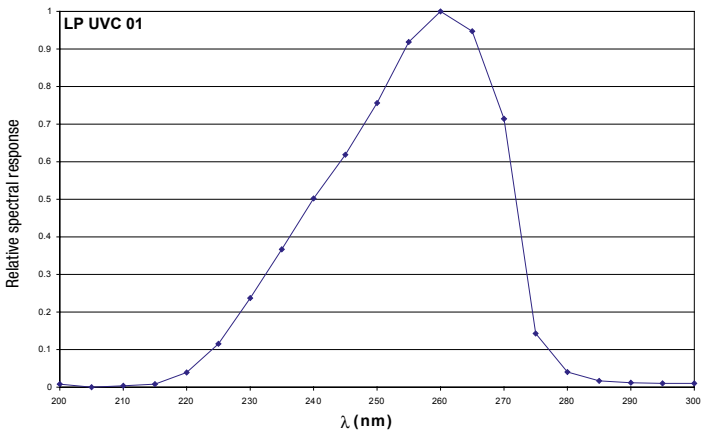


LP UVC 01:
LP UVC 01 probe measures irradiance (W/m²) defined as the ratio between the radiant flux (W) passing through a surface and the surface area (m²) in the UVC (200nm ÷280nm) spectral range. Thanks to a new type of photodiode, LP UVC 01 is blind to visible and infrared light. **The probe calibration is carried out by measuring irradiance coming from an Hg lamp at 254nm.**

TECHNICAL SPECIFICATIONS

Typical sensitivity:	0.19 µV/(µW/cm²)
Measuring range:	0-200 mW/cm²
Typical spectral range:	peak at 260 and FWHM 32nm
Calibration accuracy:	<10%
Working temperature:	0-50°C
Output impedance:	2 kΩ

Typical spectral response LP UVC 01

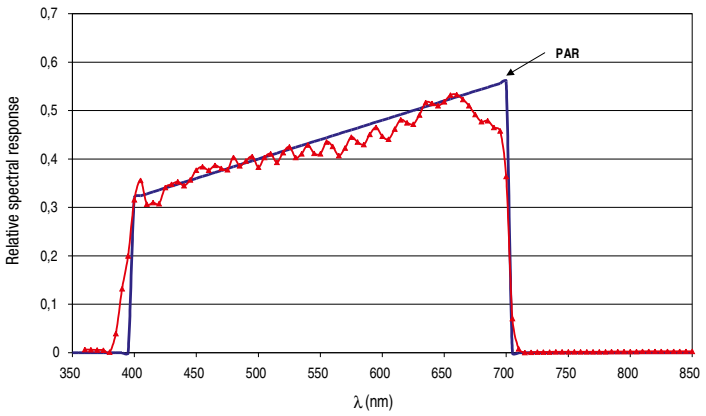


LP PAR 01:
LP PAR 01 probe measures the ratio between the number of photons that strike a surface in one second, in the 400nm - 700nm spectral range and the surface area (m²). This quantity is defined as PAR: Photosynthetically Active Radiation.
The probe calibration is carried out by using an alogen lamp, with a known spectral irradiance in a specific spectral range.
Temperature slightly affects the probe spectral response.
The diffuser and the probe particular structure, allow the response to the variation of the light incidence angle on the diffuser, to be cosine corrected

TECHNICAL SPECIFICATIONS

Typical sensitivity:	30 µV/(µmol/(m⁻²s⁻¹)
Measuring range:	0-5000 (µmol/(m⁻²s⁻¹)
Typical spectral range:	400 nm ÷ 660 nm
Calibration accuracy:	<6%
f_2 (cosine response/directional error):	<7%
Operating temperature:	0-50°C
Output impedance:	1 kΩ

Typical spectral response LP PAR 01



Purchasing codes:

LP PHOT 01: Photometric probe for measuring ILLUMINANCE, CIE photopic filter, diffuser for correction according to the cosine law. mV per klux output, 5 m cable.

LP RAD 01: Radiometric probe for measuring IRRADIANCE, diffuser for correction according to the cosine law. mV per klux output, 5 m cable.

LP PAR 01: Radiometric probe for measuring PHOTONS FLUX in the range of PAR (Photosynthetically Active Radiation). Cosine correction. mV/micromol/m⁻²s⁻¹, 5 m cable.

LP UVA 01: Radiometric probe for measuring IRRADIANCE in the UVA (315…400nm). µV/µWcm² output, 5m cable

LP UVB 01: Radiometric probe for measuring IRRADIANCE in the UVB (280…315nm). µV/µWcm² output, 5m cable.

LP UVC 01: Radiometric probe for measuring IRRADIANCE in the UVC (200…280nm). µV/µWcm² output, 5m cable

LP BL: Base with levelling device. On request for assebly with the probes at the time of placing the order.

HD978TR3: Configurable signal converter amplifier with 4÷20mA (20÷4mA) output. Input measuring range –10..+60mV. Default setting 0÷20mV. For DIN rail attachment. Minimum measuring range 2mV.

HD978TR4: Configurable signal converter amplifier with 0÷10 (10÷0Vdc) output. Input measuring range –10..+60mV. Default setting 0÷20mV. For DIN rail attachment. Minimum measuring range 2mV.

HD978TR5: Configurable signal converter amplifier with 4÷20mA (20÷4mA) output. Input measuring range –10..+60mV. Default setting 0÷20mV. Minimum measuring range 2mV.

HD978TR6: Configurable signal converter amplifier with 0÷10 (10÷0Vdc) output. Input measuring range –10..+60mV. Default setting 0÷20mV. Minimum measuring range 2mV.

LP PHOT 03
LP RAD 03
LP PAR 03
LP UVA 03
LP UVB 03

PHOTOMETRIC AND RADIOMETRIC PROBES WITH OUTPUT SIGNAL IN mV OR NORMALIZED 4÷20mA OR 0÷10Vdc OUTPUT

Photo-radiometric probes with output signal in mV or standard output 4÷20mA or 0÷10Vdc The probes of the series LP…03 **for outdoor use** allow to measure photometric and radiometric quantities such as: illuminance (lux), irradiance (W/m²) in the near ultraviolet spectral region VIS-NIR, UVA, UVB, and the photon flow across the PAR region (400nm...700nm). The probes with mV output do not require any power supply. The output signal is obtained from a resistance that short-circuits the terminal of the photodiode. The ratio of generated photocurrent to incident light power is converted into a Difference of Potential that can be read by a voltmeter. Once the DDP (Difference of Potential) is known, the measured value can be calculated through the calibration factor. All probes are individually calibrated and the calibration factor is also **shown on the probe housing**. The probes with normalized output current 4÷20mA or voltage 0÷10Vdc require external power supply. The probe LP UVB 03 is available only with standard output voltage 0÷5Vdc and requires external power supply.
All probes of the series LP…03 are equipped with diffuser for cosine correction and protection dome.
The heating option allows you to operate at low temperatures with good results.
M12 male 4-pole connector, heated version 8-poles.
Cables with female connectors and with 2, 5 or 10m length available on request.
On request female connector cable 2, 5 or 10 m long.

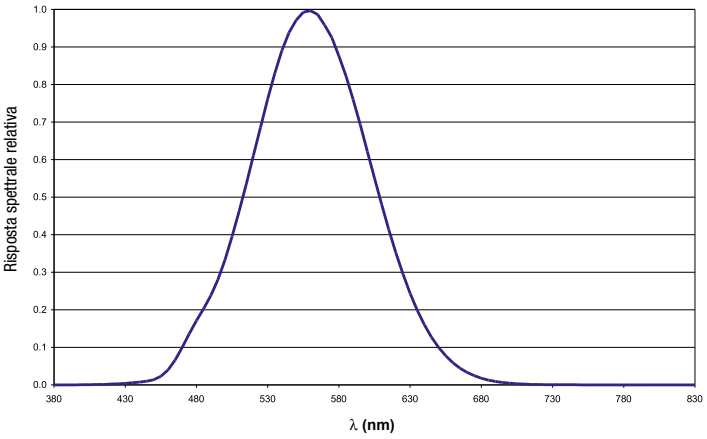
LP PHOT 03

The probe LP PHOT 03 measures illuminance (lux), defined as the ratio between the luminous flux (lumen) passing through a surface and the surface area (m²).
The spectral response curve of a photometric probe is similar to the human eye curve, known as standard photopic curve V(λ). The difference in spectral response between LP PHOT 03 and the standard photopic curve V(λ) is calculated by means of the error f1.
Calibration is carried out by comparison with a reference luxmeter, calibrated by a Primary Metrological Laboratory. The Calibration Procedure complies with the CEI publication No.69 "Methods of characterizing illuminance meters and luminance meters: Performance, characteristics and specifications, 1987".
The photometric measurement probe is designed for **outdoor** readings. CIE photopic filter. Cosine correction filter and K5 glass dome.
The heating option allows you to operate at low temperatures with good results.
Output, according to the chosen configuration, mV or normalized output 4÷20mA or 0÷10Vdc.

TECHNICAL SPECIFICATIONS:

Typical sensitivity:	0.5 ÷ 1.5 mV/(klux)
Spectral range:	V(λ) (see figure)
Calibration uncertainty:	< 4%
f'_1 (agreement with the standard curve V(λ)):	<6%
f_2 (Cosine response)	<3%
f_3 (linearity)	<1%
Measuring range:	0-200 klux
Viewing angle:	2π sr
Operating temperature:	-40°C ÷ +60°C heated version -20°C ÷ +60°C standard version
Impedance:	0.5 ÷ 1.0 KΩ non-normalized version
Version with normalized output 4÷20mA:	4mA = 0 klux, 20mA = 150 klux
Version with normalized output 0÷10Vdc	0V = 0 klux, 10V = 150klux
Power supply:	10…30Vdc for version with normalized output 4÷20mA 15…30Vdc for version with normalized output 0÷10Vdc

Typical spectral response curve of **LP PHOT 03:**



PURCHASING CODE

LP PHOT 03: Photometric probe for the measurement of illuminance, complete with K5 dome, silica gel cartridge, flying female 4-pole or 8-pole connector (depending on the version), calibration report. **Cable with female connector has to be ordered separately.** Cables: **CPM12 AA** …with cable length 2, 5 or 10 meters.

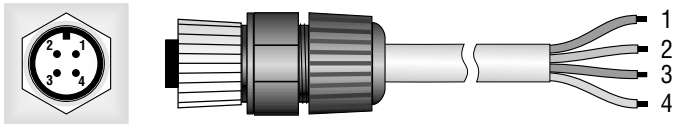
LP PHOT [ ] [ ]
- **R** = heating option
- **Blank** = not heated

- **03** = mV per klux
- **03BL** = mV per klux, base with levelling device
- **03BLAC** = mV per klux, base with levelling device output 4÷20 mA
- **03BLAV** = mV per klux, base with levelling device output 0÷10 mA

CABLE:
CPM12 AA [ ] [ ]
- **2** = length 2m
- **5** = length 5m
- **10** = length 10m

- **4** = 4-pole cable for non-heated versions
- **8** = 8-pole cable for heated versions, **option R**

WIRING DIAGRAM
4-pole wire CPM12AA4…



Fixed 4-pole plug M12 **Flying 4-pole M12 socket**

LPPHOT 03, LP PHOT 03BL

Connector	Function	Color
1	Positive (+)	Red
2	Negative (-)	Blue
3	Not connected	White
4	Shield	Black

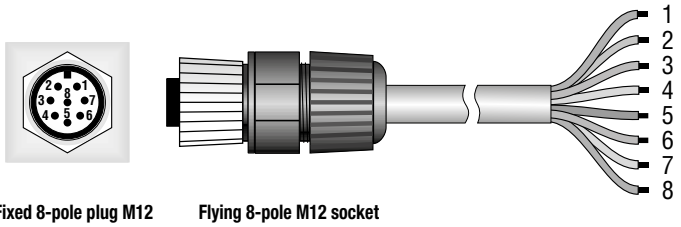
LP PHOT 03BLAV

Connector	Function	Color
1	(+) V out	Red
2	(-) V out and (-) Vdc	Blue
3	(+) Vdc	White
4	Shield	Black

LP PHOT 03BLAC

Connector	Function	Color
1	Positive (+), (+) Vdc	Red
2	Negative (-), (-) Vdc	Blue
3	Not connected	White
4	Shield	Black

8-pole wire CPM12AA8…



Fixed 8-pole plug M12 **Flying 8-pole M12 socket**

LP PHOT 03R, LP PHOT 03BLR

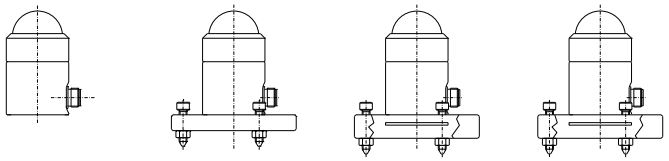
Connector	Function	Color
1	Positive signal (+)	Red
2	Negative signal (-)	Blue
3	Not connected	
4	Shield	Braid
5	NTC (10K)	Brown
6		White
7	Heater	Black
8		Green

LP PHOT 03BLAVR

Connector	Function	Color
1	(-) V out and (-) Vdc	Red
2	(+) V out	Blue
3	Not connected	
4	(+) Vdc	Braid
5	NTC (10K)	Brown
6		White
7	Heater	Black
8		Green

LP PHOT 03BLACR

Connector	Function	Color
1	Positive signal (+), (+) Vdc	Red
2	Negative signal (-), (-)Vdc	Blue
3	Not connected	
4	Shield	Braid
5	NTC (10K)	Brown
6		White
7	Heater	Black
8		Green



LP PHOT 03 **LP PHOT 03BL** **LP PHOT 03BLAC** **LP PHOT 03BLAV**

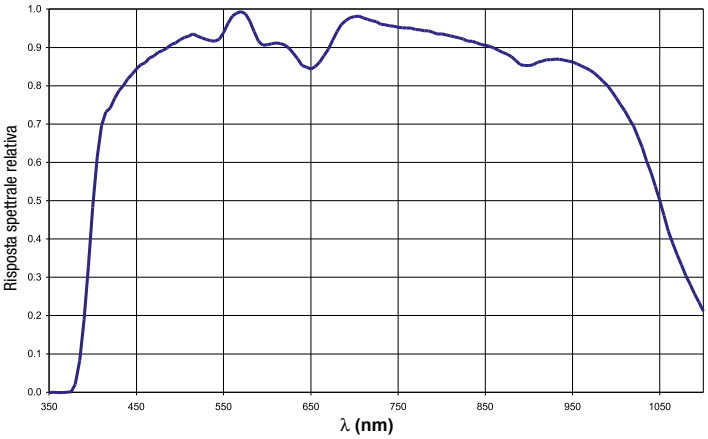
LP RAD 03

LP RAD 03 probe measures irradiance (W/m2) defined as the ratio between the radiant flux (W) passing through a surface and the surface area (m2) in the VIS-NIR (400nm-1050nm) spectral range. The probe is designed for **outdoor** readings.
Cosine correction filter and K5 glass dome.
The heating option allows you to operate at low temperatures with good results.
Output, according to the chosen configuration, in µV per µW/cm² or 4÷20mA or 0÷10Vdc normalized output.

Technical specifications

Typical sensitivity:	1÷2.5 µV/(µW/cm2)
Spectral range:	400nm ÷1050nm
Calibration uncertainty:	<5%
f_2 (cosine response):	<3%
f_3 (linearity)	<1%
Operating temperature:	-40°C ÷ +60°C heated version
	-20°C ÷ +60°C standard version
Impedance:	0.5 ÷ 1.0 KΩ non-normalized version
Version with normalized output 4÷20mA:	4mA = 0 W/m², 20mA = 2000 W/m²
Version with normalized output 0÷10Vdc	0V = 0 W/m², 10V = 2000 W/m²
Output impedance:	0.5 ÷ 1.0 KΩ non-normalized version
Power supply:	10…30Vdc for version with normalized output 4÷20mA
	15…30Vdc for version with normalized output 0÷10Vdc

Typical spectral response curve **LP RAD 03**



PURCHASING CODE

LP RAD 03: Radiometric probe for the measurement of irradiance, complete with K5 dome, silica gel cartridge, flying 4-pole or 8-pol connector (depending on the version). Cable with female connector has to be ordered separately Cables: **CPM12 AA** …with cable length 2, 5 or 10 meters.

LP RAD ☐☐
- **R** = heating option
- **Blank** = not heated

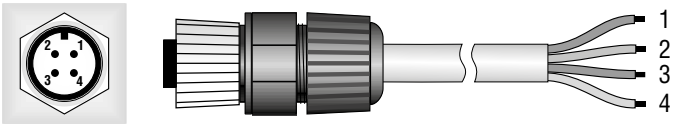
- **03** = µV per µW/cm²
- **03BL** = µV/(µW/cm²), base with levelling device
- **03BLAC** = µV/(µW/cm²), base with levelling device output 4÷20 mA
- **03BLAV** = µV/(µW/cm²), base with levelling device output 0÷10 mA

CABLE:
CPM12 AA ☐☐
- **2** = length 2m
- **5** = length 5m
- **10** = length 10m

- **4** = 4-pole cable for non-heated versions
- **8** = 8-pole cable for heated versions, **option R**

WIRING DIAGRAM

4-pole wire CPM12AA4…



Fixed 4-pole plug M12 **Flying 4-pole M12 socket**

LP RAD 03, LP RAD 03BL

Connector	Function	Color
1	Positive (+)	Red
2	Negative (-)	Blue
3	Not connected	White
4	Shield	Black

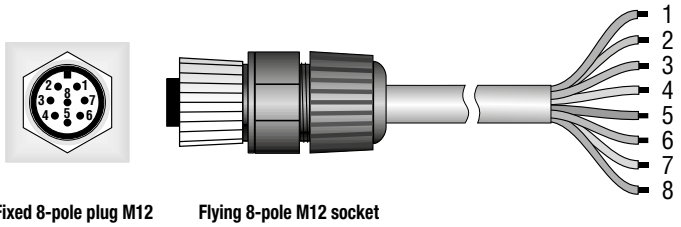
LP RAD 03BLAV

Connector	Function	Color
1	(+) V out	Red
2	(-) V out and (-) Vdc	Blue
3	(+) Vdc	White
4	Shield	Black

LP RAD 03BLAC

Connector	Function	Color
1	Positive (+)	Red
2	Negative (-)	Blue
3	Not connected	White
4	Shield	Black

8-pole wire CPM12AA8…



Fixed 8-pole plug M12 **Flying 8-pole M12 socket**

LP RAD 03R, LP RAD 03BLR

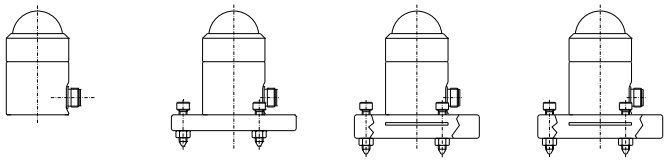
Connector	Function	Color
1	Positive signal (+)	Red
2	Negative signal (-)	Blue
3	Not connected	
4	Shield	Braid
5	NTC (10K)	Brown
6		White
7	Heater	Black
8		Green

LP RAD 03BLAVR

Connector	Function	Color
1	(-) V out and (-) Vdc	Red
2	(+) V out	Blue
3	Not connected	
4	(+) Vdc	Braid
5	NTC (10K)	Brown
6		White
7	Heater	Black
8		Green

LP RAD 03BLACR

Connector	Function	Color
1	Positive signal (+), (+) Vdc	Red
2	Negative signal (-), (-)Vdc	Blue
3	Not connected	
4	Shield	Braid
5	NTC (10K)	Brown
6		White
7	Heater	Black
8		Green



LP RAD 03 **LP RAD 03BL** **LP RAD 03BLAC** **LP RAD 03BLAV**

LP PAR 03

The probe LP PAR 03 measures the ratio between the number of photons that strike a surface in one second, in the 400nm-700nm spectral range and the surface area (m²). This quantity is defined as PAR: Photo-synthetically Active Radiation.

The probe calibration is carried out by using an halogen lamp, with a known spectral irradiance in a specific spectral range.

Temperature slightly affects the probe spectral response.

The probe is designed for **outdoor** readings.

Cosine correction filter and K5 glass dome.

The heating option allows you to operate at low temperatures with good results.

Output, according to the chosen configuration, in µV per µmol $m^{-2}s^{-1}$ or normalized outputs 4÷20mA or 0÷10Vdc.

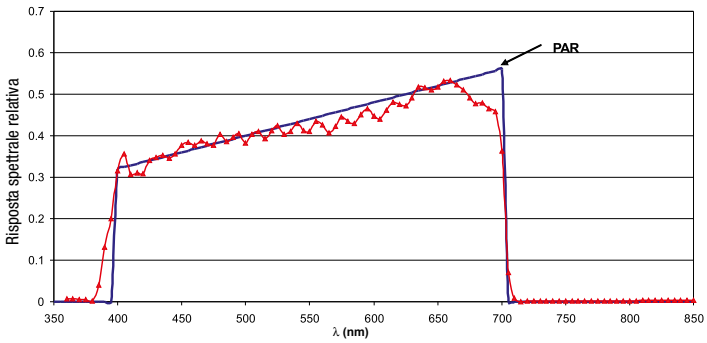
TECHNICAL SPECIFICATIONS

Typical sensitivity:	1÷2.5 µV/(µmol/($m^{-2}s^{-1}$))
Typical spectral range:	400 nm ÷ 700 nm
Calibration uncertainty:	<5%
f_2 (cosine response):	<3%
f_3 (linearity)	<1%
Operating temperature:	-40°C ÷ +60°C heated version
	-20°C ÷ +60°C standard version
Impedance:	0.5 ÷ 1.0 KΩ non-normalized version

Version with normalized output 4÷20mA: 4mA = 0 µmol/($m^{-2}s^{-1}$), 20mA = 5000 µmol/($m^{-2}s^{-1}$)
Version with normalized output 0÷10Vdc 0V = µmol/($m^{-2}s^{-1}$), 10V = 5000 µmol/($m^{-2}s^{-1}$)

Power supply: 10…30Vdc for version with normalized output 4÷20mA
15…30Vdc for version with normalized output 0÷10Vdc

Typical spectral response curve **LP PAR 03:**



PURCHASING CODE

LP PAR 03 Radiometric probe for the measurement of the Photon flux in the PAR action spectra, complete with K5 dome, silica gel cartridge, flying 4-pole or 8-pole connector (depending on the version). **Cable with female connector has to be ordered separately**. Cables: **CPM12 AA** …with cable length 2, 5 or 10 meters.

LP PAR [ ][ ]
- **R** = heating option
- **Blank** = not heated

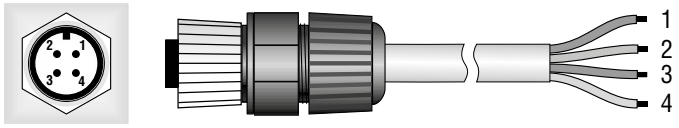
[ ][ ]
- **03** = µV per µmol $m^{-2}s^{-1}$
- **03BL** = µV per µmol $m^{-2}s^{-1}$, base with levelling device
- **03BLAC** = µV per µmol $m^{-2}s^{-1}$, base with levelling device output 4÷20 mA
- **03BLAV** = µV per µmol $m^{-2}s^{-1}$, base with levelling device output 0÷10 mA

CABLE:

CPM12 AA [ ][ ]
- **2** = length 2m
- **5** = length 5m
- **10** = length 10m

[ ]
- **4** = 4-pole cable for non-heated versions
- **8** = 8-pole cable for heated versions, **option R**

WIRING DIAGRAM
4-pole wire CPM12AA4…



Fixed 4-pole plug M12 **Flying 4-pole M12 socket**

LP PAR 03, LP PAR 03BL

Connector	Function	Color
1	Positive (+)	Red
2	Negative (-)	Blue
3	Not connected	White
4	Shield	Black

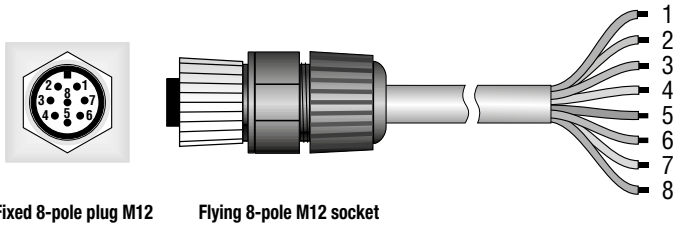
LP PAR 03BLAV

Connector	Function	Color
1	(+) V out	Red
2	(-) Vout and (-) Vdc	Blue
3	(+) Vdc	White
4	Shield	Black

LP PAR 03BLAC

Connector	Function	Color
1	Positive (+)	Red
2	Negative (-)	Blue
3	Not connected	White
4	Shield	Black

8-pole wire CPM12AA8…



Fixed 8-pole plug M12 **Flying 8-pole M12 socket**

LP PAR 03R, LP PAR 03BLR

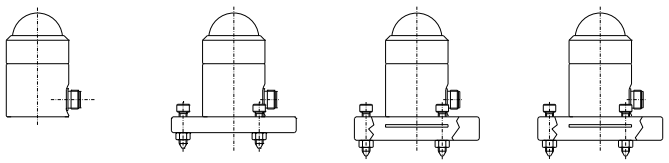
Connector	Function	Color
1	Positive signal (+)	Red
2	Negative signal (-)	Blue
3	Not connected	
4	Shield	Braid
5	NTC (10K)	Brown
6		White
7	Heater	Black
8		Green

LP PAR 03BLAVR

Connector	Function	Color
1	(-) V out and (-) Vdc	Red
2	(+) V out	Blue
3	Not connected	
4	(+) Vdc	Braid
5	NTC (10K)	Brown
6		White
7	Heater	Black
8		Green

LP PAR 03BLACR

Connector	Function	Color
1	Positive signal (+), (+) Vdc	Red
2	Negative signal (-), (-)Vdc	Blue
3	Not connected	
4	Shield	Braid
5	NTC (10K)	Brown
6		White
7	Heater	Black
8		Green



LP PAR 03 **LP PAR 03BL** **LP PAR 03BLAC** **LP PAR 03BLAV**

LP UVA 03

The LP UVA 03 probe measures irradiance (W/m²) defined as the ratio between the radiant flux (W) passing through a surface and the surface area (m²) in the UVA (315 nm –400 nm) spectral range. Thanks to a new type of photodiode, LP UVA 03 is blind to visible and infrared light.

Probe calibration is carried out by using a 365 nm line of a Xe-Hg, filtered through a special interferential filter. Measurement is carried out by comparison with the primary standards, assigned to Delta Ohm Metrological Laboratory. The probe is designed for **outdoor** readings.

Cosine correction filter and K5 glass dome.

The heating option allows you to operate at low temperatures with good results.

Output, according to the chosen configuration, in µV per µW/cm² or 4÷20mA or 0÷10Vdc normalized output.

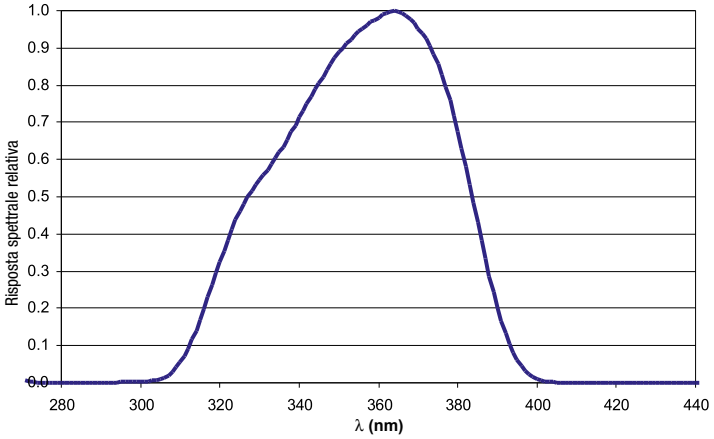
TECHNICAL SPECIFICATIONS

Typical sensitivity:	70÷200 µV/(W/cm²)
Measuring range:	327÷384nm (1/2) 312÷393nm (1/10) 305÷400nm (1/100) Peak: 365nm
Calibration uncertainty:	<6%
f_2 (cosine response):	<6%
f_3 (linearity)	<1%
Operating temperature:	-40°C ÷ +60°C heated version -20°C ÷ +60°C standard version
Impedance:	0.5 ÷ 1.0 KΩ non-normalized version

Version with normalized output 4÷20mA: 4mA = 0 W/m² 20mA = 200W/m²
Version with standard output 0÷10Vdc : 0V = 0 W/m10V = 200W/m²

Power supply: 10…30Vdc for version with normalized output 4÷20mA
15…30Vdc for version with normalized output 0÷10Vdc

Typical spectral response curve **LP UVA 03:**



PURCHASING CODE

LP UVA 03: Radiometric probe for the measurement of the UVA irradiance, complete with with K5 dome, silica gel cartridge, flying 4-pole or 8-pole connector (depending on the version). **Cable with female connector has to be ordered separately**. Cables: **CPM12 AA** …with cable length 2, 5 or 10 meters.

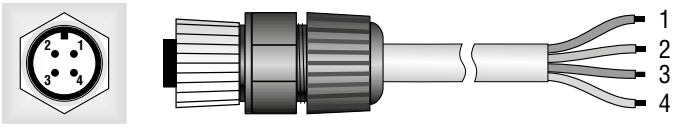
LP UVA □□
- **R** = heating option
- **Blank** = not heated

- **03** = µV per µW/cm²
- **03BL** = µV per µW/cm², base with levelling device
- **03BLAC** = µV per µW/cm², base with levelling device output 4÷20 mA
- **03BLAV** = µV per µW/cm², base with levelling device output 0÷10 mA

CABLE:
CPM12 AA □□
- **2** = length 2m
- **5** = length 5m
- **10** = length 10m

- **4** = 4-pole cable for non-heated versions
- **8** = 8-pole cable for heated versions, **option R**

WIRING DIAGRAM
4-pole wire CPM12AA4…



Fixed 4-pole plug M12 **Flying 4-pole M12 socket**

LP UVA 03, LP UVA 03BL

Connector	Function	Color
1	Positive (+)	Red
2	Negative (-)	Blue
3	Not connected	White
4	Shield	Black

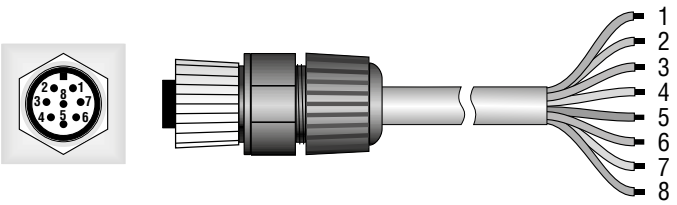
LP UVA 03BLAV

Connector	Function	Color
1	(+) V out	Red
2	(-) Vout and (-) Vdc	Blue
3	(+) Vdc	White
4	Shield	Black

LP UVA 03BLAC

Connector	Function	Color
1	Positive (+)	Red
2	Negative (-)	Blue
3	Not connected	White
4	Shield	Black

8-pole wire CPM12AA8…



Fixed 8-pole plug M12 **Flying 8-pole M12 socket**

LP UVA 03R, LP UVA 03BLR

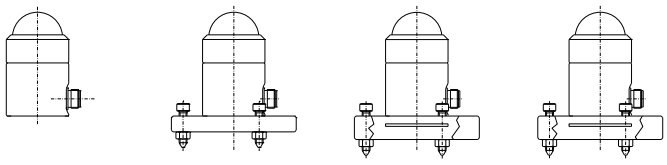
Connector	Function	Color
1	Positive signal (+)	Red
2	Negative signal (-)	Blue
3	Not connected	
4	Shield	Braid
5	NTC (10K)	Brown
6		White
7	Heater	Black
8		Green

LP UVA 03BLAVR

Connector	Function	Color
1	(-) V out and (-) Vdc	Red
2	(+) V out	Blue
3	Not connected	
4	(+) Vdc	Braid
5	NTC (10K)	Brown
6		White
7	Heater	Black
8		Green

LP UVA 03BLACR

Connector	Function	Color
1	Positive signal (+), (+) Vdc	Red
2	Negative signal (-), (-)Vdc	Blue
3	Not connected	
4	Shield	Braid
5	NTC (10K)	Brown
6		White
7	Heater	Black
8		Green



LP UVA 03 **LP UVA 03BL** **LP UVA 03BLAC** **LP UVA 03BLAV**

LP UVB 03BLAVR:
The LP UVB 03BLAVR probe measures global irradiance (W/m^2) defined as the ratio between the radiant flux (W) passing through a surface and the surface area (m^2) in the UVB (280 nm ÷315 nm) spectral region. In particular, the spectral sensitivity is focused at 365nm, with a bandwidth (FWHM) of 5nm.

The global irradiance is the result of the sum of direct solar irradiance and of diffused irradiance
incident on a planar surface. In the UVB spectral region, unlike in the visible portion where the direct component prevails over the direct component, the light is strongly diffused by the atmosphere and thus the two components are equivalent, therefore is very important that the instrument is capable of measuring accurately both the components.

The probe is designed for **outdoor** readings.

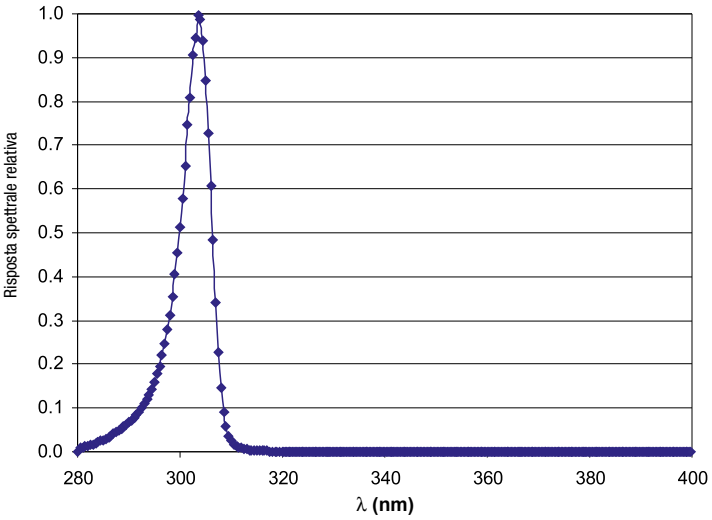
Cosine correction filter and Quartz dome.

The heating option allows you to operate at low temperatures with good results.
Standard output 0÷5Vdc.

TECHNICAL SPECIFICATIONS

Typical sensitivity:	≈6V/(W/m²)
Typical spectral range:	301nm ÷ 306nm (1/2) 295 ÷ 308.5nm (1/10) 290 ÷ 311.5nm (1/100) Peak at 304nm
Calibration uncertainty:	<6%
f_2 (cosine response):	<6%
f_3 (linearity)	<1%

Typical spectral response curve **LP 03BLAVR**



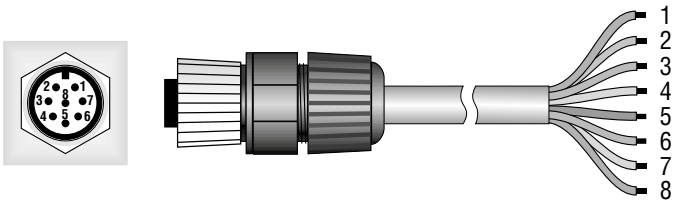
PURCHASING CODE
LP UVB 03BLAVR: Radiometric probe for the measurement of the UVB irradiance, complete with Quartz dome, 3 silica gel cartridges, flying 8-pole connector, calibration report. Cable with female connector has to be ordered separately. Cables: **CPM12 AA8** …, with cable lengths 2, 5 or 10 meters.

LP UVB ☐ — **03BLAVR** = 0÷5 V, complete with levelling device and heater

CABLE:
CPM12 AA ☐☐
- **2** = length 2m
- **5** = length 5m
- **10** = length 10m
- **8** = 8-pole cable for heated versions, **option R**

WIRING DIAGRAM

8-pole wire CPM12AA8…

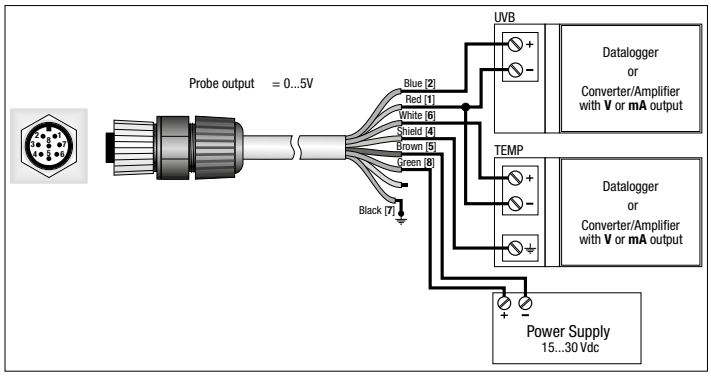


Fixed 8-pole plug M12 **Flying 8-pole M12 socket**

LP UVB 03BLAVR, LP UVB 03BLAVR

Connector	Function	Color
1	Signal GND	Red
2	V out UV (+)	Blue
3	Not connected	
4	Shield	Braid
5	Power GND	Brown
6	V out Temp. (+)	White
7	Housing	Black
8	Power 7-30Vdc	Green

LP UVB 03BLAV CONNECTION DIAGRAMS



ACCESSORIES

Heating option R

LP G: Packet with 5 silica gel spare cartridge

CPM12 AA4.2: 4-pole cable for not heated versions. Length 2 m. Connector M12 8-pole on one side, open wires on the other sid

CPM12 AA4.5: 4-pole cable for not heated versions. Length 5 m. Connector M12 8-pole on one side, open wires on the other side.

CPM12 AA4.10: 4-pole cable for not heated versions. Length 10 m. Connector M12 8-pole on one side, open wires on the other side.

CPM12 AA8.2: 8-pole cable for heated versions. Length 2m. 8-pole M12 connector on one end, open wires on the other side.

CPM12 AA8.5: 8-pole cable for heated versions. Length 5m. 8-pole M12 connector on one end, open wires on the other side.

CPM12 AA8.10: 8-pole cable for heated versions. Length 10m. 8-pole M12 connector on one end, open wires on the other side.

Configurable amplifiers and converters

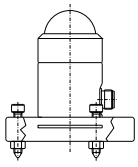
HD978TR3: Configurable signal converter amplifier with 4÷20mA (20÷4mA) output. Input measuring range –10..+60mV. **Default setting 0÷20mV.** Two DIN module (35mm) for rail attachment. Minimum measuring range 2mV. **Configurable with HD 778 TCAL.**

HD978TR4: Configurable signal converter amplifier with 0÷10 (10÷0Vdc) output. Input measuring range –10..+60mV. **Default setting 0÷20mV.** Two DIN module (35mm) for rail attachment. Minimum measuring range 2mV. **Configurable with HD 778 TCAL.**

HD978TR5: Configurable signal converter amplifier with 4÷20mA (20÷4mA) output. Input measuring range –10..+60mV. **Default setting 0÷20mV.** Minimum measuring range 2mV. **Configurable with HD 778 TCAL. For wall mounting.**

HD978TR6: Configurable signal converter amplifier with 0÷10 (10÷0Vdc) output. Input measuring range –10..+60mV. **Default setting 0÷20mV.** Minimum measuring range 2mV. **Configurable with HD 778 TCAL. For wall mounting.**

HD 778 TCAL: Power generator in the range –60mv…+60mV, **regulated by PC through RS232C serial port. DeltaLog-7** software to configure type K, J, T and N thermocouple transmitters and HD978TR3, HD978TR4, HD978TR5 and HD974TR6 converters.



LP UVB 03BLAVR

LP RAD 03 BLAC

LP RAD 03 BL

LP RAD 03

LP PHOT 02 – LP PHOT 02AC – LP PHOT 02AV PHOTOMETRIC PROBES

The LP PHOT 02, LP PHOT 02AC, and LP PHOT 03AV probes measure illuminance (lux), defined as the ratio between the luminous flux (lumen) passing through a surface and the surface area (m^2).
The spectral response curve of a photometric probe is similar to the human eye curve, known as *standard photopic curve V(λ).* The difference in spectral response between LP PHOT 02 and the standard photopic curve V(λ) is calculated by means of the error f_1'.
LP PHOT 02 is designed for outdoor installation for long period.
The photometric measurement for external use is used for measurement of daylight in meteorology and climatology.

Working principle
LP PHOT 02 probe is based on a solid state sensor, whose spectral response was corrected using filters to fit on the response of the human eye. The relative spectral response curve is shown in fig.1.

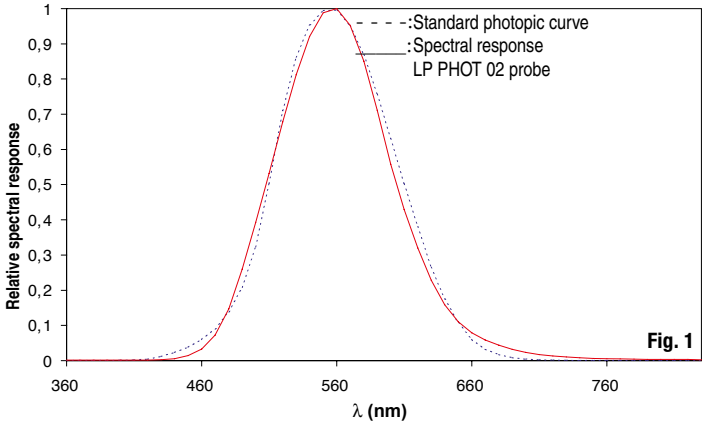


Fig. 1

LP PHOT 02 is equipped with a 50 mm diameter transparent glass dome, in order to protect the sensor against atmospheric damage.
The cosine corrected response has been obtained through both the PTFE diffuser and case particular shapes. Deviation between the theoretical response and the real one, is shown in fig.2.
The LP PHOT 02 excellent cosine response allows for use even when the sun elevation is low.

Installing and mounting the LP PHOT 02 probe for global radiation measurements:
Before installing the probe, the silica-gel cartridge must be refilled. Silica-gel crystals absorb humidity in the dome chamber and in case of particular climatic conditions, prevent internal condensation forming on the dome inner wall, with a consequent alteration in measurements.
Do not wet or touch the instrument with your hands while refilling the silica-gel cartridge. Carry out the following instructions in a (possibly) dry environment:

1- Loosen the three screws that fix the white shade disk
2- Unscrew the silica-gel cartridge using a coin
3- Remove the cartridge perforated cap
4- Open the silica-gel sachet (supplied with the luxmeter)
5- Fill the cartridge with silica-gel crystals
6- Close the cartridge with its own cap, and check that the sealing O-Ring is in the right position.
7- Screw the cartridge to the luxmeter using a coin
8- Make sure the cartridge is tightly screwed (otherwise silica-gel crystal will last for a shorter time)
9- Position the shade and tighten it with the screws
10- The probe is ready for use

Fig.3 shows the operations needed to refill the cartridge with silica-gel crystals

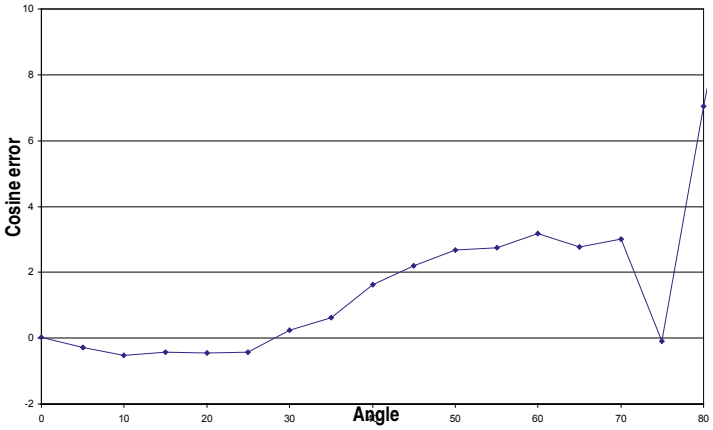


Fig. 2

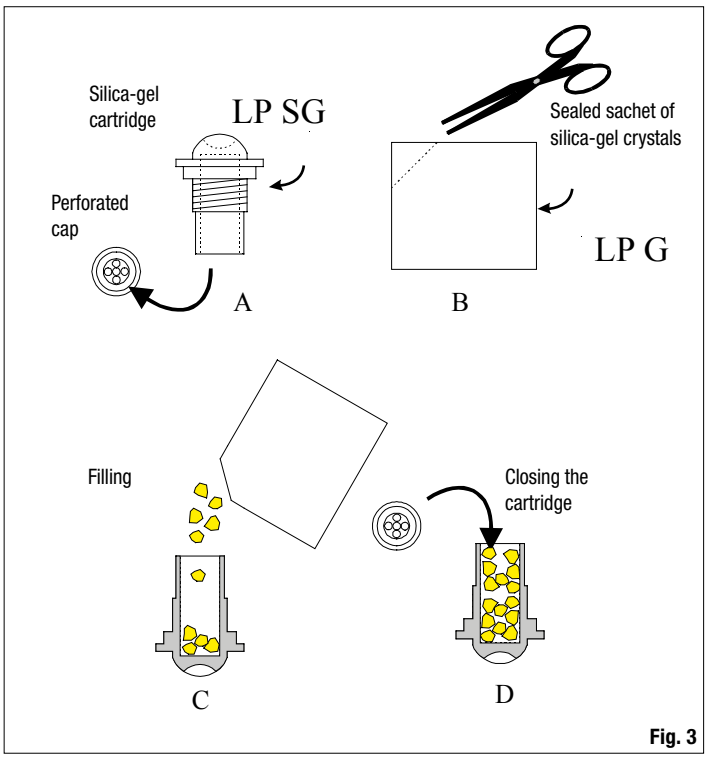


Fig. 3

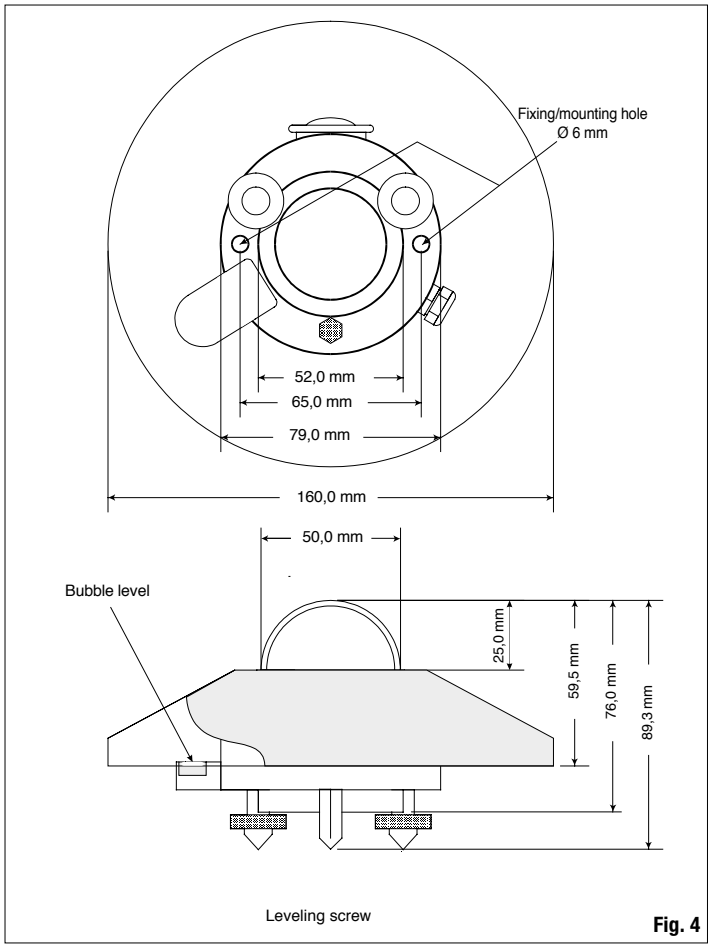
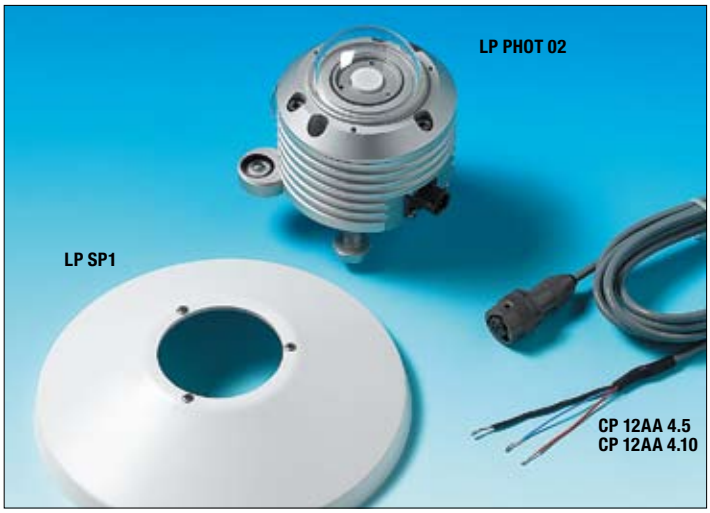


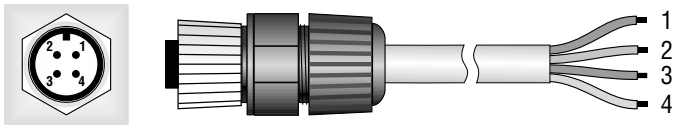
Fig. 4



the adjustment is by means of the two screws with adjusting nut for adjusting the tilt. The fixation on a plane can be performed using the two holes of 6mm diameter and spacing of 65 mm. To access holes to remove the screen and reposition it after mounting, see Figure 4.

- The support LP S1, available on request as an accessory, allows easy installation of the probe on a support pole. The maximum diameter of the pole to which the media can be set is 50 mm. The installer must take care that the height of the mast does not exceed the level of the probe, not to introduce measurement errors caused by reflections and shadows caused by the pole. To secure the probe to the support bracket remove the screen by removing the three screws, attach the probe and once the installation is complete, refit the white screen.
- It is better to insulate the probe from its support.
- Ensure good electrical contact to earth.

WIRING DIAGRAM LP PHOT 02



Fixed 4-pole plug M12 **Flying 4-pole M12 socket**

P PHOT 02

Connector	Function	Color
1	V out (+)	Red
2	V out (-)	Blue
3	Not connected	White
4	Shield (⏚)	Black

LP PHOT 02 AC

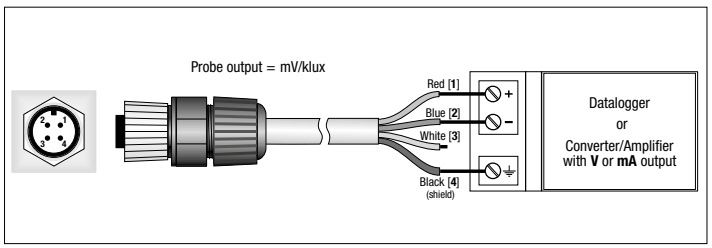
Connector	Function	Color
1	Positivo (+), +Vdc	Red
2	Negativo (-), -Vdc	Blue
3	Not connected	White
4	Shield (⏚)	Black

LP PHOT 02 AV

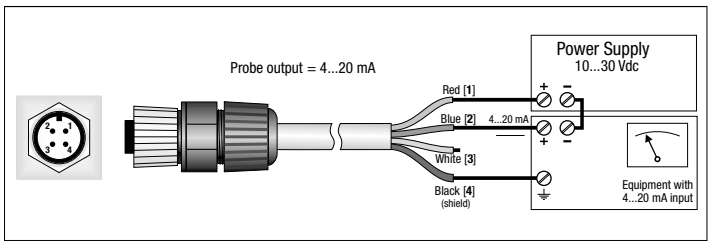
Connector	Function	Color
1	(+) Vout	Red
2	(-) Vout e (-) Vdc	Blue
3	(+) Vdc	White
4	Shield (⏚)	Black

- The LP PHOT 02 is installed in a location easily accessible for periodic cleaning of the outer dome and maintenance. At the same time you should avoid buildings, trees or obstacles of any kind exceeds the horizontal plane on which lies the probe. In case this is not possible it is advisable to choose a location where obstacles on the path of the sun from sunrise to sunset is less than 5°.
- The probe should be placed away from any obstacle that might reflect the sun (or shadow) on the probe itself.
- For accurate horizontal positioning, the probe LP PHOT 02 is equipped with bubble level,

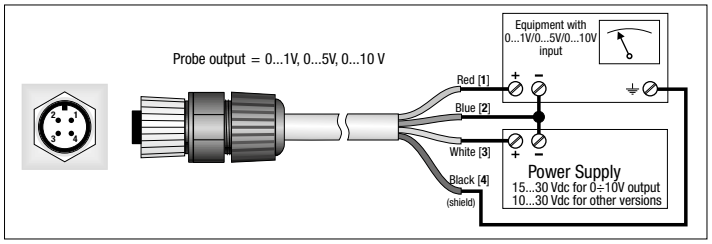
LP PHOT 02 CONNECTION DIAGRAMS



LP PHOT 02 AC



LP PHOT 02 AV



LP PHOT 02 Electrical Connections and requirements for electronic readout devices

- LP PHOT 02 probe is passive and it does not require any power supply.
- LP PHOT 02 is supplied with a flying 4-pole M12 connector
- UV-proof cables are available already assembled, with standard length 5m or 10m.
- Amplified probes are available, with current output signal 4÷20mA or voltage output 0…1Vdc, 0…5Vdc or 0…10Vdc.
- The **optional** cable is UV-proof, cable colors and connector poles are matched as follows:
  Black → shield braid
  Red → (+) signal generated by the detector
  Blue → (-) negative signal generated by the detector (in contact with the housing)
  See wiring scheme.
- LP PHOT 02 is to be connected to a millivoltmeter or data acquisition unit which input load resistance must be > 100kΩ.

Maintenance:

To ensure a high measurement accuracy is necessary for the outer dome to be always kept clean, so the higher the frequency of cleaning of the dome greater the precision of the measurements. Cleaning can be done with normal maps for the cleaning of lens paper and water, otherwise just use pure ethyl alcohol. After cleaning with alcohol, it is necessary to clean the dome again with just water.

Due to the high temperature changes between day and night it is possible the presence of condense on the dome of the probe, in this case the reading performed is strongly overestimated. To minimize condensation inside the light meter there is a proper cartridge inside with absorbent material: Silica gel. The efficiency of silica-gel crystals decreases over time with the absorption of moisture. When crystals of silica gel are efficient their color is **yellow**, while gradually losing efficiency the color turns to **white**, see the instructions for replacing.

Typically the duration of silica gel ranges from 4 to 6 months depending on environmental conditions in which it operates the probe.

Calibration and measurements:

The photometric probe sensitivity, indicated as **S** (or calibration factor), allows determining illuminance by measuring a signal in Volts at the probe ends. **S** factor is measured in **V/klux.**

- Once the difference of potential (DDP) has been measured at sensor ends, E_e illuminance is obtained through the following formula:

$$E_e = DDP/S$$

where;

E_e: indicates Illuminance expressed in klux,

DDP: indicates the difference of potential expressed in mV and measured by the multimeter,

S: indicates the calibration factor expressed in mV/klux and shown on the luxmeter label (calibration factor is also mentioned in the calibration report).

Each photomatric probe is individually factory calibrated and is distinguished by its calibration factor. Calibration is carried out by using a standard **illuminant A**, as indicated in CIE publication N° 69 "Methods of characterizing illuminance meters and luminance meters: Performance, characteristics and specifications, 1987". Calibration is carried out by comparison with a reference luxmeter, assigned to Delta Ohm Metrological Laboratory.

To get the best performances from LP PHOT 02, we strongly recommend to check calibration annually.

Technical specifications:

Typical sensitivity:	0,5 ÷2,0 mV/klux
Response time:	<0.5 sec (95%)
Impedance:	0.5 ÷ 1 KΩ
Measuring range:	0-150 klux
Viewing angle:	2π sr
Spectral range:	Standard photopic curve
Operating temperature:	-40°C ÷ 80°C
Error f'_1	<9 %
Cosine response/directional error:	< 8 % (between 0° and 80°)
Long term instability(1 year):	<|±3| %
Non-linearity:	<1 %
Temperature response	< 0.1%/°C
Weight:	0.90 Kg
Dimensions:	fig. 4

PURCHASING CODES

LP PHOT 02: Photometric probe for outdoor **Illuminance** measurements (0÷150klux), CIE photopic filter, diffuser for cosine correction, complete with LP SP1 protection and silica gel cartridge, bubble level, flying 4-pole M12 plug and Calibration Report. Cable has to be ordered separately.

LP PHOT 02AC: Photometric probe for outdoor **Illuminance** measurements (0÷150klux), CIE photopic filter, diffuser for cosine correction. **4÷20mA output**, integrated transmitter amplifier. Power supply 10…30Vdc. complete with LP SP1 protection and silica gel cartridge, bubble level, flying 4-pole M12 plug and Calibration Report. **5m or 10m cables with connectors available on request.**

LP PHOT 02AV: Photometric probe for outdoor **Illuminance** measurements (0÷150klux), CIE photopic filter, diffuser for cosine correction. **0÷1Vdc, 0÷5Vdc, 0÷10Vdc output**, integrated transmitter amplifier. Power supply 10…30Vdc **(15..30Vdc for 0…10Vdc output).** Complete with LP SP1 protection and silica gel cartridge, bubble level, flying 4-pole M12 plug and Calibration Report. **5m or 10m cables with connectors available on request.**

LP S1: Mounting kit for LP PHOT 02: bracket for attachment to a mast, including fasteners and levelling screws.

LP SP1: UV resistant plastic shade disk (BASF LURAN S777K).

LP SG: Desiccant sachet with silica gel crystals, complete with inner O-ring and cap.

LP G: Packet with 5 silica gel spare cartridge.

CPM12 AA4.5: 4-pole UV resistant cable L=5 m. For the instruments LP PHOT 02, LP PHOT 02AC, LP PHOT 02AV.

CPM12 AA4.10: 4-pole UV resistant cable L=10 m. For the instruments LP PHOT 02, LP PHOT 02AC, LP PHOT 02AV.

Configurable amplifiers and converters

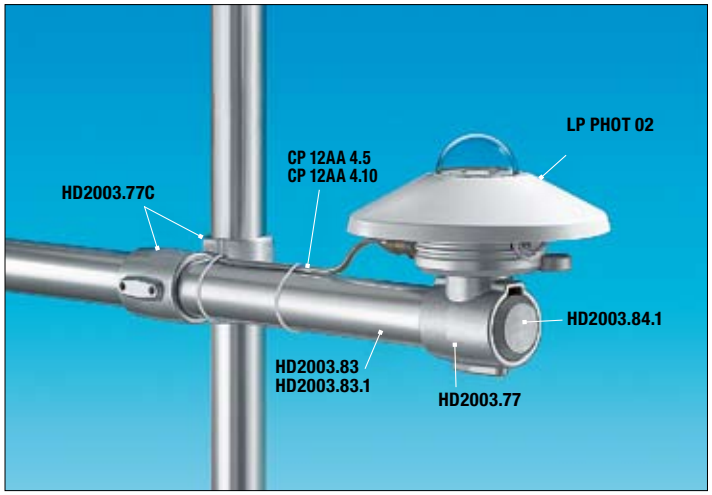
HD978TR3: Configurable signal converter amplifier with 4÷20mA (20÷4mA) output. Input measuring range –10..+60mV. **Default setting 0÷20mV.** Two DIN module (35mm) for rail attachment. Minimum measuring range 2mV. **Configurable with HD 778 TCAL.**

HD978TR4: Configurable signal converter amplifier with 0÷10 (10÷0Vdc) output. Input measuring range –10..+60mV. **Default setting 0÷20mV.** Two DIN module (35mm) for rail attachment. Minimum measuring range 2mV. **Configurable with HD 778 TCAL.**

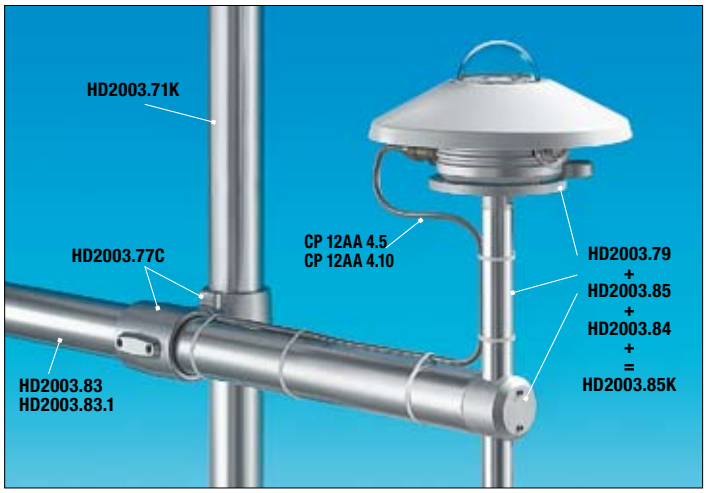
HD978TR5: Configurable signal converter amplifier with 4÷20mA (20÷4mA) output. Input measuring range –10..+60mV. **Default setting 0÷20mV.** Minimum measuring range 2mV. **Configurable with HD 778 TCAL. For wall mounting.**

HD978TR6: Configurable signal converter amplifier with 0÷10 (10÷0Vdc) output. Input measuring range –10..+60mV. **Default setting 0÷20mV.** Minimum measuring range 2mV. **Configurable with HD 778 TCAL. For wall mounting.**

HD 778 TCAL: Power generator in the range –60mv…+60mV, **regulated by PC through RS232C serial port. DeltaLog-7** software to configure type K, J, T and N thermocouple transmitters and HD978TR3, HD978TR4, HD978TR5 and HD974TR6 converters.



LP PHOT 02



LP PHOT 02

LP UVA 02 - LP UVA 02AC - LP UVA 02AV
RADIOMETRIC PROBES

The radiometric LP UVA 02, LP UVA 02AC, and LP UVB02AV probes measure the broadband UVA irradiance on a plane surface (Watt/ m^2). Measured irradiance is the result of the sum of direct solar irradiance and of diffuse irradiance.
The radiometer can also be used for monitoring UVA irradiance indoor.

Working Principle
LP UVA 02 radiometer is based on a solid state sensor, whose spectral response sensor has been adapted to that desired by using appropriate filters. The relative spectral response is reported on figure 4.
In order to protect the diffuser from the dust, LP UVA 02 is equipped with a 50mm glass dome.
The cosine low response is obtained with a particular shaped PTFE diffuser. In figure 5 the cosine error versus angle of incident is reported.
The excellent cosine law response of LP UVA 02 allow to use the radiometer at any sun's zenith angle. (The diffused component of the UVA increases as the sun moves away from the zenith, so the error on direct component due to imperfect response according to the cosine becomes negligible on the measurement of global irradiance).

Installation and Mounting of the Radiometer for the Measurement of Global Radiation:
Before installing the radiometer, refill the cartridge containing silica-gel crystals. Silica gel absorbs humidity in the dome chamber and prevents (in particular climatic conditions) internal condensation forming on the internal walls of the domes and measurement alteration.
Do not touch the silica gel crystals with your hands while refilling the cartridge. Carry out the following instructions in an environment as dry as possible:

1- Loosen the three screws that fix the white shade disk
2- Unscrew the silica gel cartridge using a coin
3- Remove the cartridge perforated cap
4- Open the sachet containing silica gel (supplied with the radiometer)
5- Replace the silica gel crystals
6- Close the cartridge with its own cap, paying attention that the sealing O-ring be properly positioned.
7- Screw the cartridge to the radiometer body using a coin
8- Check that the cartridge is screwed tightly (if not, silica gel life will be reduced)
9- Position the shade disk and screw it with the screws
10- The radiometer is ready for use.

Figure N.1 shows the operations necessary to fill the cartridge with the silica gel crystals.

- The LP UVA 02 radiometer is installed in a location easily accessible for periodic cleaning of the outer dome and maintenance. At the same time you should avoid buildings, trees or obstacles of any kind exceeds the horizontal plane on which lies the radiometer. In case this is not possible, it is advisable to choose a location where obstacles on the path of the sun from sunrise to sunset is less than 5 °.
- The radiometer should be placed away from any obstacle that might reflect the sun (or shadow) on the same radiometer.
- For accurate horizontal positioning, the LP UVA 02 radiometer has a bubble level, the adjustment is by means of two screws with adjusting nut for adjusting the angle of the radiometer. The fixation on a plane can be performed using the two holes of 6mm diameter and spacing of 65 mm. To access holes to remove the screen and reposition it after mounting, see Figure 2.
- The support LP S1, supplied on request as an accessory, allows easy installation of the radiometer on a mast. The maximum diameter of the pole to which the media can be set is 50 mm. The installer must take care that the height of the mast does not exceed the level of the radiometer, not to introduce measurement errors caused by reflections and shadows caused by the pole. To secure the probe to the support bracket remove the screen by removing the three screws, attach the probe and once the installation is complete, refit the white screen.
- It is better to insulate the radiometer from its support, while ensuring that there is a good electrical contact to earth.

Electrical Connection and Requirements for Electronic Readout Devices:

- LP UVA 02 radiometer does not require any power supply.
- LP UVA 02 is supplied with a flying 4-pole M12 connector
- UV-proof PTFE cables are **available on request**, cable colors and connector poles of the screened 2-wire cable are matched as follows:
  Black → shield braid
  Red → (+) signal generated by the detector
  Blue → (-) negative signal generated by the detector (connected to the housing)
- LP UVA 02 is to be connected either to a millivoltmeter or data acquisition unit which input load resistance must be > 5MΩ. Typically, the radiometer output signal does not exceed 20mV. In order to better exploit the radiometer features, the readout instrument should have a 1μV resolution.

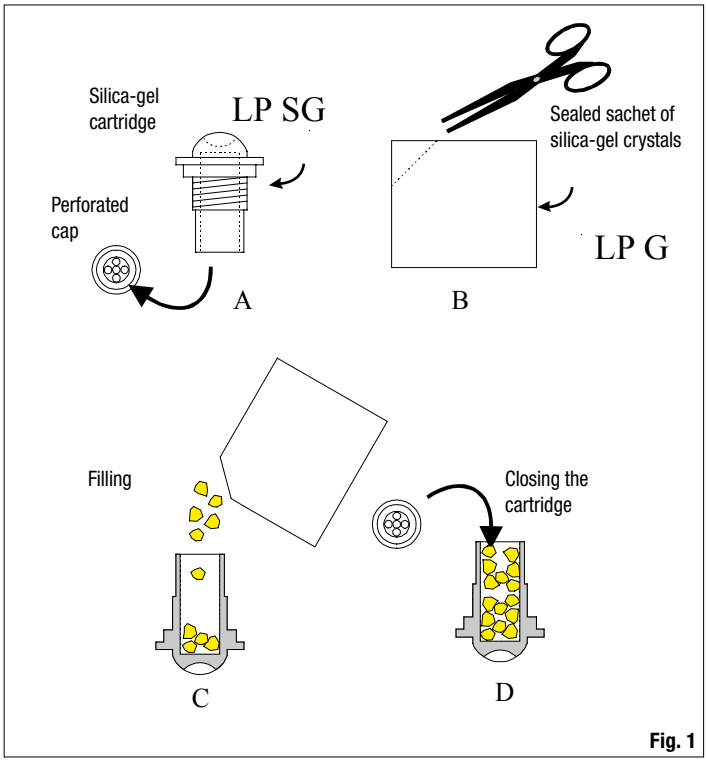


Fig. 1

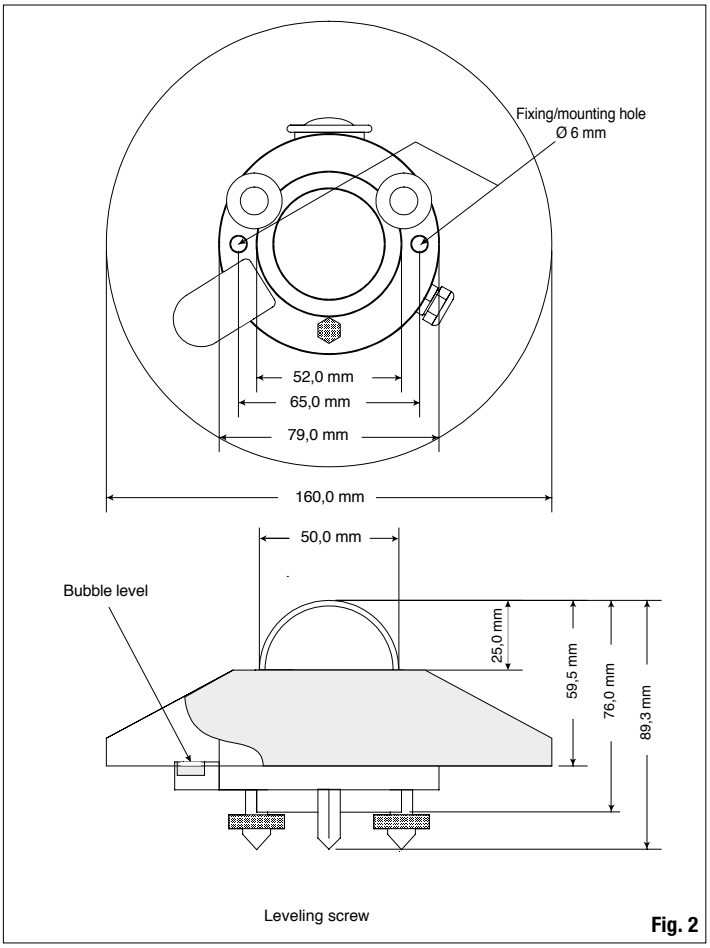
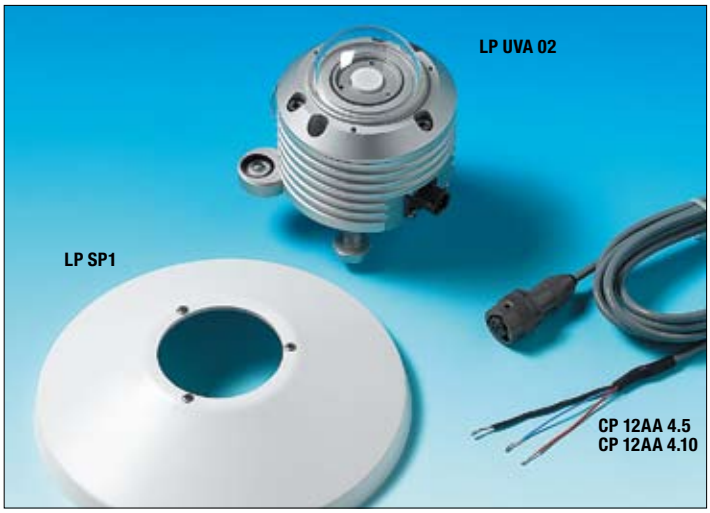


Fig. 2



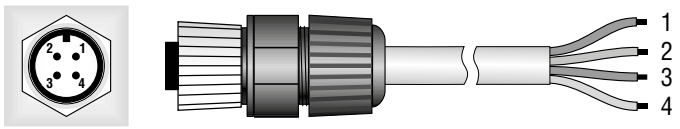
mated. To minimize condensation inside the light meter there is a proper cartridge inside with absorbent material: Silica gel. The efficiency of silica-gel crystals decreases over time with the absorption of moisture. When crystals of silica gel are efficient their color is **yellow**, while gradually losing efficiency the color turns to **white**, see the instructions for replacing.
Typically the duration of silica gel ranges from 4 to 6 months depending on environmental conditions in which it operates the probe.

Calibration and Measurements:
The radiometer **S** sensitivity (or calibration factor) allows to determine the irradiance by measuring a signal in Volts at the ends of the resistance which short-circuits the terminals of the photodiode ends. The **S** factor is measured in μV/(Wm^{-2}).

- Once the difference of potential (DDP) has been measured at the ends of the sensor, the E_e irradiance is obtained applying the following formula:

$$E_e = DDP/S$$

WIRING DIAGRAM LP PHOT 02



Fixed 4-pole plug M12 **Flying 4-pole M12 socket**

LP UVA 02

Connector	Function	Color
1	V out (+)	Red
2	V out (-)	Blue
3	Not connected	White
4	Shield (⏚)	Black

LP UVA 02 AC

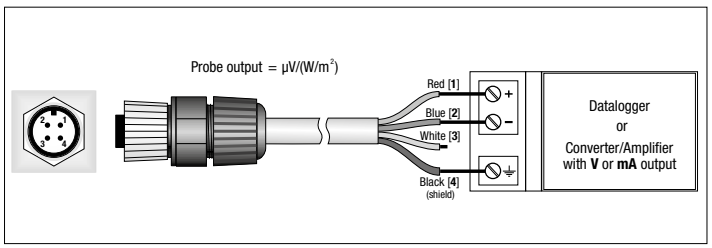
Connector	Function	Color
1	Positivo (+), +Vdc	Red
2	Negativo (-), -Vdc	Blue
3	Not connected	White
4	Shield (⏚)	Black

LP UVA 02 AV

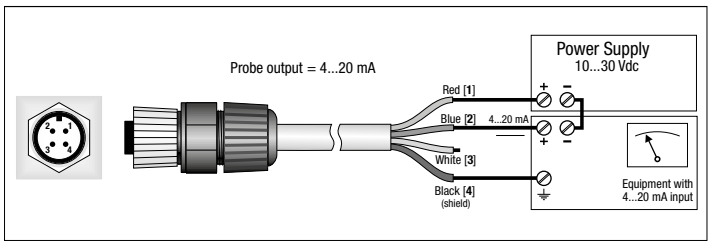
Connector	Function	Color
1	(+) Vout	Red
2	(-) Vout e (-) Vdc	Blue
3	(+) Vdc	White
4	Shield (⏚)	Black

Maintenance:
To ensure a high measurement accuracy is necessary for the outer dome to be always kept clean, so the higher the frequency of cleaning of the dome greater the precision of the measurements. Cleaning can be done with normal maps for the cleaning of lens paper and water, otherwise just use pure ethyl alcohol. After cleaning with alcohol, it is necessary to clean the dome again with just water.
Due to the high temperature changes between day and night it is possible the presence of condense on the dome of the probe, in this case the reading performed is strongly overesti-

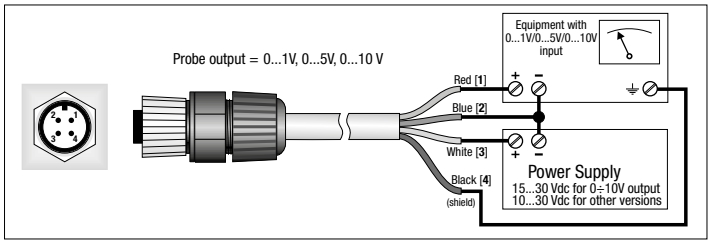
LP UVA 02 CONNECTION DIAGRAMS



LP UVA 02 AC



LP UVA 02 AV



Where:
E_e: is the Irradiance expressed in W/m^2,
DDP: is the difference of potential expressed in µV and measured by the multimeter,
S: is the calibration factor in µV/(W/m^2) shown on the radiometer label (and mentioned in the calibration report) .

Each radiometer is individually calibrated at factory and is distinguished by its calibration factor.
The calibration is carried out following procedure N° DHLF-E-59. This procedure is used in the SIT calibration center N° 124 for the calibration of UVA radiometer.
The calibration was performed by reference to Delta Ohm srl primary standard with monochromatic light at 365 nm obtained separating the emission line of a Xe-Hg lamp with an inferential filter. To get best performances from your LP UVA 02 it is strongly recommended that the calibration be checked annually.
N.B. At the moment no international agreement exists for the calibration of this kind of radiometer, so the calibration coefficient is dependent from the calibration procedure like reported in the following article:
"*Source of Error in UV Radiation Measurements*", T. C. Larason, C. L. Cromer on "*Journal of Research of the National Institute of Standards and Technology*" Vol. 106, Num. 4, 2001. (The article is free on the NIST's WEB site at the following address : http://www.nist.gov/jers)

Technical Specifications:

Typical sensitivity:	150 ÷ 350µV/(W/m^2)
Response time:	<0.5 sec (95%)
Impedance:	5 ÷ 7.5 KΩ
Measuring range:	0-200 W/m^2
Viewing angle:	2π sr
Spectral range:	327 nm ÷ 384 nm (1/2) 312 nm ÷ 393 nm (1/10) 305 nm ÷ 400 nm (1/100)
Operating temperature:	-40 °C ÷ 80 °C
Cosine response:	< 8 % (between 0° and 80°)
Long-term non-stability: (1 year)	<|±3| %
Non-linearity:	<1 %
Temperature response:	< 0.1%/°C
Dimensions:	figure 2
Weight:	0.90 Kg

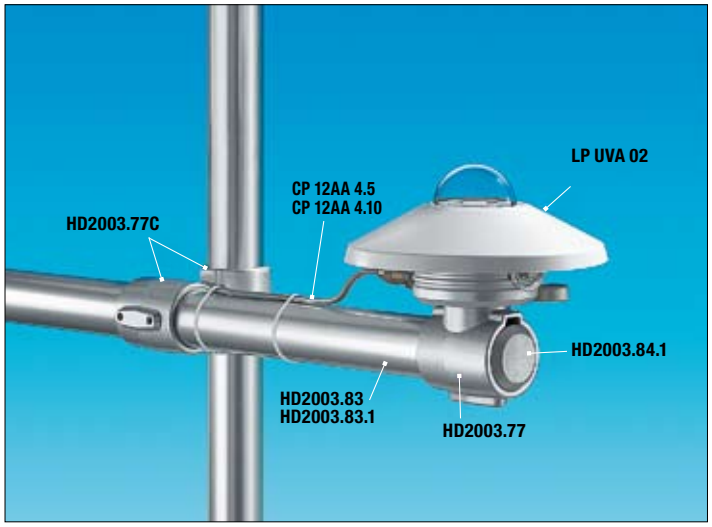
PURCHASING CODES

LP UVA 02: Radiometric probe for the outdoor measurement of UVA irradiance (315…400nm), complete with LP SP1 protection, silica gel cartridge, 2 spare sachets with silica gel crystals, bubble level, flying M12 4-pole connector and Calibration Report. **Cable has to be ordered separately.**

LP UVA 02AC: Amplified radiometric probe for the outdoor measurement of UVA irradiance (315…400nm), **4÷20mA output (0…150W/m²)**, integrated transmitter amplifier, **power supply 10…30Vdc**. Complete with flying M12 4-pole connector and Calibration Report. **Cable has to be ordered separately.**

LP UVA 02AV: Amplified radiometric probe for the outdoor measurement of UVA irradiance (315…400nm), **0÷1Vdc, 0÷5Vdc, 0÷10Vdc output (0…150W/m²)**, integrated transmitter amplifier, **power supply 10…30Vdc**. **(15..30Vdc for 0…10Vdc output).** Complete with flying M12 4-pole connector and Calibration Report. **Cable has to be ordered separately.**

LP S1: Mounting kit for LP UVA 02: bracket for attachment to a mast, including fasteners and leveling screws.



LP UVA 02

LP SP1: UV resistant plastic shade disk (BASF LURAN S777K).

LP SG: Desiccant sachet with silica gel crystals, complete with inner O-ring and cap.

LP G: Packet with 5 silica gel spare cartridge.

CPM12 AA4.5: 4-pole UV resistant cable L=5 m. For the instruments LP UVA 02, LP UVA 02AC, LP UVA 02AV.

CPM12 AA4.10: 4-pole UV resistant cable L=10 m. For the instruments LP UVA 02, LP UVA 02AC, LP UVA 02AV.

Configurable amplifiers and converters

HD978TR3: Configurable signal converter amplifier with 4÷20mA (20÷4mA) output. Input measuring range –10..+60mV. **Default setting 0÷20mV.** Two DIN module (35mm) for rail attachment. Minimum measuring range 2mV. **Configurable with HD 778 TCAL.**

HD978TR4: Configurable signal converter amplifier with 0÷10 (10÷0Vdc) output. Input measuring range –10..+60mV. **Default setting 0÷20mV.** Two DIN module (35mm) for rail attachment. Minimum measuring range 2mV. **Configurable with HD 778 TCAL.**

HD978TR5: Configurable signal converter amplifier with 4÷20mA (20÷4mA) output. Input measuring range –10..+60mV. **Default setting 0÷20mV.** Minimum measuring range 2mV. **Configurable with HD 778 TCAL. For wall mounting.**

HD978TR6: Configurable signal converter amplifier with 0÷10 (10÷0Vdc) output. Input measuring range –10..+60mV. **Default setting 0÷20mV.** Minimum measuring range 2mV. **Configurable with HD 778 TCAL. For wall mounting.**

HD 778 TCAL: Power generator in the range –60mv…+60mV, **regulated by PC through RS232C serial port. DeltaLog-7** software to configure type K, J, T and N thermocouple transmitters and HD978TR3, HD978TR4, HD978TR5 and HD974TR6 converters.

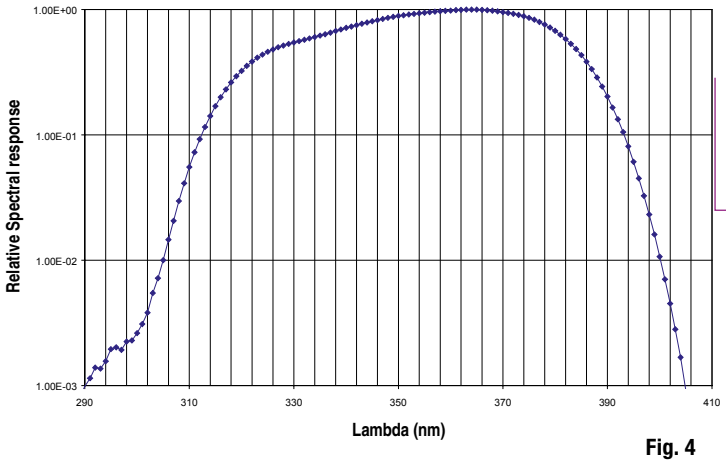


Fig. 4

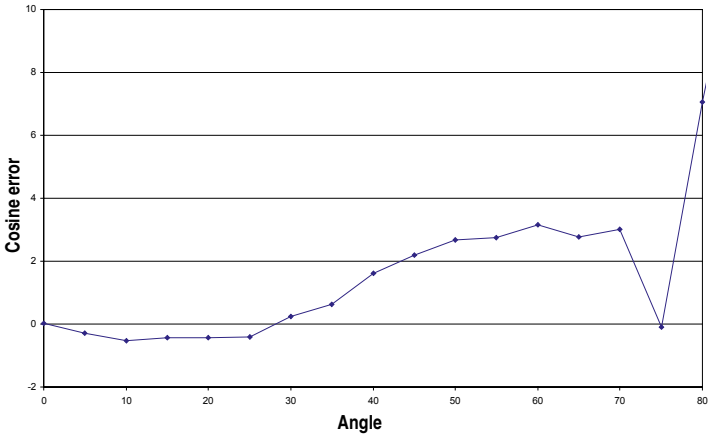


Fig. 5

LP UVB 02
RADIOMETRIC PROBE FOR ENVIRONMENTAL USE

The LP UVB 02 radiometer measures the global irradiance in the UVB spectral region on a plane surface (Watt/m^2). In particular, the instrument's spectral sensitivity is centered at 305nm with a 5nm band width (FWHM). The global irradiance is the sum of the direct solar irradiance and the sky diffuse irradiance on a surface parallel to the ground. In contrast to the visible spectrum where the direct component prevails over the diffuse component, in the UVB spectral region light is strongly diffused by atmosphere and thus the two components are equivalent. Therefore it is of primary importance for the instrument to be capable of measure both components accurately.

The LP UVB 02 probe is typically used in the following sectors:

- Monitoring the ozone layer. Indeed, the radiation around 295nm–315nm is strongly absorbed by ozone located in the stratosphere, therefore each small variation of the ozone layer corresponds to an increase or decrease of the radiation reaching the ground.
- Effects of UVB radiation (the most harmful to human health) on living beings.
- UVB radiation measurement in work spaces.

The LP UVB 02 radiometer needs power to function. Power is required to amplify the weak signal generated by the photodiode. Indeed, the radiometer is a current/voltage amplifier (transimpedance amplifier). This choice measures sun-produced UVB irradiance. Indeed, the need to use sophisticated filters (partially attenuating the signal concerned) and the relatively weak sun-produced irradiation in this spectral area, in the best case, make the photodiode-generated current in the order of hundreds of pAmpere. So it is not possible to use cable meters or tens of meters long as the noise might be greater than the signal itself. Therefore the signal must be amplified.

LP UVB 02 is robust and was manufactured to operate for long periods without maintenance (if powered correctly). This characteristic makes it suitable for location in meteorological stations.

A platinum-resistance thermometer (Pt100) is inserted inside the LP UVB 02 in order to control its temperature. Internal temperature must remain within its functioning range, otherwise measurements could be affected by higher systematic errors than those asserted in the manual. Exposure to temperature higher than +60°C can alter the interferential-filters spectral characteristics.

WORKING PRINCIPLE

The LP UVB 02 radiometer is based on an innovative solid state photodiode, the spectral response of which was adapted to that desired by using special interferential filters. In particular, the used photodiode and filters have exceptional stability characteristics, both for temperature and through time. This allowed manufacturing of an instrument that does not need heating, thus reducing energy consumption.

Particular attention has been given to filter design so as to make the instrument completely blind to wavelengths outside the concerned pass-band. The solar energy within the 302nm–308nm spectral band is only 0.01% of the total energy from the sun reaching Earth's surface. The relevant spectral response curve is shown in Fig. 1A (in linear scale) and Fig. 1B (in logarithmic scale).

The LP UVB 02 is provided with a 50mm-external-diameter dome in order to supply a suitable protection of the sensor to the atmospheric agents. Quartz was chosen due to its optimum transmission in the UV range.

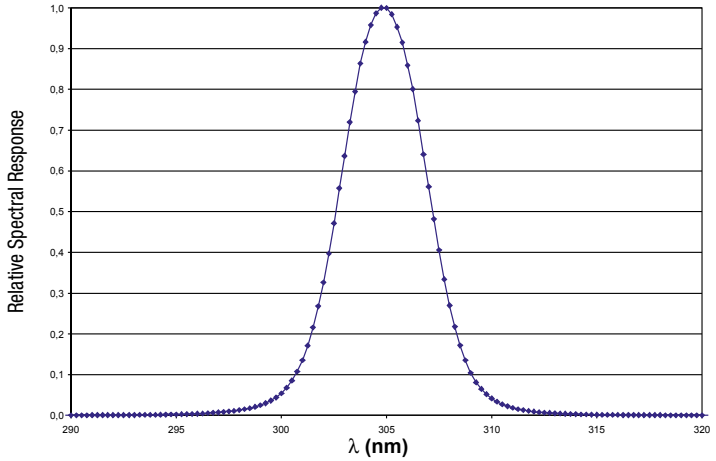


Fig. 1A

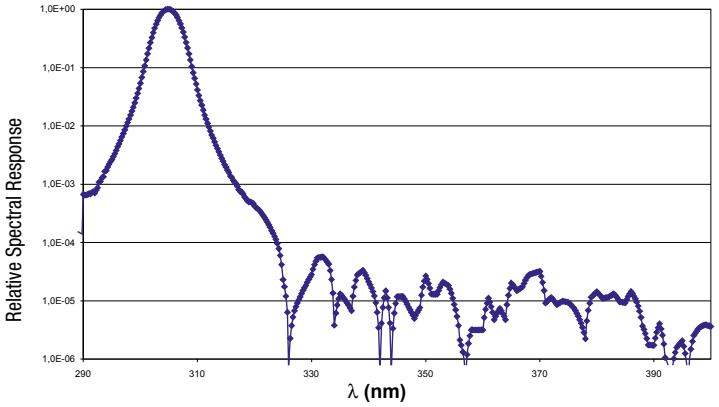


Fig. 1B

The response in accordance with the cosine law has been obtained thanks to the particular shape of the diffuser and of the housing. The departure between a theoretical response and the measured one is shown in the Fig. 2.

The excellent relation between the response of the LP-UVB-02 and the cosine law allows to use the instrument also when the sun has a very low raising (the UVB diffuse radiation increases as the sun is leaving the zenith, therefore the error on the direct radiation, owing to the imperfect response according to the cosine law, becomes negligible referred to the measurement of the global radiation).

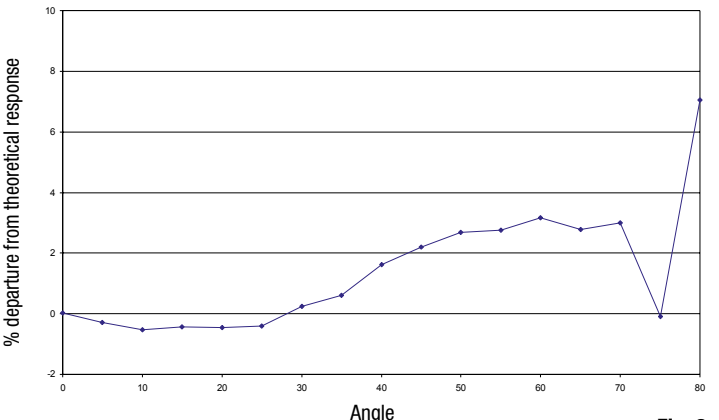


Fig. 2

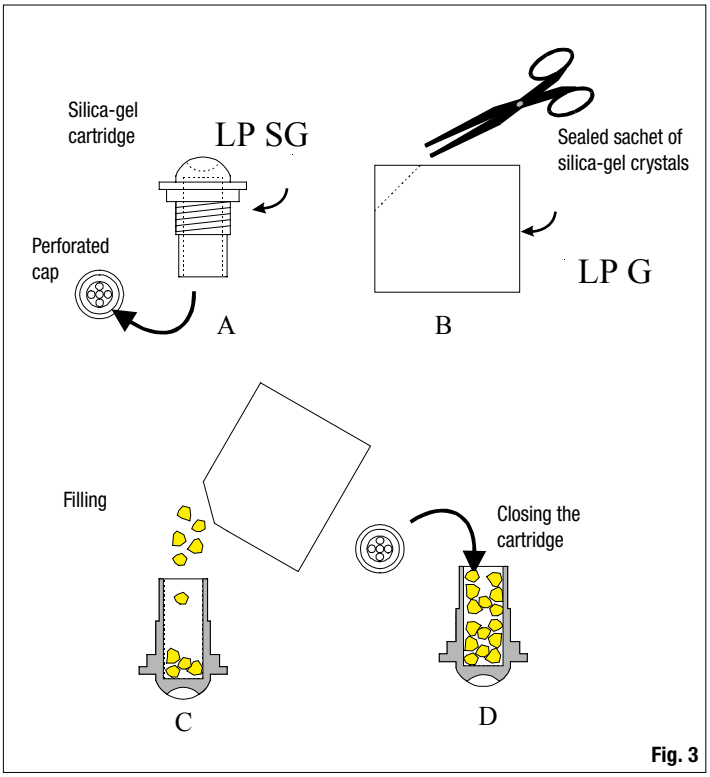


Fig. 3

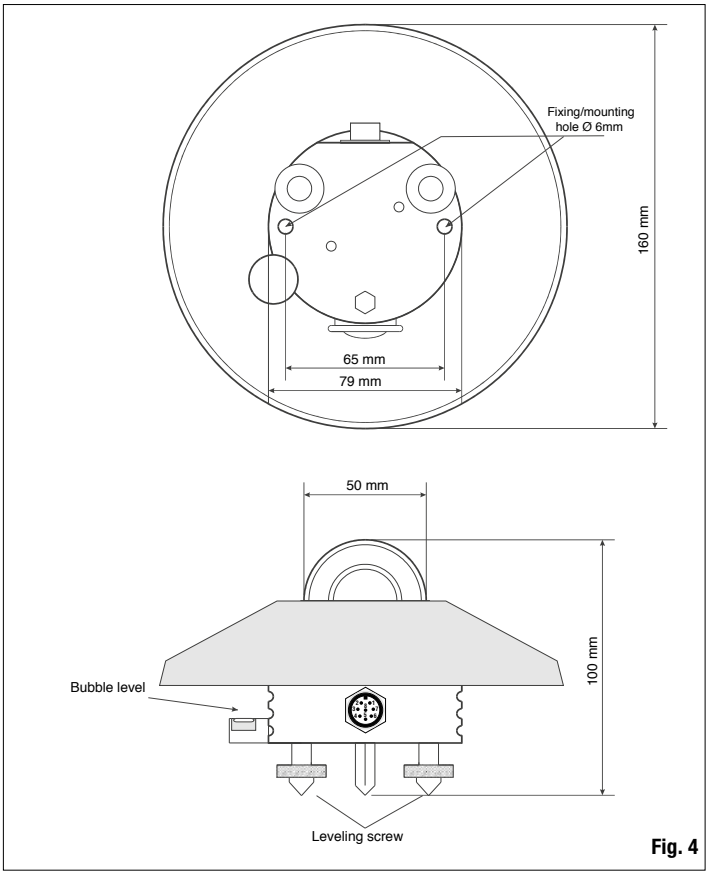


Fig. 4

Installation and Mounting of the Radiometer for the Measurement of the Global Radiation
Before installing the radiometer refill the cartridge containing the silica-gel crystals. Silica gel absorbs humidity in the dome chamber; in case of particular climatic conditions this humidity can cause condensation on the internal side of the dome and then modify the measurement. Do not touch the silica gel crystals with your hands and do not wet them while refilling the cartridge. Carry out the following instructions in an environment as dry as possible:

1- loosen the three screws that fix the white shade disk
2- unscrew the silica gel cartridge using a coin
3- remove the cartridge perforated cap
4- open the sachet containing the silica gel (supplied with the radiometer)
5- fill the cartridge with the silica-gel crystals
6- close the cartridge with its own cap, paying attention that the sealing O-ring be properly positioned and undamaged
7- screw the cartridge to the radiometer body using a coin
8- **check that the cartridge is screwed tightly** (if not, the silica-gel life will be reduced)
9- position the shade disk and tighten it with the screws
10- the radiometer is ready for use

Fig. 3 shows the operations necessary to fill the cartridge with the silica-gel crystals.

- The LP UVA 02 radiometer is installed in a location easily accessible for periodic cleaning of the outer dome and maintenance. At the same time you should avoid buildings, trees or obstacles of any kind exceeds the horizontal plane on which lies the radiometer. In case this is not possible, it is advisable to choose a location where obstacles on the path of the sun from sunrise to sunset is less than 5 °.
- The radiometer should be placed away from any obstacle that might reflect the sun (or shadow) on the same radiometer.
- For accurate horizontal positioning, the LP UVA 02 radiometer has a bubble level, the adjustment is by means of two screws with adjusting nut for adjusting the angle of the radiometer. The fixation on a plane can be performed using the two holes of 6mm diameter and spacing of 65 mm. To access holes to remove the screen and reposition it after mounting, see figure 4.
- The support LP S1 (figure 5), supplied on request as an accessory, allows easy installation of the radiometer on a mast. The maximum diameter of the pole to which the media can be set is 50 mm. The installer must take care that the height of the mast does not exceed the level of the radiometer, not to introduce measurement errors caused by reflections and shadows caused by the pole. To secure the probe to the support bracket remove the screen by removing the three screws, attach the probe and once the installation is complete, refit the white screen.
- It is better to insulate the radiometer from its support, while ensuring that there is a good electrical contact to earth.

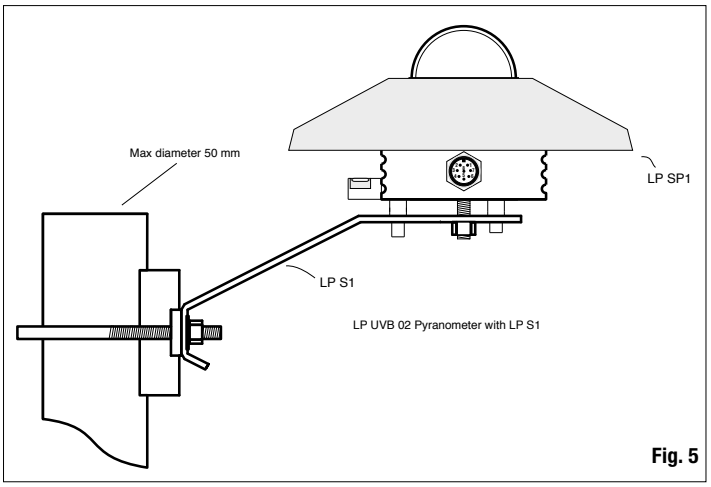


Fig. 5

Electrical Connections and Requirements for Electronic Readout Devices

The connections on the output connector are indicated below:

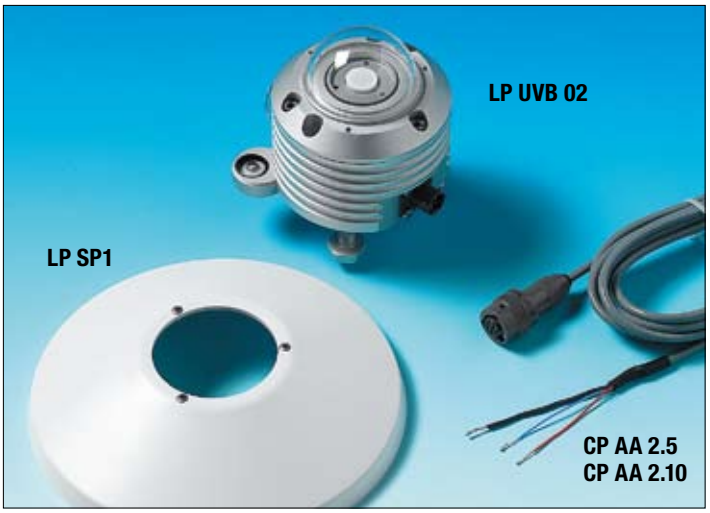
Pin8: V+, positive supply voltage for LP UVB 02 internal electronics. 7Vdc < V+ <30Vdc
Pin6: VoutTemp+, output signal for temperature measurement. 0V (-40°C) < Vout Temp+ < 1V (+60°C)
Pin2: Vout+, output signal for irradiance measurement in the UVB band. 0V < VoutUV+ < 4V.
Pin1: Ground of the two output signals, VoutTemp+, VoutUV+
Pin7: Housing.
Pin5: Power supply grounding.

- The LP UVB 02 has to be connected either to a voltmeter or to a data acquisition system with input impedance greater than 10KΩ. Typically, the radiometer output signal, when exposed to the sun, does not exceed 1 volt. In order to better exploit the radiometer features, the readout instrument should have 0.1mV resolution.

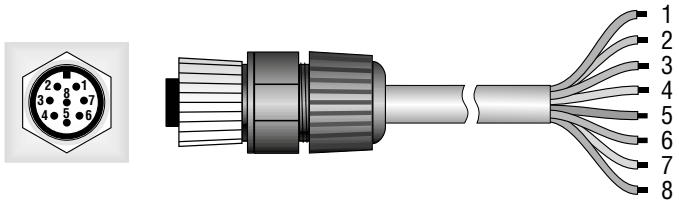
N.B. The input load resistance of the data acquisition system must be greater than 10KΩ. The connection scheme is shown in figure 6.

The cable supplied with the UV-resistant output connector has 5 wires plus the braid (screen); the colour code is shown in fig. 6.

Maintenance
To ensure a high measurement accuracy is necessary for the outer dome of the radiometer is always kept clean, so the higher the frequency of cleaning of the dome will be the best measurement accuracy. Cleaning can be done with normal maps for the cleaning of lens paper and water, if not just use pure ethyl alcohol. After cleaning with alcohol is necessary to clean the dome again with just water.
Due to the high temperature changes between day and night it is possible the presence of



WIRING DIAGRAM LP UVB 02

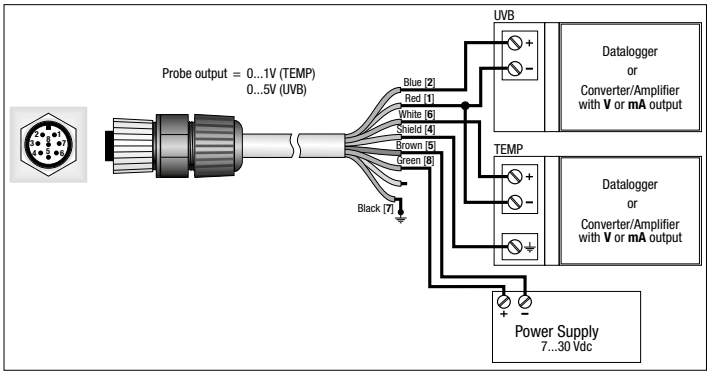


Fixed 8-pole plug M12 **Flying 8-pole M12 socket**

LP UVB 02

Connector	Function	Color
1	Signal GND	Red
2	V out UV (+)	Blue
3	Not connected	
4	Shield	Braid
5	Power GND	Brown
6	Vout Temp. (+)	White
7	Housing	Black
8	Power 7-30Vdc	Green

LP UVA 02 CONNECTION DIAGRAMS



condense on the dome of the probe, in this case the reading performed is strongly overestimated. To minimize condensation inside the radiometer there is a proper cartridge inside with absorbent material: Silica gel. The efficiency of silica-gel crystals decreases over time with the absorption of moisture. When crystals of silica gel are efficient their color is **yellow**, while gradually losing efficiency the color turns to **white**, to replace the instructions to see Figure 3. Typically the duration of silica gel ranges from 4 to 6 months depending on environmental conditions within which the radiometer.

The instrument calibration is recommended annually. The calibration can be performed at the Metrology Laboratory Delta Ohm, or alongside the same instrument calibrated with reference to a Primary Metrological Institute with known calibration factor.

Calibration and Measurements

The radiometer **S** sensitivity (or calibration factor) allows to determine the irradiance by measuring a signal in Volts generated by the internal amplification circuit. It is possible that an offset be present on the output signal of some fractions of millivolts (0.3-0.4mV), in which case it is also recommended that the data be acquired at night and subtract the night-measurement offset from the performed measurements. Once the difference of potential (VoutUV+) has been measured at the ends of the resistance, the E_e irradiance is obtained applying the following formula:

$$E_e = [VoutUV+] / S$$

where:

E_e: is the irradiance expressed in W/m^2,
VoutUV+: is the difference of potential measured by the multimeter and expressed in V,
S: is the calibration factor in V/(W/m^2), shown on the radiometer label (and mentioned on the calibration report).

In the presence of a possible offset of OF Volts, the previous calculations must be modified as follows:

$$E_e = ([VoutUV+] - OF)/S$$

Similarly, to know the instrument internal temperature once the "VoutTemp+" voltage in volts is known, we get:

$$T=100 \cdot [VoutTemp+] - 40 \ °C$$

Supposing a voltage VoutTemp+=0.532V is read, the previous formula gives the radiometer internal temperature:

$$T=(100 \bullet 0.532) - 40 \ °C = 13.2 \ °C$$

Each radiometer is individually calibrated at factory and is distinguished by its calibration factor. Calibration is carried out by measuring the radiometer-produced output signal when hit by a parallel and homogeneous light-beam of 304nm monochromatic light.

Note: currently no international calibration standards for this type of radiometer exist; therefore, the calibration coefficient only makes sense if the procedure followed to obtain it has been specified. Therefore the user has to consider that the same radiometer calibrated with different procedures can have different sensitivity factors, as explained in the article "*Source of Error in UV Radiation Measurements*", T. C. Larason, C. L. Cromer issued in the "*Journal of Research of the National Institute of Standards and Technology*" Vol. 106, Num. 4, 2001. (The article is available free of charge on the NIST web site at the following address: http://www.nist.gov/jers)

Technical characteristics

UV MEASUREMENT

Typical sensitivity:	≈5V/(W/m^2)
Response time:	<0.5 sec (95%)
Min. load impedance:	10 KΩ
Measurement range:	0-8 W/m^2
Viewing range:	2π sr
Spectral range:	305nm Peak 302.5nm ÷ 307.5 nm (1/2) 304nm ÷ 309 nm (1/10) 297.5nm ÷ 311.75nm (1/100) 292.5nm ÷ 316.255nm (1/1000)
Working temperature:	-40 °C ÷ +60 °C
Response according to the cosine law:	< 8 % (between 0° and 80°)
Long-term instability(1 year):	<|±3| %
Non linearity:	<1 %
Response according to temperature:	< 0.01%/°C

TEMPERATURE MEASUREMENT

Measurement range	-40°C +60°C
Accuracy	±0.2°C
Min. load impedance:	10 KΩ

POWER SUPPLY

Vdc+	7÷30 V DC
Typical consumption:	3 mA
Dimensions:	Fig. 4
Weight:	0.90 Kg.

PUCHASING CODES:

LP UVB 02: Radiometer for outdoor measurements, complete with LP SP1 protection, 2 spare sachets with silica gel crystals, bubble level, flying M12 8-pole connector and Calibration Report. **Cable has to be ordered separately.**

LP S1: Mounting kit for LP UVB 02: bracket for attachment to a mast, including fasteners and leveling screws

LP SP1: UV resistant plastic shade disk (BASF LURAN S777K).

LP SG: Desiccant sachet with silica gel crystals, complete with inner O-ring and cap.

LP G: Packet with 5 silica gel spare cartridge.

CPM12 AA2.5: 8-pole UV resistant cable L=5 m.

CPM12 AA2.10: 8-pole UV resistant cable L=10 m.

HD 2021T…
TRANSMITTERS FOR ILLUMINANCE AND IRRADIANCE MEASUREMENTS.

GENERAL DESCRIPTION

The HD 2021T series allows conversion of photometric and radiometric quantities as illuminance (Lux) and irradiance (W/m²) - across, UVA, UVB, UVC spectral regions and 400 ÷ 1000nm band - into a 0 ÷10 voltage signal. The voltage output 0 ÷ 10 V (0 ÷ 1 V, 0 ÷ 5V, 4 ÷ 20mA on request for substantial orders) comes factory set calibrated to the full scale range specified at the time of order.

HD 2012T transmitters wide range of applications include:

• Measurement of illumimance (HD 2021T) in offices and laboratories, manufacturing plants and production areas, commercial sites, theatres, museums, sports lighting, roadway lighting, tunnels and nursery-gardening systems.

• Measurement of solar irradiance, within 400nm ÷ 1000nm spectral band (HD 2021T.1).

• Monitoring tanning lamps irradiance within UVA (HD 2021T.2) and UVB (HD2021T.3) spectral regions, as well as efficiency control in filters for high pressure UV lamps.

• Efficiency control in UV lamps used in water purification plants, where UVC (HD2021T.4) band irradiance needs to be constantly monitored.

HD2021T transmitters can be installed either for indoor or outdoor applications (Protection: IP66). In case of extremely intense light sources measuring, the transmitter sensitivity can be reduced upon request. The HD 2021T series employs filters and photodiodes especially studied to adjust spectral response to a specific region of interest.

INSTALLATION OF TRANSMITTERS

After choosing the right position where to install HD2021T, you need to provide the electric connections inside the transmitter. Loosen the four screws on the lid in order to lift it; the inside of the transmitter will look as in figure n.1. On the terminal board we will locate three terminals with the following tags:

GND ➔ meaning the ground referred to power supply and output signal

+Vdc ➔ where the positive pole of the power supply has to be connected (in case of continuous power being employed)

Vlux (output) ➔ system output to be connected to the positive pole of a Multimeter or Data Logger

The sample below shows the installation of HD2021T illuminance transmitter monitoring lamps intensity. For this kind of application, HD2021T transmitters are generally installed on ceilings, close to the area where illuminance needs to be monitored (figure 2). Through a reference Luxmeter (ex. HD2102.1(2) with probe LP471 PHOT) previously placed in the operating area, we work on HD2021T potentiometer until we get to the desired reference value. HD2021T output is able to control several adjustable feeders at the same time.

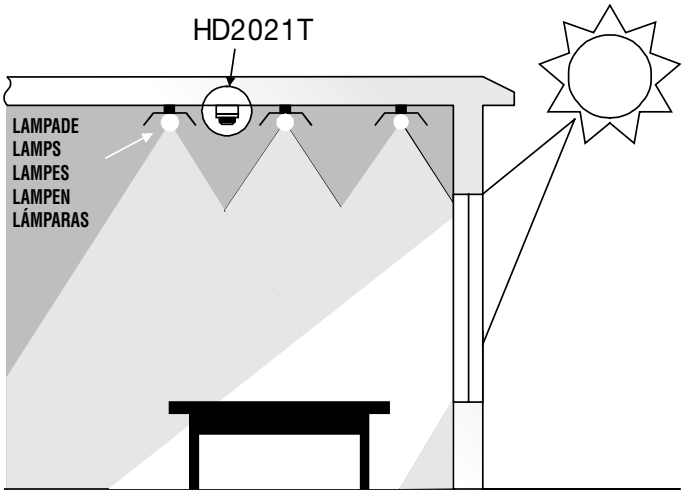


fig. 2

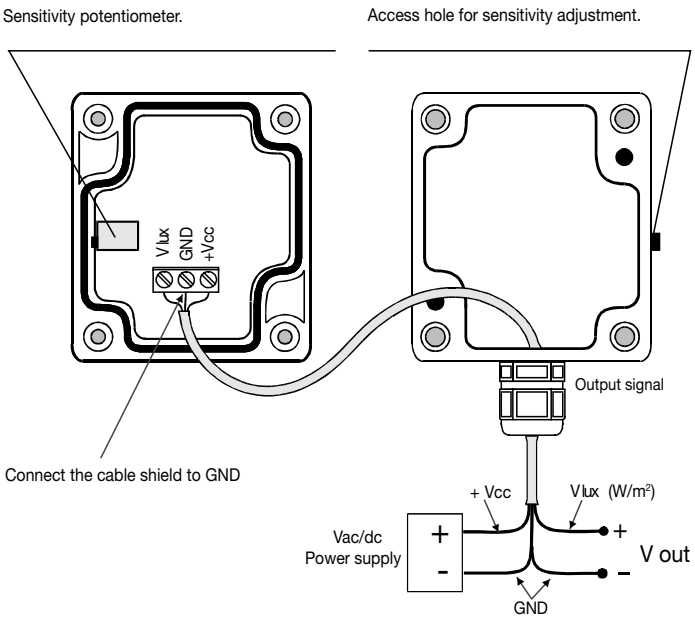
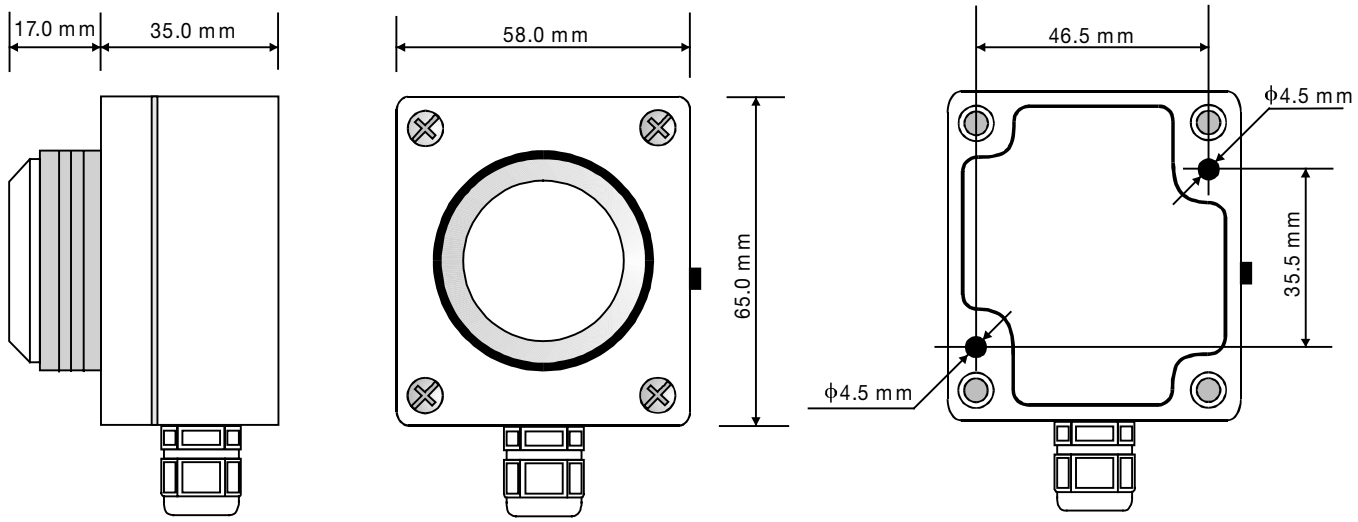


fig. 1

DIMENSIONS:
HD2021T, HD2021T.1, HD2021T.2, HD2021T.3, HD2021T.4



TECHNICAL SPECIFICATIONS

	HD2021T	HD2021T.1	HD2021T.2	HD2021T.3	HD2021T.4
Sensor	Photodiode Si	Photodiode Si	Photodiode GaP	Photodiode SiC	Photodiode SiC
Spectral range	Curva V(l)	450 ÷ 1100 nm	UVA	UVB	UVC
Measure	Photometric	Radiometric			
Viewing angle	Corrected in accordance with the Cosine law				
Measurement range	see table **A - B - C**				
	mV/lux	mV/(mW/m²)	mV/(mW/m²) peak 360 nm	mV/(mW/m²) peak 305 nm	mV/(mW/m²) peak 260 nm
Output signal	0 ÷ 10 V (0 ÷ 1 V, 0 ÷ 5 V minimum order 5 pcs) 4 ÷ 20mA				
Power supply	16 ÷ 40 Vdc or 24 Vac, for 0 ÷ 10 V output 10 ÷ 40 Vdc or 24 Vac for 0 ÷ 1 V, 0 ÷ 5 V output - 10 ÷ 40 Vdc for 4 ÷ 20 mA output				
Power consumption	10 mA				
Working temperature	-20 ÷ +60 °C				
Electrical protection	Protected against polarity inversions				
Maximum dimensions	58 mm x 65 mm x 52 mm				
Degree of protection	IP 66				
Maximum cable length	150 m				

PURCHASING CODES

* The full scale value has to be selected in the fields A, B, C

MODEL	A	B	C	X
HD 2021T	0.02÷2 klux	0.2÷20 klux	2÷200klux	**Other ranges on request for at least 5 pcs per order**
HD 2021 T1	0.2÷20 W/m²	2÷200 W/m²	20÷2000 W/m²	
HD 2021 T2	0.2÷20 W/m²	2÷200 W/m²	20÷2000 W/m²	
HD 2021 T3	2÷200 W/m²	20÷2000 W/m²		
HD 2021 T4	2÷ 200 W/m²	20÷2000 W/m²		

** For voltage output 0÷10V please indicate: V
For current output 4÷20mA please indicate: A
i.e. HD2021TBA: Transmitter for illuminance range 0,2÷20klux, Output 4÷20mA

HD 2021T7
HD 2021T6

HD 2021T7, HD 2021T6
EQUIVALENT VEILING LUMINANCE PROBE, LUMINANCE PROBE

The HD2021T7 probe allows converting a photometric quantity such as the "equivalent veiling luminance" (cd/m^2) into a current (4-20 mA) or a voltage signal (0-10 V) according to the version that you choose.
If the acquisition station is far from the probe (>50m), the current output version is required.
The HD2021T7 probe has IP67 protection. In order to grant high accuracy, it is important to keep the outer lens clean. You can wash them using only water and standard papers for lens. The transmitter full scale can be chosen (when ordering) between two different values: 2000cd/m^2 or 20000cd/m^2. The full scale can be customized for orders greater than 5 pcs.
The field of application of the transmitter includes road lighting. In particular the equivalent veiling luminance is necessary to calculate the threshold luminance at tunnel entrances (UNI 11095).

INSTRUMENT TECHNICAL SPECIFICATIONS

Dimensions
(Length x Width x Height) 147mm x 58 mm x 65mm)

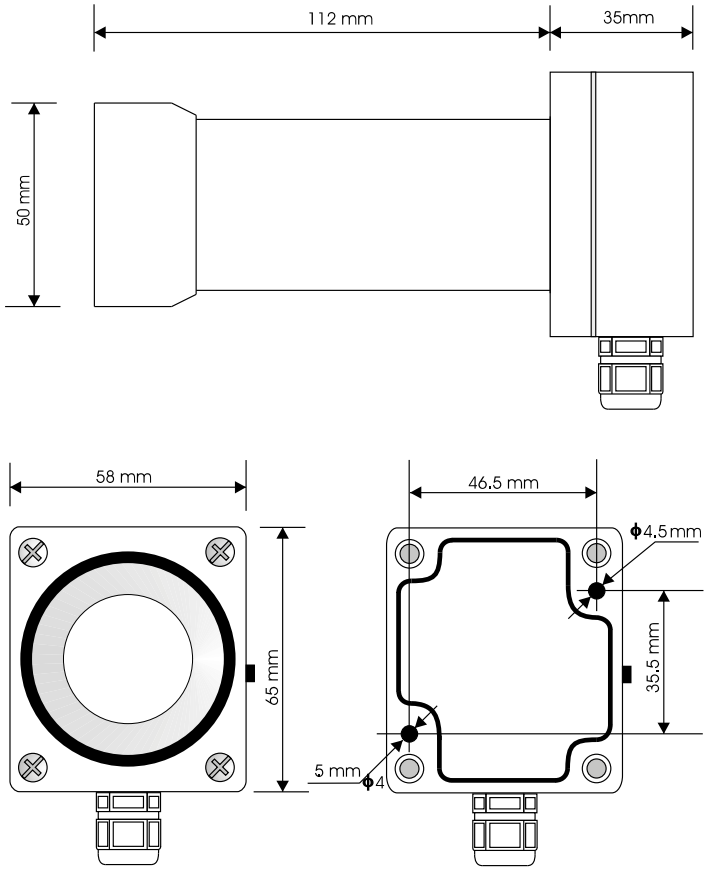


Figure 1 Dimensions of the HD2021T7 probe

SPECTRAL RESPONSE

The probe is fitted with a silicon photodiode and a set of filters in order to match the spectral response curve to that of the human eye (photopic vision).
Figure 2 shows relative spectral response versus wavelength .
f'1 <9% in accordance with the photopic curve to V(λ).

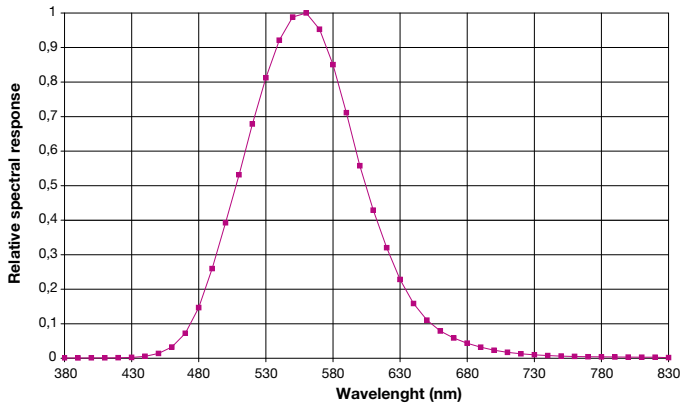


Figure 2. HD2021T7 Relative spectral response

ANGULAR RESPONSE

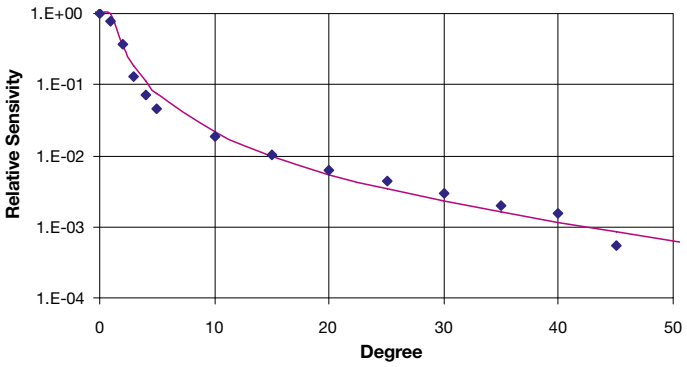
The equivalent veiling luminance (L_v) is estimated by the following formula:

$$L_v = 10 \sum_{\beta=1°}^{\beta=90°} \frac{L(\beta)\cdot\cos(\beta)}{\beta\cdot(\beta+1.5)}\cdot\Omega \qquad \textbf{A}$$

where:
L(β) is the luminance of the disturbing source at angle β,
β is the angle between the disturbing source and the observing direction,
Ω is the solid angle

Figure 3 shows the relative sensitivity versus angle.
In the CIE88:2004 standard the equivalent veiling luminance is calculated considering contributions up to 28.4° angles. Therefore the DeltaOhm HD 2021T7 probe allows estimating contributions also to greater angles (up to 40°).

Figure 3. HD2021T7 Relative angular response



WORKING TEMPERATURE

The probe can operate in a temperature range from -20 ° to +60° C. If the probe is placed in watertight containers, you should prevent the exit window from misting up or being covered with condensation. In this case the reading would be altered.

CALIBRATION

The calibration of the HD2021T7 probe is carried out by measuring the luminance on the output port of an integrating sphere with a known luminance. The equivalent veiling luminance veil is calculated by the formula **A** with a total field of view for the HD2021T7 probe of ±40°. The probe calibration uncertainty, with fixed full scale is 10% (at a 95% level of confidence).

TRANSMITTER INSTALLATION

To calculate the *threshold luminance* at the tunnel entrance the probe must be installed in compliance with UNI 11095.
To connect the transmitter, unscrew the lid which covers the terminal board. Figure 4 refers to the 4-20mA version, while figure 5 relates to the 0-10 V version.

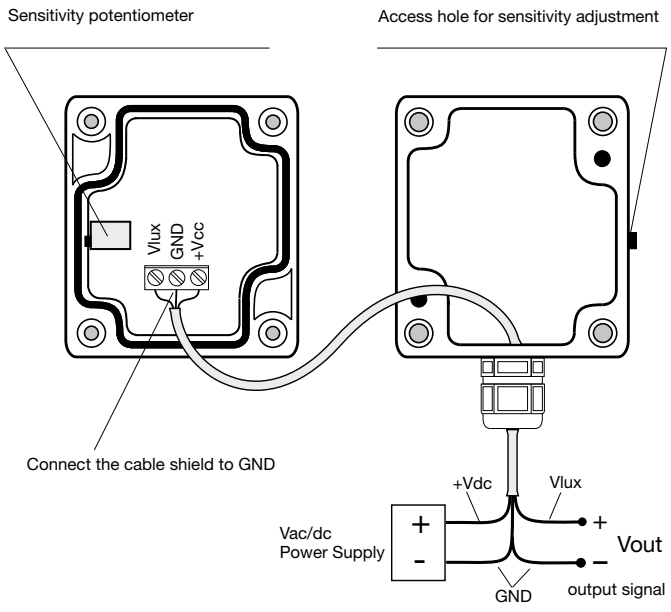


Figure 4. Connection diagram for HD2021T… with current output

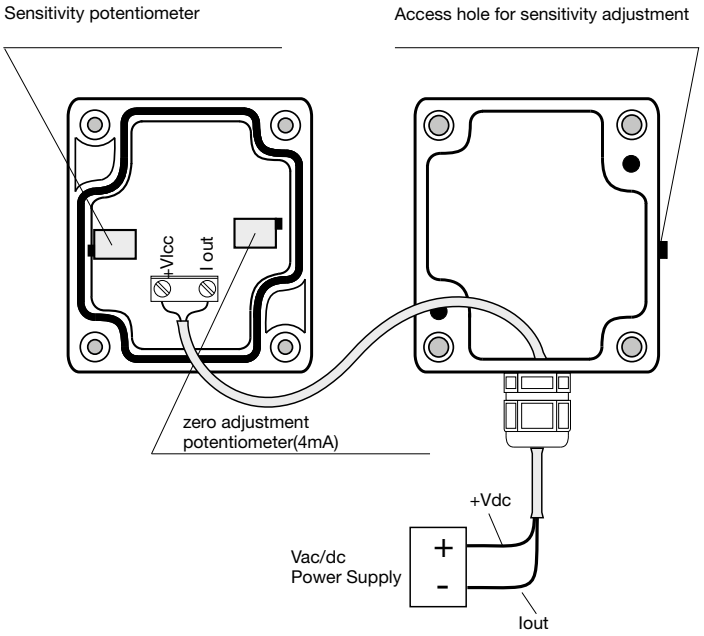


Figure 5. Connection diagram for HD2021T… with voltage output

PURCHASING CODES:

	Output	Measurement range	Power supply	Spectral response
HD2021T7A.V	0-10 V	0-2000 cd/m²	16-40 Vac/dc	V(λ)
HD2021T7B.V		0-20 kcd/m²		
HD2021T7X.V		On request *		
HD2021T7A.A	4-20 mA	0-2000 cd/m²		
HD2021T7B.A		0-20 kcd/m²		
HD2021T7X.V		On request *		

*minimum order 5 pcs

HD2021T6

The HD 2021T6 probe allows converting a photometric quantity such as Luminance (cd/m^2) into a current (4-20 mA) or voltage (0-10 V) signal according to the version. If the acquisition station is far from the probe (>50m), the current version is required.

The protection class of the HD2021T6 transmitter is IP67. To ensure correct measurements, the outer surface of the lens must be kept clean. If necessary, clean the lens with water and lens cleaning paper.

The transmitter sensitivity can be chosen from three previously set values when placing the order: 2 kcd/m^2 , 20 kcd/m^2 or 200 kcd/m^2. For orders of more than 5 pieces the full scale can be customized.

The probe is used for road lighting control. In particular, the measurement of luminance at a 20 degree angle (L_{20}) is necessary to estimate *threshold luminance* at a tunnel entrance (CIE standard 88:2004. This standard foresees the measurement of equivalent veiling luminance in future).

Besides, the probe can be used for calculating vertical illuminance (E_v) as prescribed in the above-mentioned standard.

Finally, the probe can be used for any application where the measurement of luminance is required, for example projector screens, diaphanoscopes etc..

INSTRUMENT TECHNICAL SPECIFICATIONS

Dimensions

(Length x Width x Height) 145mm x 58 mm x 65mm

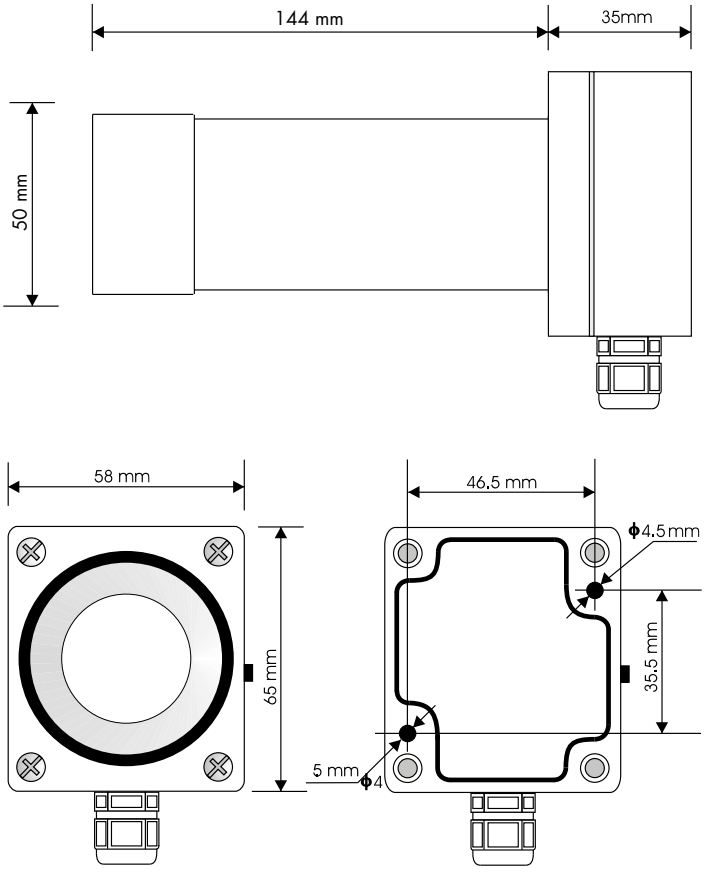


Figure 1. HD2021T6 probe dimensions

SPECTRAL RESPONSE

The probe is fitted with a silicon photodiode and a set of filters to match the spectral response curve to that of the human eye (photopic response). Figure 2 shows the relative spectral response depending on wavelength.

f'1 <9% in accordance with the standard photopic curve V(λ).

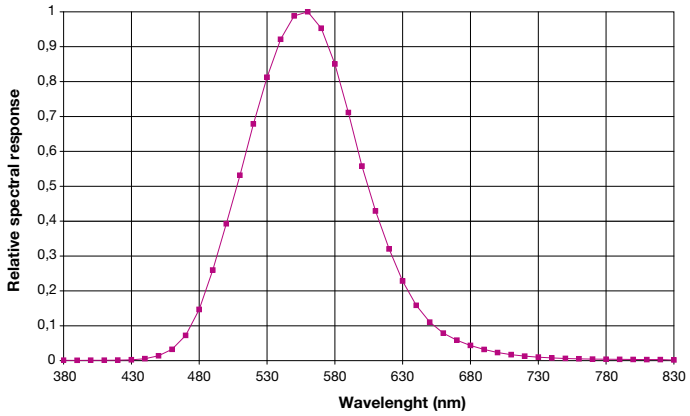


Figure 2. HD2021T6 probe relative spectral response

FIELD OF VIEW

The total field of view of HD2021T6 probe is 20°.

WORKING TEMPERATURE

The probe can work in the temperature range -20° to +60° C.

If the probe is placed inside watertight containers, you should prevent the window from misting up or being covered with condensation. In this case, the equivalent veiling luminance reading would be altered.

CALIBRATION

The HD2021T6 probe is calibrated by measuring luminance on the output port of an integrating sphere with a known luminance. The probe calibration uncertainty with fixed full scale is 5%, if demanded (95% confidence level).

TRANSMITTER INSTALLATION

To measure Threshold luminance at a tunnel entrance, the probe must be installed in compliance with CIE standard 88:2004.

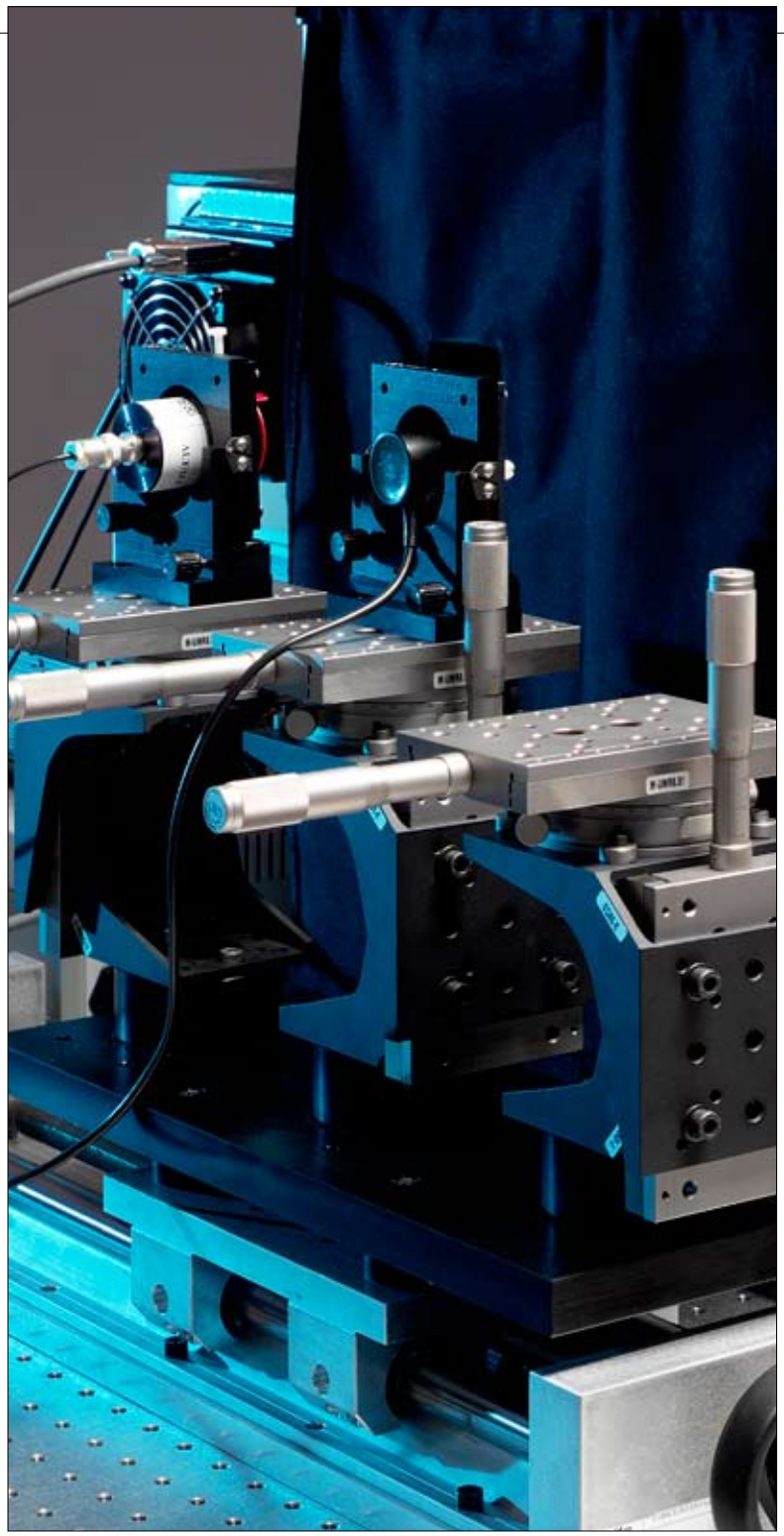
To connect the transmitter, unscrew the lid which covers the terminal board. Figure 4 refers to the 4-20mA version, while figure 5 of HD2021T7, page 188 relates to the 0-1V version.

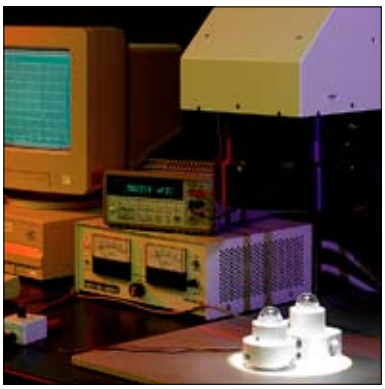
PURCHASING CODES:

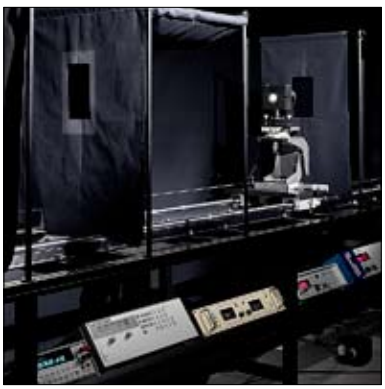
Model	Output	Measurement range	Power supply	Spectral Response
HD2021T6A.V	0-10 V	0-2000 cd/m^2	16-40 Vac/dc	V(λ)
HD2021T6B.V		0-20 kcd/m^2		
HD2021T6C.V		0-200 kcd/m^2		
HD2021T6X.V		On request *		
HD2021T6A.A	4-20 mA	0-2000 cd/m^2		
HD2021T6B.A		0-20 kcd/m^2		
HD2021T6C.A		0-200 kcd/m^2		
HD2021T6X.A		On request *		

*minimum order 5 pieces

SIT N° 124 Laboratory - photometry radiometry measurements







Italian calibration service

SIT centre n° 124:
DELTA OHM s.r.l.
Via G. Marconi, 5
35030 CASELLE DI SELVAZZANO (PD) - ITALIA
Telefono: +39 049 89 77 150
Telefax: +39 049 63 55 96
E-mail: deltaohm@tin.it
URL http://www.deltaohm.com

Permanent Laboratory **SIT ACCREDITATION TABLE**

Measure	Instrument to calibrate	Measuring range	Measuring conditions	Uncertainty (*)
Illuminance	Luxmeters	from 2,5 lux to 4000 lux		2 %
Luminous Intensity	Incandescence lamps	from 1 cd to 3000 cd		2,7 %
Luminance	Luminance meters	from 1 cd m^{-2} to 10000 cd m^{-2}		3,2 %
Correlated colour temperature	Incandescence lamps	from 2200 K to 3300 K		50 K
Spectral Radiance	Source	$(4 \cdot 10^{-5} \div 3 \cdot 100)$ W·m^{-2}·sr^{-1}·nm^{-1} $(4 \cdot 10^{-5} \div 3 \cdot 100)$ W·m^{-2}·sr^{-1}·nm^{-1}	from 300 nm to 400 nm from 400 nm to 800 nm	5 % 4,4 %
Spectral Irradiance	Source	$(1 \cdot 10^{-5} \div 1 \cdot 100)$ W·m^{-2}·nm^{-1} $(1 \cdot 10^{-5} \div 1 \cdot 100)$ W·m^{-2}·nm^{-1} $(1 \cdot 10^{-5} \div 1 \cdot 100)$ W·m^{-2}·nm^{-1} $(1 \cdot 10^{-5} \div 1 \cdot 100)$ W·m^{-2}·nm^{-1} $(1 \cdot 10^{-5} \div 1 \cdot 100)$ W·m^{-2}·nm^{-1} $(1 \cdot 10^{-5} \div 1 \cdot 100)$ W·m^{-2}·nm^{-1}	from 200 nm to 250 nm from 250 nm to 300 nm from 300 nm to 350 nm from 350 nm to 400 nm from 400 nm to 700 nm from 700 nm to 800 nm	10 % 7,0 % 4,4 % 3,8 % 3,2 % 3,6 %
	UV-A Radiometers UV-B Radiometers UV-C Radiometers	from 1 W/m^2 to 50 W/m^2 1,2 W/m^2 1,5 W/m^2	(365) nm (311) nm (254) nm	5,0 % 6,6 % 7,2 %
Spectral Sensitivity	Detectors	from $1 \cdot 10^{-2}$ A·W^{-1} to $1 \cdot 10^{1}$ A·W^{-1} from $1 \cdot 10^{-3}$ A·W^{-1} to $1 \cdot 10^{1}$ A·W^{-1} from $1 \cdot 10^{-4}$ A·W^{-1} to $1 \cdot 10^{1}$ A·W^{-1} from $1 \cdot 10^{-4}$ A·W^{-1} to $1 \cdot 10^{1}$ A·W^{-1} from $1 \cdot 10^{-4}$ A·W^{-1} to $1 \cdot 10^{1}$ A·W^{-1} from $1 \cdot 10^{-4}$ A·W^{-1} to $1 \cdot 10^{1}$ A·W^{-1} from $1 \cdot 10^{-4}$ A·W^{-1} to $1 \cdot 10^{1}$ A·W^{-1}	from 200 nm to 240 nm from 240 nm to 375 nm from 375 nm to 920 nm from 920 nm to 1000 nm from 1000 nm to 1100 nm from 1100 nm to 1550 nm from 1550 nm to 1650 nm	6,6 % 3,7 % 1,9 % 2,0 % 2,2 % 2,0 % 2,6 %

(*) The uncertainty of measurement is stated as expanded uncertainty corresponding to a confidence level of 95% and is obtained by multiplying the standard uncertainty by the coverage factor k specified.

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Acoustics - Vibrations

- HD 2010 UC, HD 2010 UC/A, HD 2010, HD 2110 — pag. 194
  Integrating sound level meters
- HD 8701 — pag. 213
  Sound level meter
- HD 2020, HD 9101, HD 9102 — pag. 214
  Mono-frequency acoustic calibrators
- HD 2030 — pag. 218
  Vibration meter, accelerometer
- Accredited Laboratory SIT Centre 124 for Acoustic — pag. 222

The qualitative level of our instruments is the result of a continuous evolving of the product itself. This may bring to slight differences between what written in the following manual and the instrument you bought. We cannot completely exclude the presence of errors inside the manual, which we apologise for. Data, images and descriptions included in this manual cannot be enforced legally. We reserve the right to perform modifications and corrections at any time without notice.

it consists of HD2010UC class 1 sound level meter (class 2 for HD2010UC kit2), HD WME weatherproof microphone unit for outdoor use, HD2010PNE2W heated preamplifier, HD2010PNE2 preamplifier, UC52/1 microphone for free fields (UC52 for HD2010UC kit2), HD SAV windscreen, 5m extension cable and serial RS232 or USB connection cable. Noise Studio PC programme.

Accessories

Option 0 "Memory Expansion": 4MB memory expansion. **It needs Option 2 "Data Logger".**

Option 2 "Data logger": storage of sound level profiles, continuous and with intervals. It includes the memory expansion from 2MB to 4MB.

Option 5 "Advanced Analyser": Profiles+reports+events data logging, event capture and full statistical analysis. **Only for HD2010UC class 1 with Option 2 "Data Logger"**.

Option 7 "SIT Calibration": SIT calibration which replaces ISO9001 Reports. **For new instruments only**.

Option LCD: Backlit display. **For new instruments only**.

HD9101: class 1 calibrator according to IEC60942:1988. Features:
- Cavity for 1" and ½" standard microphones according to IEC 61094,
- Frequency: 1000Hz,
- Sound level: 94dB/114dB.

The calibrator is supplied with ISO 9001 report of calibration.

HD9102: class 2 calibrator according to IEC60942:1988. Features:
- Cavity for 1" and ½" standard microphones according to IEC 61094,
- Frequency: 1000Hz,
- Sound level: 94dB/114dB.

The calibrator is supplied with ISO 9001 report of calibration.

HD2020: class 1 calibrator according to IEC60942:2003 with I.N.RI.M. n.90-003-01 Certificate of Conformity. Features:
- LCD Display,
- Static pressure compensation from 65 kPa to 108 kPa,
- Cavity for ½" standard microphones according to IEC 61094,
- Frequency: 1000Hz,
- Sound level: 94dB/114dB.

The calibrator is supplied with ISO 9001 report of calibration.

HD2110/RS: serial RS232 cable for connection to a PC or to HD40.1 printer.

HD2110/USB: serial USB cable for connection to a PC

SWD10: stabilized mains power supply with Vin=100÷230Vac Vout=12Vdc/1000mA voltage.

CPA/10: 10m extension cable.

VTRAP: tripod, 1550mm maximum height.

HD 2010UC
INTEGRATING SOUND LEVEL METER

HD2010UC is an integrating portable sound level meter performing statistical analysis. The instrument has been designed combining maximum low cost and simplicity of use. Attention has been paid to the possibility of adjusting the instrument and adding options at any time to the HD2010UC so to extend its applications. The user can upgrade the firmware directly by means of the Noise Studio programme supplied with the instrument.

Technical regulations:

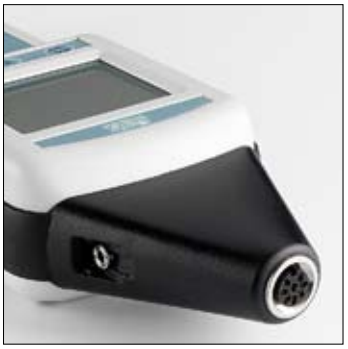
- **Class 1 or 2 sound level meter according to IEC 61672-1 dated 2002 (Certificate of Compliance I.N.RI.M. n. 07-0124-02)**, IEC 60651 and IEC 60804.

Applications:

- Assessment of the environmental noise level,
- Optional "data logging" function,
- Optional capture and analysis of sound events,
- Statistical analysis with the calculation of 3 percentile level and optional full statistical analysis,
- Identification of impulsive noises,
- Measurements in workplaces,
- Selection of personal protective equipments (SNR and HML methods),
- Production quality control,
- Measurement of machine noise.

Sound level meter class 1 or 2 Kit

- **HD2010UC kit1 and kit2**: consists of HD2010UC sound level meter class 1 (class 2 for HD2010UC kit2), HD2010PNE2 preamplifier, UC52/1 microphone for free field (UC52 for HD2010UC kit2), windscreen, 5m extension cable and serial RS232 or USB connection cable. Noise Studio PC programme.
- **HD2010UC kit1/E and kit2/E**: version for outdoor measurements, it consists of HD2010UC sound level meter class 1 (class 2 for HD2010UC kit2), HD WME weatherproof microphone unit for outdoor use, HD2010PNE2W heated preamplifier, UC52/1 microphone for free field (UC52 for HD2010UC kit2) and serial RS232 or USB connection cable. Noise Studio PC programme
- **HD2010UC kit1/IE e kit2/IE**: version for indoor and outdoor measurements,



HD WME

HD2110/SA: support to fix preamplifier to tripod.
HD40.1: portable serial thermal printer with 57mm paper tape equipped with SWD10 stabilizer mains.
HD2010MC: SD memory card interface equipped with SD 1GB card. **It needs Option 2 "Data Logger"**.

Software for Windows® 98/XP/Vista operating systems
Noise Studio: Programme for Windows® 98,XP and Vista supplied with the sound level meter kit. Instrument configuration, download and graphic display of the stored data. This programme supports some sound analysis application modules which can be enabled by licence with the hardware key. The programme includes demo versions of the modules.
CH20: Hardware key for PC working with Windows® operating system. It enables the software modules of Noise Studio when introduced into the USB port.
NS1: "Workers' Protection" module in Noise Studio programme. Noise analysis in working environment according to L.D. 81 dated 2008 and to standard UNI 9432 dated 2008.
NS2: "Acoustic pollution" module in Noise Studio programme. Acoustic climate analysis and road, railway and airport noise evaluation. **It needs Option 2 "Data Logger".**
NS4: "Monitor" module in Noise Studio programme. Real time PC data acquisition. Synchronized audio recording. Monitor and remote control programming. Connection by modem.

With HD2010UC sound level meter it is possible to measure the sound level by programming 3 parameters with the possibility of freely selecting the frequency weightings and the time constants. It is possible to measure parameters such as Leq, SEL and maximum and minimum sound levels with integration times from 1 second to 99 hours. If an undesired sound event produces an over-load indication, or simply alters the result of integration, it is always possible to exclude it by using the versatile Back-Erase function.
The measured sound levels can be recorded in the large non-volatile memory in order to be transferred to a PC using the supplied Noise Studio programme.

As a statistical analyzer the HD2010UC samples the sound signal 8 times per second with A-frequency weighting and FAST constant, and it analyzes it statistically in 0.5 dB classes. It is possible to display up to 3 percentile levels between L_1 and L_{99}. By using "Advanced Analyser" it is possible to choose whether sampling L_{Fp}, L_{eq} or L_{pk} with A, C or Z weightings (only C and Z for L_{pk}).

For further analysis, the LINE un-weighted output allows recording the sound sample either on tape or directly on a PC equipped with a data acquisition card.

The high speed of the USB interface combined with the flexibility of the RS232 interface allows quick data transfers from the sound level meter to the PC mass storage, but can also control a modem or printer. For example, in case of lengthy recordings, you can activate the "Monitor" function. This function allows to send the displayed data to a PC via the RS232 serial interface, to be directly stored on the PC mass storage.
The sound level meter can be completely controlled by a PC through the multi-standard serial interface (RS232 and USB) by using a special communication protocol. Through the RS232 interface, the sound level meter can also be connected to a PC via modem.

The calibration can be performed either by using the provided acoustic calibrator (type 1 according to IEC 60942) or the built-in reference generator. The electric calibration uses a special preamplifier and checks the sensitivity of the measuring channel, microphone included. A protected area in the non-volatile memory, reserved to factory calibrations, is used as a reference for the user's calibrations, so to allow keeping instrument drifts under control and to prevent the instrument from losing of calibrations.
The control of the complete sound level meter functionality can be made directly by the user, on site, thanks to a diagnostic programme.

The HD2010UC sound level meter can perform all the measurements according to the law with respect to workers' protection from of exposure to noise (Legislative Decree n.81/2008). The selection of the personal protective equipment can be carried out through comparison of the A and C weighted equivalent levels that can be measured simultaneously (SNR method).

The class 1 HD2010UC sound level meter with the "Data Logger" option is suitable for performing sound level monitoring and acoustic mapping and, by using the "Advanced Analyzer" option, also assessments of the acoustic climate with capture and analysis of sound events function. When measuring traffic noise near airports, railways and roads, the sound level meter can be used as a multi-parameter sound recorder, combining statistical and spectrum analyzer features. Remote electrical calibrations and diagnostic tests can be executed by using its remote control capabilities.

Italian Legislation
- Noise in working environment: D.L. 81/2008, UNI 9432/2008 standard and 2003/10/CE European regulation.
- Noise assessment in airports environment: Decree dated 31/10/97.
- Noise in entertainment dancing spaces: D.P.C.M. 215 dated 16/4/99.
- Noise emitted by machineries Lgs.D. 262 dated 4/9/2002 and 2005/88/CE European regulation.

Inputs and outputs
DC outputs corresponds to the A-weighed sound level with FAST time constant, updated 8 times per second (Ø 2.5mm jack).
Un-weighted LINE output (Ø 3.5mm jack).
RS232C standard serial port according to EIA/TIA574. Baud Rate from 300 to 115200 bauds.
USB 1.1 serial port.
9÷12Vdc External power supply (Ø 5.5mm jack).

Options and accessories:
HD2110/MC reader (it needs "Data Logger" Option 2)
It allows interfacing SD memory cards to the sound level meter.
This device is connected to the sound level meter by means of a serial interface which supplies the necessary power supply as well. Further to the remarkable recording capacity, the interface allows to quickly download data stored in the internal memory of the sound level meter. It is possible to connect cards having up to 2GB capacity. 1GB card is supplied.

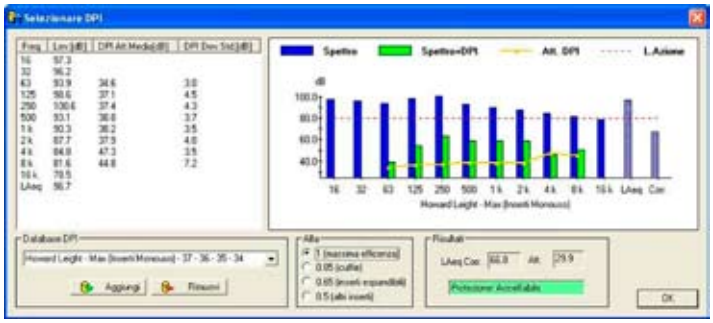
Option 2 "Data Logger"
It includes the internal memory expansion from 2 MB to 4 MB.
It displays and records the A-weighted sound level profile with FAST time constant, sampled 8 times per second. It storages the profiles of 3 programmable parameters, sampled twice per second. It is possible to storage 3 programmable parameters at intervals from 1 second up to 1 hour for sound level monitoring. By this recording mode it is possible to storage 3 parameters by intervals of 1 minute for over 80 days by using the supplied memory (4MB expandable to 8MB). "Data Logger" option transforms the HD 2010UC sound level meter into a sound level recorder suitable for recording the profile of 4 parameters for over 23 hours. Impulsive events can be easily identified thanks to the possibility of analysing simultaneously sound level profiles with FAST, SLOW and IMPULSE constant.
During noise assessment in airport, railways or roads environments, the sound level meter can be used as multi parameters sound events recorder, making the most of the static analyser characteristics or the possibility for recording simultaneously the profile with FAST constant level and sound exposure level.

Option 5 "Advanced Analyser"
(it can be installed on the HD2010UC Class 1 with "Data logger" option")
This Option integrates the complete functions of sound level analyser with the following functions:
- Statistical analysis is available in graphic form both as probability distribution and as cumulative distribution.
- Trigger for the capture of sound events with threshold level and filter length.
- Record of the measuring reports with intervals from 1 s to 1 hour with a dedicated set of parameters which includes the complete statistic analysis.
- Record of the event parameters with the possibility of setting the maximum temporal resolution for the record of events and a lower resolution for the ground recording.
- Possibility of storing markers.
- Timer for programming delayed start of capture.

Software:
Noise Studio
The Noise Studio programme allows interfacing HD2010UC to the PC in a simple and intuitive way. Main functions are:
Transfer of stored data from the sound level meter to the PC memory.
Visualization of the captured data under graphic and tabular form.
Export to Excel and PDF format.
Printing of graphs and data tables.
Control of acquisition from a PC.
Sound level meter setup management.
Sound level meter firmware update.
It results easier drafting documents regarding the sound level meter's relief due to the handy function which allows to copy graphs or visualized tables from other applications and to create PDF files.
Moreover Noise Studio is a post processing programme able to perform different kind of analyses, studied for specific applications assembled in software modules to be enabled with licence. Demo versions of the software modules are provided.

Noise Studio: 'Worker protection' module (to be activated by license)
This application module analyzes noise in the workplace according to the DL 81/2008, the European directive 2003/10/EC and the UNI 9432:2008. Data sound level measurement in work environment is organized in a project where they can be handled according to regulatory requirements. In addition to calculating the noise exposure of workers the program allows to evaluate the effectiveness of protective equipment by the methods SNR and OBM. According to UNI 9432 of 2008, the program also calculates the index of impulsiveness of a machine.

Noise Studio: 'Acoustic Pollution' module (to be activated by license)
This application module analyzes sound level profiles detected both in indoor and outdoor environments for assessment of the noise climate, of noise in airports and transport infrastructures.
The analysis of the noise climate is made on a daily, weekly and annual basis with resolutions up to 1 minute.



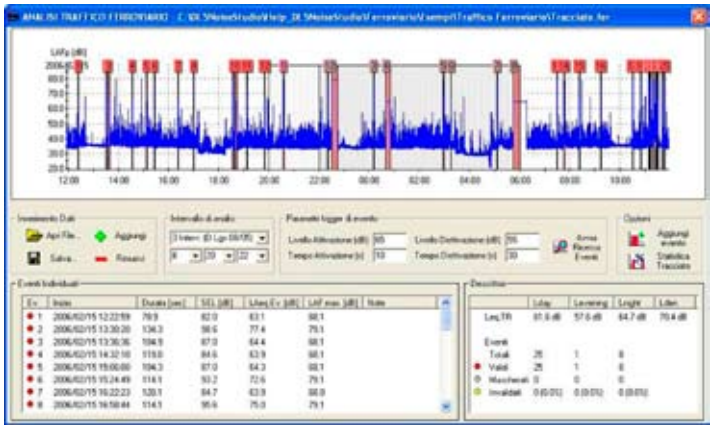
Noise studio: "workers' protection" module: analysis of the effectiveness of IPD

The profiles of noises detected in the external environment are analyzed in order to search for disturbing sources characterized by a sequence of events such as railways and airports. The analysis is performed on a daily basis with a resolution equal to 1/8 of a second and with automated search and analysis of sound events. **This module needs Option 2 "Data Logger"**.

Noise Studio: 'Monitor' module (to be activated by license)

This software module allows to control the sound level meter with PC in remote location. The main functions are:

- Real time display of acquired data, in graphical and tabular form.
- Possibility of connection via modem with the sound level meter.
- Acquisition of data sound level data directly into the mass memory of the PC (monitor function).
- Management of diagnostic and calibration functions.
- Automatic acquisition and monitoring programme.
- Possibility of logging synchronized audio along with the sound level meter measures, by using the easy trigger function.



Noise studio: "railway traffic" module: analysis of 24 hours with automatic search of transit

Codes for ordering the new kits and accessories

HD2010UC kit 1 and kit 2: it includes class 1 sound level meter HD2010UC (class 2 for HD2010UC kit2), HD2010PNE2 preamplifier, UC52/1 microphone for free field (UC52 microphone for HD2010UC kit2), windscreen, 5m extension cable and RS232 serial (HD2110/RS) or USB (HD2110/USB) connection cable. Noise Studio PC program).

HD2010UC kit 1/E and kit 2/E: version for outdoor measurements, it includes HD2010UC class 1 sound level meter (class 2 for HD2010UC kit2), weatherproof microphone unit for outdoor use HD WME equipped with bird spike, wind screen and rain screen, HD2010PNE2W heated preamplifier with 5m connection cable (other lengths upon request), UC52/1 microphone for free field (UC52 for HD2010UC kit2) and serial RS232 or USB connection cable. The kit also includes: Noise Studio software and RS232 (HD2110/RS) or USB (HD2110/USB) cable for connection to PC.

HD2010UC kit 1/IE and kit 2/IE: version for indoor and outdoor measurements, it includes HD2010UC class 1 sound level meter (class 2 for HD2010UC kit2), weatherproof microphone unit for outdoor use HD WME equipped with bird spike, wind screen and rain screen, HD2010PNE2W heated preamplifier with 5m connection cable (other lengths upon request), HD2010PNE2 preamplifier, HD SAV wind screen, CPA/5 5m extension cable and UC52/1 microphone for free field (UC52 for HD2010UC kit2). The kit also includes: Noise Studio software and RS232 (HD2110/RS) or USB (HD2110/USB) cable for connection to PC.

Option 0 "Memory Expansion": 4 MB memory expansion. **It can be installed on the HD2010UC with option 2 "Data Logger".**

Option 2 "Data logger": recording of 4 profiles continuously and at programmable intervals from 1s to 1 hour. It includes memory expansion from 2 MB to 4 MB.

Option 5 "Advanced Analyzer": Profile+report+event data logging, capture and analysis of events, full statistical analysis. **It can be installed on the class 1 HD2010UC with option 2 "Data Logger".**

Option 7 "SIT Calibration": SIT calibration replaces ISO9001 reports. **For new instruments only**.

Option "LCD": Backlit LCD. **For new instruments only**.

HD9101: Class 1 calibrator according to IEC90942:1988. Features:
- Cavity for 1" and ½" microphones according to IEC61094,
- 1000Hz frequency,
- 94dB/114dB sound level.

The calibrator is supplied complete with calibration report according to ISO 9001 (replaced by a SIT certificate if combined with option 7 "SIT Calibration").

HD2020: Class 1 calibrator according to IEC60942:2003 equipped with I.N.RI.M. n.90-003-01 Certificate of Conformity. Features:
- Backlit LCD,
- Static pressure compensation from 65kPa to 108kPa,
- Cavity for 1" and ½" microphones according to IEC61094,
- 1000Hz frequency,
- 94dB/114dB sound level.

The calibrator is supplied complete with calibration report according to ISO 9001 (replaced by a SIT certificate if combined with option 7 "SIT Calibration").

HD9102: Class 2 calibrator according to IEC90942:1988. Features:
- Cavity for 1" and ½" microphones according to IEC 61094,
- 1000Hz frequency,
- 94dB/114dB sound level.

The calibrator is supplied complete with calibration report according to ISO 9001 (replaced by a SIT certificate if combined with option 7 "SIT Calibration").

HD2110/RS: RS232 serial cable for PC connection or connection to HD40.1 printer.

HD2110/USB: serial USB cable for PC connection.

SWD10: Stabilized mains power supply Vin=100÷230Vac / Vout=12Vdc/1000mA.

CPA/10: 10m extension cable for HD2010PNE2 preamplifier.

VTRAP: Tripod, 1550 mm maximum height.

HD2110/SA: Support to fix the preamplifier to the tripod.

HD40.1: Portable thermal serial printer with 57mm paper rolls equipped with SWD10 power supply.

BAT40: Replacement battery pack for HD40.1.

RCT: 4 rolls of thermal paper, 57width and 32mm diameter.

HD2010MC: SD memory card interface. This device includes a 1GB SD card and **it needs Option 2 "Data Logger"**.

Codes for ordering spare parts and other accessories

Upgrade 1: Conversion of HD2010UC (**equipped with Option "Data Logger"**) into HD2010UC/A. It includes:
- Octave band spectrum analysis
- Sound level meter and filters ISO 9001 calibration report.

HD WME/UC1: outdoor microphone unit **for class 1 sound level meters** equipped with:
- HD WME Weather protection with HD WME3 preamplifier housing, HD WME1 bird spike and HD SAV3 wind screen as well as HD WME2 rain screen,
- HD2010PNE2W Heated preamplifier with 5m connection cable (other lengths upon request),
- UC52/1 Pre-polarized microphone.

HD WME/UC2: outdoor microphone unit **for class 2 sound level meters** equipped with:
- HD WME Weather protection with HD WME3 preamplifier housing, HD WME1 bird spike and HD SAV3 wind screen as well as HD WME2 rain screen,
- HD2010PNE2W Heated preamplifier with 5m connection cable (other lengths upon request),
- UC52 Pre-polarized microphone.

HD WME/PNE: Weather protection **for class 1 and class 2 sound level meters** equipped with:
- HD WME Weather protection with HD WME3 preamplifier housing, HD WME1 bird spike and HD SAV3 wind screen as well as HD WME2 rain screen,
- Heated preamplifier HD2110PNE2W with 5m connection cable (other length upon request).

HD WME: Weather protection, complete with:
- Stainless steel housing for preamplifier HD WME3 with holder for rain shield HD WME2,
- Bird spike HD WME1,
- Wind screen HD SAV3,
- Rain shield HD WME2.

HD SAV: Windscreen for ½" microphones.

HD SAV2: Windscreen with bird spike for weather protection HD WME950.
HD SAVP: Rain shield for HD WME950 weather protection.
HD SAV3: Windscreen for HD WME and HD WME950 weather protection.
HD WME1: Bird spike for HD WME weather protection.
HD WME2: Rain shield for HD WME microphone unit.
HD WME3: Stainless steel housing for the preamplifier of HD WME weather protection, with holder for rain shield HD WME2.
HD2010PNE2: Microphone preamplifier for pre-polarized UC52 microphones. Equipped with CTC device for electrical calibration.
HD2010PNE2W: Microphone preamplifier to be housed in outdoor protection WME950 HD and HD WME. The preamplifier is heated, provided with standard connection for pre-polarized UC52 microphones and provided with CTC device for electrical calibration. Ending with a connection 5m cable (other lengths upon request).
UC52/1: Class 1 pre-polarized microphone for free field.
UC52: Class 2 pre-polarized microphone for free field.
CPA/5: Microphone 5m extension cable.

TECHNICAL SPECIFICATIONS

Standards	Class 1 or 2 X group according to IEC 61672:2002 and class 1 or 2 according to IEC 60651:2001 and IEC 60804:2000 type 1 or 2 according to ANSI S1.4-1983 and S1.43-1997
½" Microphone	UC52 condenser type, pre-polarized, for free field.
Dynamic range	30 dBA ÷ 143 dB Peak
Linear Field	80 dB
Acoustic Parameters	SpI, L_{eq}, SEL, $L_{EP,d}$, L_{max}, L_{min}, L_{pk}, Dose, L_n
Frequency Weights	simultaneous A, C, Z (only C and Z for L_{pk})
Temporal Weights	simultaneous FAST, SLOW, IMPULSE
Integration	from 1s to 99 hours with erasing function (Back-Erase)
Statistical Analysis	It displays up to 3 percentile levels, from L_1 to L_{99} Probability distribution and percentile level calculation from L_1 to L_{99} (Option 2 "Data Logger" and option 5 "Advanced Analyzer") ✓Parameter: L_{Fp}, L_{eq}, L_{pk} weighted A, C o Z (solo C o Z per L_{pk}) ✓Sampling frequency: 8 samples/second ✓Classification: Classes of 0.5 dB
Analysis of Events (Option 2 Data Logger" and option 5 "Advanced Analyzer")	✓Calculation of 5 freely-programmable event parameters ✓Calculation of statistical levels from L_1 to L_{99} ✓Event identification trigger with programmable threshold and duration filter ✓Manual trigger
Profile Data Logging (Option: "Data Logger")	1 profile with programmable sampling from 1/8 s to 1 hour and 3 profiles with 2 samples/second
Display	Graphic display 128x64 ✓3 parameters in numeric format ✓Backlit LCD ("LCD" option): ✓Profile L_{AFp} with 8 samples/second (Option 2 "Data Logger") ✓Graph of sound level probability distribution (Option 2 "data Logger" and option 5 "Advanced Analyzer") ✓Graph of percentile levels from L_1 to L_{99} (Option 2 "data Logger" and option 5 "Advanced Analyzer")
Memory	✓Internal, equal to 2 MB, enough to store over 500 recordings. With option 2 "Data Logger", internal memory equal to 4 MB (1 profile for 23 hours or over 80 recording days of 3 parameters per minute). Expandable to 8 MB with option 0 "Memory expansion". ✓External, via the HD2110MC memory card interface, using MMC or SD cards up to 2 GB. The interface requires option 2 "Data Logger".
Input/Output	✓RS232 serial and USB interfaces ✓AC output (LINE) ✓DC output
PC Programs	**Noise Studio (supplied with the instrument):** PC interface for data download, set up and instrument management. Licensed software modules to be enabled by hardware key. ✓**"Worker protection" module.** Analysis of noise in the workplace in accordance with Decree 81 of 2008 and the UNI 9432-2008. ✓**"Acoustic pollution" module**. Analysis of environmental noise according to the Law 447/1995 and Decree of 16/03/1998. Analysis of the noise climate and assessment of noise from road, rail and airport according to the law. **Requires option 2 "Data Logger".** ✓**"Monitor" module**. Acquisition in real time on PC. Synchronized audio recording. Remote monitoring and data capture. Connection via Modem. The program allows programming of measurements and calibrations with timer and audio recording with programmable event triggers.
Operating conditions	✓Working temperature -10÷50°C, 25÷90%RH (without condensation), 65÷108kPa. Protection degree: IP64
Power Supply	✓4 alkaline or rechargeable NiMH type AA batteries or external 9÷12Vdc 300mA
Dimension and weight	✓445x100x50 mm equipped with preamplifier, 740 g (with batteries).

HD 2010UC/A
INTEGRATING SOUND LEVEL METER - PORTABLE ANALYZER

HD2010UC/A is a portable integrating sound level meter, with data logging function, suitable for performing statistical and spectral analyses The instrument has been designed by combining maximum flexibility and simplicity. Attention has been paid to the possibility of adjusting the instrument so to comply with the changes in the rules about noise and to the necessity of comply with the current and future requests of the users. It is possible to add options to the HD2010UC/A so to extend its applications; the user can update the firmware directly by means of the Noise Studio programme supplied with the instrument.

Technical regulations:
- Class 1 or 2 sound level meter according to IEC 61672-1, 2002 (Certificate of Compliance I.N.RI.M. No. 07-0124-02), IEC 60651 and IEC 60804.
- Class 1 octave and third octave filters according to IEC 61260.

Applications:
- Assessment of the environmental noise level,
- Noise monitoring and optional capture and analysis of sound events,
- Octave and optional third octave band spectrum analysis from 25 Hz to 12.5 kHz,
- Statistical analysis with the calculation of 3 percentile levels and optional full statistical analysis,
- Identification of impulsive noise,
- Measurements in workplaces,
- Selection of personal protective equipment (SNR, HML, and OBM methods),
- Sound insulation and reclamation,
- Production quality control,
- Measurement of machine noise,
- Optional architectural acoustics and building measurements.

Sound level meter class 1 or 2 Kit

HD2010UC/A kit1 and kit2: consists of HD2010UC/A class 1 sound level meter (class 2 for HD2010UC/A kit2), HD2010PNE2 preamplifier, UC52/1 microphone for free field (UC52 for HD2010UC kit2), windscreen, 5m extension cable and serial RS232 or USB connection cable. Noise Studio PC programme.

HD2010UC/A kit1/E and kit2/E: version for outdoor measurements, it consists of HD2010UC/A class 1 sound level meter (class 2 for l'HD2010UC/A kit2), HD WME weatherproof microphone unit for outdoor use, HD2010PNE2W heated preamplifier, UC52/1 microphone for free field (UC52 for HD2010UC kit2) and serial RS232 or USB connection cable. Noise Studio PC programme.

HD2010UC/A kit1/IE e kit2/IE: version for indoor and outdoor measurements, it consists of HD2010UC/A class 1 sound level meter (class 2 for l'HD2010UC/A kit2), HD WME weatherproof microphone unit for outdoor use, HD2010PNE2W heated preamplifier, HD2010PNE2 preamplifier, UC52/1 microphone for free field (UC52 for HD2010UC kit2) and serial RS232 or USB connection cable. Noise Studio PC programme.

Accessories

Option 0 "Memory Expansion": 4MB memory expansion. **It needs Option 2 "Data Logger".**

Option 1 "Third Octave": Third octave band spectrum analysis in real time from 25 Hz to 12.5 kHz.

Option 4 "Reverberation Time": Measurement using sound source interruption or impulse response integration. **Only for class 1 HD2010UC/A.**

Option 5 "Advanced Analyzer": Profile+report+event data logging, capture and analysis of events, full statistical analysis. **Only for class 1 HD2010UC/A.**

Option 7 "SIT Calibration": SIT calibration which replaces ISO9001 Reports. **For new instruments only.**

Option LCD: Backlit display. **For new instruments only.**

HD9101: class 1 calibrator according to IEC60942:1988. Features:
- Cavity for 1" and ½" standard microphones according to IEC 61094,
- Frequency: 1000Hz,
- Sound level: 94dB/114dB.

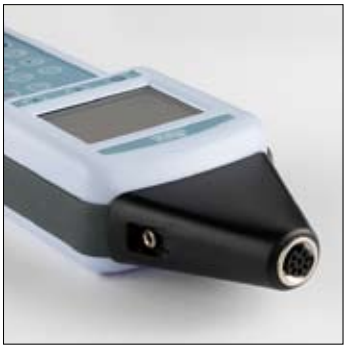
The calibrator is supplied with ISO 9001 report of calibration.

HD9102: class 2 calibrator according to IEC60942:1988. Features:
- Cavity for 1" and ½" standard microphones according to IEC 61094,
- Frequency: 1000Hz,
- Sound level: 94dB/114dB.

The calibrator is supplied with ISO 9001 report of calibration.

HD2020: class 1 calibrator according to IEC60942:2003 with I.N.RI.M. n.90-003-01 Certificate of Conformity. Features:
- LCD Display,
- Static pressure compensation from 65 kPa to 108 kPa,
- Cavity for ½" standard microphones according to IEC 61094,
- Frequency: 1000Hz,
- Sound level: 94dB/114dB.

The calibrator is supplied with ISO 9001 report of calibration.



HD WME

HD2110/RS: serial RS232 cable for connection to a PC or to HD40.1 printer.
HD2110/USB: serial USB cable for connection to a PC
SWD10: stabilized mains power supply with Vin=100÷230Vac Vout=12Vdc/1000mA voltage.
CPA/10: 10m extension cable.
VTRAP: tripod, 1550mm maximum height.
HD2110/SA: support to fix preamplifier to tripod.
HD40.1: portable serial thermal printer with 57mm paper tape equipped with SWD10 stabilizer mains.
HD2010MC: SD memory card interface equipped with SD 1GB card. **It needs Option 2 "Data Logger".**

Software for Windows® 98/XP/Vista operating systems
Noise Studio: Programme for Windows® 98, XP and Vista supplied with the sound level meter kit. Instrument configuration, download and graphic display of the stored data. This programme supports some sound analysis application modules which can be enabled by licence with the hardware key. The programme includes demo versions of the modules.
CH20: Hardware key for PC working with Windows® operating system. It enables the software modules of Noise Studio when introduced into the USB port.
NS1: "Workers' Protection" module of Noise Studio programme. Noise analysis in working environment according to L.D. 81 dated 2008 and to standard UNI 9432 dated 2008.
NS2: "Acoustic pollution" module of Noise Studio programme. Acoustic climate analysis and road, railway and airport noise evaluation. **Some of the functions need Option 1 "Third octaves".**
NS3: "Acoustic Insulation" module of Noise Studio programme. Calculations of acoustic and architectural evaluation of passive acoustic requirements of buildings according to D.P.C.M. dated 5/12/1997. **It needs Option 1 "Third octaves" and Option 4 "Reverberation Time"**.
NS4: "Monitor" module in Noise Studio programme. Real time PC data acquisition. Synchronized audio recording. Monitor and remote control programming. Connection by modem.
Noise Studio Suite: Noise Studio programme equipped with the following application modules:
- "Workers' Protection"
- "Acoustic pollution"
- "Acoustic Insulation"
- "Monitor"

By using the HD2010UC/A, you can log the time profile of 4 simultaneous parameters freely selecting temporal or frequency weightings. The possibility of displaying, storing and even printing the multi-parameter analysis of the sound level allows the sound level meter to work as a sound level logger capable of storing for more than 23 hours. For sound level monitoring, you can store 3 programmable parameters and the average spectrum at intervals of 1 second to 1 hour. In this recording mode, you can store the sound level (3 parameters + spectra) at intervals of 1 minute for over 23 days using the supplied memory (4 MB expandable to 8 MB).
An advanced acquisition mode ("Advanced Analyzer" option) allows storing report sequences with dedicated parameters, average spectra and full statistical analysis, as well as sound level profiles. Moreover, a versatile trigger function can identify the sound events and record their analysis with 5 dedicated parameters, average spectrum and statistical analysis.

The spectrum analysis is carried out simultaneously with the profile logging in real time by octave bands and optionally by third octave bands. The sound level meter calculates the sound signal spectrum twice a second and it integrates it linearly for up to 99 hours. The average spectrum is displayed together with an A, C or Z -weighted wideband level.

As a statistical analyzer, the HD2010UC/A samples the sound signal 8 times per second with A-weighting and FAST constant and it analyzes it statistically in 0.5 dB classes. Up to 4 percentile levels, selectable between L_1 and L_{99}, can be programmed. The "Advanced Analyzer" option can be used to choose the sampling of the following: L_{Fp}, Leq and L_{pk} with A, C and Z -weightings (only C and Z for L_{pk}).

For further analyses, the LINE unweighted output allows recording the sound sample either on tape or directly on a PC equipped with a data acquisition card.

Recordings can be located in memory and visualized on the graphic display using the "Replay" function, which reproduces the time trend of the sound track. The high-speed USB interface, combined with the flexible RS232 interface, allows quick data transfers from the sound level meter to the PC mass storage, as well as controlling a modem or printer. For example, should the supplied memory not be enough, this is the case of lengthy recordings, you can activate the "Monitor" function. This function allows sending the displayed data to a PC via the serial interface, to be directly stored on the PC mass storage.
The sound level meter can be completely controlled by a PC through the multi-standard serial interface (RS232 and USB) by using a special communication protocol. Through the RS232 interface, the sound level meter can also be connected to a PC via modem.

The calibration can be performed either by using the provided acoustic calibrator (type 1 according to IEC 60942) or the built-in reference generator. The electric calibration uses a special preamplifier and checks the sensitivity of the measuring channel, microphone included. A protected area in the non-volatile memory, reserved to factory calibrations, is used as a reference for the user's calibrations, so to allow keeping instrument drifts under control and to prevent the instrument from losing of calibrations.
The control of the complete sound level meter functionality can be made directly by the user, on site, thanks to a diagnostic programme.

HD2010UC/A sound level meter can perform all the measurements required to evaluate workers' noise exposure (Legislative Decree no.81 of 2008). The selection of the personal protective equipment can be carried out through octave band spectrum analysis (OBM method) or comparison of the A and C-weighted equivalent levels that can be measured simultaneously (SNR method). If an undesired sound event produces an overload indication, or simply alters the result of integration, its contribution can be excluded using the versatile Back-Erase function.

HD2010UC/A sound level meter is suitable for sound level monitoring and acoustic mapping. Using the "Advanced Analyzer" option, it can also perform analysis of the acoustic climate with capture and analysis of sound events. When measuring traffic noise near airports, railways and roads, the sound level meter can be used as a multi-parameter sound recorder, combining the statistical and spectrum analyzer features. Remote electrical calibrations and diagnostic tests can be executed using its remote control capabilities.

HD2010UC/A sound level meter with the "Third Octave" and "Reverberation Time" options can perform all measurements prescribed by the regulations on room acoustics evaluation (D.P.C.M. of 5/12/1997). The sound level meter powerful DSP calculates 32 spectra/second, and it can measure reverberation times both using the sound source interruption and impulsive response integration. The analysis is carried out simultaneously by both octave and third octave bands.

Inputs and outputs
DC output corresponding to the A-weighted sound level with FAST constant time, updated 8 times/s (∅ 2.5 mm jack). This output is not available for all models.
LINE unweighted output (∅ 3.5 mm jack).
Standard RS232C serial port complying with EIA/TIA574. Baud Rate 300 to 115200 baud.
USB 1.1 serial port.
External power supply 9÷12Vdc (∅ 5.5 mm jack).

Italian Legislation
- Noise in working environment: D.L. 81/2008, UNI 9432/2008 standard and 2003/10/CE European regulation.
- Noise assessment in airports environment: Decree dated 31/10/97.
- Noise in entertainment dancing spaces: D.P.C.M. 215 dated 16/4/99.
- Noise emitted by machineries Lgs.D. 262 dated 4/9/2002 and 2005/88/CE European regulation.
- Room acoustics evaluation: D.P.C.M. of 05.12.97

Options and accessories:
HD2110/MC reader
It allows interfacing SD memory cards to the sound level meter.
This device is connected to the sound level meter by means of a serial interface which supplies the necessary power supply as well. Further to the remarkable recording capacity, the interface allows to quickly download data stored in the internal memory of the sound level meter. It is possible to connect cards having up to 2GB capacity. 1GB card is supplied.

Option 1 "Third Octave"
Octave and third octave band spectrum analyzer class 1 according to IEC 61260.
Using the "Third Octave" option you can analyze the spectrum of a sound source in real time from 25 Hz to 12.5 kHz. The audibility of the different spectrum components can be evaluated thanks to the equal loudness curves calculation of Noise Studio, the program supplied with the instrument.

Option 4 "Reverberation Time"
(it can be installed on the class 1 HD2010UC/A with "Third Octave" option)
Reverberation time measurement using the sound source interruption technique and the impulsive source method.
The reverberation time measurement is made simultaneously by wideband, octave band from 125 Hz to 8 kHz and, optionally, third octave band from 100 Hz to 10 kHz.
Sampling interval $^1/_{32}$ s.
Automatic calculation of reverberation times EDT, T10, T20 and T30 for all bands

Option 5 "Advanced Analyser"
(it can be installed on the HD2010UC Class 1 with "Data logger" option")

This Option integrates the complete functions of sound level analyser with the following functions:

- Statistical analysis is available in graphic form both as probability distribution and as cumulative distribution.
- Trigger for the capture of sound events with threshold level and filter length.
- Record of the measuring reports with intervals from 1 s to 1 hour with a dedicated set of parameters which includes the complete statistic analysis.
- Record of the event parameters with the possibility of setting the maximum temporal resolution for the record of events and a lower resolution for the ground recording.
- Possibility of storing markers.
- Timer for programming delayed start of capture.

Software:
Noise Studio

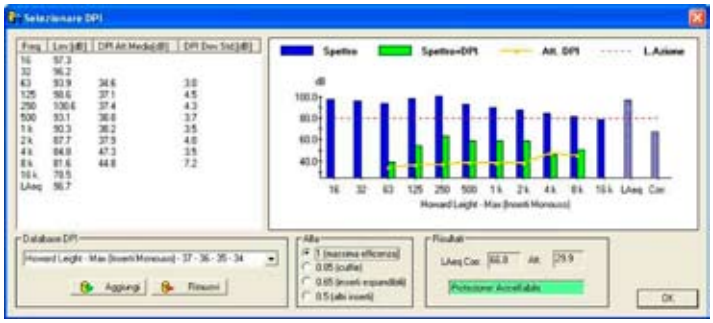
The Noise Studio programme allows interfacing HD2010UC to the PC in a simple and intuitive way. Main functions are:

Transfer of stored data from the sound level meter to the PC memory.
Visualization of the captured data under graphic and tabular form.
Export to Excel and PDF format.
Printing of graphs and data tables.
Control of acquisition from a PC.
Sound level meter setup management.
Sound level meter firmware update.

It results easier drafting documents regarding the sound level meter's relief due to the handy function which allows to copy graphs or visualized tables from other applications and to create PDF files.
Moreover Noise Studio is a post processing programme able to perform different kind of analyses, studied for specific applications assembled in software modules to be enabled with licence. Demo versions of the software modules are provided.

Noise Studio: 'Worker protection' module (to be activated by license)

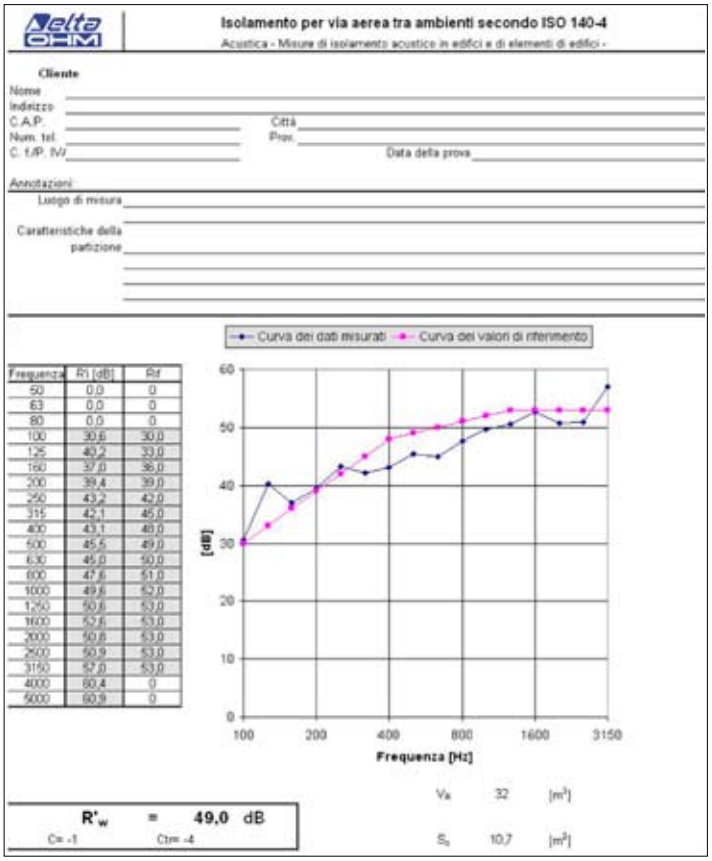
This application module analyzes noise in the workplace according to the DL 81/2008, the European directive 2003/10/EC and the UNI 9432:2008. Data sound level measurement in work environment is organized in a project where they can be handled according to regulatory requirements. In addition to calculating the noise exposure of workers the program allows to evaluate the effectiveness of protective equipment by the methods SNR and OBM. According to UNI 9432 of 2008, the program also calculates the index of impulsiveness of a machine.



Noise studio: "workers' protection" module: analysis of the effectiveness of IPD

Noise Studio: 'Acoustic Pollution' module (to be activated by license)

This application module analyzes sound level profiles detected both in indoor and outdoor environments for assessment of the noise climate, of noise in airports and transport infrastructures.
The analysis of the noise climate is made on a daily, weekly and annual basis with resolutions up to 1 minute.
The profiles of noises detected in the external environment are analyzed in order to search for disturbing sources characterized by a sequence of events such as railways and airports. The analysis is performed on a daily basis with a resolution equal to 1/8 of a second and with automated search and analysis of sound events.
Some of the functions need Option 1 "Third octaves".



Noise studio "acoustic insulation" module: filling iso report.

Noise Studio: 'Acoustic Insulation' module

This module performs calculations of building acoustics for the assessment of passive acoustic requirements of buildings, according to ISO standard, and according to the DPCM of 5/12/1997.
The measures necessary for the analysis of a building are grouped in a project to simplify their storage and research. Also, technical reports, comments, graphics, photos, etc. which remain part of the work can be added to the same measures and, if necessary, may be found easily.
An updateable database, divided by walls and floors, contains the principal characteristics of sound-insulating structures. The data contained in the database can be compared graphically with measures in place.
With the program you can calculate:

- Average reverberation time (ISO 3382)
- Area of equivalent absorption coefficient of sound absorption (ISO 354)
- Isolation by air: indices R, R 'and D_{nT} (ISO 140/III and IV)
- Insulation of facades and facade elements: indices $D_{2m,nT}$ and R_g (ISO 140 / V)
- Isolation of noise impact: indices L_n, DL, The N and L'_{nT} (ISO 140/VI, VII and VIII)

The form requires the Option 1 "Third Octave" also for the calculation of indices; you must have the Option 4: "Reverberation Time".

Noise Studio: 'Monitor' module (to be activated by license)

This software module allows to control the sound level meter with PC in remote location. The main functions are:

- Real time display of acquired data, in graphical and tabular form.
- Possibility of connection via modem with the sound level meter.
- Acquisition of data sound level data directly into the mass memory of the PC (monitor function).
- Management of diagnostic and calibration functions.
- Automatic acquisition and monitoring programme.
- Possibility of logging synchronized audio along with the sound level meter measures, by using the easy trigger function.

Codes for ordering the new kits and accessories

HD2010UC/A kit1 and kit2: Includes HD2010UC/A class 1 Sound Level Meter (class 2 for kit HD2010UC/A kit 2), carrying case, HD2010PNE2 preamplifier, UC52/1 microphone for free field (UC52 for kit HD2010UC/A kit2), windscreen HD SAV, 5m extension cable CPA/5, Noise Studio software and serial cable for connection to a PC (HD2110/RS) or USB (HD2101/USB interface).

HD2010UC/A kit1/E and kit2/E: Version for outdoor measurements, includes class 1 Sound Level Meter HD2010UC/A (class 2 for HD2010UC/A kit2), carrying case, HD WME weather protection complete with bird spike, windscreen and rain shield, heated preamplifier HD2010PNE2W with 5m connection cable (other lengths on request), UC52/1 microphone for free field (UC52 microphone for HD2010UC/A kit2), RS232 serial (HD2110/RS) or USB (HD2110/USB) connection cable. Noise Studio PC programme.

HD2010UC/A kit1/IE and kit2/IE: Version for indoor and outdoor measurements, includes class 1 Sound Level Meter HD2010UC/A (class 2 for HD2010UC/A kit2), carrying case, HD WME weather protection with bird spike, wind screen and rain shield, heated preamplifier HD2010PNE2W with 5m extension cable (other lengths on request), wind screen HD SAV, preamplifier HD2010PNE2, UC52/1 microphone for free field (UC52 microphone for HD2010UC kit2), 5m extension cable CPA/5, and RS232 serial (HD2110/RS) or USB (HD2110/USB) connection cable. Noise Studio PC programme.

Option 0 "Memory Expansion": Additional 4 MB memory expansion.

Option 1 "Third Octave": Spectrum analysis in real time by third octave bands from 25 Hz to 12.5 kHz. Includes calibration report according to ISO9001.

Option 4 "Reverberation Time": Reverberation time measurement using the sound source interruption technique and the impulsive source method. **It can be installed on the class 1 HD2010UC/A with "Third Octave" option.**

Option 5 "Advanced Analyzer": Profile+report+event data logging, capture and analysis of events, full statistical analysis. **It can be installed on the class 1 HD2010UC/A.**

Option 7 "SIT Calibration": SIT calibration replaces ISO9001 reports**. For new instruments only.**

Option "LCD": Backlit LCD. **For new instruments only.**

HD9101: Class 1 calibrator according to IEC90942:1988. Features:
- Cavity for 1" and ½" microphones according to IEC61094,
- 1000Hz frequency,
- 94dB/114dB sound level.

The calibrator is supplied complete with calibration report according to ISO 9001 (replaced by a SIT certificate if combined with option 7 "SIT Calibration").

HD2020: Class 2 calibrator according to IEC60942:2003 equipped with I.N.RI.M. n.90-003-01 Certificate of Conformity. Features:
- Backlit LCD,
- Static pressure compensation from 65kPa to 108kPa,
- Cavity for 1" and ½" microphones according to IEC61094,
- 1000Hz frequency,
- 94dB/114dB sound level.

The calibrator is supplied complete with calibration report according to ISO 9001 (replaced by a SIT certificate if combined with option 7 "SIT Calibration").

HD9102: Class 2 calibrator according to IEC90942:1988. Features:
- Cavity for 1" and ½" microphones according to IEC 61094,
- 1000Hz frequency,
- 94dB/114dB sound level.

The calibrator is supplied complete with calibration report according to ISO 9001 (replaced by a SIT certificate if combined with option 7 "SIT Calibration").

HD2110/RS: RS232 serial cable for PC connection or connection to HD40.1 printer.

HD2110/USB: serial USB cable for PC connection.

SWD10: Stabilized mains power supply Vin=100÷230Vac / Vout=12Vdc/1000mA.

CPA/10: 10m extension cable for HD2010PNE2 preamplifier.

VTRAP: Tripod, 1550 mm maximum height.

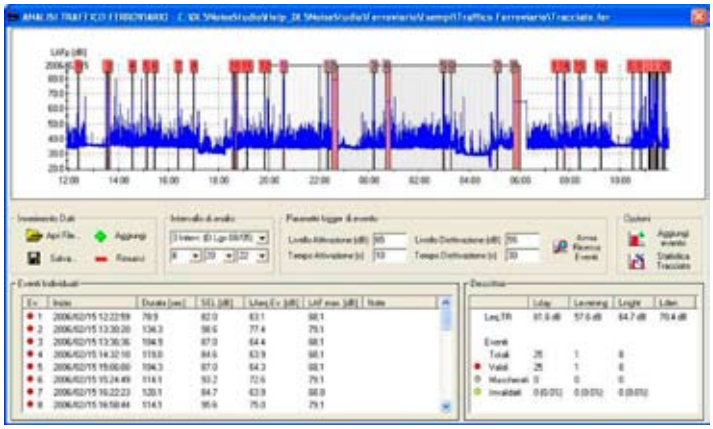
HD2110/SA: Support to fix the preamplifier to the tripod.

HD40.1: Portable thermal serial printer with 57mm paper rolls equipped with SWD10 power supply.

BAT40: Replacement battery pack for HD40.1.

RCT: 4 rolls of thermal paper, 57 width and 32mm diameter.

HD2010MC: SD memory card interface. This device includes a 1GB SD card.



Noise studio: "railway traffic" module: analysis of 24 hours with automatic search of transit

Codes for ordering spare parts and other accessories

HD WME/UC1: outdoor microphone unit **for class 1 sound level meters** equipped with:
- HD WME Weather protection with HD WME3 preamplifier housing, HD WME1 bird spike and HD SAV3 wind screen as well as HD WME2 rain screen,
- HD2010PNE2W Heated preamplifier with 5m connection cable (other lengths upon request),
- UC52/1 Pre-polarized microphone.

HD WME/UC2: outdoor microphone unit **for class 2 sound level meters** equipped with:
- HD WME Weather protection with HD WME3 preamplifier housing, HD WME1 bird spike and HD SAV3 wind screen as well as HD WME2 rain screen,
- HD2010PNE2W Heated preamplifier with 5m connection cable (other lengths upon request),
- UC52 Pre-polarized microphone.

HD WME/PNE: Weather protection **for class 1 and class 2 sound level meters** equipped with:
- HD WME Weather protection with HD WME3 preamplifier housing, HD WME1 bird spike and HD SAV3 wind screen as well as HD WME2 rain screen,
- Heated preamplifier HD2110PNE2W with 5m connection cable (other length upon request).

HD WME: Weather protection, complete with:
- Stainless steel housing for preamplifier HD WME3 with holder for rain shield HD WME2,
- Bird spike HD WME1,
- Wind screen HD SAV3,
- Rain shield HD WME2.

HD SAV: Windscreen for ½" microphones.

HD SAV2: Windscreen with bird spike for HD WME950 weather protection.

HD SAV3: Windscreen for HD WME and HD WME950 weather protections.

HD SAVP: Rain shield for HD WME950 weather protection.

HD WME1: Bird spike for HD WME weather protection.

HD WME2: Rain shield for HD WME microphone unit.

HD WME3: Stainless steel housing for the preamplifier of HD WME weather protection, with holder for rain shield HD WME2.

HD2010PNE2: Microphone preamplifier for pre-polarized UC52 microphones. Equipped with CTC device for electrical calibration.

HD2010PNE2W: Microphone preamplifier to be housed in outdoor protection WME950 HD and HD WME. The preamplifier is heated, provided with standard connection for pre-polarized UC52 microphones and provided with CTC device for electrical calibration. Ending with a connection 5m cable (other lengths upon request).

UC52/1: Class 1 pre-polarized ½" microphone for free field.

UC52: Class 2 pre-polarized ½" microphone for free field.

CPA/5: 5m extension cable for preamplifier HD2010PNE2.

TECHNICAL SPECIFICATIONS

Standards	Class 1 or 2 group X according to IEC 61672:2002, and class 1 or 2 according to IEC 60651:2001 and IEC 60804:2000 Class 1 according to IEC 61260:1995 Type 1 or 2 according to ANSI S1.4-1983 and S1.43-1997 Class 1-D, order 3, Extended range according to ANSI S1.11-1986
½ inch Microphone	UC52 condenser type, pre-polarized, for free field
Dynamic Range	30 dBA ÷ 143 dB Peak
Linear Field	80 dB
Acoustic Parameters	SpI, L_{eq}, SEL, $L_{EP,d}$, L_{max}, L_{min}, L_{pk}, Dose, L_n
Frequency Weighting	Simultaneous A, C, Z (only C and Z for L_{pk})
Temporal Weighting	Simultaneous FAST, SLOW, IMPULSE
Integration	From 1s to 99 hours with Back-Erase function
Spectrum Analysis	Parallel filters in real time complying with class 1 specifications according to IEC61260 ✓ Octave bands from 32 Hz to 8 kHz ✓ Third octave bands from 25 Hz to 12.5 kHz (“Third Octave” option) Average spectrum (AVR) mode
Statistical Analysis	It displays up to 3 percentile levels, between L_1 and L_{99} Probability distribution and percentile level calculation from L_1 to L_{99} (“Advanced Analyzer” option) ✓ Parameter: L_{Fp}, L_{eq}, L_{pk} A, C or Z -weighted (only C or Z for L_{pk}) ✓ Sampling frequency: 8 samples/second Classification: Classes of 0.5 dB
Analysis of Events Option 5 “Advanced Analyzer”	This option is only available for class 1 instruments. Calculation of 5 freely-programmable event parameters Average spectrum calculation by octave and third octave bands Calculation of statistical levels from L_1 to L_{99} Event identification trigger with programmable threshold and duration filter External and manual trigger
Reverberation Time (option 4 “Reverberation Time”)	The reverberation time measurement option requires the option 1 “Third Octave” and is available for class 1 instruments only. Reverberation time measurement using sound source interruption or impulse response integration
Profile Data Logging	1 profile with programmable sampling from 1/8 s to 1 hour and 3 profiles with 2 samples/second
Spectrum Data Logging	Programmable sampling from 1 second to 1 hour (AVR mode)
Display	Graphic display 128x64 ✓ 3 parameters in numeric format ✓ Profile L_{AFp} with 8 samples/second ✓ Octave band spectrum from 32 Hz to 8 kHz ✓ Backlit LCD (“LCD” option) ✓ Third octave band spectrum from 25 Hz to 12.5 kHz (option 1 “Third Octave”) ✓ Graph of sound level probability distribution (option 5 “Advanced Analyzer”) ✓ Graph of percentile levels from L_1 to L_{99} (option 5 “Advanced Analyzer”)
Memory	Internal, equal to 4 MB (4 profiles for 23 hours or over 23 recording days of 3 parameters + spectra per minute) expandable to 8 MB External, via the HD2110MC memory card interface, using MMC or SD cards up to 2 GB
Input/Output	✓ RS232 serial and USB interfaces ✓ AC output (LINE) ✓ DC output
PC Programs	**Noise Studio (supplied with the instrument): PC interface for data download, set up and instrument management. Licensed software modules to be enabled by hardware key.** ✓ **“Worker protection” module. Analysis of noise in the workplace in accordance with Decree 81 of 2008 and the UNI 9432-2008.** ✓ **“Acoustic pollution” module. Analysis of environmental noise according to the Law 447/1995 and Decree of 16/03/1998. Analysis of the noise climate and assessment of noise from road, rail and airport according to the law. Some of the functions need option 1 “Third octaves”.** ✓ **“Acoustic Insulation” module. Calculations of acoustic and architectural evaluation of passive acoustic requirements of buildings according to DPCM of 5/12/1997. It needs option 1 “Third octaves” and option 4 “Reverberation time”.** ✓ “Monitor” module. Acquisition in real time on PC. Synchronized audio recording. Remote monitoring and data capture. Connection via Modem.
Operating conditions	✓ Working temperature -10÷50°C, 25÷90%RH (not condensing), 65÷108kPa. Protection degree: IP64
Power	✓ 4 alkaline or rechargeable NiMH type AA batteries or external 9÷12Vdc 300mA
Dimension and weight	✓ 445x100x50 mm equipped with preamplifier, 740 g (with batteries)

HD2010 kit 1/E: Version for outdoor measurements. It consists of HD2010 Sound Level Meter, HD WME weather protection, free field microphone unit MK223, windscreen, heated preamplifier HD2010PNW, RS232 serial or USB connection cable. Noise Studio PC Program.

HD2010 kit 1/IE: Version for indoor and outdoor measurements. It includes HD2010 Sound Level Meter, HD WME weather protection, free field microphone unit MK223, windscreen HDSAV, heated preamplifier HD2010PNW, preamplifier HD2010PN, 5m extension cable CPA/5 and RS232 serial or USB connection cable. Noise Studio PC Program.

Accessories

Option 0 "Memory Expansion": Additional 4 MB memory expansion.

Option 1 "Third Octave": Third octave band spectrum analysis in real time from 16 Hz to 20 kHz. Includes calibration report according to ISO 9001.

Option 4 "Reverberation Time": Measurement using sound source interruption or impulse response integration. **It requires option 1 "Third octaves".**

Option 5 "Advanced Analyzer": Profile+report+event data logging, capture and analysis of events, full statistical analysis.

Option 7 "SIT Calibration": SIT calibration replaces ISO 9001 reports. **For new instruments only.**

MK231: Class 1 microphone for diffuse field type WS2D according to IEC 61094-4:1995.

MK223: Class 1 Microphone for free field, type WS2F, according to IEC 61094-4:1995. Coated membrane for outdoor use.

HD9101: Class 1 calibrator according to IEC90942:1988. Specifications:
- Cavity for 1" and ½" microphones according to IEC61094
- Sound level 94dB/114dB.

The calibrator is supplied complete with calibration report according to ISO 9001.

HD2020: class 1 calibrator according to IEC60942:2003 with I.N.RI.M. certificate of conformity n.90-003-01. Specifications:
- LCD display,
- Static pressure compensation from 65kPa to 108kPa,
- Cavity for 1" and ½" microphones according to IEC61094,
- 1000Hz frequency,
- Sound level 94dB/114dB.

The calibrator is supplied complete with calibration report according to ISO 9001.

HD2110/RS: RS232 serial cable for PC connection or connection to HD40.1 printer.

HD2110/USB: serial USB cable for PC connection.

SWD10: Stabilized mains power supply Vin=100÷230Vac / Vout=12Vdc/1000mA.

CPA/10: 10m extension cable.

HD 2010
INTEGRATING SOUND LEVEL METER - PORTABLE ANALYZER

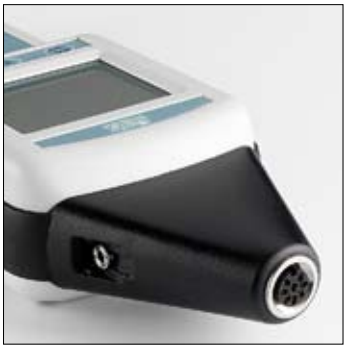
The HD2010 is a precision integrating portable sound level meter, with data logging functions, performing both spectrum and statistical analysis. The instrument has been designed combining maximum flexibility and simplicity. Attention has been paid to the possibility of adjusting the instrument to regulatory modifications and to the necessity of meeting its users' needs of today and tomorrow. The HD2010 can be integrated with other options to extend its application scope at any time; the firmware can be directly updated by the user by means of the Noise Studio program (supplied with the instrument).

Technical regulations:
- **Class 1 sound level meter according to IEC 61672-1, 2002 (Certificate of Compliance I.E.N. No. 37035-01C)**, IEC 60651 and IEC 60804.
- Class 1 octave and third octave filters according to IEC 61260
- Microphone complying with IEC 61094-4.

Applications:
- Assessment of the environmental noise level,
- Noise monitoring and optional capture and analysis of sound events,
- Octave and optional third octave band spectrum analysis from 16 Hz to 20 kHz,
- Statistical analysis with calculation of 3 percentile levels and optional full statistical analysis,
- Identification of impulsive noise
- Measurements in workplaces
- Selection of personal protective equipment (SNR, HML, and OBM methods),
- Sound insulation and reclamation,
- Production quality control,
- Measurement of machine noise,
- Optional architectural acoustics and building measurements.

Sound level meter Kits

HD2010 kit 1: consists of HD2010 Sound Level Meter, HD2010PN preamplifier, MK221 microphone for free field, windscreen, 5m extension cable and RS232 serial or USB connection cable. Noise Studio PC Program.



HD WME

VTRAP: Tripod, 1550 mm maximum height.
HD2110/SA: Support to fix the preamplifier to the tripod.
HD40.1: Portable serial printer with 57mm paper rolls and SWD10 power supply.
HD2010/MC: SD memory card interface complete with 1GB SD card

Software for Windows®/98/ME/2000/XP/Vista operating systems
Noise Studio: Software for Windows® ME/2000/XP and Vista operating systems supplied in the sound level meter kit. Configuration of the instrument, downloading and graphical display of stored data. This programme supports some sound analysis application modules which can be enabled by licence with the hardware key. The program contains demo versions of the modules.
CH20: Hardware key for PC with Windows ® operating systems. Inserted into a USB port enables PCs to use software modules of the program Noise Studio.
NS1: Activation of module "Worker protection" of the Noise Studio program. Analysis of noise in the workplace in accordance with Decree 81 of 2008 and the UNI 9432-2008**.**
NS2: Activation of module "Noise pollution" of the Noise Studio Program. Analysis of environmental noise according to the Law 447/1995 and Decree of 16/03/1998. Analysis of the noise climate and assessment of noise from road, rail and airport according to the law. **Some program functions require option 1 "Third octaves".**
NS3: Activation of the module "Acoustic Insulation" of the Noise Studio program. Calculations of acoustic and architectural evaluation of passive acoustic requirements of buildings according to DPCM of 5/12/1997. **Requires option 4 "Reverberation time".**
NS4: Activation of the module "Monitor" of the Noise Studio program. Acquisition in real time on PC. Synchronized audio recording. Remote monitoring and data capture. Connection via Modem.
Noise Studio Suite: Noise Studio Program complete with following application modules:

- "Worker Protection "
- "Noise Pollution"
- "Acoustic Insulation"
- "Monitor"

Using the HD2010 you can log the time profile of 4 simultaneous parameters freely selecting temporal or frequency weightings. The possibility of displaying, storing and even printing the multi-parameter analysis of the sound level allows the sound level meter to work as a sound level logger capable of storing for more than 23 hours. For sound level monitoring, you can store 3 programmable parameters and the average spectrum at intervals of 1 second to 1 hour. In this recording mode, you can store the sound level (3 parameters + spectra) at intervals of 1 minute for over 23 days using the supplied memory (4 MB expandable to 8 MB).
An advanced logging mode ("Advanced Analyzer" option) allows storing report sequences with dedicated parameters, average spectra and full statistical analysis, as well as sound level profiles. Moreover, a versatile trigger function can identify the sound events and record their analysis with 5 dedicated parameters, average spectrum and statistical analysis.

The spectrum analysis is carried out in real time, simultaneous with profile acquisition, by octave bands and optionally by third octave bands. The sound level meter calculates the sound signal spectrum twice a second and it integrates it linearly for up to 99 hours. The average spectrum is displayed together with an A, C or Z -weighted wideband level.

As a statistical analyzer, the HD2010 samples the sound signal 8 times per second with A- weighting and FAST constant, and it analyzes it statistically in 0.5 dB classes. Up to 4 percentile levels, selectable between L_1 and L_{99}, can be programmed. The "Advanced Analyzer" option can be used to choose if you want to sample L_{Fp}, Leq and L_{pk} with A, C and Z weightings (only C and Z for L_{pk}).

For further analysis, the LINE unweighted output allows recording the sound sample either on tape or directly on a PC equipped with a data acquisition card.

Recordings can be located in memory and viewed on the graphic display using the "Replay" function, which reproduces the time trend of the sound track. The high-speed USB interface combined with the flexible RS232 interface allows quick data transfers from the sound level meter to the PC mass storage, as well as controlling a modem or printer. For example, should the supplied memory not be enough, this is the case of lengthy recordings, you can activate the "Monitor" function. This function allows sending the displayed data to a PC via the serial interface, to be directly stored on the PC memory.

The sound level meter can be completely controlled by a PC through the multi-standard serial interface (RS232 and USB) by using a special communication protocol. Through the RS232 interface, the sound level meter can also be connected to a PC via modem.

The calibration can be made either using an acoustic calibrator (class 1 according to IEC 60942) or the built-in reference generator. The electrical calibration employs a special preamplifier and it checks the sensitivity of the measuring channel, microphone included. A protected area in the non-volatile memory, reserved for factory calibration, is used as a reference in the user's calibrations, and it allows keeping instrument drifts under control and preventing the instrument from "going out of calibration".

The control of the complete sound level meter functionality can be made directly by the user, on site, thanks to a diagnostic programme.

The HD2010 sound level meter can perform the measurements required to evaluate workers' noise exposure (Legislative Decree 10.04.06 No. 195). The selection of the personal protective equipment can be carried out through octave band spectrum analysis (OBM method) or comparison of the A and C weighted levels that can be measured simultaneously (SNR method). If an undesired sound event produces an overload indication or simply alters the result of the integration, its contribution can be excluded using the versatile Back-Erase function.

The HD2010 sound level meter is suitable for sound level monitoring and acoustic mapping. Using the "Advanced Analyzer" option, it can also perform analysis of the acoustic climate with capture and analysis of sound events. When measuring traffic noise near airports, railways and roads, the sound level meter can be used as a multi-parameter sound recorder, combining the statistical and spectrum analyzer features. Remote electrical calibrations and diagnostic tests can be executed using its remote control capabilities.

The HD2010 sound level meter with the "Third Octave" option meets the technical requirements of art. 2 of the Decree of 16 March 1998.
Impulsive events can be easily identified thanks to the possibility of analyzing the profile of the A-weighted level with FAST, SLOW, and IMPULSE constants. All measuring parameters can be stored for subsequent analysis. The identification of tonal components using the HD2010 has its limitations: the source can be identified only if dominant in the acoustic climate being examined. Moreover, the sound level meter cannot identify the tonal components at the standard third octave band crossing point. The audibility of the tonal component, to be compared with that of the remaining spectrum areas, can also be evaluated using the Noise Studio program supplied with the instrument, thanks to the calculation of the equal loudness curves.

The HD2010 sound level meter, with the "Third Octave" and "Reverberation Time" options, can perform all measurements prescribed by the regulations on room acoustics evaluation (D.P.C.M. of 5/12/1997). The sound level meter powerful DSP calculates 32 spectra/second, and it can measure reverberation times both using the sound source interruption and the impulsive source integration technique. The analysis is carried out simultaneously both by octave and third octave bands.

Inputs and outputs
DC output corresponding to the A-weighted sound level with FAST constant time, updated 8 times/s (∅ 2.5 mm jack).
LINE unweighted output (∅ 3.5 mm jack).
Standard RS232C serial port complying with EIA/TIA574. Baud Rate 300 to 115200 baud.
USB 1.1 serial port.
External power supply 9÷12Vdc (∅ 5.5 mm jack).

Italian Laws

- Workplace noise: D.L.81/2008, Eurpoean Standard UNI 9432/2008 and European Directive 2003/10/CE.
- Noise pollution: Law 447 of 26/10/95, D.P.C.M. of 1/3/91, Decree of 16/03/98, D.L. 194 dated 19/08/2005 and European Directive 2002/49/CE.
- Airport noise: Decree of 31.10.97.
- Entertainment noise: D.P.C.M. 215 of 16.04.99.
- Machine noise emissions: D. Lgs. 262 of 4/9/2002 and European Directive 2005/88/CE.
- Room acoustics evaluation: D.P.C.M. of 05.12.97.

Options and accessories:
HD2110/MC reader
It allows interfacing SD memory cards with the sound level meter.
This device is connected to the sound level meter through the serial interface that also gives the required power supply.
In addition to the remarkable recording capacity, the interface allows quickly downloading the data stored in the sound level meter internal memory. Cards up to 2 GB can be connected. Includes a 1GB SD card.

Option 1 "Third Octave"
Class 1 octave and third octave band spectrum analyzer according to IEC 61260.
Using the "Third Octave" option you can analyze the spectrum of a sound source from 16 Hz to 20 kHz in real time. The audibility of the different spectrum components can be evaluated thanks to the calculation of equal loudness curves using the Noise Studio program supplied with the instrument.

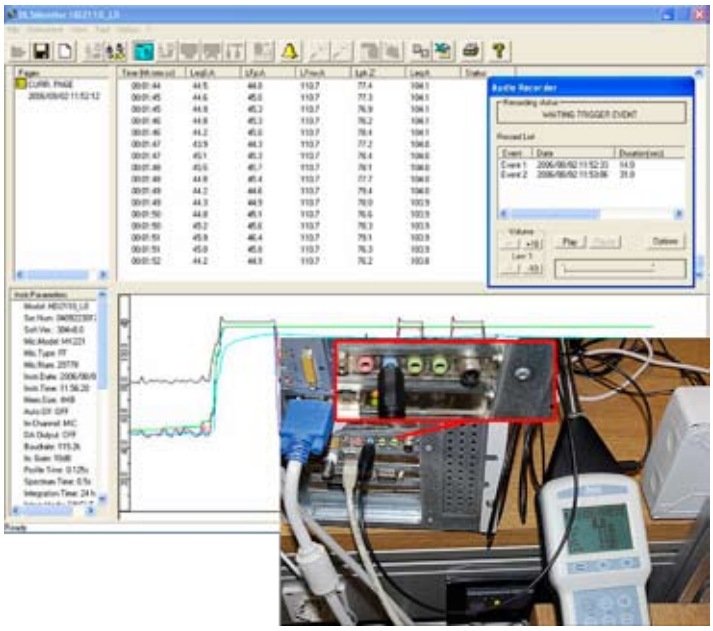
Option 4 "Reverberation Time" (it requires the "Third Octave" option)
Reverberation time measurement using the sound source interruption technique and the impulsive source method.
The reverberation time measurement is made simultaneously by wideband, octave band from 125 Hz to 8 kHz and, optionally, by third octave band from 100 Hz to 10 kHz. Sampling interval $^1/_{32}$ s.
Automatic calculation of reverberation times EDT, T10, T20 and analysis of the decay profile with the possibility to calculate the reverberation time in an interval of your choice.

Option 5 "Advanced Analyzer"
This option completes the sound level analyzer functions with the following:
- Statistical analysis available graphically, both as probability distribution and cumulative distribution.
- Trigger function to capture sound events with programmable threshold and duration filter.
- Recording of reports at intervals of 1s to 1 hour, with a dedicated set of parameters that includes average spectra and full statistical analysis.
- Recording of event parameters with the possibility of setting the maximum time resolution for event recording and a lower resolution for background noise recording.
- Possibility of storing markers.
- Timer for a delayed start of the acquisition.

Software:
Noise Studio
The Noise Studio program allows easily interfacing the sound level meter with the PC. Its main functions are:
- Data transfer from the sound level meter to the PC's memory.
- Display of the logged data as a table or a graph.
- Export to Excel
- Comparison of third octave band spectra with equal loudness curves.
- Logging control through PC (with the "Data Logger" option).
- Sound level meter setup.
- Sound level meter firmware upgrade

Writing reports is easier, thanks to a convenient function that allows copying the graphs or tables to other applications and the ability to create PDF files. Noise Studio is a program of post-processing that can perform different types of analysis designed for specific applications and grouped into modules with licensed software. Demo versions of the software modules are included.

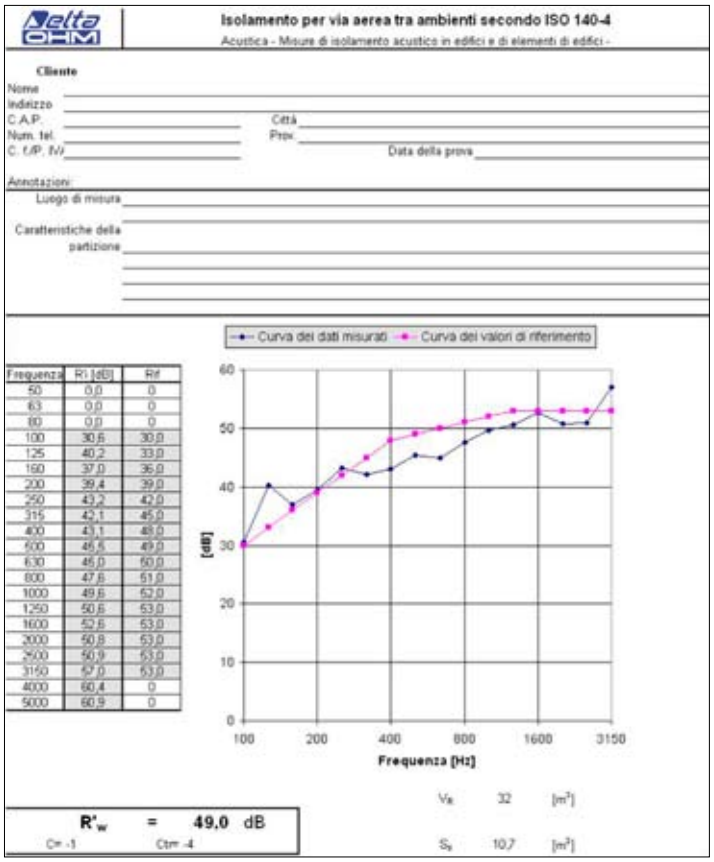
Noise Studio: 'Worker protection' module
This application module analyzes noise in the workplace according to the DL 81/2008, the European directive 2003/10/EC and the UNI 9432:2008. Data sound level measurements in work environment are organized in a project where they can be handled according to regulatory requirements. In addition to calculating the noise exposure of workers the program allows to evaluate the effectiveness of protective equipment by the methods SNR and OBM. According to UNI 9432 of 2008, the program also calculates the index of impulsiveness of a machine.



Noise studio: "monitor" module: acquisition om pc with synchronized audio recording

Noise Studio: 'Acoustic Pollution' module
This application module analyzes sound level profiles detected in indoor and outdoor environment for the assessment of the noise climate, the noise of industrial sites, ports, airports and transport infrastructure, and noise generally understood as a disturbance of human activity. The analysis of the noise climate is made on a daily, weekly and annual basis with resolutions up to 1 minute, according to DL 194, 19/08/2005.
The profiles of noise detected in the external environment are analyzed to search for disturbing sources characterized by a sequence of events such as railways and airports. The analysis is performed on a daily basis with a resolution equal to 1/8 of a second and with automatic search and analysis of sound events, according to the Ministerial Decree D.L. 194, 19/08/2005 of 16/03/1998. For the evaluation of the disturbance caused to the population from any source of noise even domestic, according to DM of 16/03/1998, the measured noise profiles are analyzed in search of impulsive or tonal components.
For some functions you need option 1: "Third octaves".

Noise Studio: 'Acoustic Insulation' module
This module performs calculations of building acoustics for the assessment of passive acoustic requirements of buildings, according to ISO standard, and according to the DPCM of 5/12/1997. The measures necessary for the analysis of a building are grouped in a project to simplify their storage and research. You can also add to the measures themselves, a technical report, comments, graphics, photos, etc. that remain part of the work and, if necessary, may be found easily. An updateable database, divided by walls and floors, contains the principal characteristics of sound-insulating structures. The data contained in the database can be compared



Noise studio "acoustic insulation" module: filling iso report.

graphically with measures in place.
With the program you can calculate:
- Average reverberation time (ISO 3382)
- Area of equivalent absorption coefficient of sound absorption (ISO 354)
- Isolation by air: indices R, R 'and DNT (ISO 140/III and IV)
- Insulation of facades and facade elements: indices $D_{2M,\,NT}$ and R_θ (ISO 140 / V)
- Isolation of noise impact: indices L_n, D_L, The N and L'_{nT} (ISO 140/VI, VII and VIII)
- Global Indices (ISO 717-1 and 717-2)
- **The program requires option 1 "Third octave" and for the calculation of some indices also the option 'Reverberation time'**

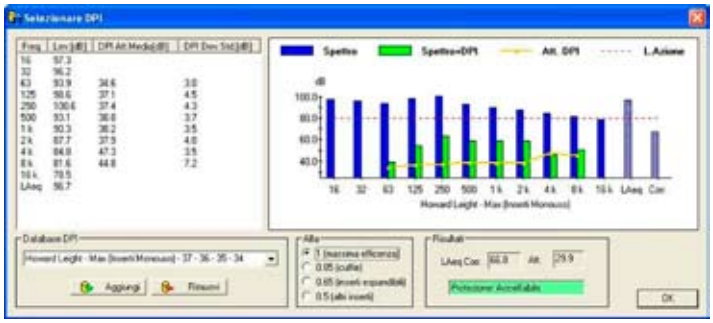
Noise Studio: 'Monitor' module

- This software module allows to control the sound level meter with PC in remote location. The main functions are:
- Real time display of acquired data, in graphical and tabular form.
- Possibility of connection via modem with the sound level meter.
- Acquisition of data sound level data directly into the mass memory of the PC (monitor function).
- Management of calibration and diagnostic functions.
- Automatic acquisition and monitoring program.
- Possibility of synchronized audio recording with the sound level measures, using a versatile trigger function

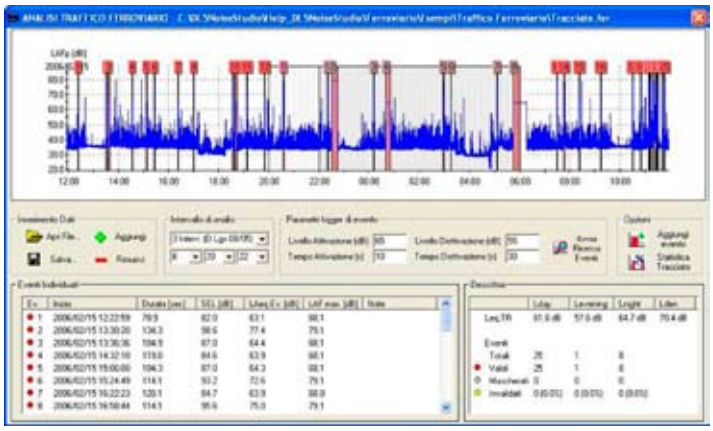
Purchasing codes for kit and accessories

HD2010 kit 1: consists of HD2010 Sound Level Meter, carrying case, HD2010PN preamplifier, MK221 microphone, CPA/5 5m extension cable, HD SAV windscreen, Noise Studio software and serial cable for connection to a PC (HD2110/RS) or USB (HD2101/USB interface).

HD2010 kit1/E: Version for outdoor measurements. It consists of: HD2010 Sound Level Meter, carrying case, HD WME weather protection with bird spike, wind screen and rain shield. HD SAV windscreen, heated preamplifier HD2010PNW with 5m extension cable(other lengths available on request), MK223 microphone, Noise Studio software and serial cable for connection to a PC (HD2110/RS) or USB (HD2101/USB interface).



Noise studio: "workers' protection" module: analysis of the effectiveness of ipd



Noise studio: "railway traffic" module: analysis of 24 hours with automatic search of transit

HD2010 kit1/IE: Version for indoor and outdoor measurements. It consists of HD2010 Sound Level Meter, carrying case, HD WME weather protection with bird spike, wind screen and rain shield, heated preamplifier HD2010PNW with 5m extension cable CPA/5, preamplifier HD2010PN, HD SAV windscreen, free field microphone unit MK223, Noise Studio software and serial cable for connection to a PC (HD2110/RS) or USB (HD2101/USB interface).

Option 0 "Memory Expansion": Additional 4 MB memory expansion.

Option 1 "Third Octave": Real-time third octave band spectrum analysis from 16 Hz and 20 kHz.

Option 4 "Reverberation Time": Reverberation time measurement using the sound source interruption technique and the impulsive source method. **It requires the "Third Octave" option and, for instruments manufactured before 2007, also the "Data logger" option.**

Option 5 "Advanced Analyzer": Profile+report+event data logging, capture and analysis of events, full statistical analysis. **It requires the "Data Logger" option for instruments manufactured before 2007.**

Option 7 "SIT Calibration": SIT calibration replaces ISO 9001 reports. **Only for new instruments**.

HD9101: Class 1 calibrator according to IEC90942:1988. Characteristics:

- Cavity for 1" and ½" microphones according to IEC61094
- 1000Hz Frequency
- Sound level 94dB/114dB

The calibrator is supplied complete with calibration report according to ISO 9001 (replaced by a SIT certificate if combined to Option 7 "SIT Calibration").

HD2020: class 1 calibrator according to IEC60942:2003 with I.N.RI.M. certificate of conformity n.90-003-01. Characteristics:

- LCD display
- Static pressure compensation from 65kPa to 108kPa
- Cavity for 1" and ½" microphones according to IEC61094
- Frequency 1000Hz
- Sound level 94dB/114dB

The calibrator is supplied complete with calibration report according to ISO 9001 (replaced by a SIT certificate if combined to Option 7 "SIT Calibration").

MK231: Class 1 Microphone for diffuse field, type WS2D, according to IEC 61094-4:1995.

MK223: Class 1 Microphone for free field, type WS2F, according to IEC 61094-4:1995. Coated membrane for outdoor use.

HD2110/RS: RS232 serial cable for PC connection or connection to HD40.1 printer.

HD2110/USB: serial USB cable for PC connection.

SWD10: Stabilized mains power supply with Vin=100÷230Vac / Vout=12Vdc/1000mA.

CPA/10: 10m extension cable for HD2010PN preamplifier.

VTRAP: Tripod, 1550 mm maximum height.

HD2110/SA: Support to fix the preamplifier to the tripod.

HD40.1: Portable serial printer with 57mm paper rolls and SWD10 power supply.

BAT40: Spare battery pack for HD40.1

RCT: 4 rolls of thermal paper, 57 width and 32mm diameter.

HD2010/MC: SD memory card interface complete with 1GB SD card

Codes for spare parts and other accessories

Option 2 "Data logger": Storage of 4 sound level profiles, continuously and at intervals. It includes memory expansion from of 2 MB. **This option is included in the new instruments.**

HD WME/PNMK: HD WME weather protection equipped with:

- HD WME consisting of preamplifier housing WME3 HD, bird spikes WME1, HD SAV wind screen SAV3 and rain shield HD WME2.
- Heated preamplifier HD2010PNW with 5m connection cable (other lengths upon request),
- MK223 microphone for free field type WS2F according to IEC 61094-4:1995 with coated membrane for outdoors use.

HD WME/PN

: HD WME weather protection equipped with:

- HD WME consisting of preamplifier housing WME3 HD, bird spikes WME1, HD SAV wind screen SAV3 and rain shield HD WME2.
- Heated preamplifier HD2010PNW with 5m connection cable (other lengths upon request),

HD WME: Weather protection equipped with:

- Stainless steel housing for HD WME3 preamplifier with rain shield HD WME2 support,
- HD WME1 bird spike,
- HD SAV3 wind-screen,
- HD WME2 rain shield.

HD SAV: Windscreen for ½" microphone.

HD SAV2: Windscreen with bird spike for HD WME950 microphone unit.

HD SAVP: Rain shield for HD WME950 microphone unit.

HD SAV3: Windscreen for HD WME and HD WME950 weather protections.

HD WME1: Bird spike for HD WME microphone unit.

HD WME2: Rain shield for HD WME microphone unit.

HD WME3: Stainless steel housing for the preamplifier of the outdoor microphone unit HD WME with holder for rain protection HD WME2.

HD2010PN: Microphone preamplifier for ½" microphones. Provided with CTC device for electrical calibration.

HD2010PNW: Microphone preamplifier for HDWME950N and HDWME weather protections. Heated and provided with CTC device for electrical calibration. Ending with 5m connection cable (other lengths upon request).

MK221: Class 1 microphone for free field, type WS2F, according to IEC 61094-4:1995

CPA/5: 5m extension cable for HD2010PN preamplifier.

HD2101/USB: USB serial cable for PC connection. **For sound level meters with serial Mini-Din connector**.

HD2110CSNM: RS232 serial cable for PC connection. **For sound level meters with serial Mini-Din connector**.

TECHNICAL SPECIFICATIONS

Standards	Class 1 group X according to IEC 61672:2002 and class 1 according to IEC 60651:2001 and IEC 60804:2000 Class 0 according to IEC 61260:1995 Type 1 or 2 according to ANSI S1.4-1983 and S1.43-1997 Class 1-D, order 3, Extended range according to ANSI S1.11-1986
½ inch Microphones	MK221 condenser microphone pre-polarized (200V), for free field, high stability, type WS2F according to IEC 61094-4. MK223 condenser microphone with coated membrane, polarized (200V), for free field, high stability, type WS2F according to IEC 61094-4 (combined with the HDWME950 weatherproof unit). MK231 condenser microphone, polarized (200V), for diffuse field, high stability, type WS2D according to IEC 61094-4.
Dynamic range	21 dBA ÷ 143 dB Peak
Linear Field	80 dB (110 dB for the HD2010RE version)
Acoustic Parameters	Spl, L_{eq}, SEL, $L_{EP,d}$, L_{max}, L_{min}, $L_{pk,}$ Dose, L_n
Frequency Weighting	Simultaneous A, C, Z (only C and Z for L_{pk})
Temporal Weighting	Simultaneous FAST, SLOW, IMPULSE
Integration	From 1s to 99 hours with Back-Erase function
Spectrum Analysis	Parallel filters in real time complying with class 1 specifications according to IEC61260 ✓ Octave bands from 16 Hz to 16 kHz ✓ Third octave bands from 16 Hz to 20 kHz (option 1 “Third Octave”) Average spectrum (AVR) mode
Statistical Analysis	It displays up to 3 percentile levels for, L_1 to L_{99} Probability distribution and percentile level calculation from L_1 to L_{99} (option 5 “Advanced Analyzer”) ✓ Parameter: A, C or Z weighted, L_{Fp}, L_{eq}, L_{pk} (only C or Z for L_{pk}) ✓ Sampling frequency: 8 samples/second ✓ Classification: Classes of 0.5 dB
Analysis of Events	Option 5 “Advanced Analyzer” ✓ Calculation of 5 freely programmable event parameters ✓ Average spectrum calculation by octave and third octave bands ✓ Calculation of statistical levels from L_1 to L_{99} ✓ Event identification trigger with programmable threshold and duration filter ✓ External and manual trigger.
Reverberation Time (optional)	The reverberation time measurement option requires the “Third Octave” option Reverberation time measurement using sound source interruption or impulse response integration
Profile Data Logging	1 profile with programmable sampling from 1/8 s to 1 hour and 3 profiles with 2 samples/second
Spectrum Data Loggin	Programmable sampling from 1 second to 1 hour (AVR mode)
Display	Backlit graphic display 128x64 ✓ 3 parameters in numeric format ✓ Profile L_{AFp} with 8 samples/second Octave band spectrum from 16 Hz to 16 kHz ✓ “Third Octave” option ✓ Third octave band spectrum from 16 Hz to 20 kHz “Advanced Analyzer” option ✓ Graph probability distribution of sound level ✓ Graph of percentile levels from L_1 to L_{99}
Memory	Internal, equal to 4 MB (4 profiles for 23 hours or over 23 days recording 3 parameters + spectra per minute). Expandable to 8 MB External, via the HD2110MC memory card interface, using MMC or SD cards up to 2 GB
Input/Output	✓ RS232 serial and USB interfaces ✓ AC output (LINE) ✓ DC output
PC Programs	✓ Noise Studio (supplied with the instrument): PC interface for data download, set up and instrument management. Licensed software modules to be enabled by hardware key. ✓ “Worker protection” module. Analysis of noise in the workplace in accordance with Decree 81 of 2008 and the UNI 9432-2008. ✓ “Acoustic pollution” module. Analysis of environmental noise according to the Law 447/1995 and Decree of 16/03/1998. Analysis of the noise climate and assessment of noise from road, rail and airport according to the law. Some program functions require option 1 “Third octaves”. ✓ “Acoustic Insulation” module. Calculations of acoustic and architectural evaluation of passive acoustic requirements of buildings according to DPCM of 5/12/1997. Requires option 4 “Reverberation time”. ✓ “Monitor” module. Acquisition in real time on PC. Synchronized audio recording. Remote monitoring and data capture. Connection via Modem. The program allows programming of measurements and calibrations with timer and audio recording with programmable event triggers.
Operating conditions	Working temperature -10÷50°C, 25÷90%RH (without condensation), 65÷108kPa. Protection degree: IP6
Power	4 alkaline or rechargeable NiMH type AA batteries or external 9÷12Vdc 300mA
Dimensions and weight	445x100x50 mm equipped with preamplifier, 740 g (with batteries)

HD 2110
INTEGRATING SOUND LEVEL METER - PORTABLE ANALYZER

The HD2110 is a precision integrating portable sound level meter, with data logging functions, performing both spectrum and statistical analysis. The instrument has been designed in order to offer high-performance analysis of acoustic phenomena, with particular regard to Italian legislation on environmental noise. Attention has been paid to the possibility of adjusting the instrument to regulatory modifications and to the necessity of meeting its users' needs of today and tomorrow. The HD2110 can be integrated with other options to extend its application scope at any time; the firmware can be updated directly by the user by means of the Noise Studio program supplied with the instrument.

Technical regulations:
- **Class 1 sound level meter according to IEC 61672-1, 2002 (Certificate of Compliance I.E.N. No. 37035-01C)**, IEC 60651 and IEC 60804.
- Class 0 octave and third octave filters according to IEC 61260
- Microphone in compliance with IEC 61094-4

Applications:
- Noise monitoring with sound event capture and analysis function,
- Real-time octave and third octave band spectrum analysis from 16 Hz to 20 kHz,
- Statistical analysis with calculation of all percentile levels from L_1 to L_{99},
- **Environmental noise measurement according to the decree of 16/03/1998,**
- **Identification of tonal components even at the standard third octave band crossing point,**
- **Estimate of the audibility of spectral components through comparison with equal loudness curves in real time**
- Measurement in workplaces,
- Selection of personal protective equipment (SNR, HML, and OBM methods),
- Sound insulation and reclamation,
- Production quality control,
- Measurement of machine noise,
- Optional architectural acoustics and building measurements.

Sound level meter kit

HD2110 kit 1: consists of HD2110 Sound Level Meter, HD2110P preamplifier, MK221 microphone for free field, windscreen, 5m extension cable and RS232 serial or USB connection cable. Noise Studio PC program.

HD2110 kit 1/E: Version for outdoor measurements. It consists of HD2110 Sound Level Meter, HD WME weatherproof microphone unit, heated preamplifier HD2110PW, MK223 microphone cartridge for free field, 5m extension cable and RS232 serial or USB connection cable. Noise Studio PC program.

HD2110 kit 1/IE: Version for indoor and outdoor measurements. It consists of HD2110 Sound Level Meter, HD WME weatherproof microphone unit, HD2110PW heated preamplifier, preamplifier HD2110P, MK223 microphone cartridge for free field, windscreen HD SAV, 5m extension cable CPA/5 and RS232 serial or USB connection cable. Noise Studio PC program.

Accessories

Option 4 "Reverberation Time": Measurement by sound source interruption or impulse response integration.

Option 6 "FFT": 1/32 s Short Leq profile, narrow band spectrum analysis (FFT).

Option 7 "SIT Calibration": SIT calibration replaces ISO 9001 reports. **For new instruments only.**

MK231: Class 1 microphone for diffuse field, type WS2D according to IEC 61094-4:1995.

MK223: Class 1 microphone for free field, type WS2F according to IEC 61094-4:1995. Protected membrane for outdoor use.

HD9101: Class 1 calibrator according to IEC90942:1988. Characteristics:
- Cavity for 1" and ½" microphones according to IEC61094,
- Frequency 1000Hz,
- Sound level 94dB/114dB.

The calibrator is supplied complete with calibration report according to ISO 9001.

HD2020: class 1 calibrator according to IEC60942:2003 with I.N.RI.M. certificate of conformity n.90-003-01. Characteristics:
- LCD display,
- Static pressure compensation from 65kPa to 108kPa,
- Cavity for 1" and ½" microphones according to IEC61094,
- 1000Hz frequency,

Sound level 94dB/114dB.
The calibrator is supplied complete with calibration report according to ISO 9001.

HD2110/RS: RS232 serial cable for PC connection or connection to HD40.1 printer.

HD2110/USB: serial USB cable for PC connection.

HD SAV2

SWD10: Stabilized mains power supply Vin=100÷230Vac / Vout=12Vdc/1000mA.
CPA/10: 10m extension cable.
VTRAP: Tripod, 1550 mm maximum height.
HD2110/SA: Support to fix the preamplifier to the tripod.
HD40.1: Portable serial printer with 57mm paper rolls and SWD10 power supply.
HD2010/MC: SD memory card interface complete with 1GB SD card

For Windows® /98/ME/2000/XP/Vista operating systems

Noise Studio: Software for Windows® 95/ME/2000/XP and Vista operating systems supplied in the sound level meter kit. Configuration of the instrument, downloading and graphical display of stored data. This programme supports some sound analysis application modules which can be enabled by licence with the hardware key. The program contains demo versions of the modules.

CH20: Hardware key for PC with Windows® operating systems. Inserted into a USB port enables PCs to use software modules of the program Noise Studio.

NS1: Activation of module "Worker protection" of the Noise Studio program. Analysis of noise in the workplace in accordance with Decree 81 of 2008 and the UNI 9432-2008.

NS2: Activation of module "Noise pollution" of the Noise Studio Program. Analysis of environmental noise according to the Law 447/1995 and Decree of 16/03/1998. Analysis of the noise climate and assessment of noise from road, rail and airport according to the law.

NS3: Activation of the module "Acoustic Insulation" of the Noise Studio program. Calculations of acoustic and architectural evaluation of passive acoustic requirements of buildings according to DPCM of 5/12/1997. **Requires option 4 "Reverberation time".**

NS4: Activation of the module "Monitor" of the Noise Studio program. Acquisition in real time on PC. Synchronized audio recording. Remote monitoring and data capture. Connection via Modem.

Noise Studio Suite: Noise Studio Program equipped with the following application modules:
- "Worker Protection"
- "Noise Pollution"
- "Acoustic Insulation"
- "Monitor".

Using the HD2110 sound level meter you can log the time profile of 6 simultaneous parameters choosing freely temporal or frequency weightings. The possibility of displaying, storing and even printing the multi-parameter sound level analysis allows the sound level meter to log sound level and store for more than 46 hours. For sound level monitoring, you can store 5 programmable parameters and the average spectrum at intervals of 1 second to 1 hour, both by octave and third octave bands. Thanks to its high dynamic range, long integrations can be carried out with a minimum possibility of under- or over-range indications. The measurement dynamic range exceeds 110 dB and it is limited downwards only by the instrument intrinsic noise. For example, if you set the measuring upper limit at 140 dB, you can carry out measurements at the typical sound levels of a quiet office, with high accuracy and without overload indications, peak levels up to 143 dB.
The sound level meter can also log report sequences with dedicated parameters, at programmable intervals of 1 second to 1 hour, average spectra and full statistical analysis, in addition to sound level profiles. Moreover, a versatile trigger function can identify sound events and record their analysis with 5 dedicated parameters, average spectrum and statistical analysis.

The spectrum analysis is carried out simultaneous with the logging of the 6 profiles in real time, both by octave and third octave bands. The spectrum of sound signal is calculated twice a second and integrated linearly for up to 99 hours. Alternatively, the instrument can perform multi-spectrum analyses, even maximum or minimum, both with linear and exponential weighting. Spectra are displayed together with an A, C or Z -weighted wideband level. The third octave band spectrum analysis can be carried out, in addition to standard bands from 16 Hz to 20 kHz, also with bands shifted downwards by $^1/_{6^{th}}$ octave, from 14 Hz to 18 kHz. This feature is useful for finding tonal components hidden at the standard band crossing point. While the third octave band spectrum is displayed, you can enable the calculation of equal loudness curves in real time, for quickly estimating the audibility of spectral components.

As a statistical analyzer, the HD2110 samples the sound signal 8 times per second with A-frequency weighting and FAST constant, and it analyses it in 0.5 dB classes. You can program 4 percentile levels from L_1 to L_{99} and choose to sample L_{Fp}, L_{eq} or L_{pk} with A, C and Z-weightings (only C and Z for L_{pk}).

The Digital Audio interface allows recording the sound sample on tape, for further analysis. Recording in digital format guarantees the best accuracy. Audio tracks recorded with other instruments can also be analyzed using the Line input. For further analysis, the LINE unweighted output allows recording the sound sample either on tape or directly on a PC equipped with a data acquisition card.

Recordings can be located in memory and viewed on the graphic display using the "Replay" function, which reproduces the time trend of the sound track. The high-speed USB interface, combined with the flexible RS232 interface, allows quick data transfers from the sound level meter to the PC mass memory, as well as controlling a modem or printer. For example, should the supplied memory not be enough, this is the case for lengthy recordings, you can activate the "Monitor" function. This function allows sending the displayed data to a PC via the serial interface and storing them directly on the PC mass memory.
The HD2110 can be completely controlled by a PC through the multi-standard serial interface (RS232 and USB) by using a special communication protocol. Through the RS232 interface, the sound level meter can also be connected to a PC via modem.

The calibration can be performed either by using the provided acoustic calibrator (type 1 according to IEC 60942) or the built-in reference generator. The electric calibration uses a special preamplifier and checks the sensitivity of the measuring channel, microphone included. A protected area in the non-volatile memory, reserved to factory calibrations, is used as a reference for the user's calibrations, so to allow keeping instrument drifts under control and to prevent the instrument from losing of calibrations.
The control of the complete sound level meter functionality can be made directly by the user, on site, thanks to a diagnostic programme.
Most of the damages occurred to the instrument, microphone included, can be promptly identified thanks to a complete analysis program that includes the frequency response measurement of the whole measuring chain: microphone, preamplifier and sound level meter. The regular execution of diagnostic programs allows making reliable sound measurements, avoiding any repetition due to a malfunction later discovered.

The HD2110 sound level meter can perform the measurements required to evaluate workers' noise exposure (Legislative Decree 81/2008). The personal protective equipment can be selected through octave band spectrum analysis (OBM method) and a comparison of the A and C-weighted equivalent levels that can be measured simultaneously (SNR method). If an undesired sound event produces an overload indication, or simply alters the result of integration, its contribution can be excluded using the versatile Back-Erase function.

The HD2110 sound level meter is suitable for sound level monitoring, acoustic mapping and the assessment of the acoustic climate with capture and analysis of sound events. When measuring traffic noise near airports, railways and roads, the sound level meter can be used as a multi-parameter sound recorder, combining statistical and spectrum analyzer features. Remote electrical calibrations and diagnostic tests can be executed using its remote control capabilities.

The HD2110 can also perform the measurements required to evaluate environmental noise (Decree of 16 March 1998, GU No.76 of 1 April 1998). Impulsive events can be easily identified thanks to the possibility of analysing the profile of the A-weighted level with FAST, SLOW, and IMPULSE constants. All measuring parameters can be stored for subsequent analysis. The identification of tonal components is also easy and certain as it allows displaying and recording the minimum spectrum with any wideband weightings (Z, C or A) both by third octave bands with standard nominal frequencies 16 Hz to 20 kHz, and with central frequencies shifted on the former crossing point 14Hz to 18 kHz. The audibility of the tonal component can be evaluated in the field thanks to the real-time calculation of equal loudness curves. The audibility of the tonal component, to be compared with that of the remaining spectrum, can also be evaluated using the Noise Studio program supplied with the instrument, thanks to the calculation of the equal loudness curves.

The HD2110 sound level meter with the "Reverberation Time" option can perform any measurement prescribed by the regulations on the room acoustics evaluation (D.P.C.M. of 5/12/1997). The sound level meter powerful DSP calculates 32 spectra/second, and it can measure reverberation times both using the sound source interruption method and the integration of impulse response technique. The analysis is carried out simultaneously by both octave and third octave bands.

Inputs and outputs

Digital audio input/output (IEC 60958:1999 type II) with RCA connector (S/PDIF).
LINE unweighted input/output (∅ 3.5 mm jack).
TRIGGER input/output (∅ 3.5 mm jack).
Standard RS232C serial port in compliance with EIA/TIA574. Baud Rate 300 to 115200 baud.
USB 1.1 serial port.
External power supply 9÷12Vdc (∅ 5.5 mm jack).

Italian Laws

- Noise in workplaces: D. Lgs 81/2008, UNI 9432/2008 and European Directive 2003/10/CE.
- Noise pollution: Law 447 of 26/10/95, D.P.C.M. of 1/3/91, Decree of 16/03/98, Decree No. 194 of 19/08/2005 and European Directive 2002/49/CE.
- Airport noise: Decree of 31.10.97.
- Noise in dancing entertainment locals: D.P.C.M. 215 dated 16/4/99.
- Noise emission from machines D. Lgs 262 of 4/9/2002 and European Directive 2005/88/CE.
- Evaluation of passive requirements of buildings: D.P.C.M. of 05.12.97.

Options and accessories:

HD2110MC reader

It allows interfacing SD and MMC memory cards with the sound level meter.
This device is connected to the sound level meter through the serial interface that also gives the required power supply. In addition to its remarkable storing capacity, the interface allows quickly downloading the data stored in the sound level meter internal memory. Cards with a maximum capacity of 2 GB can be connected. Includes a 1GB SD card.

Option 4 "Reverberation Time"

The measure of reverberation time is performed by using the sound source interruption and the impulsive source method.
The measure of reverberation time is performed simultaneously by wideband, octave band from 125 Hz to 8 kHz, and third octave band from 100 Hz to 10 kHz. Sampling interval 1/32 s.
Automatic calculation of reverberation times EDT, T10, T20 and T30 by all bands, and decay profile analysis with the possibility of calculating the reverberation time over a chosen interval.

Option 5 "Advanced Analyzer"

(included in new sound level meters only)

This option combines the sound level analyzer functions with the following:

- Statistical analysis available graphically, both as probability distribution and cumulative distribution.
- Trigger for noise event capture with level threshold and duration filter.
- Recording of measurement reports at intervals of 1s to 1 hour, with a dedicated set of parameters that includes average spectra and full statistical analysis.
- Recording of event parameters with the possibility of setting the maximum time resolution for event recording and a lower resolution for background noise recording.
- Possibility of storing markers.
- Timer for a delayed start of the capture.

Option 6 "FFT"

(only for HD2110 sound level meters with "Advanced Analyzer" option)

This option adds:

- Leq profile at 1/32 s intervals.
- Narrow band spectrum analysis (FFT) over the whole audio range with variable resolutions according to the frequency from 1.5Hz to 100Hz.

Software:

Noise Studio

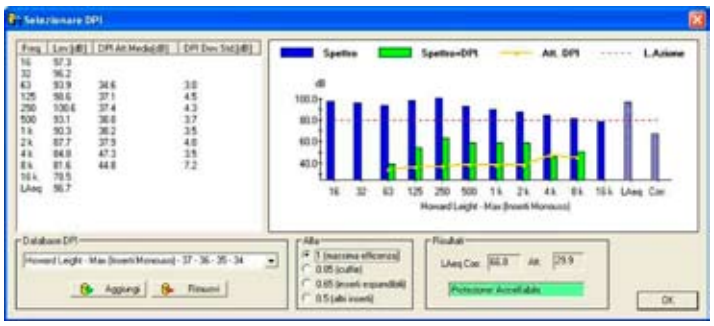
The Noise Studio programme allows interfacing HD2110 to the PC in a simple and intuitive way. Main functions are:

Transfer of stored data from the sound level meter to the PC memory.
Display of captured data under graphic and tabular form.
Export to Excel and PDF format.
Printing of graphs and data tables.
Comparison of spectra for third octave bands with noise contours.
Logging control by a PC.
Sound level meter setup management.
Sound level meter firmware update.

It results easier drafting documents regarding the sound level meter's relief due to the handy function which allows to copy graphs or visualized tables from other applications and to create PDF files.
Moreover Noise Studio is a post processing programme able to perform different kind of analyses, studied for specific applications assembled in software modules to be enabled with licence. Demo versions of the software modules are provided.

Noise Studio: 'Worker protection' module (to be activated by license)

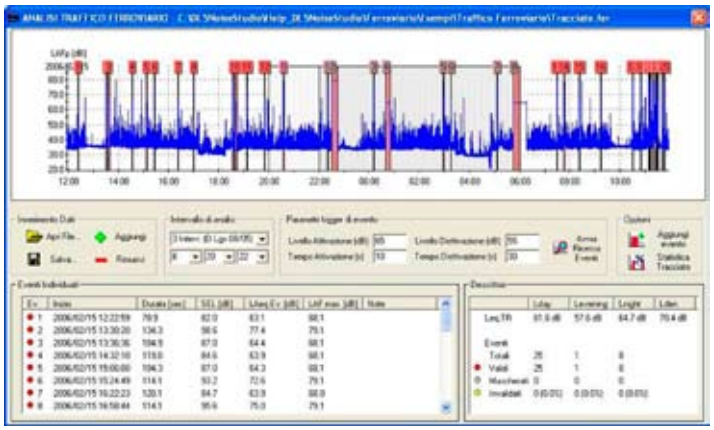
This application module analyzes noise in the workplace according to the DL 81/2008, the European directive 2003/10/EC and the UNI 9432:2008. Data sound level measurement in work environment is organized in a project where they can be handled according to regulatory requirements. In addition to calculating the noise exposure of workers the program allows to evaluate the effectiveness of protective equipment by the methods SNR and OBM. According to UNI 9432 of 2008, the program also calculates the index of impulsiveness of a machine.



Noise studio: "workers' protection" module: analysis of the effectiveness of ipd

Noise Studio: 'Acoustic Pollution' module (to be activated by license)

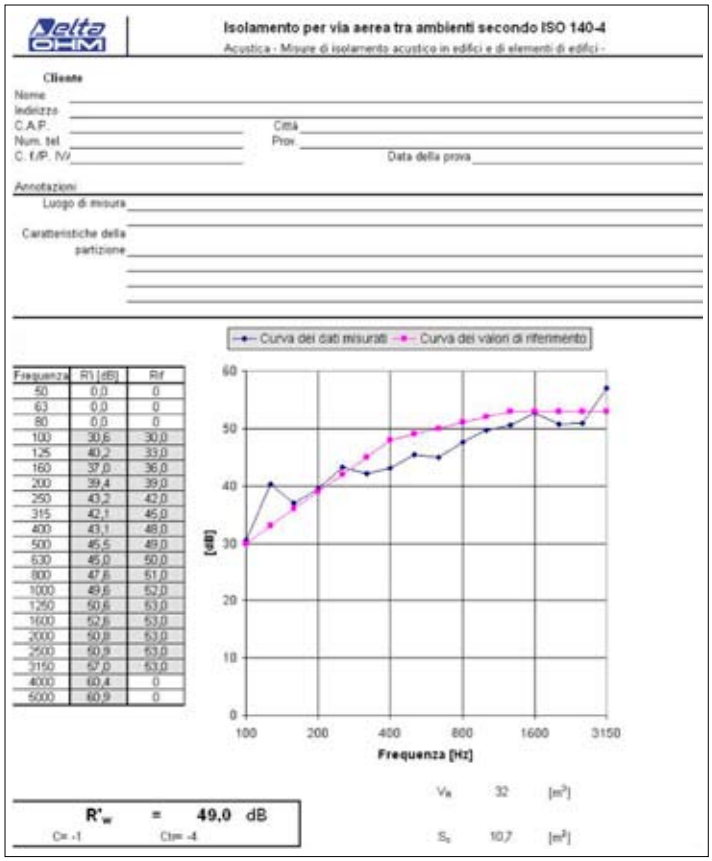
This application module analyzes sound level profiles detected in indoor and outdoor environment for the assessment of the noise climate, the noise of industrial sites, ports, airports and transport infrastructure, and noise generally understood as a disturbance of human activity. The analysis of the noise climate is made on a daily, weekly and annual basis with resolutions up to 1 minute, according to DL 194, 19/08/2005. The profiles of noise detected in the external environment are analyzed to search for disturbing sources characterized by a sequence of events such as railways and airports. The analysis is performed on a daily basis with a resolution equal to 1/8 of a second and with automatic search and analysis of sound events, according to the Ministerial Decree D.L. 194, 19/08/2005 of 16/03/1998. For the evaluation of the disturbance caused to the population from any source of noise even domestic, according to DM of 16/03/1998, the measured noise profiles are analyzed in search of impulsive or tonal components.



Noise studio: "railway traffic" module: analysis of 24 hours with automatic search of transit

Noise Studio: 'Acoustic Insulation' module (to be activated by license)

according to the DPCM of 5/12/1997.
The measures necessary for the analysis of a building are grouped in a project to simplify their storage and research. You can also add to the measures themselves, a technical report, comments, graphics, photos, etc... which remain part of the work and, if necessary, can be found easily.
An updateable database, divided by walls and floors, contains the principal characteristics of sound-insulating structures. The data contained in the database can be compared graphically with measures in place.
With this program you can calculate:
Average reverberation time (ISO 3382)
Area of equivalent absorption coefficient of sound absorption (ISO 354)
Isolation by air: indices R, R 'and D_{nT} (ISO 140/III and IV)
Insulation of facades and facade elements: indices $D_{2m,nT}$ and Rθ (ISO 140 / V)
Isolation of noise impact: indices L_n, DL, The N and L'_{nT} (ISO 140/VI, VII and VIII)
Global Indices (ISO 717-1 and 717-2)
For the calculation of some indices, option 4 'Reverberation time' is required.



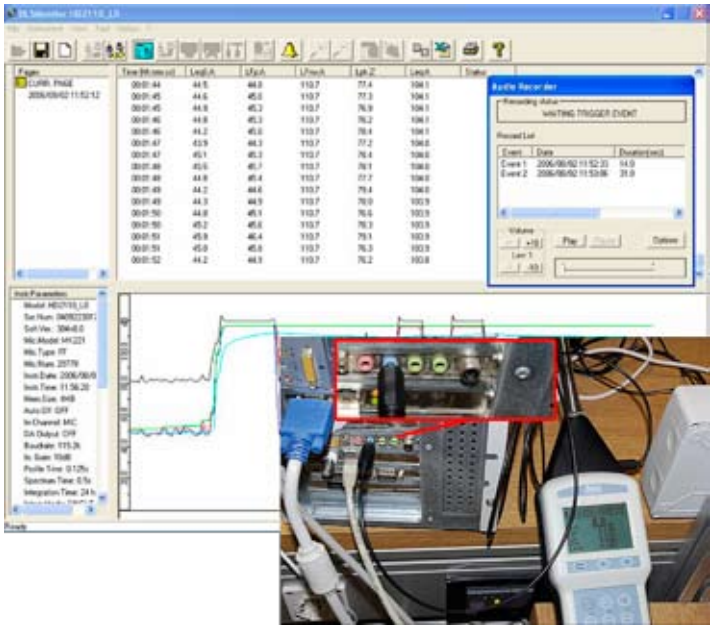
Noise studio "acoustic insulation" module: filling iso report.

Noise Studio: 'Monitor' module (to be activated by license)

This software module allows to control the sound level meter with PC in remote location. The main functions are:

Real time display of acquired data, in graphical and tabular form.
Possibility of connection via modem with the sound level meter.
Acquisition of data sound level data directly into the mass memory of the PC (monitor function).
Management of calibration and diagnostic functions.
Automatic acquisition and monitoring program.

Possibility of synchronized audio recording with the sound level measures, using a versatile trigger function.



Noise studio: "monitor" module: acquisition om pc with synchronized audio recording

Kit and accessories purchasing codes

HD2110 kit 1: consists of HD2110 Sound Level Meter, carrying case, HD2110P preamplifier, MK221 microphone, 5m extension cable CPA/5, HD SAV windscreen, Noise Studio software and RS232 serial (HD2110RS) or USB connection (HD2110/USB) cable.

HD2110 kit1/E: Version for outdoor measurements. It consists of HD2110 Sound Level Meter, carrying case, HD WME weather equipped with bird spike protection, wind screen and rain shield, HD2110PW heated preamplifier with 5m extension cable (other lengths available upon request) and MK223 microphone. The kit includes also Noise Studio software and serial cable for connection to a PC (HD2110/RS) or USB (HD2101/USB interface).

HD2110 kit1/IE: Version for indoor and outdoor measurements. It consists of HD2110 Sound Level Meter, carrying case, HD WME weather equipped with bird spike protection, wind screen and rain shield, HD2110PW heated preamplifier with 5m extension cable (other lengths available upon request), HD2110P preamplifier, 5m extension cable CPA/5, HD SAV wind screen and MK223 microphone. The kit includes also Noise Studio software and serial cable for connection to a PC (HD2110/RS) or USB (HD2101/USB interface).

Option 4 "Reverberation Time": Reverberation time measurement by source interruption and the impulsive source method.

Option 6 "FFT": Short Leq profiles at 1/32 s, narrow band spectrum analysis (FFT). **It requires the "Advanced Analyzer" option**.

Option 7 "SIT Calibration": SIT calibration replaces ISO 9001 reports. **For new instruments only.**

HD9101: Class 1 calibrator according to IEC90942:1988. Characteristics:
- Cavity for 1" and ½" microphones according to IEC61094,
- Frequency 1000Hz,
- Sound level 94dB/114dB.

The calibrator is supplied complete with calibration report according to ISO 9001.

HD2020: class 1 calibrator according to IEC60942:2003 with I.N.RI.M. certificate of conformity n.90-003-01. Characteristics:
- LCD display,
- Static pressure compensation from 65kPa to 108kPa,
- Cavity for 1" and ½" microphones according to IEC61094,
- 1000Hz frequency,

Sound level 94dB/114dB.
The calibrator is supplied complete with calibration report according to ISO 9001 (replaced by a SIT certificate when combined to Option 7 "SIT Calibration").

MK231: Class 1 microphone for diffuse field, type WS2D according to IEC 61094-4:1995.

MK223: Class 1 microphone for free field, type WS2F according to IEC 61094-4:1995. Protected membrane for outdoor use.

HD2110/RS: RS232 serial cable for PC connection or connection to HD40.1 printer.

HD2110/USB: serial USB cable for PC connection.

SWD10: Stabilized mains power supply Vin=100÷230Vac / Vout=12Vdc/1000mA.

CPA/10: 10m extension cable for HD2110P preamplifier.

CPA/20: 20m extension cable for HD2110P preamplifier.

CPA/50: 50m extension cable for HD2110P preamplifier.

VTRAP: Tripod, 1550 mm maximum height.

HD2110/SA: Support to fix the preamplifier to the tripod.

HD40.1: Portable serial printer with 57mm paper rolls and SWD10 power supply.

BAT40: Spare battery pack for HD40.1

RCT: rolls of thermal paper, 57 width and 32mm diameter.

HD2010/MC: SD memory card interface including 1GB SD card

Codes of spare parts and other accessories

Option 5 "Advanced Analyzer": Profile+report+event data logging, capture and analysis of events, full statistical analysis. **This option is included in new instruments.**

HD WME/PMK: HD WME weather protection complete with bird spike, windscreen and rain shield, HD2010PW heated preamplifier with CPA/5 5m extension cable, HDSAV windscreen, MK223free field microphone unit.

HD WME/P: HD WME weather protection complete with bird spike, windscreen and rain shield, HD2010PW heated preamplifier with CPA/5 5m extension cable (other lengths upon request).

HD WME: Weather protection, equipped with:
- Stainless steel housing for the preamplifier WME3 HD with holder for rain protection HD WME2,
- WME1 HD bird spike,
- HD SAV3 wind-screen,
- HD WME2 rain-shield.

HD SAV: Windscreen for 1/2" microphone.

HD SAV2: Windscreen with bird spike for HD WME950 microphone unit.

HD SAVP: Rain shield for HD WME950 microphone unit.

HD SAV3: Windscreen for HD WME microphone unit.

HD WME1: Bird spike for HD WME microphone unit.

HD WME2: Rain shield for HD WME microphone unit.

HD WME3: Stainless steel housing for the preamplifier of the outdoor microphone unit HD WME with holder for rain protection HD WME2.

HD2010P: Microphone preamplifier for ½" microphones. Provided with CTC device for electrical calibration. The HD2010P is also equipped with a driver for extension cable up to 100m length.

HD2010PW: Heated microphone preamplifier for HDWME950 and HD WME. It is heated and provided with CTC device for electrical calibration. Ending with 5m connection cable (other lengths upon request). The HD2010PW is also equipped

with a driver for extension cable up to 100m length.

HD2110PW: Heated microphone preamplifier to be housed in outdoor protection WME950 HD and HD WME. The preamplifier for ½"microphones is heated and provide with CTC device for electrical calibration; it ends with a 5m connection cable (other lengths on request). The HD2110PW is also equipped with a driver for extension cable up to 100m length.

CPA/5: 5m extension cable for HD2010PN and HD2110P preamplifiers.

HD2101/USB: USB serial cable for PC connection. **For sound level meters with serial Mini-Din connector**.

HD2110CSNM: RS232 serial cable for PC connection. **For sound level meters with serial Mini-Din connector**.

TECHNICAL SPECIFICATIONS

Standards	Class 1 group X according to IEC 61672:2002 and class 1 according to IEC 60651:2001 and IEC 60804:2000 Class 0 according to IEC 61260:1995 Type 1 according to ANSI S1.4-1983 and S1.43-1997 Class 1-D, order 3, Extended range according to ANSI S1.11-1986
½ inch Microphones	✓MK221 condenser microphone, polarized (200V), for free field, high stability, type WS2F according to IEC 61094-4 ✓MK223 condenser microphone with coated membrane, polarized (200V), for free field, high stability, type WS2F according to IEC 61094-4 (combined with the HDWME950 weatherproof microphone unit) ✓MK231 condenser microphone, polarized (200V), for diffuse field, high stability, type WS2D according to IEC 61094-4
Dynamic range	23 dBA ÷ 143 dB Peak
Linear range	110 dB
Acoustic Parameters	Spl, L_{eq}, SEL, $L_{EP,d}$, L_{max}, L_{min}, L_{pk}, Dose, L_n
Frequency Weighting	Simultaneous A, C, Z (only C and Z for L_{pk})
Temporal Weighting	Simultaneous FAST, SLOW, IMPULSE
Integration	From 1s to 99 hours with Back-Erase function
Spectrum Analysis	Parallel filters in real time complying with IEC61260 class 0 specifications. ✓Octave bands from 16 Hz to 16 kHz ✓Third octave bands from 16 Hz to 20 kHz ✓Third octave bands from 14 Hz to 18 kHz ✓Optional FFT from 7 Hz to 22 kHz with variable resolutions from 1.5 Hz to 100 Hz Average spectrum (AVR) mode, multi-spectrum analysis (MLT), maximum spectrum (MAX), and minimum spectrum (MIN)
Audibility	Real-time comparison of third octave band spectrum with equal loudness curves according to ISO 266:2003
Statistical Analysis	Probability distribution and percentile level calculation from L_1 to L_{99} ✓Parameter: L_{Fp}, L_{eq}, L_{pk}, A, C or Z weighted (only C or Z for L_{pk}) ✓Sampling frequency: 8 samples/second ✓Classification: 0.5 dB classes
Event Analysis	✓Calculation of 5 freely programmable event parameters ✓Calculation of octave and third octave band average spectra ✓Calculation of statistical levels from L_1 to L_{99} ✓Event identification trigger with programmable threshold and duration filter ✓External and manual trigger
Reverberation Time (opt.)	Reverberation time measurement by sound source interruption and impulse response integrated
Profile Data Logging	1 profile with programmable sampling from 1/8 s to 1 hour and 5 profiles with 2 samples/second
Spectrum Data Logging	Programmable sampling from 0.5s to 1 hour (MLT, MAX, or MIN modes)
Display	Backlit graphic display 128x64 ✓5 numerical parameters ✓Profile of a selectable parameter with sampling time from 1/8 s to 1 hour ✓Octave band spectrum from 16 Hz to 16 kHz ✓Third octave band spectrum from 16 Hz to 20 kHz or 14 Hz to 18 kHz ✓Graph of sound level probability distribution ✓Graph of percentile levels from L_1 to L_{99} ✓Optional narrow band spectrum analysis (FFT) from 7Hz to 22 kHz
Memory	Internal, equal to 8 MB (1 profile for 72 hours or over 46 recording days of 5 parameters + spectra per minute) External, via the HD2110MC memory card interface, using MMC or SD cards up to 2 GB
Input/Output	✓ RS232 serial and USB interfaces ✓ AC input and output (LINE) ✓ S/PDIF digital audio input and output ✓ External event identification trigger
PC Programs	✓ Noise Studio (supplied with the instrument): PC interface for data download, set up and instrument management. Licensed software modules to be enabled by hardware key. ✓ "**Worker protection**" module. Analysis of noise in the workplace in accordance with Decree 81 of 2008 and the UNI 9432-2008. ✓ "**Acoustic pollution**" module. Analysis of environmental noise according to the Law 447/1995 and Decree of 16/03/1998. Analysis of the noise climate and assessment of noise from road, rail and airport according to the law. Some program functions require option 1 "Third octaves". ✓ "**Acoustic Insulation**" module. Calculations of acoustic and architectural evaluation of passive acoustic requirements of buildings according to DPCM of 5/12/1997. Requires option 4 "Reverberation time". ✓ "**Monitor**" module. Acquisition in real time on PC. Synchronized audio recording. Remote monitoring and data capture. Connection via Modem. The program allows programming of measurements and calibrations with timer and audio recording with programmable event triggers.
Operating conditions	Working temperature -10÷50°C, 25÷90%RH (without condensation), 65÷108kPa. Protection degree: IP64
Power supply	4 alkaline or rechargeable NiMH type AA batteries or external 9÷12Vdc 300mA
Dimensions and weight	445x100x50 mm equipped with preamplifier, 740 g (with batteries)

HD 8701
SOUND LEVEL METER

The sound level meter **HD 8701** is a portable instrument, easy and quick to use, suitable for measuring industrial and civil noise levels.
The noise levels can be read easily in dB (A) on the large liquid crystal display which also shows all the information concerning the mode of operation of the instrument. One second after switching on and with a resolution of 0.1 dB, the digital reading gives the continuously updated value of the RMS sound pressure level, with a type A frequency weighting. The single range from 30 to 130 dB further simplifies the use of the instrument, as the user does not have to change scale. With the keyboard the following operations are possible:
- selecting the response time constant S/F
- displaying the maximum value recorded “MAX” and zeroing it “RESET MAX”
- freezing the indication on the display “HOLD”.

DIRECTIONS OF USE
When pressing ON/OFF key the instrument switches on; by pressing it again, the instrument switches off.
S/F key allows to select selecting the time constant: Slow (1 second) - Fast (125 milliseconds) are displayed with “S” or “F”. HOLD key allows holding the indication on display. By pressing HOLD again, you go back to the normal operation (continuous updating of reading). The frozen state is indicated on the display with “HOLD”.
By hold the MAX key, you display the maximum value considered (for periods not exceeding one minute) automatically by the instrument, by the switching on or since pressing the RESET MAX. The display also indicates if the battery is low.
The instrument switches off automatically if it is in the measure, after about 3 minutes from ignition. In MAX and HOLD disables automatic shutdown of the instrument.

Automatic shutdown of the instrument in measuring can be disabled by moving the jumper in the battery compartment. In order to ensure the accuracy of the instrument over time, it is advised by the calibration trimmer multi-turn “CAL” in the probe, after connecting the microphone to the calibrator HD 9102.

TECHNICAL SPECIFICATIONS
- Measuring range: 30 dB (A)...130 dB (A)
- Frequency response: weighted A
- Time constants: S = slow (1 s) and F = Fast (125 ms)
- Resolution: 0.1 dB - Precision: class 2
- Display: 12 mm LCD with indication of operating mode and low battery
- Power supply: 9 V batteries
- Autonomy: (continuous duty) 15 hours with zinc-carbon battery, 30 hours with alkaline battery
- Working temperature: -5...+50°C
- Storage temperature: -20...+70°C
- Dimensions instrument: 80 x 160 x 40 mm
- Weight: 350 gr.

HD 2020
ACOUSTIC CALIBRATOR

The HD 2020 sound level calibrator is a portable, battery operated sound source, suitable for sound level meters (portable and laboratory) and acoustic stations. It allows calibrating ½" microphones with mechanical dimensions compliant with IEC 61094-1 ("Measurement microphones. Part 1: Specifications for laboratory standard microphones") and IEC 61094-4 ("Measurement microphones. Part 4: Specifications for working standard microphones"). The calibration pressure levels of 94dB and 114dB can be selected by the keypad. The 1000 Hz frequency cannot be changed.
If the microphone is absent or not inserted correctly into the calibrator cavity, the sound level will blink on the display.
To conserve battery life, the instrument is provided with an automatic power off function: if you leave the instrument on with open cavity, it switches off automatically after 30 seconds. If the cavity is closed and the microphone is inserted, the instrument switches off 5 minutes after turning on, provided that you don't press any key.
The calibrator display shows calibration pressure level, battery life, current date and time.

ACOUSTIC CALIBRATOR

1. **ON-OFF** key: turns on and off the instrument. When you turn the instrument on, the display will switch on about three seconds later.
2. **SETUP** key: allows you to enter and scroll menu. To exit, press it repeatedly until you go back to the standard screen.
3. Display. When you turn the instrument on, it shows all segments on, and then the sound pressure level (94 or 114dB) will appear in standard view.
4. Calibrator cavity for conventional ½ inch microphones.
5. ▼ key: in standard mode, it selects 94dB and 114dB pressure levels alternately. In menu mode, it decreases the current value.
6. ▲ key: in standard mode, it selects 94dB and 114dB pressure levels alternately. In menu mode, it increases the current value.
7. Battery lid.

Advantages of the HD 2020 calibrator are:

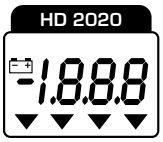
- The 1000Hz frequency allows calibrating sound level meters with any weighting (LIN, A, B, ...), without applying any correction factor.
- The calibration sound pressure level is independent of atmospheric pressure: you don't need to adjust the value according to static pressure over a wide range of values.
- The HD 2020 calibrator can be conveniently used both in laboratory and in the field. The 114 dB sound level allows performing calibrations even in high background noise environments.
- Its simplicity of use allows the use even by unskilled personnel.
- The presence of the LCD helps you through the steps of setting the calibrator, signal the end of the span and allows you to check the status of the battery.

DESCRIPTION KEYBOARD AND DISPLAY

The keyboard instrument consists of 4 buttons.
The following describes in detail the functions performed by each.

ON-OFF key

Press the ON/OFF key to turn the instrument on and off.
When instrument is on, all display segments are shown for a few seconds,



...an auto-test including the level of battery charge starts and brings the instrument to the standard working condition.

Nota: between the instant when you press the ON / OFF button and switching the display pass about three seconds: this time it is necessary to perform the initial self-test.

Auto-off feature (*Auto-Power Off*)

The instrument has the auto-off feature (Auto-Power Off) that turns the meter off after 5 minutes if, in this interval, the microphone is inserted into the cavity of the calibrator and press any button.
If the cavity is open, indicating the noise level in the display: in these conditions the instrument will turn off automatically after 30 seconds
***Auto-off feature* cannot be excluded.**

SETUP key

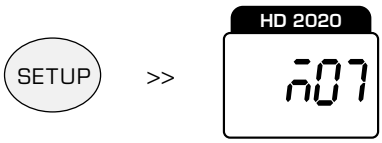
The SETUP key allows entering and viewing the menu. To exit, press the SETUP key until you go back to the standard screen, or keep it pressed for more than 2 seconds.
The menu shows:

- Current date and time in the format year, month, day, hour, minute, second.
- Current date and time in the format year, month, day of the last calibration.
- The interval between the calibration date and the expiry date in years and months.

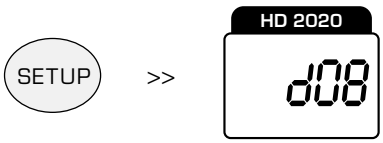
The user can set each of these items by selecting the SETUP button and modifying it with the arrow keys ▲▼. To confirm the setting, press the SETUP.

From the standard display, press SETUP to see the current year:

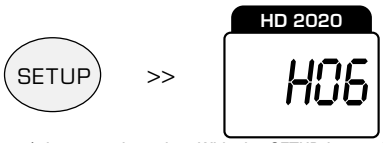
Use the arrows to increase / decrease the value. With the SETUP button is confirmed and changes to current month:



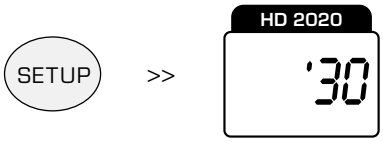
Use the arrows to increase / decrease the value. With the SETUP button is confirmed and passed to the current day:



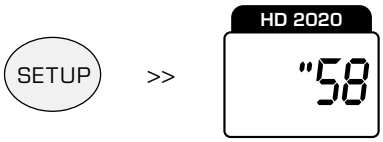
Use the arrows to increase / decrease the value. With the SETUP button is confirmed and the current time passes.



Use the arrows to increase / decrease the value. With the SETUP button is confirmed and passed to the current minutes.



Use the arrows to increase / decrease the value. With the SETUP button is confirmed and passed to the second current.



Each time you press the arrow keys, the seconds value to zero. With the SETUP button you confirm and move to the menu section on the calibration with the lighting of the first triangle to the left and display of calibration (the parameter is not user editable).

(calibration year - first triangle)

With the SETUP button switches per month span (the parameter is not user editable).

(calibration month - first triangle)

With the SETUP button switches per day span (the parameter is not user editable).

(calibration day - first triangle)

With the SETUP button switch setting the date of calibration with the lighting of the second triangle to the left and display the number of years of calibration. You can type the number of years and months between the date of calibration, entered by the laboratory conducting the formal point and the expiry date.
After the interval set, the triangle is flashing to indicate that it is necessary to re-start point of the calibrator.

(validity years - second triangle)

Use the arrows to increase / decrease the value. With the SETUP button you confirm and pass the number of months of validity.

(validity months - second triangle)

Use the arrows to increase / decrease the value. With the SETUP button you confirm and back to the default mode of operation.

s arrow key

Under standard conditions, select either the sound pressure levels of 94dB and 114dB. In the menu increases the current value.

t arrow key

Under standard conditions, select either the sound pressure levels of 94dB and 114dB. In the menu decrements the current value.

CALIBRATION PROCEDURE

The HD 2020 can calibrate standard ½" microphones compliant with IEC 61094-1 and IEC61094-2. To calibrate the microphone, insert it deep into the cavity. The O-ring will offer some resistance.
The calibration can be effected by holding the HD2020 upright as well as by leaning the instruments on a worktable.
While measuring, you should move neither the microphone nor the calibrator; make sure that the worktable doesn't transmit vibrations.
A small misalignment of the microphone and calibrator axes is allowed.

- Before beginning to calibrate, you should make sure that the ambient noise level doesn't affect the calibration. After inserting the microphone into the cavity, with the sound level meter and the calibrator off, switch on the sound level meter and detect the unweighted ambient sound pressure level. If the measured level is below 78 dB, you can use both calibration sound levels (94 dB and 114 dB); if the level is between 78 dB and 98 dB you can use the 114 dB level only, while a sound level above 98 dB means that calibration is not possible.
- Press the ON/OFF key to switch the instrument on.
- Use the arrow keys to select the sound level: 94 dB or 114 dB.
- If the value displayed on the display stops flashing within a few seconds, this indicates improper placement of the microphone.
- Proceed with the calibration of sound level meter, following the procedure indicated on the instrument manual.
- Apply the correction to the pressure level generated in the type of microphone (see the following chapter).
- At the end, turn the sound level meter and calibrator off and remove the microphone from the cavity.

With the HD 2020 calibrator can calibrate any type of SLM is provided with a microphone or laboratory sample of work from ½" in conformity with the standards described in IEC 61094-01 and IEC 61094-4.

Corrections for the type of microphone

The HD2020 calibrator generates a sound pressure level equal to 94 dB (or 114 dB) reported in 20μPa. The normal working microphones ½", used on sound level meters are engineered to have a flat frequency response in terms of free field or diffuse field is respectively in a field of progressive plane waves with propagation direction coincides with the axis of microphone and in a field of sound waves from all directions. These propagation conditions are different from those experienced in the cavity of the sound calibrator. Free field reflections caused by the presence of the microphone alter the sound level by increasing the effective sensitivity of the capsule at high frequencies. The microphones are optimized for free-field measurements exploit this phenomenon to obtain a flat frequency response up to very high frequencies. In these microphones increase in noise level at 1 kHz is approximately 0.05 dB ÷ 0:20 dB. When you calibrate a microphone for free field should therefore reflect this difference in sound level meter by setting a noise level less than 0.1 dB and 0.2 dB compared to the nominal calibrator. The microphones are optimized for diffuse field measurements do not need instead of corrections when calibrated cavity closed at 1 kHz.

REPORTING FOR LOW BATTERY AND BATTERY REPLACEMENT

The calibrator HD 2020 is equipped with two batteries: a user-replaceable 9V alkaline battery and lithium. This serves to keep the clock and calendar function even if the external battery: its replacement should be done at an authorized by Delta Ohm.
The charge level of the 9V battery is continuously monitored:

- If the battery is fully charged, its symbol is off;
- If the battery is partially charged, its symbol blinks: please replace the battery as soon as possible;
- If the charge is insufficient to ensure normal operation of the instrument, the symbol remains constantly lit. When the battery is discharged, the calibrator is turned off within approximately 10 seconds.

To replace the 9V battery, turn off the power and open the door at the bottom of the instrument. Replace the battery. Close the door. The date, time interval expires calibration will be saved if the battery is fully charged. The average duration of the battery depends on the presence or absence of the external, if the external battery is present; the average life of battery is approximately 5 years.

Warning on use of batteries
- If the battery is low, replace it as soon as possible.
- Make sure that there is no loss of liquid.
- Use good quality sealed batteries (alkaline if possible).

CONSTRUCTION AND OPERATION
Mechanical construction

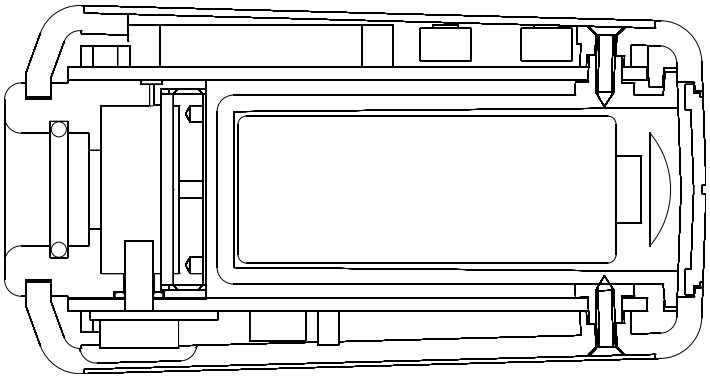


Fig. 3 Mechanical construction of the calibrator (section).

In Fig 3 is the schematic structure of the calibrator HD 2020 (in section). On the right side of the container is the battery compartment. Above and below the battery compartment are printed circuit boards and electronics. The upper one is reserved for the display and keyboard. At left is the electro-acoustic transduction system consists of a large volume cavity with piezoceramic generator and sensor feedback. The system emits a signal through the microphone located ½ ". A capillary hole outward balances the static pressure chamber protects the microphones from excessive pressure caused by the advertiser.

Electronic control
In Fig 4 shows the block diagram of the calibrator.

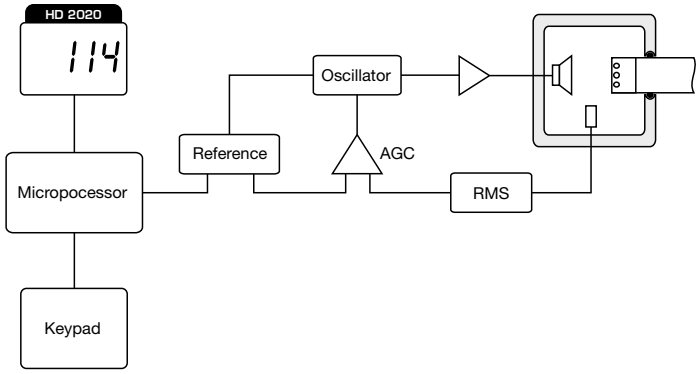


Fig 4 Block diagram of electronics.

The main part of electronics is an oscillator with high stability and low distortion plus an RMS converter, the automatic gain control (AGC), the driver for the ceramic resonator and electronics packaging of the signal provided by sensor feedback . The RMS level of the signal provided by the sensor is compared with the reference level set at the factory, the difference corrected by the automatic gain control, the amplitude of the signal generated by the oscillator and then the acoustic signal generated by the piezoelectric transducer. The signal from the sensor has minimal variation with temperature and static pressure, the frequency of the signal provided by the oscillator is stable in relation to environmental parameters.

INSTRUMENT STORAGE
Storage conditions of the instrument:
- Temperature: -25 ... +55 ° C.
- Humidity: less than 90% RH non-condensing.
- Do not store where:
  The humidity is high.
  The instrument is exposed to direct sun radiation.
  The instrument is exposed to a source of high temperature.
  There are strong vibrations.
  There is pressure, salt and / or corrosive gas.

The instrument body is ABS plastic: do not use incompatible solvents for clearing.

NOTES ON THE OPERATION AND OPERATIONAL SAFETY
Authorized use
Observe the specifications given in chapter "SPECIFICATIONS". It only authorizes the use and operation in accordance with the instructions in this operating manual. Any other use is considered unauthorized.

General Safety Instructions
This instrument was manufactured and tested according to EN 61010-1 safety standards relating to electronic measuring instruments and left the factory in perfect condition safety techniques. The smooth functioning and operational safety of the instrument can only be guaranteed if you look all normal security measures as well as those specifications described in this manual. The smooth functioning and operational safety of the instrument can be guaranteed only under conditions specified in "Technical Specifications".

Do not use or store the instrument in the manner and / or where are present:
- Rapid changes in temperature that may cause condensation.
- Corrosive or flammable.
- Direct vibration or shock to the instrument.
- High intensity electromagnetic fields, static electricity.

If the instrument is transported from a cold to a warm place, condensation may cause it to function. In this case we expect that the temperature of the instrument to reach room temperature before putting it back on.

User requirements
The user of the instrument must ensure that compliance with the following rules and guidelines concerning the treatment of hazardous materials:
- EC directives on occupational safety
- National laws and safety at work
- Accident prevention regulations

TECHNICAL SPECIFICATIONS
The calibrator HD 2020 falls in the characteristics of **class 1 according to IEC 60942-2003 and meets the requirements of the ANSI S1.40-1984**.

Coupling cavity:	for standard 1/2" microphones (12.7 ±0.03 mm) according to IEC 61094-1 and IEC 61094-4
Frequency:	1000 Hz
Frequency tolerance:	1% in the range -10...+50°C and 10%...90%RH
Sound pressure level:	94.0 dB and 114.0 dB ±0.2 dB at 1 kHz (referred to 101.3 kPa, 23°C ±3°C and 65%R.H.)
Reference conditions:	20°C, 50% RH, 101.3kPa, 10 mm^3 cartridge volume
Stabilization time:	10s
Total distortion:	<1%
Ambient condition influence	
- Temperature and humidity influence:	< 0.3 dB in the range ± 10°C...50°C and 10%...90%RH
- Static pressure influence:	< 0.1 dB in the range 65 kPa ... 108 kPa
Stability levels	
- Short-term stability:	±0.03 dB
- Stability after 1 year, normal use:	±0.1 dB
Operating conditions	
- Working temperature:	-10 … +50°C
- Relative humidity:	≤90% R.H.
Storage temperature:	-25 … +70°C
Microphone equivalent volume:	5 to 250 mm3
Power supply:	9V alkaline battery IEC type 6LR61. 9V rechargeable batteries are also allowed.
9V battery autonomy:	48-hour continuous functioning with good quality alkaline batteries.
Automatic power off:	5 minutes – it cannot be disabled
Watch/date-indicator:	internal with 3V lithium buffer battery
Case material:	ABS
Dimensions:	53x43x83mm
Weight:	160g.
IP Protection degree	IP64
Effects of electromagnetic fields:	< 0.3 dB

PURCHASING CODES
HD2020: The kit consists of: HD2020 calibrator, 1 9V alkaline battery, instruction manual and report of calibration.

HD 9101
HD 9102

HD 9101 AND HD 9102
SOUND LEVEL METERS CALIBRATORS

APPLICATION FIELD

The generator noise level 9101/HD HD 9102 is a portable, battery-powered sound source, suitable for calibration of sound level meters (portable and laboratory) and acoustic measuring stations. And 'possible to calibrate directly microphones 1 / 2 "of mechanical dimensions conform to the requirements of IEC 61094-1 ("Measurement Microphones, Part 1: Specifications for Laboratory Standard Microphones") and IEC 61094-4 ("Measurement Microphones. Part 4: Specifications for working Standard Microphones)

ADVANTAGES OF CALIBRATORS HD 9101 / HD 9102 ARE:

- With the frequency of the sound signal at 1000Hz can perform calibration of sound level meters with any frequency weighting (LIN, A, B, ...), without introducing correction factors.
- The sound pressure level generated is independent of atmospheric pressure is therefore not necessary to correct the value function of atmospheric pressure.
- The calibrator 9101/HD HD 9102 can be conveniently used in both laboratory and field.
- Ease of use allows the use even by unskilled personnel.

TECHNICAL SPECIFICATIONS

The calibrator **HD9101** satisfies **Class 1 specifications according to the standard IEC 60942-1988 and complies with the requirements of the standard ANSI S1.40-1984.**
The calibrator **HD9102** satisfies **Class 2 specifications according to the standard IEC 60942-1988 and complies with the requirements of the standard ANSI S1.40-1984.**

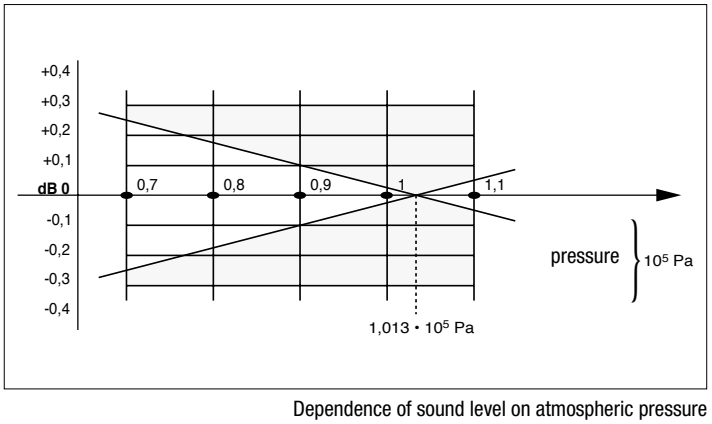
- Diameter of microphones that may be calibrated:
  23.77 ±0.05 mm 1"
  12.7 ± 0.03 mm 1/2" (with 1/2" adapter mod. 9101040) standard according to IEC 61094-1 and IEC 61094-4
- Stabilization time: 60 sec
- Frequency HD 9101: 1000Hz ± 2%
- Frequency HD 9102: 1000Hz ± 4%
- Sound pressure level HD 9101: 94db/114dB ± 0.3dB
- Sound pressure level HD 9102: 94db/114dB ± 0.5dB (ref.101.3kPa, 23°C ±3°C and 65% RH)
- Total distortion: <0.5%
- Static pressure influence (Ref. to 101.3kPa): ±0.1 dB between 90 kPa and 108kP ±0.3 dB between 65 kPa and 108kP
- Temperature influence: ±0.05 dB between 5°C and 35°C ±0.2 dB between -10°C and 50°C
- Relative humidity influence (ref. to 50%R.H.) ±0.1dB between 10% RH and 90% RH Free from condensation
- Stability (one year, standard use): ± 0.1 dB
- Working temperature: -10°C ÷ +50°C
- Storage temperature: -25°C ÷ +55°C
- Relative humidity: _90% RH
- Equivalent volume of the calibration room (+23°C): 10 cm3
- Power supply: 9V alkaline battery IEC type 6F22
- Battery life: about 15 hours with an alkaline battery
- Housing made of: NORYL NE110 resin
- Dimensions: 60x140 mm, H=46 mm
- Weight: 400 gr.

PURCHASING CODES

HD9101: class 1 calibrator according to IEC609442:1988. Frequency 1000 Hz, sound level 94dB/114dB.
HD9102: class 2 calibrator according to IEC609442:1988. Frequency 1000 Hz, sound level 94dB/114dB.

ACCESSORIES:

- Adapter for 1/2" model 9101040
- 9V alkaline battery IEC 6LF22
- Instructions manual



Dependence of sound level on atmospheric pressure

HD 2030
FOUR CHANNEL VIBRATION ANALYZER

HD2030 is a portable vibration analyzer performing spectral and statistical analysis on four channels simultaneously. The instrument measures all parameters required by current regulations concerning workers protection from vibration related risks and is able to measure vibrations transmitted to both hand-arm and whole body.

Main features

HD2030 has been designed combining maximum flexibility and easy of use with the possibility to update the instrument according to the evolution of regulations concerning vibrations. The user can directly update the instrument firmware by means of the program Noise & Vibration Studio supplied with the instrument.
The HD2030 satisfies the specifications of standards **ISO 8041:2005, ISO 5349-1:2001** (hand-arm vibrations) and **ISO 2631-1, 2 and 4 1997** (whole-body vibrations). Octave and third octave filters satisfy class 1 specifications of IEC 61260 standard.

The HD2030 vibration analyzer detects accelerations on four axes through two accelerometers with integrated amplifying electronics (IEPE or equivalent type). Three axes are grouped in the right input, where it is possible to connect three accelerometers or a tri-axial one; the fourth axis is associated to left input. Accelerometers with integrated electronics allow using standard cables to achieve low impedance and low noise connections between the accelerometer and the instrument, simplifying its use and decreasing the probability to get wrong or altered measurements, because of interferences or electromagnetic disturbances.
The HD2030 analyzes accelerometer signals and makes calculations simultaneously on four axes. The instrument calculates, in parallel for all the measurement channels, weighted acceleration values and octave or third octave spectra; acceleration, velocity or displacement values can be shown for each frequency band. Frequency weightings can be freely chosen according to the specific application. Together with values of instantaneous and mean acceleration, the analyzer calculates in addition peak levels, vibration dose (VDV), crest factors and performs statistical analysis.
As statistical analyzer HD2030 calculates the probability distribution of a measurement parameter in 1dB classes. Both the probability distribution graph and the percentile levels from L1 up to L99 are available. The measurement of acceleration on four axes allows, as an example, to measure vibration transmitted to the driver body through the vehicle seat isolating driver movements or to evaluate, during design and production verification, the damping effectiveness of seat suspension and absorbing material in general. In building analysis it is possible to correlate the signal of the hammer used to excite the structure with the signal received by a high sensitivity tri-axial accelerometer.

A flexible data logger function stores multiple profiles and spectra either into the internal 8MB memory or into a memory card (SD up to 2GB). When needed, it's possible to add to profiles the logging of accelerometer signals, directly recording the digital samples. Analysing stored data, it's useful to examine accelerometer signals in order to verify the absence of artefacts like, for example, those generated by DC-shift. Each recording can be documented including a vocal comment. Besides HD2030 can be used like an audio recorder, another possibility to document the measurements.
The "Navigator" program available in the analyzer, allows to examine logged measurements and to hear vocal comments.

For a quick instrument setting the HD2030 can store up to nine setups, customized by the user according to specific applications. The desired setup can be easily identified through the associated title.

Calibration can be performed using either accelerometer calibration data or using a vibration generator. The last 120 performed calibrations are written in a register file and logged in a reserved and protected area of the instrument permanent memory. The interface program Noise & Vibration Studio, included with the instrument, adds automatically the calibration file to the measurements when downloading data into the PC memory.
HD2030 can be completely controlled by a PC, through the RS232 and USB serial interfaces, using a special communication protocol.

Software

The interface program Noise & Vibration Studio is provided with the instrument and allows to download and visualize data logged in the instrument and to manage setups, sensor configurations and calibration register file.
Instrument settings can be customized by the user and stored with a title in a setup file for later use. In order to easily perform different kind of measurements it is possible to upload up to nine instrument settings, selected from the setup file.
Sensor configurations can be set either manually, filling in the accelerometer data table, or automatically, using the CD provided with the accelerometers supplied by Delta Ohm.
The HD2030 stores calibration information in a reserved area of internal memory. The calibration register file is downloaded to PC memory together with logged data and stored in the same folder.
Several optional analysis modules can be activated by means of license. The program can be automatically updated through the web and includes demonstrative versions of all modules.
- NS1 Application module "Workers' Protection":
- Analysis of workers' exposure to noise and vibration, both hand-arm and whole-body, in accordance with Decree Law n.81/2008 9432/2008 and UNI.
- Evaluation of hearing protectors with the methods and OBM SNR according to UNI EN 458.
- Evaluation of measurement uncertainties in accordance with UNI 9432/2008.
- Calculation of the impulsiveness of noise sources according to the requirements of UNI 9432/2008.

Applications

The HD2030 analyzer executes all measurements required by the European regulations concerning workers protection from mechanical vibration exposition at the workplace (2002/44/EC). The choice to perform hand-arm (HA) or whole body (WB or BV) measurements modifies

Input details

Output details

the frequency range of spectral analysis. For hand-arm measurements the range goes from 3.15Hz up to 3.15kHz (from 4Hz to 2kHz for octave band spectrum), while for whole body measurements the range of central frequencies is shifted downward from 0.32Hz up to 315Hz (from 0.5Hz to 250Hz for octave band spectrum).

The HD2030 is suitable for the evaluation of workers exposure to vibrations and to assess the risk of injury in the following cases:
• vibrations transmitted to hand-arm system through vibrating tools or items subject to vibrations or impacts, vibrations transmitted to whole body system through the seat of transport vehicles, vibrations transmitted to whole body system by vibrating floors or seats at the workplace,
• vibrations transmitted to whole body system by buildings with vibrations or impacts.

The HD2030 is a vibration analyzer suitable for the following applications:
• Vibration spectral analysis by octave o third octave bands,
• Statistic analysis with percentile calculation from L1 to L99,
• Evaluation of vibration attenuation of anti-vibration gloves, seats and materials, Structural verification of buildings.

Technical standards
HD2030 vibration analyzer conforms to the following standards:
ISO 8041:2005 "Human response to vibration – Measuring instrumentation"
ISO 5349-1:2001 "Mechanical vibration – Measurement and evaluation of human exposure to hand-transmitted vibration – General requirements"
ISO 5349-2:2001 "Mechanical vibration – Measurement and evaluation of human exposure to hand-transmitted vibration – Practical guidance for measurement at the workplace"
ISO 2631-1:1997 "Mechanical vibration and shock – Evaluation of human exposure to whole body vibration – General requirements"
ISO 2631-2:1989 "Evaluation of human exposure to whole body vibration – Continuous and shock-induced vibrations in buildings (1 to 80 Hz)"
IEC 61260:1995 "Electroacustics – Octave band and fractional-octave band filters"

Accelerometer models
HD356A02: **tri-axial** accelerometer for the measurement of vibrations transmitted to the hand-arm system; sensitivity of 10mV/g and maximum acceleration equal to 500g. This sensor is mainly used for hand-arm measurements.
HD356B21: miniature **tri-axial** accelerometer for the measurement of vibrations transmitted to the hand-arm system; sensitivity of 10mV/g and maximum acceleration equal to 500g. This sensor is mainly used for hand-arm measurements.
HD356B41: tri-axial accelerometer inserted in a rubber pad for the measurement of the vibrations trasnmitted to the whole body. 1,5m connection cable to the HD2030 analyser included. Sensitivity 100mV/g and maximum acceleration 10g.
HD356A22: tri-axial accelerometer for general application with sensitivity of 100mV/g and maximum acceleration equal to 50g.
HD352C34: mono-axial accelerometer for general application with nominal sensitivity of 100mV/g and maximum acceleration equal to 50g.
HD356B20: miniature tri-axial accelerometer for the measurement of vibrations transmitted to the hand-arm system at high shock level. Sensitivity of 1mV/g and maximum acceleration equal to 5000g.

Accessories
In order to measure vibrations transmitted to the hand-arm system, it's necessary to use adapters coupling the accelerometer to the tool handle. The available accessories are:
HD2030AC1: cubic shaped mounting block to be fastened to the handle with a cable tie or a metal clamp as near as possible to the hand position. This adapter is suitable for measurements on light tools, where the weight of the measurement chain has to be minimized. Material: light alloy.
HD2030AC2: adapter to be held between the hand and the handle. The accelerometer is placed in lateral position, at the left or the right of the hand. This adapter is suitable for large cylindrical handles. The measurement must be repeated positioning the accelerometer on both hand sides. Material: light alloy.
HD2030AC3: adapter to be held between the hand and the handle. The accelerometer is placed in lateral position, at the left or the right of the hand. This adapter is suitable for large cylindrical handles and for accelerometers with integrated screw. The measurement must be repeated positioning the accelerometer on both hand sides. Material: stainless steel
HD2030AC4: adapter to be held between the hand and the handle. The accelerometer is placed in central position, between the middle and the ring fingers or between the index and the middle fingers. This adapter is suitable for anatomical handles, not necessarily cylindrical and of small dimensions. Material: light alloy.
HD2030AC5: Support for measurement on floors and vibrating surfaces in general. An air bubble level is included and the height of two out of the three feet can be adjusted as needed. The support has a cavity on the lower face, where a high sensitivity tri-axial accelerometer, suitable for measurements in buildings, can be fastened. On the upper face there is a tapped hole (10-32 UNF) for accelerometer mounting. In order to use three mono-axial accelerometers instead of a tri-axial one, a cubic adapter is included to be mounted on the upper face. Material: stainless steel, weight 1.9kg.

The following accessories, needed to keep the accelerometers in contact with various surfaces, are available on request:
- Adhesive metal plate for accelerometer mounting with magnet • Permanent magnet for accelerometer mounting on metal surfaces
- Adhesive mounting base (glue or wax)
- Insulated mounting base
- Screws with various threading

The following accessories are included with the HD2030 analyzer:
- Wax
- Silicon grease
- USB cable for PC connection
- 1GB SD memory card
- CD with the interface program for PC with Windows operating system "Nose & Vibration Studio" and the HD2030 user manual

Each accelerometer comes with the following accessories:
- Mounting screw
- 2m connecting cable to the HD2030 analyzer (other lengths on request)
- CD with calibration and configuration data and accelerometer manual

Technical specifications of HD2030
- ***Technical standards:***
  ISO 8041:2005
  ISO 5349-1:2001 (hand transmitted vibration)
  ISO 2631-1,2,4 1997 (whole body vibration)
  IEC 61260:1995 class 1 (octave and third octave filters)
- ***Measurement modes:***
  Hand-transmitted vibrations
  Whole-body vibrations
  Building vibrations
- ***Measurement parameters:***
  RMS, VDV, MTVV, Peak, Max, Min
- ***Frequency weightings:***
  Fz, Fc, Wh for hand-transmitted vibrations
  Fz, Fa, Wb, Wc, Wd, We, Wj, Wk for whole body vibrations
  Fz, Fm, Wm for building vibrations
- ***Octave or third octave band spectral analysis:***
  The range of central frequencies depends on the chosen application according to the following table

Application	Central frequency range	
	Octave Band	Third Octave Band
	[Hz]	[Hz]
Hand-Arm	4 ÷ 2000	3.15 ÷ 3150
Whole-Body	0.5 ÷ 250	0.315 ÷ 315
Building-Vibration	0.5 ÷ 250	0.315 ÷ 315

- ***Statistic Analysis*** The selected measurement parameter is analyzed in 1dB classes. Both the probability and the percentile graphs can be shown.
- ***Measurement range*** 0.1m/s2 ÷ 7000 m/s2 with accelerometer HD356A02 for hand-arm measurements
- ***Linearity range*** three ranges of 80dB overlapped by 70dB
- ***Digital converter*** Four analog to digital converters with a resolution of 25 bits at 8k samples per second
- ***Inherent noise level*** Less than 30mm/s2 with accelerometer HD356A02 for hand-arm measurements and Wh filter
- ***Display*** Graphic backlit display 128x64 pixels Screens:
  VLM1: Three parameters for each measurement axis
  VLM2: Three parameters of acceleration vector calculated from the three right channel input axes
  VLM3: Three global parameters for each measurement axis
  VLM4: Three global parameters of acceleration vector calculated from the three right channel input axes
  PROFILE: Graphic profile of one parameter for each measurement axis with integration time programmable from 1s to 1 hour
  SPECTRUM: Octave or third octave spectrum for each measurement axis with calculation of one wideband filter. The graph can show the spectrum of acceleration, velocity or displacement.
  STATISTICS: the statistical distribution of the parameter chosen in PROFILE
  PERCENTILES: Percentile level graph of the parameter chosen in PROFILE.
- ***Memory*** 8MB Internal FLASH type memory and connector for memory card SD type up to 2GB.
- ***Interface*** Serial RS232 and USB type
- ***nput/Output*** LINE output for the four measurement channels: 2Vpp F.S.
  TRGIN electrically isolated input: instrument trigger used by external devices
  TRGOUT 3V logic output: trigger output used by external devices
- ***Power supply*** Four alkaline batteries AA 1.5V type with 10 hour lifetime-
  The instrument can use rechargeable batteries Ni-MH type. The HD2030 does not perform the function of charger.

- ***Ambient parameters*** Storage: -25°C ÷ 70°C relative humidity less than 90% without condensation
  Operating: -10°C ÷ 50°C relative humidity less than 90% without condensation
- ***Weight and Dimensions*** 95mm X 240mm X 50mm, weight 680gr.

Technical specifications of accelerometers:

Model HD356A02

- ***Type:*** Tri-axial accelerometer with integrated electronics (LIVM™). This sensor is used for hand-arm measures.
- ***Sensitivity:*** 10mV/g
- ***Measuring range:*** 500g pk
- ***Frequency Range*** (±5%)**:** 1Hz ÷ 5000Hz
- ***Resonant frequency:*** >25kHz
- ***Linearity:*** 1% F.S.
- ***Transverse sensitivity:*** 5% max
- ***Overload Limit (Shock):*** 7000g pk
- ***Working temperature:*** -50°C ÷ 120°C
- ***Temperature drift:*** 0.1%/°C
- ***Bias voltage:*** 8V÷12V
- ***Mechanical specifications:*** Weight: 10,5gr
  Dimensions: (Height x Length x Width) 14.0mm x 20.3mm 14.0mm
  Mounting Thread: 10-32 female (10-32 UNF to 10-32 UNF, 10-32 UNF to M6 screws included)
  Connector: ¼-28 4-Pin side type
  Housing Material: Titanium alloy
  Isolation: case grounded

Model HD356B21

- ***Type:*** Miniature tri-axial accelerometer with integrated electronics (LIVM™). This sensor is used for hand-arm measurements.
- ***Sensitivity:*** 10mV/g
- ***Measuring range:*** 500g pk
- ***Frequency Range*** (±5%)**:** 2Hz ÷ 10000Hz (y or z axis)
- ***Frequency Range*** (±5%)**:** 2Hz ÷ 7000Hz (x axis)
- ***Resonant frequency:*** >55kHz
- ***Linearity:*** 1% F.S.
- ***Transverse sensitivity:*** 5% max
- ***Overload Limit (Shock):*** 10000g pk
- ***Working temperature:*** -50°C ÷ 120°C
- ***Temperature drift:*** <0.17%/°C
- ***Bias voltage:*** 7V ÷ 11V
- ***Mechanical specifications:*** Weight: 4gr
  Dimensions: (Height x Length x Width) 10.2mm x 15.5mm 10.2mm
  Mounting Thread: 5-40 female (5-40 UNF to 5-40 UNF, 10-32 UNF to 5-40 UNF and 5-40 UNF to M3 screws included)
  Connector: 8-36 4-Pin side type
  Housing Material: Titanium alloy
  Insulation: case grounded

Model HD356B41

- ***Type:*** Low profile tri-axial accelerometer with integrated electronics (LIVM™) put in a rubber pad. This sensor is used for measures of whole body vibration through the seat.
- ***Sensitivity:*** 100mV/g
- ***Measuring range:*** 10g pk
- ***Frequency response*** (±5%)**:** 0.5Hz ÷ 1000Hz
- ***Resonant frequency:*** >27kHz
- ***Linearity:*** 1% F.S.
- ***Transverse sensitivity:*** 5% max
- ***Overload Limit (Shock):*** 2000g pk
- ***Working temperature:*** -10°C ÷ 50°C
- ***Temperature drift:*** <0.17%/°C
- ***Bias voltage:*** 2.8V ÷ 4.5V
- ***Mechanical specifications:*** Weight: 272gr
  Dimensions: (diameter x thickness) 200mm x 12mm
  Cable: 3m integrated cable with 4 pin LEMO connector (supplied)
  Material: hard rubber with accelerometer and integrated cable replaceable
  Connector: ¼-28 4-Pin side type
  Mounting Thread: threaded screw hole 10-32 UNF
  Insulation: accelerometer case grounded

Model HD356A22

- ***Type:*** mono-axial accelerometer with integrated electronics (LIVM™). This sensor is used for general applications.
- ***Sensitivity:*** 100mV/g
- ***Measuring range:*** 50g pk
- ***Frequency Range*** (±5%)**:** 0.5Hz ÷ 4000Hz
- ***Resonant frequency:*** >25kHz
- ***Linearity:*** 1% F.S.
- ***Transverse sensitivity:*** 5% max
- ***Overload Limit (Shock):*** 5000g pk
- ***Working temperature:*** -54°C ÷ 77°C
- ***Temperature drift:*** 0.1%/°C
- ***Bias voltage:*** 8V ÷ 12V
- ***Mechanical specifications*** Weight: 5.4gr
  Dimensions: (Height x Length x Width) 11.4mm x 16.7mm X 11.4mm
  Mounting Thread: 5-40 female (5-40 UNF to 5-40 UNF, 10-32 UNF to 5-40 UNF and 5-40 UNF to M3 screws included)
  Connector: 8-36 4-Pin side type
  Material: Titanum
  Isolation: case grounded

Model HD352C34

- ***Type:*** mono-axial accelerome with integrated electronics (LIVM™). This sensor is used for general applications.
- ***Sensitivity:*** 100mV/g
- ***Measuring range:*** 50g pk
- ***Frequency Range*** (±5%)**:** 0.5Hz ÷ 100000Hz
- ***Resonant frequency:*** >50kHz
- ***Linearity:*** 1% F.S.
- ***Transverse sensitivity:*** 5% max
- ***Overload Limit (Shock):*** 5000g pk
- ***Working temperature:*** -54°C ÷ 93°C
- ***Temperature drift:*** 0.1%/°C
- ***Bias voltage:*** 7V ÷ 12V
- ***Mechanical specifications*** Weight: 6gr
  Dimensions: (Hex x Height) 11.2mm x 22.4mm
  Mounting Thread: 10-32 female (10-32 UNF to 10-32 UNF, 10-32 UNF to M6 screws included)
  Connector: top mounted 10-32 coaxial jack
  Material: Titanum
  Isolation: case grounded

Model HD356B20

- ***Type:*** miniature tri-axial accelerometer with integrated electronics (LIVM™). It is mainly used for hand-arm and shock measurements.
- ***Sensitivity:*** 1.0mV/g
- ***Measuring range:*** 5000g pk
- ***Frequency Range*** (±5%)**:** 2Hz ÷ 10000Hz (y or z axis)
- ***Frequency Range*** (±5%)**:** 2Hz ÷ 7000Hz (x axis)
- ***Resonant frequency:*** >55kHz
- ***Linearity:*** 1% F.S.
- ***Transverse sensitivity:*** 5% max
- ***Overload Limit (Shock):*** 7000g
- ***Working temperature:*** -50°C ÷ 120°C
- ***Temperature drift:*** <0.1%/°C
- ***Bias voltage:*** 7V ÷ 11V
- ***Mechanical specifications*** Weight: 4gr
  Dimensions: (Height x Length x Width) 10.2mm x 15.5mm X 10.2mm
  Mounting Thread: 5-40 female (5-40 UNF to 5-40 UNF, 10-32 UNF to 5-40 UNF and 5-40 UNF to M3 screws included)
  Connector: 8-36 4-Pin side type
  Material: titanium alloy
  Isolation: case grounded

Purchasing codes for kits and accessories

HD2030 kit 1: it consists of: four channel analyzer HD2030, carrying case, program "Noise & Vibration Studio", USB serial cable (CP22) and 1GB SD memory card (HD2030MC). **Accelerometers, connection cables and accessories have to be specified at the time of placing the order**.

HD2030 kit "HA & WB": it includes,
- HD2030 kit 1 consisting of:
- HD2030: 4 channels vibration analyser with ISO 9001 reports of calibration,
- HD2030MC: 1GB SD memory card,
- CP22: USB serial cable,
- silicone grease (HD6188) and wax bonding (HD6273)
- user manual and case;
- HD356B41: tri-axial accelerometer in a rubber pad with connection cable to HD2030 analyser;
- HD356A02: Miniature tri-axial accelerometer with 081B02 and M081B05 screws and connection cable to HD2030 analyser (HD2030CAB3-3M);
- Reports of calibrations for accelerometers HD356B41 and HD356A02;
- "Noise Studio" interfacing programme for PC.

HD2030 kit "Acoustic & Vibrations": Including
- HD2010UC/A kit 1 consisting of:
- HD2010UC/A: type 1 analyzer sound level meter IEC 61672 with spectral analysis octave bands from 32Hz to 8kHz, data logging with 4MB memory, backlit display;
- UC52/1C: pre-polarized and removable ½" condenser microphone,
- HD2010PNE2: removable microphone preamplifier and 5m extension cable (CPA/5),
- HD SAV: Windscreen for ½" microphones,
- HD2110USB: serial USB cable for PC connection (as an alternative COM-type serial

RS232 cable is supplied),
- HD2020: type 1 acoustic calibrator IEC 60942,
- user manual and case;
- HD2030 kit "HA & WB" consisting of:
- HD2030: 4 channels vibration analyser with ISO 9001 reports of calibration,
- HD356B41: tri-axial accelerometer in a rubber pad with connection cable to HD2030 analyser;
- HD356A02: Miniature tri-axial accelerometer with 081B02 and M081B05 screws and connection cable to HD2030 analyser (HD2030CAB3-3M);
- HD2030MC: 1GB SD memory card,
- CP22: USB serial cable,
- "Noise Studio" interfacing programme for PC with user licence (CH20) for application modul NS1 "Workers protection",
- silicone grease (HD6188), wax bonding (HD6273) and glue (080A90)
- user manual and case;
- ISO 9001 Reports of calibration for:
- HD2010UC/A sound level meter,
- HD2020 acoustic calibrator,
- accelerometers HD356B41 and HD356A02,
- HD2030 4 channels vibration analyser.

HD2030AC1: cubic shaped mounting block to be fastened to the handle, by means of a cable tie or a metal clamp, as near as possible to the hand position. This adapter is suitable for measurements on light tools, where the weight of the measurement chain has to be minimized. Material: light alloy. It includes:
- Hexagon socket head cap screw 10-32 UNF
- 4mm hex key
- 10 cable ties (length x width) 200mm x 4.5mm
- 1 metal clamp with 9mm width

HD2030AC2: adapter to be held between the hand and the handle. The accelerometer is placed in lateral position, at the left or the right of the hand. This adapter is suitable for large cylindrical handles. The measurement must be repeated positioning the accelerometer on both hand sides. Material: light alloy. Includes:
- Hexagon socket head cap screw 10-32 UNF
- 4mm hex key
- 10 cable ties (length x width) 200mm x 4.5mm
- 2 flat velcro straps, 24.5mm size

HD2030AC3: adapter to be held between the hand and the handle. The accelerometer is placed in lateral position, at the left or the right of the hand. This adapter is suitable for large cylindrical handles and for accelerometers with integrated screw with 10-32 UNF-2A threading. The measurement must be repeated positioning the accelerometer on both hand sides. Material: stainless steel. Includes:
- 10 cable ties (length x width) 200mm x 4.5mm
- 2 flat velcro straps, 24.5mm size

HD2030AC4: adapter to be held between the hand and the handle. The accelerometer is placed in central position, between the middle and the ring fingers or between the index and the middle fingers. This adapter is suitable for anatomical handles, not necessarily cylindrical and of small dimensions. Material: light alloy. Includes:
- Hexagon socket head cap screw 10-32 UNF
- 4mm hex key
- 10 cable ties (length x width) 200mm x 4.5mm
- 2 flat velcro straps, 24.5mm size

HD2030AC5: Support for measurement on floors and vibrating surfaces in general. An air bubble level is included and the height of two out of the three feets can be adjusted as needed. The support has a cavity on the lower face, where a high sensitivity tri-axial accelerometer, suitable for measurements in buildings, can be fastened. On the upper face there is a tapped hole (10-32 UNF) for accelerometer mounting. In order to use three mono-axial accelerometers instead of a tri-axial one, a cubic adapter is included to be mounted on the upper face. Material: stainless steel, weight 1.9kg. Includes:
- Stainless steel base with air bubble level and three feets. There are a tapped hole on the upper face (10-32 UNF) and a cavity with tapped hole (M4) on the lower face.
- Cubic adapter to be mounted on the upper face using two M4 screws (included). The cube has threaded holes (10-32 UNF) on three orthogonal faces.
- 3mm hex key

HD356B21: miniature tri-axial accelerometer for the measurement of hand transmitted vibrations. Sensitivity 10mV/g, range ±500g. Mounting screws included.

HD356B41: tri-axial accelerometer contained within a rubber pad for the measurement of whole body transmitted vibrations. Analyzer 1.5m connecting cable included. Sensitivity 100mV/g, range ±50g.

HD356B20: tri-axial accelerometer for the measurement of hand transmitted vibrations at high shock levels. Sensitivity 1mV/g, range ±5000g. Mounting screws included.

HD352C34: mono-axial accelerometer for general purpose. Sensitivity 100mV/g, range ±50g. Mounting screws included.

HD356A22: high sensitività tri-axial accelerometer. Sensitivity 100V/g, range ±50g. Mounting screws included.

HD2110/CSNM: serial cable connection to PC COM interface.

CP22: serial cable for connection to a PC with USB interface.

HD2030CAB1-3M: low noise coaxial cable for connection of mono-axial accelerometers (mini-coax SMA 10-32 connector) to the HD2030 analyzer (4 pin push-pull circular connector). 3m Long (other lengths upon request). Equipped with connectors.

HD2030CAB3-3M: coaxial cable for connection of tri-axial accelerometers (4 pin SMA connector) to the HD2030 analyzer (4 pin push-pull circular connector). 3m Long (other lengths upon request). Equipped with connectors.

HD2030CAB13: coaxial cable for connection of three mono-axial accelerometers to the HD2030 analyzer. 400mm Long, BNC connectors.

HD2030CAB1B-5M: coaxial cable for connection of mono-axial accelerometers to the HD-2030CAB13 cable. 5m Long (other lengths upon request). Equipped with connectors.

HD2030CAB1B-10M: coaxial cable for connection of mono-axial accelerometers to the HD-2030CAB13 cable. 10m Long (other lengths upon request). Equipped with connectors.

HD2030CAB1B-3M: coaxial cable for connection of mono-axial accelerometers HD2030CAB13 analyzer. 3m Long. Equipped with connectors.

HD2030CAB.BNC-xxM: coaxial cable, extension for HD2030CAB1B-3M cable. 30m maximum length.

HD2030MC: 1GB SD memory card.

HD2030AM: headset with microphone.

SWD10: Stabilized mains power supply Vin=100÷230Vac / Vout=12Vdc/1000mA.

CH20: hardware key for PC with Windows® operating systems. When inserted into a PC USB port enables execution of software modules.

NS1: "Workers Protection" Module. Analysis of noise and vibration in the workplace in accordance with Decree 81/2008

HD40.1: Portable serial printer with 57mm paper rolls and SWD10 power supply.

BAT-40: Replacement battery pack for HD40.1

RCT: 4 rolls of thermal paper, 57width and 32mm diameter.

VTRAP: tripod.

Available accessories for the accelerometers are:

HD6188: Silicone grease repellent to water and electrically insulating.

HD6273: Pan with wax bonding

080A90: Glue for quick fixing.

081B05: screw with double thread 10-32 UNF, included in accelerometers HD356A02 and HD356C34.

081A90: screw with double thread 5-40 UNC and 10-32 UNF, included in accelerometers HD356B21, HD356A22 and HD356B20.

M081B05: screw with double thread 10-32 UNF and M6x0,75, included in accelerometers HD336A02 and HD352C34.

M081A27: screw with double thread 5-40 UNC and M3x0,5", included in accelerometers HD356B21, HD356A22 and HD356B20.

081A27: screw with double thread 5-40 UNC, included in accelerometers HD356B21, HD356A22 and HD356B20.

HD6239: tip for accelerometer.

HD6286: metal disk to be applied by adhesive; for magnetic bases HD6284 and HD6196.

HD6284: magnetic base with 10-32 UNF threaded hole; for any accelerometer.

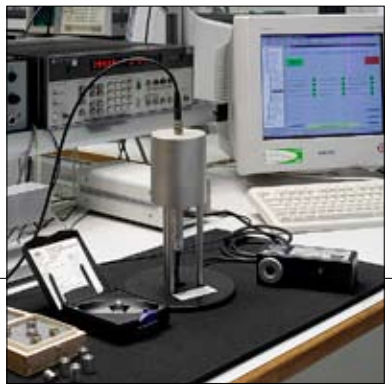
HD6194: magnetic base with 10-32 UNF screw integrated; for accelerometers HD356A02, HD356C34 and HD356B41 (by removing the rubber pad).

HD6226: base with 10-32 UNF threaded hole for mounting by adhesive; for any accelerometer.

HD6245: isoltaed base with integrated 10-32 UNF screw for mounting by adhesive, for accelerometers HD356A02, HD356C34 and HD356B41 (by removing the rubber pad).

HD6220: isolated base with integrated 10-32 UNF screw and threaded 10-32 UNF hole for mounting the accelerometer; for any accelerometer.

Acoustic measures SIT N° 124 Laboratory



Italian calibration service

SIT centre n° 124:
DELTA OHM s.r.l.
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35030 CASELLE DI SELVAZZANO (PD) - ITALIA
Telefono: +39 049 89 77 150
Telefax: +39 049 63 55 96
E-mail: deltaohm@tin.it
URL http://www.deltaohm.com

Permanent Laboratory **SIT ACCREDITATION TABLE**

Quantity	Instruments to be calibrated	Measuring range	Measuring conditions	Uncertainty (*)	Notes
Acoustics pressure level	Pistonphones	124 dB	250 Hz	0,10 dB	
	½" Calibrators	94 dB… 114 dB	250, 1000 Hz	0,11 dB	
	Multifrequency calibrators	94 dB … 124 dB	31,5 Hz… 125 Hz 250 Hz… 500 Hz 2000 Hz… 4000 Hz 8000 Hz 2500 Hz… 16000 Hz	0,30 dB 0,25 dB 0,30 dB 0,27 dB 0,63 dB	
	Sound level meter	25 dB… 140 dB	31,5 Hz… 16000 Hz	0,3 dB… 1,9 dB	⧖
	Octave band and octave fractional band filters		20 Hz < f_c < 20000 Hz	0,1 dB… 0,5 dB	⧓
Sensitivity to the acoustic pressure	1" Reference microphones	124 dB	250 Hz	0,10 dB	
	½" Reference microphones	124 dB	250 Hz	0,12 dB	
	½" Microphones	94 dB	31,5 Hz… 12500 Hz	0,3 dB… 0,9 dB	⧖
	¼" Microphones	124 dB	250 Hz	0,16 dB	

(*) The measuring uncertainties are expressed as twice the standard deviation, corresponding in the case of normal distribution to the confidence level of about 95%.
⧖ The uncertainty depends on the frequency.
⧓ f_c is the midband frequency of filter operating band.

POWER
Delta OHM

Air Quality - CO - CO_2

- HD 37AB1347 pag. 226
  Portable instruments for measuring humidity, air velocity, barometric pressure, temperature, CO and CO_2
- HD 37AB17D, HD 37B17D pag. 230
  Data logger CO, CO_2, temperature and humidity
- HD 37BT... HD 377BT... pag. 232
  Transmitters CO_2, CO_2 and temperature
- HD 45..., HD 46... pag. 236
  Wall mounting CO_2 Transmitters, Humidity and Temperature for Building Automation

The qualitative level of our instruments is the result of a continuous evolving of the product itself. This may bring to slight differences between what written in the following manual and the instrument you bought. We cannot completely exclude the presence of errors inside the manual, which we apologise for. Data, images and descriptions included in this manual cannot be enforced legally. We reserve the right to perform modifications and corrections at any time without notice.

HD37AB1347

HD37AB1347
INDOOR AIR QUALITY MONITOR

HD37AB1347 IAQ Monitor is a tool manufactured by Delta Ohm for the analysis of air quality (INDOOR AIR QUALITY, IAQ).
The instrument simultaneously measures several parameters: **Carbon Dioxide** CO_2, **Carbon monoxide** CO, **Temperature**, **Relative humidity** and calculates **Dew Point**, **wet bulb temperature**, **absolute humidity**, **mixing ratio**, **enthalpy** and **atmospheric pressure**. All this with the **P37AB147** SICRAM probe. The probe SICRAM **P37B147** does not measure the Carbon Monoxide CO. Also combined **temperature and humidity** SICRAM probes**, Hot wire Air speed** SICRAM probes, **Vane air speed** SICRAM probes and **temperature** SICRAM probes can be connected to the instrument.
The instrument, with proper procedure, calculates the percentage of outdoor air intake **(% Outside Air**) as a function of both carbon dioxide CO_2 and temperature and the **Ventilation Rate**.
HD37AB1347 data logger has a storage capacity of 67,600 presets for each of the two inputs divided into 64 blocks. Use the software DeltaLog10 version 0.1.5.0.
The instrument is equipped with a large dot matrix graphic display with a resolution of 160x160 points. Standards: **ASHRAE 62.1-2004, Decree Law 81/2008**. The rules apply to all enclosed spaces that may be occupied by people. Should be considered, depending on air quality, chemical contaminants, physical and biological or outdoor air flow inside inadequately purified (Ventilation Rate).
Typical applications of the instrument with the range of sensors mentioned above are:
- Measure IAQ and comfort conditions in schools, offices and indoor.
- Analysis and study of sick building syndrome (Sick Building Syndrome) and consequences.
- Verification of HVAC system.
- Investigation of IAQ conditions in factories to optimize the microclimate and improve productivity.
- Audits in Building Automation.

*Example of an immediate printout obtained using the **HD40.1** printer*

```
========================
  Model HD37AB1347 IAQ
========================
Firm.Ver.=01.00
Firm.Date=2010/01/15
SN=12345678
ID=0000000000000000
------------------------
Probe ch.1 description
Type: CO2-C0 Fw.V0R0
Data cal.:2010/01/15
Serial N.:10010060
------------------------
Probe ch.2 description
Type: Hot wire
Data cal.:2010/01/15
Serial N.: 10010100
========================
Date=2010/01/15 15:00:00
CO2            850   ppm
C0               0   ppm
RH            39.1   %
T1            22.0  °C
Patm         1010   hPa
Va            0.00  m/s
========================
```

Instrument model

Instrument firmware version
Instrument firmware date
Instrument serial number
Identification Code

Description of the probe connected to input 1

Description of the probe connected to input 2

Date and time
Carbon Dioxide
Carbon Monoxide
Relative Humidity
Temperature
Atmospheric Pressure
Air Speed

HD37AB1347 Technical specifications

Instrument	
Dimensions (Length x Width x Height)	185x90x40 mm
Weight	470 g (batteries included)
Materials	ABS, rubber
Display	Backlit, Dot Matrix 160x160 dots, visible area 52x42 mm
Operating conditions	
Operating temperature	-5…50°C
Storage temperature	-25…65°C
Working relative humidity	0 … 85% RH without condensation
Protection degree	**IP66**
Instrument uncertainty	± 1 digit @ 20°C
Power supply	
Mains adapter (code SWD10)	12Vdc/1A
Rechargeable batteries	4 1.2V type AA batteries Ni-MH
Autonomy	20 hours with 2200mAh Ni-MH batteries (with P37AB147 probe connected)
Power absorbed with instrument off	< 45µA
Security of stored data	Unlimited
Connections	
Input for probes with SICRAM module	Two 8-pole male DIN45326 connectors
You can connect the following probes to the **Indoor Air Quality** input:	- **P37AB147** - **P37B147** - **Temperature** probes equipped with SICRAM module - **Temperature** and **Humidity** combined probes with SICRAM module
You can connect the following probes to the **Temp - Air Velocity** input:	- **Hot-Wire Sensor Air Speed** probes with SICRAM module - **Vane Air Speed** probes with SICRAM module - **Temperature** probes equipped with SICRAM module
Serial interface:	
Socket:	8-pole M12
Type:	RS232C (EIA/TIA574) or USB 1.1 or 2.0 not insulated
Baud rate:	Between 1200 and 38400 baud. With USB baud=460800
Data bits:	8
Parity:	None
Stop bits:	1
Flow control:	Xon-Xoff
Cable length:	Max 15 m

Memory	Divided into 64 blocks.
Storage capacity	67600 recordings per each of the 2 inputs.
Logging interval	Selectable among: 15, 30 seconds, 1, 2, 5, 10, 15, 20, 30 minutes and 1 hour.

Logging interval	Storage capacity	Logging interval	Storage capacity
15 seconds	About 11 days and 17 hours	10 minutes	About 1 year and 104 days
30 seconds	About 23 days and 11 hours	15 minutes	About 1 year and 339 days
1 minute	About 46 days and 22 hours	20 minutes	About 2 years and 208 days
2 minutes	About 93 days and 21 hours	30 minutes	About 3 years and 313 days
5 minutes	About 234 days and 17 hours	1 hour	About 7 years and 261 days

Technical specifications of the probes that can be connected to the HD37AB1347 instrument

P37AB147 and P37B147 SICRAM probes

- P37AB147: Measurement of CO_2 – CO – Relative Humidity – Temperature – Atmospheric Pressure.

- **P37B147:** Measurement of CO_2 – Relative Humidity – Temperature – Atmospheric Pressure.

CO_2 Carbon Dioxide

Sensor	NDIR Dual Wavelength
Measurement range	0 … 5000ppm
Sensor working range	-5 … 50°C
Accuracy	±50ppm+3% of measurement
Resolution	1ppm
Temperature dependence	0.1%f.s./°C
Response time (T_{90})	< 120 sec (air speed = 2m/sec)
Long-term stability	5% of measurement/5 years

CO Carbon Monoxide (only P37AB147)

Sensor	Electrochemical cell
Measurement range	0 … 500ppm
Sensor working range	-5 … 50°C
Accuracy	±3ppm+3% of measurement
Resolution	1ppm
Response time (T_{90})	< 50 sec
Long-term stability	5% of measurement/year
Service life	> 5 years in normal environment conditions

Relative Humidity RH

Type of sensor	Capacitive
Sensor protection	Stainless steel grid filter (on request 20µm sintered filter P6 in AISI 316 or 10µm sintered filter P7 in PTFE)
Measurement range	0 … 100 % RH
Sensor working range	-20 … +60°C
Accuracy	±2% (10÷90% RH) ±2.5% in the remaining range
Resolution	0.1°C
Temperature dependence	±2% on all temperature range
Hysteresis and repeatability	1% RH
Response time (T_{90})	< 20 sec (air speed = 2m/sec) without filter
Long-term stability	1%/year

Temperature T

Type of sensor	NTC 10kΩ
Measurement range	-20 … +60°C
Accuracy	±0.2°C ±0.15% of measurement
Resolution	0.1°C
Response time (T_{90})	< 30 sec (air speed = 2m/sec)
Long-term stability	0.1°C/year

Atmospheric Pressure Patm

Type of sensor	Piezo-resistive
Measurement range	750 … 1100 hPa
Accuracy	±1.5 hPa @ 25°C
Resolution	1 hPa
Long-term stability	2hPa/year
Temperature drift	±3hPa with temperature -20 … +60°C

Relative humidity and temperature probes using SICRAM module

Model	Temp. sensor	Application range		Accuracy	
		%RH	Temperature	%RH	Temp.
HP472ACR	Pt100	0…100%RH	-20°C…+80°C	±1.5%RH (10…90% RH) ±2.5%RH remaining range	±0.3°C
HP473ACR	Pt100	0…100%RH	-20°C…+80°C		±0.3°C
HP474ACR	Pt100	0…100%RH	-40°C…+150°C	±2.5% (10…95% RH) ±3.5% remaining range	±0.3°C
HP475ACR	Pt100	0…100%RH	-40°C…+150°C		±0.3°C
HP475AC1R	Pt100	0…100%RH	-40°C…+150°C		±0.3°C
HP477DCR	Pt100	0…100%RH	-40°C…+150°C		±0.3°C
HP478ACR	Pt100	0…100%RH	-40°C…+150°C		±0.3°C

Common characteristics

Relative Humidity

Sensor	Capacitive
Typical capacity @30%RH	300pF±40pF
Sensor operating temperature	-20 … 80°C
Measurement range	0÷100%RH
Uncertainty	±1.5% RH (10…90% RH) ±2.5% RH in the remaining range
Resolution	0.1%RH
Temperature drift @20°C	0.02%RH/°C
Response time %RH	10sec (10÷80% RH; air speed=2m/s) at constant temperature

Temperature with sensor Pt100

Resolution	0.1°C
Temperature drift @20°C	0.003%/°C

Hot-Wire Air Speed measurement probes with SICRAM module: AP471 S1 - AP471 S2 - AP471 S3 - AP471 S4

	AP471 S1 - AP471 S3	AP471 S2	AP471 S4
Type of measurements	Air speed, calculated flow rate, air temperature		
Type of sensor			
Speed	NTC thermistor	Omni directional NTC thermistor	
Temperature	NTC thermistor	NTC thermistor	
Measurement range			
Speed	0.1 … 40m/s	0.1 … 5m/s	
Temperature	-25 … +80°C	-25 … +80°C	0 … 80°C
Measurement resolution			
Speed	0.01 m/s 0.1 km/h 1 ft/min 0.1 mph 0.1 knot		
Temperature	0.1°C		
Measurement accuracy			
Speed	±0.1 m/s (0…0.99 m/s)	±0.05m/s (0…0.99 m/s)	
	±0.3 m/s (1.00…9.99 m/s)	±0.15m/s (1.00…5.00 m/s)	
	±0.8 m/s (10.00…40.0 m/s)		
Temperature	±0.8°C (-10…+80°C)	±0.8°C (-10…+80°C)	
Minimum speed	0.1 m/s		
Air temperature compensation	0…80°C		
Sensor working conditions	Clean air, RH<80 %		
Battery life	Approx. 20 hours @ 20 m/s with alkaline batteries	Approx. 30 hours @ 5 m/s with alkaline batteries	
Unit of measurement			
Speed	m/s – km/h – ft/min – mph – knot		
Flow rate	l/s - m^3/s - m^3/min - m^3/h - ft^3/s - ft^3/min		
Pipeline section for flow rate calculation	0.0001…1.9999 m^2		
Cable length	~2m		

Vane Air Speed measurement probes with SICRAM module: AP472 S1… - AP472 S2 - AP472 S4…

	AP472 S1	AP472 S2	AP472 S4…			
			L	LT	H	HT
Type of measurements	Air speed, calculated flow rate, air temperature	Air speed, calculated flow rate	Air speed, calculated flow rate	Air speed, calculated flow rate, air temperature	Air speed, calculated flow rate	Air speed, calculated flow rate, air temperature
Diameter	100 mm	60 mm	16 mm			
Type of measurement						
Speed	Vane	Vane	Vane			
Temperature	Tc K	----	----	Tc K	----	Tc K
Measurement range						
Speed (m/s)	0.6 … 25	0.5 … 20	0.8 … 20		10 … 40	
Temperature (°C)	-25…+80 (*)		-25...+80 (*)			
Resolution						
Speed	0.01 m/s 0.1 km/h 1 ft/min 0.1 mph 0.1 knot					
Temperature	0.1°C	----	----	0.1°C	----	0.1°C
Accuracy						
Speed	±(0.3 m/s +1.5%f.s.)	±(0.3m/s +1.5%f.s.)	±(0.4 m/s +1.5%f.s.)			
Temperature	±0.8°C	----	----	±0.8°C	----	±0.8°C
Minimum speed	0.6m/s	0.5m/s	0.8m/s		10m/s	
Unit of measurement						
Speed	m/s – km/h – ft/min – mph – knot					
Flow rate	l/s - m^3/s - m^3/min - m^3/h - ft^3/s - ft^3/min					
Pipeline section for flow rate calculation	0.0001…1.9999 m^2					
Cable length	~2m					

(*) The indicated value refers to the vane's working range.

Temperature probes Pt100 using SICRAM module

Model	Type	Application range	Accuracy
TP472I	Immersion	-196°C…+500°C	±0.25°C (-196°C…+350°C) ±0.4°C (+350°C…+500°C)
TP472I.0	Immersion	-50°C…+400°C	±0.25°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP473P	Penetration	-50°C…+400°C	±0.25°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP473P.0	Penetration	-50°C…+400°C	±0.25°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP474C	Contact	-50°C…+400°C	±0.3°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP474C.0	Contact	-50°C…+400°C	±0.3°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP475A.0	Air	-50°C…+250°C	±0.3°C (-50°C…+250°C)
TP472I.5	Immersion	-50°C…+400°C	±0.3°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP472I.10	Immersion	-50°C…+400°C	±0.3°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP49A	Immersion	-70°C…+400°C	±0.25°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP49AC	Contact	-70°C…+400°C	±0.25°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP49AP	Penetration	-70°C…+400°C	±0.25°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP875	Globe thermometer Ø 150 mm	-30°C…+120°C	±0.25°C
TP876	Globe thermometer Ø 50mm	-30°C…+120°C	±0.25°C
TP87	Immersion	-50°C…+200°C	±0.25°C
TP878 TP878.1	For solar panels	+5°C…+80°C	±0.25°C
TP879	Compost	-20°C…+120°C	±0.25°C

Common characteristics

Temperature drift @20°C 0.003%/°C

PURCHASING CODES

HD37AB1347: IAQ Monitor datalogger instrument complete with: **DeltaLog10** software (**from version 0.1.5.0**) for data download, monitor, and data processing on Personal Computer, 4 x 1.2V type AA Ni-MH rechargeable batteries 2200 mAh, operating manual, case. **Probes and cables have to be ordered separately.**

CARBON DIOXIDE, CARBON MONOXIDE, RELATIVE HUMIDITY, TEMPERATURE AND ATMOSPHERIC PRESSURE PROBES WITH SICRAM MODULE

P37AB147: CO_2 Carbon Dioxide, CO Carbon Monoxide, Relative Humidity RH, Temperature T and Atmospheric Pressure Patm combined probe. Dimensions 275 mm x 45 mm x 40 mm. Connection cable 2 meters long.

P37B147: CO_2 Carbon Dioxide, Relative Humidity RH, Temperature T and Atmospheric Pressure Patm combined probe. Dimensions 275 mm x 45 mm x 40 mm. Connection cable 2 meters long.

RELATIVE HUMIDITY AND TEMPERATURE PROBES EQUIPPED WITH SICRAM MODULE

HP472ACR: Combined probe %RH and temperature, dimensions Ø 26x170 mm. Connection cable 2 meters long.

HP473ACR: Combined probe %RH and temperature. Handle size Ø 26x130 mm, probe Ø 14x120 mm. Connection cable 2 meters long.

HP474ACR: Combined probe %RH and temperature. Handle size Ø 26x130 mm, probe Ø 14x215 mm. Connection cable 2 meters long.

HP475ACR: Combined probe %RH and temperature. Connection cable 2 meters long. Handle Ø 26x110mm. Stainless steel stem Ø 12x560mm. Point Ø 26x110 mm.

HP475AC1R: Combined probe %RH and temperature. Connection cable 2 meters long. Handel 80 mm. Stainless steel stem Ø 14x480 mm.

HP477DCR: Combined sword probe %RH and temperature. Connection cable 2 meters long. Handle Ø 26x110mm. Probe's stem 18x4mm, length 520 mm.

HP478ACR: Combined probe %RH and temperature. Dimensions Ø 14x130 mm. Connection cable 5 meters long.

HOT-WIRE WIND SPEED MEASUREMENT PROBES EQUIPPED WITH SICRAM MODULE

AP471 S1: Hot-wire telescopic probe, measuring range: 0.1…40m/s. Cable 2 meters long.

AP471 S2: Omni directional hot-wire telescopic probe, measuring range: 0.1 … 5m/s. Cable 2 meters long.

AP471 S3: Hot-wire telescopic probe with terminal tip for easy position, measuring range: 0.1 … 40m/s. Cable 2 meters long.

AP471 S4: Omni directional hot-wire telescopic probe with base, measuring range: 0.1 … 5m/s. Cable 2 meters long.

VANE WIND SPEED MEASUREMENT PROBES WITH SICRAM MODULE

AP472 S1: Vane probe with thermocouple K, Ø 100 mm. Speed from 0.6 to 20 m/s; temperature from -25 to 80°C. Cable 2 meters long.
AP472 S2: Vane probe, Ø 60mm. Measurement range: 0.5…20m/s. Cable 2 meters long.
AP472 S4L: Vane probe, Ø 16 mm. Speed from 0.8 to 20m/s. Cable 2 meters long.
AP472 S4LT: Vane probe, Ø 16 mm. Speed from 0.8 to 20 m/s. Temperature from -25 to 80°C with thermocouple K sensor. Cable 2 meters long.
AP472 S4H: Vane probe, Ø 16 mm. Speed from 10 to 40m/s. Cable 2 meters long.
AP472 S4HT: Vane probe, Ø 16 mm. Speed from 10 to 40m/s. Temperature from -25 to 80°C with thermocouple K sensor. Cable2 meters long.

TEMPERATURE MEASUREMENT PROBES EQUIPPED WITH SICRAM MODULE
TP472I: Pt100 sensor immersion probe. Stem Ø 3 mm, length 300 mm. Cable 2 meters long.
TP472I.0: Pt100 sensor immersion probe. Stem Ø 3 mm, length 230 mm. Cable 2 meters long.
TP473P: Pt100 sensor penetration probe. Stem Ø 4 mm, length 150 mm. Cable 2 meters long.
TP473P.0: Pt100 sensor penetration probe. Stem Ø 4 mm, length 150 mm. Cable 2 meters long.
TP474C: Pt100 sensor contact probe. Stem Ø 4 mm, length 230 mm, contact surface Ø 5 mm. Cable 2 meters long.
TP474C.0: Pt100 sensor contact probe. Stem Ø 4 mm, length 230 mm, contact surface Ø 5 mm. Cable 2 meters long.
TP475A.0: Pt100 sensor air probe. Stem Ø 4 mm, length 230 mm. Cable 2 meters long.
TP472I.5: Pt100 sensor immersion probe. Stem Ø 6 mm, length 500 mm. Cable 2 meters long.
TP472I.10: Pt100 sensor immersion probe. Stem Ø 6 mm, length 1000 mm. Cable 2 meters long.
TP49A: Pt100 sensor immersion probe. Stem Ø 2.7 mm, length 150 mm. Cable 2 meters long. Aluminium handle.
TP49AC: Pt100 sensor contact probe. Stem Ø 4 mm, length 150 mm. Cable 2 meters long. Aluminium handle.
TP49AP: Pt100 sensor penetration probe. Stem Ø 2.7 mm, length 150 mm. Cable 2 meters long. Aluminium handle.
TP875: Globe thermometer Ø 150 mm with handle. Cable 2 meters long.
TP876: Globe thermometer Ø 50 mm with handle. Cable 2 meters long.
TP87: Pt100 sensor immersion probe. Stem Ø 3 mm with handle, length 70mm. Cable 2 meters long.
TP878: Contact probe for solar panels. Cable 2 meters long.
TP878.1: Contact probe for solar panels. Cable 5 meters long.
TP879: Penetration probe compost. Stem Ø 8 mm, length 1 meter. Cable 2 meters long.

Accessories:
SWD10: Stabilized power supply at 100-240Vac/12Vdc-1A mains voltage.
VTRAP20: Tripod to be fixed to the instrument, maximum height 270 mm.
HD2110/RS: Connection cable with M12 connector on instrument's side and sub D 9-pole female connector for RS232C on PC's side.
HD2110/USB: Connection cable with M12 connector on instrument's side and USB 2.0 connector on PC's side.
HD40.1: Printer (it uses the **HD2110/RS** cable).

Accessories for HD40.1 printer:
BAT-40: Spare batteries for the HD40.1 printer with built-in temperature sensor.
RCT: Kit of four thermo-paper rolls, width 57 mm, diameter 32 mm.

Accessories for P37AB147 and P37B147 SICRAM probes:
MINICAN.12A: Nitrogen bottle for CO and CO_2 sensor calibration at 0ppm. Volume 12 liters. **With adjustment valve.**
MINICAN.12A1: Nitrogen bottle for CO and CO_2 sensor calibration at 0ppm. Volume 12 liters. **Without adjustment valve.**
ECO-SURE-2E CO: CO spare sensor (only P37AB147)
HD37.36: Kit connection tube between instrument and MINICAN.12A for CO calibration (only P37AB147).
HD37.37: Kit connection tube between instrument and MINICAN.12A for CO_2 calibration.

Accessories for Wind Speed SICRAM probes:
AST.1: Telescopic rod (fully closed 210 mm, fully open 870 mm) for AP472S1 and AP472S2 vanes.
AP 471S1.23.6: Fixed telescopic element ∅ 16 x 300 mm, M10 male thread on one side, female thread on the other side. For AP472S1, AP472S2, AP472S4 vanes.
AP 471S1.23.7: Fixed telescopic element ∅ 16 x 300 mm, M10 female thread on one side only. For AP472S1, AP472S2, AP472S4 vanes.

Accessories for Temperature-Humidity SICRAM probes:
HD33: Saturated solution at 33.0%RH@20°C for calibration of relative humidity probes, ring M24x1.5
HD75: Saturated solution at 75.4%RH@20°C for calibration of relative humidity probes, ring M24x1.5
P5: Protection grid in stainless steel for Ø 14mm probes.
P6: Complete protection in 20µ sintered AISI 316 for Ø 14mm probes.
P7: Complete protection in 10µ sintered PTFE for Ø 14mm probes.
P8: Protection grid in stainless steel and Pocan for Ø 14mm probes, thread M12x1.

HD40.1

HD37AB17D
HD37B17D

HD 37AB17D, HD 37B17D
DATALOGGER RELATIVE HUMIDITY - TEMPERATURE - CO - CO_2

HD37AB17D and **HD37B17D** are **data loggers** able to measure and store at the same time the following parameters:
- **RH** relative Humidity
- **T** Room Temperature
- **CO** Carbon Monoxide (**only HD37AB17D**)
- **CO_2** Carbon Dioxide

HD37AB17D and **HD37B17D** are able to investigate and monitor the quality of indoor air. Typical applications are examining the air quality in buildings where there are crowds of people (schools, hospitals, auditoriums, cafeterias, etc...) and workplaces to maximize comfort and in general to see if there are small leaks of CO, with danger of explosion or fire. This analysis allows you to adjust the air conditioning (temperature and humidity) and ventilation (air change per hour) to achieve a double objective: to achieve good air quality in accordance with ASHRAE standards and current BMI and energy savings.
HD37AB17D and **HD37B17D** are instruments set to fight the so-called sick building syndrome.
RH (Relative Humidity) measurement is obtained with a capacitive sensor.
T temperature is measured with a high precision NTC sensor.
The sensor for the measurement of **CO** (Carbon Monoxide, **only for HD37AB17D**) consists of two electrodes in an electrochemical cell suitable for detecting the presence of carbon monoxide, lethal for humans, in residential and industrial.
The measurement of **CO_2** (carbon dioxide) is obtained with a special infrared sensor (NDIR technology: Non-Dispersive Infrared Technology) that, by using a double filter and a particular measurement technique, ensures accurate measurements and stable for a long time. The presence of a protective membrane, which is spread through the air portion, protects the sensor from dust and weather.
HD37AB17D and **HD37B17D** are **data loggers** capable of storing the measurements, every user preset.
HD37AB17D and **HD37B17D** can be connected to the PC via the **USB** input. Instruments are supplied with **DeltaLog13 software** which manages the operations of connection to the PC, calibration of RH sensors, CO (only HD37AB17D) and CO2, setting of the operating parameters of the instrument, data transfer, presentation graphics and printing of measurements acquired or stored.
The **software DeltaLog13** is able to assess **OA %** parameter by an appropiate procedure (percentage of outside air), according to the following formula:

Using appropriate procedure, the Software DeltaLog13 can evaluate the parameter **% OA** (percentage of external air), according to the following formula:

$$\%OA = \frac{X_r - X_s}{X_r - X_0} \cdot 100$$

whereas:
X_r = CO_2 in return air
X_s = CO_2 in the outlet air
X_0 = CO_2 in the external air

The power supply of the instrument is provided by a 2 Ni-MH **rechargeable** batteries package (code BAT-20), that that allows 8 hours of continuous working in acquisition mode.

Acquisition frequency:

frequency	samples per minute	storage capacity
3 sec.	20 samples per minute	16 hours
6 sec.	10 samples per minute	1 day 9 hours
12 sec.	5 samples per minute	2 days 12 hours
15 sec.	4 samples per minute	3 days 12 hours
30 sec.	2 samples per minute	6 days 12 hours
60 sec. = 1 minutes	1 sample per minute	13 days 12 hours
120 sec. = 2 minutes	1 sample per 2 minutes	27 days 12 hours
180 sec. = 3 minutes	1 sample per 3 minutes	41 days 12 hours
240 sec. = 4 minutes	1 sample per 5 minutes	55 days 12 hours
300 sec. = 5 minutes	1 sample per 5 minutes	69 days

Technical Features

Dimensions	275 mm x 45 mm x 40 mm
Weight	230 g (batteries included)
Materials	ABS
Mains power supply **(code SWD06)**	Batteries charger **100-240Vac/6Vdc-1A**
Batteries	Package with 2 rechargeable batteries 1.2V type AA (NiMH)
Autonomy	8 hours of continuous working in measurement mode
Current absorbed with instrument off	200µA
Instrument working temperature	5°C ... 50°C
Working relative humidity	5%RH ... 95%RH no condensed
Temperature / Storage humidity	-25°C ... +70°C / 10%RH ... 90%RH no condensed
Safety of the stored data	Unlimited

Connections

USB interface	USB 2.0 cable B type Baudrate 460800
Charger Batteries power supply (code SWD06)	2 - poles connector (positive at the centre) Output voltage: **6Vdc** Maximum current: 1600mA (9,60 VA Max).
Measuring rate	**1 sample every three seconds**
Storage capacity	20000 Records Every records includes the followingf: - date and time - measurement of the carbon dioxide (CO_2) - measurement of the carbon monoxide (CO- only HD37AB17D) - measurement of the relative humidity (RH) - measurement of the temperature (T)

Logging interval	selectable within: 3,6,12,15,30,60 seconds, 2,3,4,5 minutes. The stored values represent the average value of the samples that are stored every three seconds.
Printing interval	selectable within: 3,6,12,15,30,60 seconds, 2,3,4,5 minutes. The printed values represent the average value of the samples that are stored every three seconds.

Sensor Features

Relative Humidity RH	Capacitive sensor
Sensor protection	Net filter made of stainless steel (upon request filter P6 in AISI316 sintered 20µm or filter P7 in PTFE sintered 10µm)
Measurement range	5...100 % RH
Sensor working range	-20...+60°C
Accuracy	±2% (10÷90%RH) ±2,5% in the remaining range
Resolution	0,1%
Thermal effects	±2% on all the temperature range
Hysteresis and repeatability	1% RH
Temperature dependence	±2% on all temperature range
Response time (T_{90})	< 20 sec. (air speed = 2m/sec) without filter
Long term stability	1%/year

Temperature T

Sensor type	NTC 10KΩ
Measurement range	-20...+60°C
Accuracy	±0.2°C ±0.15% of the measure
Resolution	0,1°C
Response time (T_{90})	< 30 sec. (air speed = 2m/sec)
Long term stability	0.1°C/year

Carbon monoxide CO (only HD37AB17D)

Sensor	Electro chemical cell
Measurement range	0…500ppm
Sensor working range	-5…50°C
Accuracy	±3ppm+3% of the measure value
Resolution	1ppm
Response time (T_{90})	< 50 sec.
Long term stability	5% of the measure/year
Expected life	> 5 years in normal environmental conditions

Carbon dioxide CO_2

Sensor	NDIR with a double wave length
Measurement range	0…5000 ppm
Sensor working range	-5…50°C
Accuracy	±50ppm+3% of the measurement
Resolution	1ppm
Thermal effects	0,1%f.s./°C
Response time (T_{90})	< 120 sec. (air speed = 2m/sec)
Long term stability	5% of the measure/ 5 years

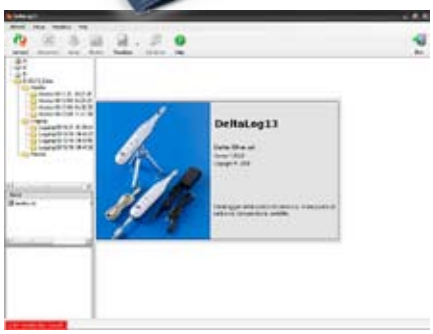
Purchasing codes

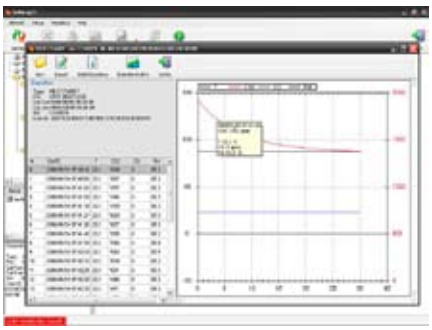
HD37AB17D: The kit consisting of: **HD37AB17D** instrument to measure CO (Carbon monoxide), CO_2 (Carbon dioxide), RH (Relative Humidity), T (Temperature), **DeltaLog13** Software, USB cable code **CP22**, **SWD06** power supply, **BAT-20** batteries package, instruction manual, carrying case.

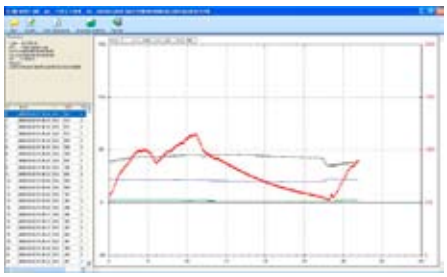
HD37B17D: instrument to measure CO_2 (Carbon dioxide), RH (Relative Humidity), T (Temperature), **DeltaLog13** Software, USB cable code **CP22**, **SWD06** power supply, **BAT-20** batteries package, instruction manual, carrying case.

Accessories:

VTRAP20: Instrument tripod, maximum height 270mm.
SWD06: 100-240Vac/6Vdc-1A mains voltage power supply.
BAT-20: Replacement batteries pack for HD37AB17D and HD37B17D instruments with integrated temperature sensor.
P5: Stainless steel grid protection for probes diameter 14, thread M12×1.
P6: Sintered stainless steel 10µ grid protection, for probes diameter 14, thread M12×1.
P7: 10µ, PTFE protection for probes diameter 14, thread M12×1.
P8: Stainless steel and Pocan protection for probes diameter 14, thread M12×1.
HD75: Saturated solution for testing the Relative Humidity with 75% RH, equipped with adapter for probes diameter 14, thread M12×1.
HD33: Saturated solution for testing the Relative Humidity with 33% RH, equipped with adapter for probes diameter 14, thread M12×1.
MINICAN.12A: Cylinder of nitrogen for the calibration of CO and CO_2 at 0ppm. Volume 12 litres. **With adjustment valve**.
MINICAN.12A1: Cylinder of nitrogen for the calibration of CO and CO_2 at 0ppm. Volume 12 litres. **Without adjustment valve**.
ECO-SURE-2E CO: Spare CO sensor.
HD37.36: Kit connection pipe between instrument and MINICAN.12A for the calibration of CO.
HD37.37: Kit connection pipe between instrument and MINICAN.12A for the calibration of CO_2.







HD37BT…
HD37BTV…
HD377BT…
HD37V7TV…

HD 37BT…, HD 37BTV…, HD 377BT…, HD 37V7TV…
CO_2, CO_2 AND TEMPERATURE TRANSMITTERS

The HD37BT… and HD37VBT... series transmitters are used mainly in air quality control by measuring CO_2 (Carbon Dioxide) in the ventilation systems. This allows you to vary the number of air change per hour according to ASHRAE and IMC norms. The purpose is twofold: to have a good air quality in the presence of people and to save energy, increasing or decreasing parts of air per hour, depending on the air quality set.
The use is for environments where there is overcrowding of people, discontinuous crowding, cafeterias, auditoriums, schools, hospitals, greenhouses, livestock breeding, etc.
The HD377BT... and HD37V7BT... models measure, in addition to CO_2, also the temperature. ***The analog outputs, current 4...20mA or voltage 0...10Vdc, should be specified when ordering***. All transmitters have an alarm digital output suitable to control, for example, an external relay coil. All transmitters have a digital alarm suitable to control eg. an external relay coil. The alarm is activated to pass a threshold set at the factory to 1500ppm, the threshold beyond which a man feels uncomfortable. The sensor element is a particular infrared sensor (NDIR technology: Non-Dispersive Infrared Technology) which, by using a double filter and a particular measurement technique, compensates for the effect of aging thus ensuring accurate and stable measurements over a long time.
The use of a protective membrane, which is spread through the air to be analyzed, minimizes the negative effect of atmospheric dust and the performance of the transmitter. At the entrance of the intake air flow in the transmitter is a filter that you can remove and clean.
The installation methods may be:
- Wall mounted – ***TV Version***,
- With power flow horizontally fixed to the container, to be extent ventilation duct – ***TO Version***,
- Wall outlet with flow separate with two tubes, connected to the electronics to the extent ventilation duet – **TC Version**,

In versions with power flow channel and separate electronics, the air is drawn into the measurement chamber. The same flow then returns to the channel through a second tube. **The air flow needs to be at least 1m/s.**
To fix the air inlet to the duct, you can use the HD9008.31 flange, a 3/8" universal biconical fitting or a PG16 metallic fairlead with a Ø 14 mm internal diameter.
The air inlets connected to the transmitter by means of flexible tubes are attached to the channels flowing air: we supply air inlets for square or rectangular ducts (code HD3719) and for circular ducts (code HD3721). In order to maintain the specified accuracy, the cable length should be 1m.

Technical characteristics			Notes
CO_2 Measurement Principle		Double wave lenght infrared technology (NDIR)	
CO_2 Measurement Range		0 … 2000ppm 0 … 5000ppm	
CO_2 Accuracy	f.s. 2000ppm	±(50ppm+3% of measurement)	at 20°C, 50%RH and 1013hPa
	f.s. 5000ppm	±(50ppm+4% of measurement)	
Temperature Measurement Range		0 …+50°C	Models HD377BT… and HD37V7BT…
Temperature Accuracy		±0.3°C	
Analog Outputs (according to the models)		4 …20mA 0 …10VDC	R_L < 500Ω R_L > 10kΩ
Digital Output (all models)	Type	Open-collector (N.O.)	(*) Factory Preset
	CO_2 Threshold	1500ppm (*)	
	Vmax	40VDC	
	Pmax	400mW	
Power supply		16…40Vdc or 24Vac ±10%	
Absorption		<2W	
Startup Stabilization Time		15 minutes	To guarantee the stated accuracy.
Response Time $\tau_{63\%}$		120s	Wind speed of at least 1m/s.
Temperature effect		0.2%/°C CO_2	Typical value
Atmospheric Pressure effect		1.6%/kPa	Deviation compared to the value at 101kPa
Long-term Stability		5% of the range / 5 years	Typical value
Calibration		At one point at 0ppm or 400ppm clear air	Automatic detection of the applied CO_2 level.
Working Temperature/Relative Humidity		-5 …+50°C, 0 ... 95%RH without condensation	
Storage Temperature/Relative Humidity		-10 …+60°C, 0 ... 95%RH without condensation	
Electronics Protection Degree		IP21	Wall mounted models (TV).
		IP65	Horizontal probe models (TO), probe excluded.
		IP65	Separate probe models (TC), probe excluded.
Case size		80x84x44	Probe excluded.
Case material		ABS	

Model description

Model	Type of output		Measured quantities	
	4 … 20mA	0 …10Vdc	CO_2	Temperature
HD37BT...	✓		✓	
HD37VBT...		✓	✓	
HD377BT...	✓		✓	✓
HD37V7BT...		✓	✓	✓

Model	Probe	CO_2 Measurement Range
...BTV	Wall mounted model	0...2000ppm
...BTV.1	Wall mounted model	0...5000ppm
...BTO.1	CO_2 model with horizontal air inlet L=115mm CO_2 /temperature model with horizontal air inlet L=120mm	0...2000ppm
...BTO.11	CO_2 model with horizontal air inlet L=115mm CO_2 /temperature model with horizontal air inlet L=120mm	0...5000ppm
...BTO.2	CO_2 model with horizontal air inlet L=315mm CO_2 /temperature model with horizontal air inlet L=320mm	0...2000ppm
...BTO.21	CO_2 model with horizontal air inlet L=315mm CO_2 /temperature model with horizontal air inlet L=320mm	0...5000ppm
...BTC	Wall mounted model with attachments for an air inlet separate from the duct	0...2000ppm
...BTC.1	Wall mounted model with attachments for an air inlet separate from the duct	0...5000ppm

Calibration

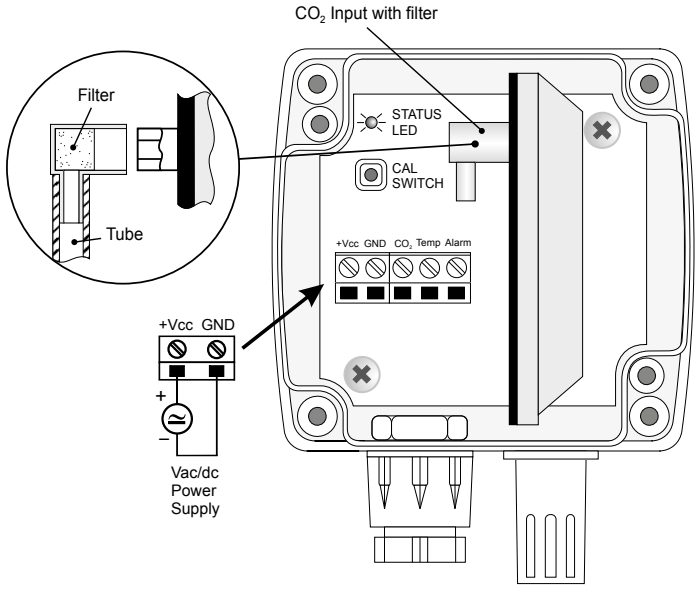
The instruments are calibrated at the factory and do not usually require further action by the user.

However, it is possible to perform a new calibration that corrects the sensor offset:

- (approx. 400ppm) in clean air
- to 0ppm with nitrogen bottles (code MINICAN.20A).

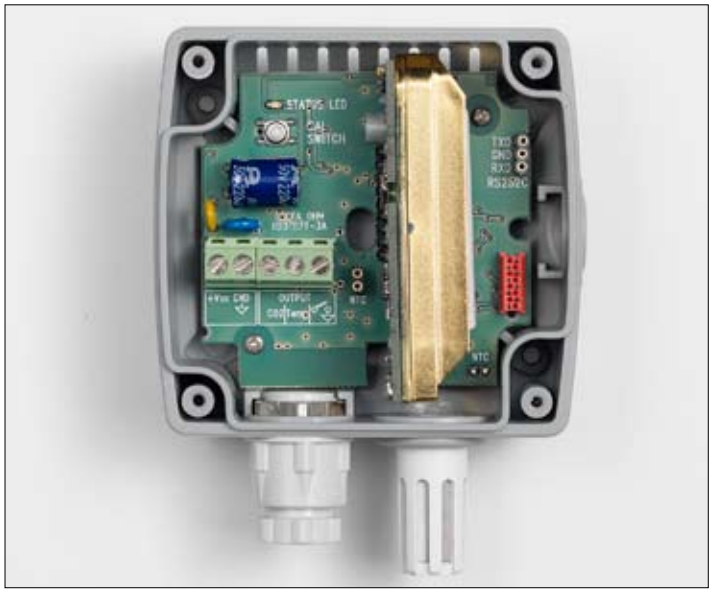
The instrument is able to recognize automatically the calibration methods used: whether 400ppm or 0ppm. The calibration should be performed one point only: each new calibration cancels the previous one.

Proceed as follows:



Open the instrument top cover to discover the CAL SWITCH calibration key on the board and the calibration gas inlet.

1. Let open the entrance if you want to calibrate around 400ppm: in which case, be sure to attach the instrument clean air.
2. For a calibration at 0ppm, connect the tube from the nitrogen bottle to the CO_2 input. Adjust the bottle flow meter on a flow from 0.3 to 0.5l/min.
3. Power up the instrument according to specifications and wait at least 15 minutes before proceeding.
4. Supply CO_2 for at least 2 minutes so as to stabilize the measurement.
5. Continue to provide CO_2 to the instrument, hold the CAL SWITCH key pressed for at least 5 seconds until the STATUS LED flashes: the two-minute calibration starts. At this stage the instrument is calibrated to measure CO_2 and a value close to 0ppm, if you use the nitrogen cylinder, to 400ppm, if you calibrate to clean air.
6. Wait the **two minutes** necessary for calibration without changing the working conditions.
7. When the LED turns off, the calibration is completed.



HD37VBTV

Installation Notes

The choice of the number of CO_2 transmitters to be used in a typical installation and location, should be based on the fact that the distribution CO_2 in the atmosphere is influenced by the same factors that determine temperature distribution. Among these factors are convection, diffusion and forced air movement in the environment.

For an accurate control, you should use a CO_2 transmitter (TV model) in any place where there is a temperature control. You can also opt for a single device (TO or TC model) installed at the point of air quality control.

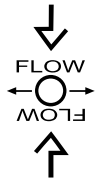
For the wall mounted TV models

The transmitter has to be installed into a location with good air circulation, away from doors, windows or entry points of fresh air from outside.

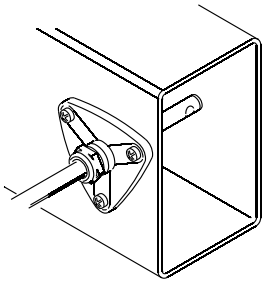
The height from the floor should be at least 1.5 meters.

For the TO models with horizontal air inlet from the duct

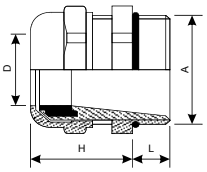
- The transmitter should be installed so that the air inlet is correctly oriented with the flow into the channel. In the probe head there is an arrow indicating the correct direction of airflow. To facilitate installation, on the left side face of the container, **near the air input to the sensor**, is engraved with the following symbol.



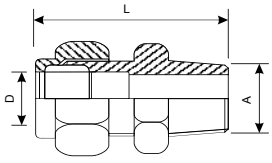
- To set the probe into a duct, with flat surface (square or rectangular), use the HD9008.31.12 flange, a PG16 metallic fairlead with Ø 14 mm internal hole, or a 3/8" biconical universal fitting with Ø 14 mm internal hole.



HD9008.31 flange



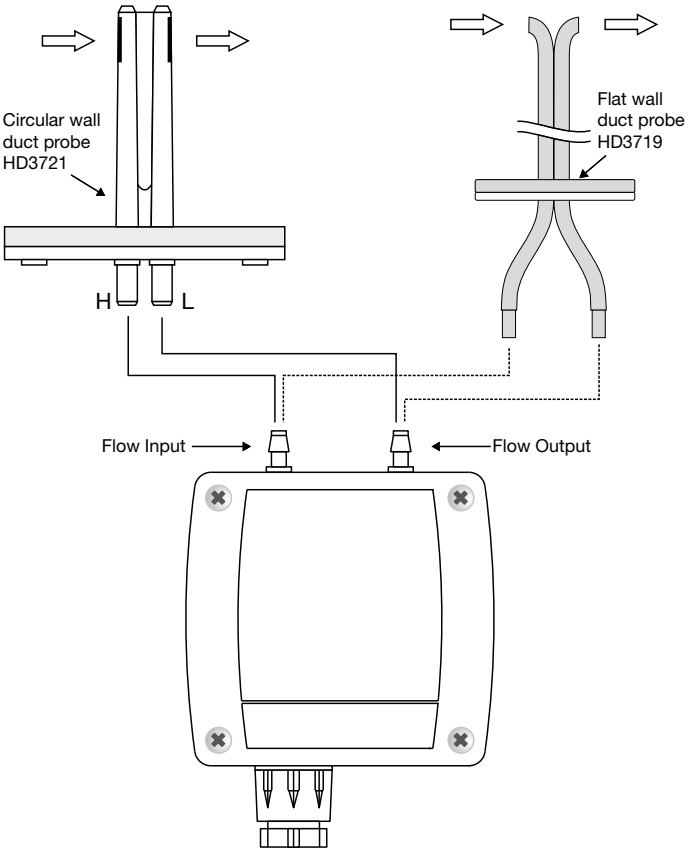
PG16 metallic fairlead
D = 10…14mm
L = 6.5mm
H = 23 mm
A = PG16



Biconical universal fitting
L = 35 mm
D = 14 mm
A = 3/8"

For the TC models with air inlet separate from electronics

We have two probes: One (code HD3719) for flat walls ducts (square or rectangular section), another (code HD3721) for circular section ducts. Please see the following figure.



The duct air inlet should be oriented so that the flow enters from the entrance connected to the junction on the left in the container leaving from the right one.

Electrical connections

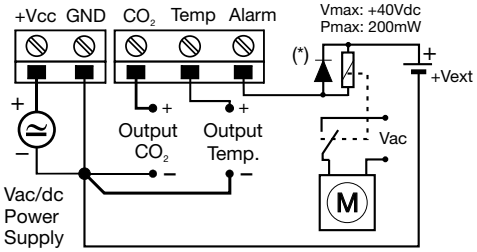
Power supply

Supply the instrument with the voltage according to what indicated in the technical characteristics: the power supply terminals are indicated by +Vdc and GND.

Analog Outputs

The output signal is acquired, depending on model:

- Between the CO_2 and GND terminals for CO_2 transmitters,
- Between the CO_2 and GND, Temp and GND terminals for CO_2 and temperature transmitters,



HD37BTC

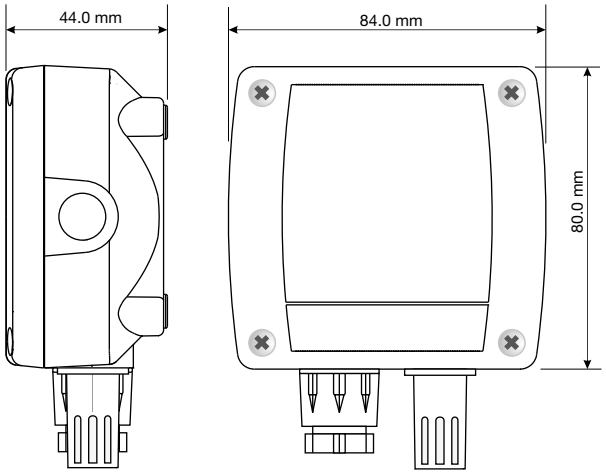
Digital Output

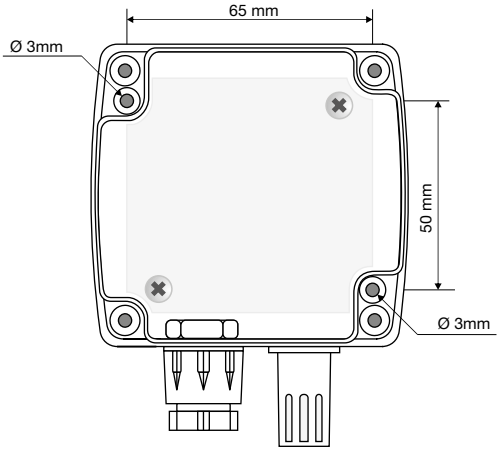
The diagram shows an example of application for a digital output that controls, in this case, an ***external relay*** coil. When exceeding the alert threshold (1500ppm), the relay contact closes and activates an adjustment device.

(*) ***Warning***: Protect the digital output by applying a protection diode as shown in the figure.

Do not exceed the maximum reverse voltage and power limits indicated in the technical information.

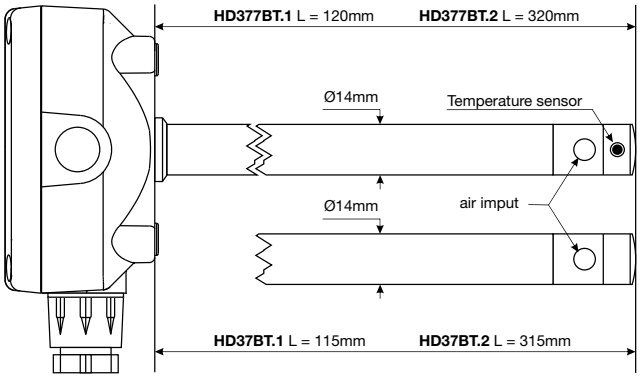
HD37BTV / HD377BTV sizes

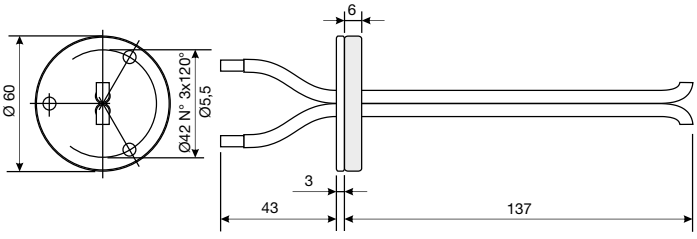




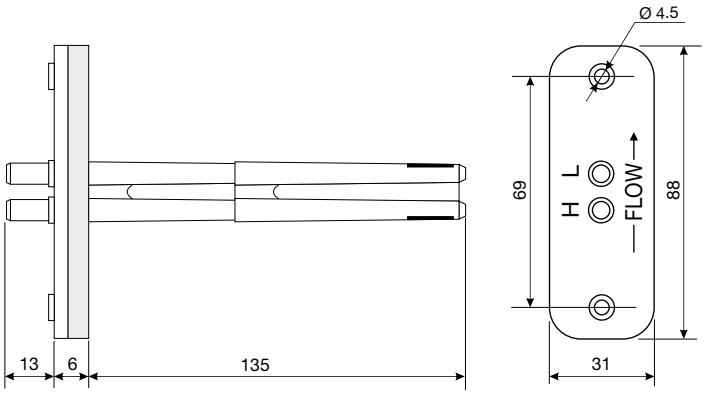
Drilling template

Duct air inlet sizes





HD3719 Duct Probe



AP3721 Duct Probe

Purchasing codes

HD37BT...: CO_2 active transmitter, analog output 4…20mA. Power supply 16...40VDC or 24VAC. Functioning temperature -5°C ... +50°C. Alarm digital output for levels of CO_2 > 1500ppm.
HD37BTV: Wall mounted one-piece version. CO2 Measurement Range 0…2000ppm.
HD37BTV.1: Wall mounted one-piece version. CO2 Measurement Range 0…5000ppm.
HD37BTO.1: Duct version with horizontal air inlet in AISI 304 steel diameter 14mm, L=115mm. CO_2 Measurement Range 0…2000ppm.
HD37BTO.11: Duct version with horizontal air inlet in AISI 304 steel diameter 14mm, L=115mm. CO_2 Measurement Range 0…5000ppm.
HD37BTO.2: Duct version with horizontal air inlet in AISI 304 steel diameter 14mm, L=315mm. CO_2 Measurement Range 0…2000ppm.
HD37BTO.21: Duct version with horizontal air inlet in AISI 304 steel diameter 14mm, L=315mm. CO_2 Measurement Range 0…5000ppm.
HD37BTC: Wall mounted one-piece version with attachments for an air inlet separate from the duct CO_2 Measurement Range 0…2000ppm.
HD37BTC.1: Wall mounted one-piece version with attachments for an air inlet separate from the duct CO_2 Measurement Range 0…5000ppm.

HD37VBT...: CO_2 active transmitter, analog output 0...10VDC. Power supply 16...40VDC or 24VAC. Functioning temperature -5°C ... +50°C. Alarm digital output for levels of CO2 > 1500ppm.
HD37VBTV: Wall mounted one-piece version. CO_2 Measurement Range 0…2000ppm.
HD37VBTV.1: Wall mounted one-piece version. CO_2 Measurement Range 0…5000ppm.
HD37VBTO.1: Duct version with horizontal air inlet in AISI 304 steel diameter 14mm, L=115mm. CO_2 Measurement Range 0…2000ppm.
HD37VBTO.11: Duct version with horizontal air inlet in AISI 304 steel diameter 14mm, L=115mm. CO_2 Measurement Range 0…5000ppm.
HD37VBTO.2: Duct version with horizontal air inlet in AISI 304 steel diameter 14mm, L=315mm. CO_2 Measurement Range 0…2000ppm.
HD37VBTO.21: Duct version with horizontal air inlet in AISI 304 steel diameter 14mm, L=315mm. CO_2 Measurement Range 0…5000ppm.
HD37VBTC: Wall mounted one-piece version with attachments for an air inlet separate from the duct CO_2 Measurement Range 0…2000ppm.
HD37VBTC.1: Wall mounted one-piece version with attachments for an air inlet separate from the duct CO_2 Measurement Range 0…5000ppm.

HD377BT...: CO_2 and temperature active transmitter, analog output 4…20mA. Temperature range 0…+50°C, non-modifiable. Power supply 16...40VDC or 24VAC. Functioning temperature -5°C ... +50°C. Alarm digital output for levels of CO_2 > 1500ppm.
HD377BTV: Wall mounted one-piece version. CO_2 Measurement Range 0…2000ppm.
HD377BTV.1: Wall mounted one-piece version. CO_2 Measurement Range 0…5000ppm.
HD377BTO.1: Duct version with horizontal air inlet in AISI 304 steel diameter 14mm, L=120mm. CO_2 Measurement Range 0…2000ppm.
HD377BTO.11: Duct version with horizontal air inlet in AISI 304 steel diameter 14mm, L=120mm. CO_2 Measurement Range 0…5000ppm.
HD377BTO.2: Duct version with horizontal air inlet in AISI 304 steel diameter 14mm, L=320mm. CO_2 Measurement Range 0…2000ppm.
HD377BTO.21: Duct version with horizontal air inlet in AISI 304 steel diameter 14mm, L=320mm. CO_2 Measurement Range 0…5000ppm.

HD37V7BT...: CO_2 and temperature active transmitter, analog outputs 0...10VDC. Temperature range 0…+50°C, non-modifiable. Power supply 16...40VDC or 24VAC. Functioning temperature -5°C ... +50°C. Alarm digital output for levels of CO_2 > 1500ppm.
HD37V7BTV: Wall mounted one-piece version. CO_2 Measurement Range 0…2000ppm.
HD37V7BTV.1: Wall mounted one-piece version. CO_2 Measurement Range 0…5000ppm.
HD37V7BTO.1: Duct version with horizontal air inlet in AISI 304 steel diameter 14mm, L=120mm. CO_2 Measurement Range 0…2000ppm.
HD37V7BTO.11: Duct version with horizontal air inlet in AISI 304 steel diameter 14mm, L=120mm. CO_2 Measurement Range 0…5000ppm.
HD37V7BTO.2: Duct version with horizontal air inlet in AISI 304 steel diameter 14mm, L=320mm. CO_2 Measurement Range 0…2000ppm.
HD37V7BTO.21: Duct version with horizontal air inlet in AISI 304 steel diameter 14mm, L=320mm. CO_2 Measurement Range 0…5000ppm.

HD9008.31: Wall flange with fairlead for Ø 14mm probe mounting.
PG16: Metallic fairlead for Ø 14mm probes.
HD3719: Air inlet for square or cylindrical ducts. Two 1 m tube segments Ø3.2/Ø6.4. For ...BTC and ...BTC.1 models.
HD3721: Air inlet for cylindrical ducts, in plastic material. Two 1 m tube segments Ø3.2/Ø6.4. For ...BTC and ...BTC.1 models.
MINICAN.20A: Nitrogen bottle for CO_2 at 0ppm calibration. Volume 20 liters. With adjustment valve.
MINICAN.20A1: Nitrogen bottle for CO_2 at 0ppm calibration. Volume 20 liters. Without adjustment valve.
T37…m: PVC Crystal tube Ø int. 3,2mm / Ø ext. 6,4mm, length upon request.

Order codes for CO_2 transmitters

HD37 X B T. X X

- **No sign** = Range CO_2 0…2000ppm.
  1 = Range CO_2 0…5000ppm.
- **V** = Wall mounted
  0.1 = 115mm air inlet from ducts
  0.2 = 315mm air inlet from ducts
  C = Separate probe from ducts
- **B** = CO_2 output
- **No sign** = Analog output 4…20mA
  V = Analog output 0…10Vdc

Order codes for CO_2 and temperature transmitters

HD37 X 7B T. X X

- **No sign** = Range CO_2 0…2000ppm.
  1 = Range CO_2 0…5000ppm.
- **V** = Wall mounted
  0.1 = 120mm air inlet from ducts
  0.2 = 320mm air inlet from ducts
- **B** = CO_2 output
  7 = Temperature output
- **No sign** = Analog output 4…20mA
  V = Analog output 0…10Vdc

HD 45…
HD 46…

HD45… AND HD46… SERIES
TRANSMITTERS AND REGULATORS FOR HUMIDITY, TEMPERATURE AND CO_2

The instruments of the series **HD45** and **HD46** are transmitters, indicators and regulators, to measure and control, depending on the model, the following environmental parameters:

- Relative humidity (RH)
- Ambient temperature (T)
- Carbon dioxide (CO_2)
- Dew point temperature (DP, calculated measurement)

They are suitable for monitoring indoor air quality.
Typical applications are a review of air quality in all buildings where there are crowds of people (schools, hospitals, auditoriums, workplaces, cafeterias, etc.). This analysis allows you to adjust the air conditioning (temperature and humidity) and ventilation (air change per hour) to achieve a double objective: to achieve good air quality in accordance with ASHRAE standards and current IMC, and energy savings.
The measurement of RH (Relative Humidity) is obtained with a capacitive sensor. In models **HD46** ... the relative humidity and temperature sensor with their calibration data are contained within an easily replaceable module. The instrument can also calculate the information on the dew point.
The temperature T is measured with a high precision NTC sensor.
The measurement of CO_2 (carbon dioxide) is obtained with a special infrared sensor (**NDIR** technology: Non-Dispersive Infrared Technology), which, by using a double filter and a particular measurement technique, ensures accurate measurements and stable measurements over time. The presence of a protective membrane, which is spread through the air portion, protects the sensor from dust and weather. The instrument can be wall mounted and sensors are internal to the instrument.
The instruments are factory calibrated and require no further adjustment by the installer.
Versions are available with **analog voltage output 0÷10V** or connectable to a PC via **RS485** with **MODBUS RTU** protocol, which allows connection of multiple transmitters on the same network.

The versions with **relay** allow to monitor the environmental parameters measured when exceeding the threshold set by the user. The activation of the control is highlighted by the LED indicators (only on models HD46 ... R). The operation of the relay is very versatile, having modes of activation above and below the threshold, and single or double threshold modes. The thresholds are configurable by the user throughout the whole measurement range.
The LCD display option allows simultaneus viewing of all values measured by the instrument.
The model **HD45 BVR** is distinguished by the ability to indicate an immediate level of air quality, through ignition of the LED indicators associated with graphic symbols.
All the functions of the instrument can be configured quickly and intuitively through a PC.
The instruments are easy to use and yet have a complete configuration possibilities, that makes them versatile and able to meet many needs in various application fields. The instruments are supplied with a standard configuration that makes them immediately operational. Upon request, the devices can be supplied with custom configurations.
Models of the series **HD46** can be equipped with keyboard that allows you to easily configure the instrument even without a PC connection. The models having a keypad are fitted with backlit display, activated by the touch of a button.
Models of the series **HD45** ... provided with relay have a switch hardware that allows quick selection of the threshold between a set of preset values.
All models carry the "logging" of continuous measures, and data can be transferred to the PC.
The instruments work with 24Vac or 15…35Vdc power supply.

Technical data
Characteristics of the sensors

Relative humidity RH *(for models HD45 17…, HD46 17… and HD46 17B…)*	
Sensor	Capacitive
Measuring range	5...98 % RH -40…+85°C Dew point Td
Working range of the sensor	-40...+80°C
Accuracy	±2% (10..90%RH) @ 20°C, ±2.5% in the remaining range. For Dew point, see table
Resolution	0,1%
Temperature dependance	2% on the whole temperature range
Hysteresis and repeatability	1%RH
Response time (T_{90})	<20 sec. (air speed = 2m/sec and stable temperature)
Long-term stability	1%/year

Temperature T *(for models HD45 17…, HD45 7B…, HD46 17… and HD46 17B…)*	
Sensor type	NTC 10KΩ
Measuring range	-30...+85°C (-22…+185°F)
Accuracy	±0.2°C ±0.15% of the measured value within 0…70°C ±0.3°C ±0.15% of the measured value within -30…0°C and 70…85°C
Resolution	0,1°C
Response time (T_{90})	<30 sec. (air speed = 2m/sec)
Long-term stability	0.1°C/year

Carbon dioxide CO_2 *(for models HD45 7B…, HD45 B…and HD46 17B…)*	
Sensor	Dual wavelength NDIR
Measuring range	0…5000 ppm
Working range of the sensor	-5…50°C
Accuracy	±(50ppm+3% of the measured value) @ 20°C and 1013hPa
Resolution	1ppm
Temperature dependance	0,1%f.s./°C
Response time (T_{90})	<120 sec. (air speed = 2m/sec and stable temperature)
Long-term stability	5% of the measured value /5years

Accuracy of the dew point Td (°C)

The dew point is a calculated quantity that depends on the accuracy of the calibration of relative humidity and temperature. The values given below refer to accuracy of ±0.25°C, 1013.25mbar, ± 2.5% RH.

Temperature (°C)	Relative humidity(%)					
	10	**30**	**50**	**70**	**90**	**100**
-20	2.50	1.00	0.71	0.58	--	--
0	2.84	1.11	0.78	0.64	0.56	0.50
20	3.34	1.32	0.92	0.75	0.64	0.62
50	4.16	1.64	1.12	0.90	0.77	0.74
100	5.28	2.07	1.42	1.13	0.97	0.91

Characteristics of the instrument

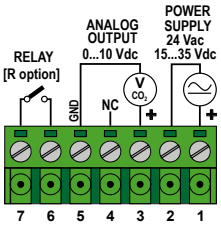
Measuring frequency	1 sample every 3 seconds
Storage capacity	2304 records
Storage interval	Selectable within 30s, 1m, and 5m The stored values represent the average values of samples collected every 3 seconds in selected storage interval.
Serial output	Serial output for USB (mini-USB/USB cable with adapter cod. RS45 or RS45I) RS485 MODBUS-RTU (only HD45…S… and HD46…S…)
Safety of stored data	Unlimited
Analogue output	0…10Vdc (R_L > 10kΩ) *(only HD45…V…and HD46…V)* 11Vdc outside the measuring range
Relay output	Two-state *(only HD45…R and HD46…R)* Contact: max 1A @ 30Vdc resistive load
Power supply	24Vac ± 10% (50…60Hz) or 15…35Vdc
Power consumption	100 mW
Stabilising time	15 minutes (to guarantee the declared accuracy)
Working temperature of the instrument	0°C ... 50°C
Working humidity of the instrument	5%RH ... 90%RH no condensate
Dimensions (LxHxW)	80 x 80 x 30 mm *(HD45.17…)* 80 x 80 x 34 mm *(HD45.B… and HD45.7B…)* 120 x 80 x 30 mm *(HD46.17…)* 120 x 80 x 34 mm *(HD46.17B…)*
Housing material	ABS

Installation

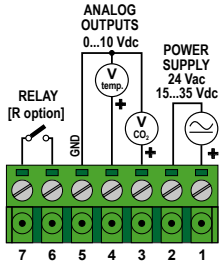
The container is easy and quick to open. Simply press the two tabs of the container to remove the front panel and have immediately available the terminal block connections and fixing holes.

Electrical connections

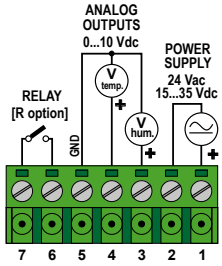
Series HD45...



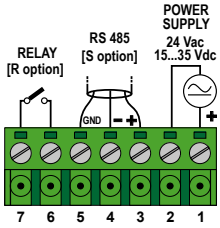
HD45 B...V
HD45 B...VR



HD45 7B...V
HD45 7B...VR

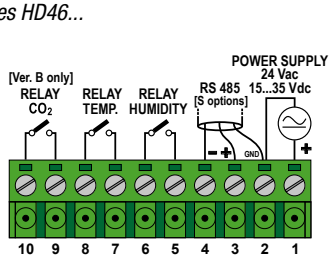


HD45 17...V
HD45 17...VR

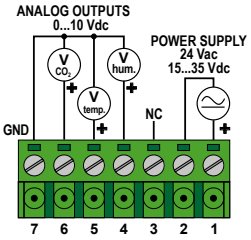


HD45...R
HD45...S
HD45...SR

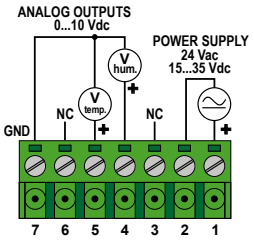
Series HD46...



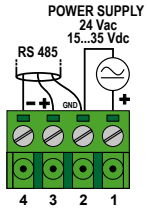
HD46...R
HD46...SR



HD46 17B...V



HD46 17...V



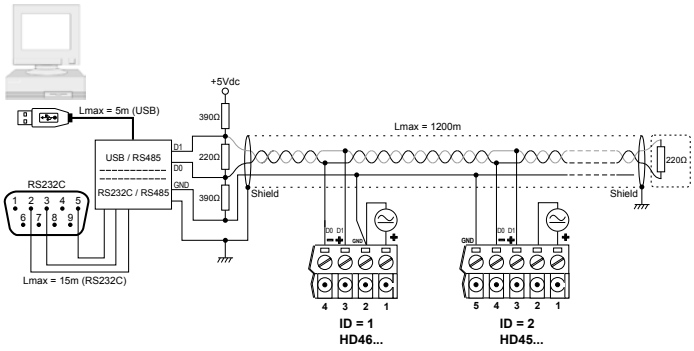
HD46...S

Configuration

The instruments are equipped with serial output easily accessible on the side of the instrument that allows you to connect to the USB port of your PC via the cable **RS45** or **RS45I** with built-in adapter, for custom configurations. With the **RS45** cable the instrument is powered directly from the USB port of your PC, thus allowing the configuration of the instrument in the field using a laptop before installing fixed.

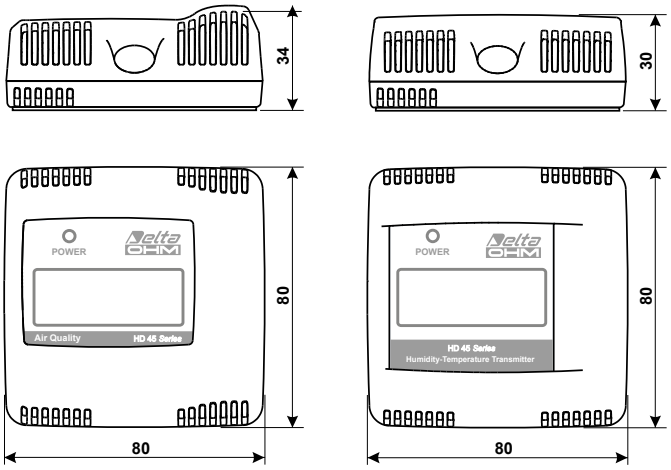
RS485 Connection

Models with RS485 output function using the **MODBUS RTU** protocol.
For PC connection, insert a converter RS232C/RS485 or USB/RS485.



Dimensions of the housing
All dimensions are expressed in mm.

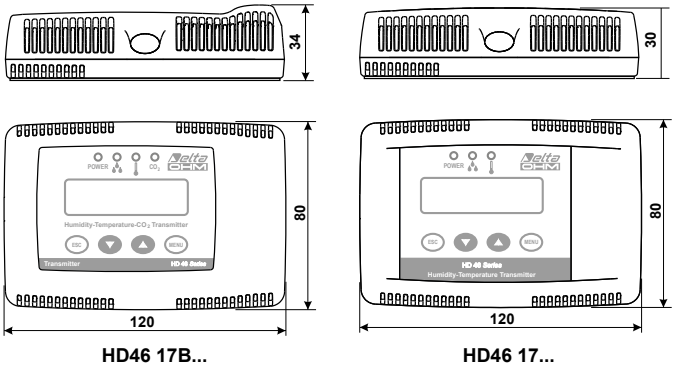
Series HD45...



HD45 B...
HD45 7B...

HD45 17...

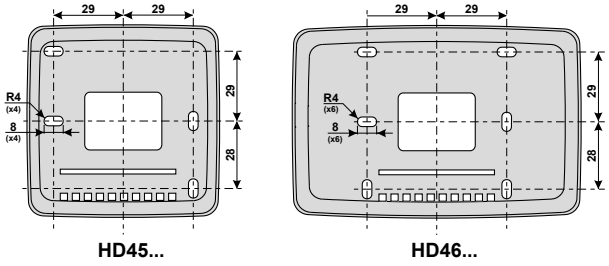
Series HD46...



HD46 17B...

HD46 17...

Fixing holes



HD45...

HD46...

ORDERING CODES

HD45 ☐☐☐

AVAILABLE OPTIONS

V = Analog output 0÷10Vdc
S = RS485 output
R = Relay output
VR = Analog output 0÷10Vdc + relay
SR = RS485 + relay
It is not possible to have the analogue output when you have the RS485, and vice versa.

D = With display
No character = without display

Sensors
17 = Relative humidity + temperature
7B = Temperature + CO_2
B = CO_2

HD46 ☐☐☐

AVAILABLE OPTIONS

V = Analogue outputs 0÷10Vdc
S = Output RS485
R = Relay output
SR = RS485 output + relay outputs
It is not possible to have the analogue output when you have the RS485, and vice versa.
Option V includes one analogue output for each measured quantity.
Options R and SR include one analogue output for each measured quantity.

D = With display
DT = With display and keyboard
No character = Without display and without keyboard
Option DT is available only together with option R or SR.

Sensors
17 = Humidity + temperature
17B = Humidity, temperature +CO_2

Available models
The instruments are available in the following versions:

HD45 17...	Humidity and temperature
HD45 7B...	Temperature and CO_2
HD45 B...	CO_2
HD46 17B...	Humidity, temperature, and CO_2
HD46 17...	Humidity and temperature

Optionally you can have the option with analog output 0 ... 10Vdc for each quantity measured by the instrument (option **V**), or RS485 serial output (option **S**). There are no models with both types of output.
There is the option with only relay (option **R**). In models **HD46 ...** there is one relay for each quantity measured by the instrument. In models **HD45** ... there is one relay that can be associated with one of the quantities measured by the instrument
It is possible to have the relay output (or the outputs) together with serial output RS485 (option **SR**).
The output relay with analog output (option **VR**) is only available in models HD45. All models can be supplied with LCD (option **D**).
In the series **HD46** ..., versions with relay outputs are available with display and keyboard (option **DT**)

The following table lists the available models:

Model	RH	T	CO_2	Analog output	RS485 output	Relay output	LCD	LED
HD45 17V	✓	✓		✓ (2 outputs)				Power
HD45 17S	✓	✓			✓			Power
HD45 17R	✓	✓				✓ (1 output)		Power
HD45 17SR	✓	✓			✓	✓ (1 output)		Power
HD45 17VR	✓	✓		✓ (2 outputs)		✓ (1 output)		Power
HD45 17DV	✓	✓		✓ (2 outputs)			✓	Power
HD45 17DS	✓	✓			✓		✓	Power
HD45 17DR	✓	✓				✓ (1 output)	✓	Power
HD45 17DSR	✓	✓			✓	✓ (1 output)	✓	Power
HD45 17DVR	✓	✓		✓ (2 outputs)		✓ (1 output)	✓	Power
HD45 7BV		✓	✓	✓ (2 outputs)				Power
HD45 7BS		✓	✓		✓			Power
HD45 7BR		✓	✓			✓ (1 output)		Power
HD45 7BSR		✓	✓		✓	✓ (1 output)		Power
HD45 7BVR		✓	✓	✓ (2 outputs)		✓ (1 output)		Power
HD45 7BDV		✓	✓	✓ (2 outputs)			✓	Power
HD45 7BDS		✓	✓		✓		✓	Power
HD45 7BDR		✓	✓			✓ (1 output)	✓	Power
HD45 7BDSR		✓	✓		✓	✓ (1 output)	✓	Power
HD45 7BDVR		✓	✓	✓ (2 outputs)		✓ (1 output)	✓	Power
HD45 BV			✓	✓ (1 output)				Power
HD45 BS			✓		✓			Power
HD45 BR			✓			✓ (1 output)		Power
HD45 BSR			✓		✓	✓ (1 output)		Power
HD45 BVR			✓	✓ (1 output)		✓ (1 output)		**4 LED CO_2 level**
HD45 BDV			✓	✓ (1 output)			✓	Power
HD45 BDS			✓		✓		✓	Power
HD45 BDR			✓			✓ (1 output)	✓	Power
HD45 BDSR			✓		✓	✓ (1 output)	✓	Power
HD45 BDVR			✓	✓ (1 output)		✓ (1 output)	✓	Power

Model	RH	T	CO_2	Analog output	RS485 output	Relay output	LCD keyboard	LED
HD46 17V	✓	✓		✓ (2 outputs)				Power
HD46 17S	✓	✓			✓			Power
HD46 17R	✓	✓				✓ (2 outputs)		Power RH + T
HD46 17SR	✓	✓			✓	✓ (2 outputs)		Power RH + T
HD46 17DV	✓	✓		✓ (2 outputs)			only LCD	Power
HD46 17DS	✓	✓			✓		only LCD	Power
HD46 17DTR	✓	✓				✓ (2 outputs)	✓	Power RH + T
HD46 17DTSR	✓	✓			✓	✓ (2 outputs	✓	Power RH+ T
HD46 17BV	✓	✓	✓	✓ (3 outputs)				Power
HD46 17BS	✓	✓	✓		✓			Power
HD46 17BR	✓	✓	✓			✓ (3 outputs)		Power RH+T+ CO_2
HD46 17BSR	✓	✓	✓		✓	✓ (3 outputs		Power RH +T+ CO_2
HD46 17BDV	✓	✓	✓	✓ (3 outputs)			only LCD	Power
HD46 17BDS	✓	✓	✓		✓		only LCD	Power
HD46 17BDTR	✓	✓	✓			✓ (3 outputs)	✓	Power RH +T+ CO_2
HD46 17BDTSR	✓	✓	✓		✓	✓ (3 outputs)	✓	Power RH +T+ CO_2

Examples of ordering codes

HD45 7BDVR: Transmitter, indicator and regulator for temperature and CO_2. Two analogue outputs 0 ÷ 10V, one configurable relay to control temperature or CO_2.

HD45 BVR: Transmitter, indicator and regulator for CO_2. Without display, with LED indicators of the CO_2 level, with analogue output 0 ÷ 10V, with relay.

HD45 17VR: Transmitter and regulator for humidity and temperature. Without display, with two analogue outputs 0 ÷ 10V, one configurable relay to control the humidity or temperature.

HD45 17DV: Transmitter and indicator for humidity and temperature. With display, two analogue outputs 0 ÷ 10V, without relay.

HD45 7BSR: Transmitter and regulator for temperature and CO_2. Without display, with RS485 output, no analogue output, with one configurable relay to control temperature or CO_2.

HD46 17BDV: Transmitter and indicator for humidity, temperature and CO_2. With display, without keyboard, with three analogue outputs 0 ÷ 10V, without relays and without RS485.

HD46 17BDTSR: Transmitter, indicator and regulator for humidity, temperature and CO_2. Display and keyboard, three relay outputs, RS485 output.

HD46 17S: Humidity and temperature transmitter. No display and no keyboard, no relays, with RS485 output.

Accessories

DeltaLog14.: Software for connecting to the PC via the serial output, for the configuration of the instrument and data download. For operating systems from Windows® 98 to Windows Vista®.

HDM46: Calibrated humidity and temperature replacement module (only for models HD46…)

RS45: Not isolated serial connection cable with built-in adapter. USB connector for PC and mini-USB connector for the serial port of the instrument. The cable powers the instrument.

RS45I: Isolated serial connection cable with built-in adapter. USB connector for PC and mini-USB connector for the serial port of the instrument. The cable does not power the instrument.

HD45TCAL: The Kit includes the **RS45** cable with built-in adapter and the CD-ROM with the **DeltaLog14** software for Windows operating systems. The cable is provided with USB connector on the PC side and mini-USB connector for the serial port of the instrument.

HD45TCALI: The Kit includes the **RS45I** cable with built-in adapter and the CD-ROM with the **DeltaLog14** software for Windows operating systems. The cable is provided with USB connector on the PC side and mini-USB connector for the serial port of the instrument.

HDM46

Multifunction

- DO 9847
Portable Multifunction Data-logger for Temperature, Humidity, Pressure, Air speed, Light

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The qualitative level of our instruments is the result of a continuous evolving of the product itself. This way bring to slight differences between what reported on this manual and the instruments you bought. We can not completely exclude the presence of errors for which we apologise. Data, images and descriptions included in this catalogue can not be enforced legally. We reserve the right to perform any modification and correction at any time without notice.

DO 9847
PORTABLE MULTIFUNCTION DATA-LOGGER INSTRUMENT

Is a multifunctional handheld board instrument and datalogger.
It is provided with a 128x64 pixel (56x38 mm) graphic display and three independent inputs. Each input can be connected to one channel or two channel dual probes (ex. two thermocouples, relative humidity/temperature, etc.).
The instrument automatically recognises SICRAM probes connected to the input (memory equipped and configurable intelligent probe).
Functions: watch, hold, max., min., average, record, immediate or deferred start record logging, difference between the two inputs, relative measures, three input channel measurement and inside reference temperature display.
Sampling time: one per second/input.
Probe calibration through SICRAM module; calibration data permanent storage inside the probe.
Storage capacity: 32.000 readings per input.
Storage interval and printing can be configured between one second and 1 hour.
RS232C serial output: from 300 up to 115.200 baud rate.
Immediate or deferred print-out.
Stored data can be displayed and stored data blocks can be deleted.
Automatic shutout after 8 minutes can be disabled.

Units of measurement can be selected according to the physical quantity of the connected probe.
Firmware update through RS232C serial port. Different types of SICRAM modules or probes can be connected to the input: Platinum sensor temperature, thermocouple, relative humidity/temperature, Discomfort index, continuous voltage (±20V), current (0…24mA), pressure, air speed and light.

TECHNICAL DATA OF THE INSTRUMENT DO9847

- Power supply:
  Battery: 4 1.5V AA alkaline batteries; operating time with high quality batteries: about 60 hours.
  Mains: through 9Vdc, 250mA external power supply, 2 pole connector.
- Operating conditions:
  Working temperature: -10...+50°C. Storage temperature: -25...+65°C.
  Relative Humidity: 0...90%R.H., not condensating.
- LCD display: 128x64 pixel (56x38 mm) graphic LCD.
- Keyboard: 18 multifuction Keys and 3 function keys.
- Recorded data safety: independently from batteries charging conditions.
- Measured values storage: on 16 files divided into 16-sample pages.
- Quantity: 32.000 samples per input channel.
- Storage interval: 1 s...1 h. Time and date, real time.
  Accuracy: 1 minute/month maximum error margin.
- Serial interface:
  RS232C type galvanically insulated — SUB D 9 male connector.
  Baud rate: 300...115.200 baud. — Data bit: 8.
  Parity: none. — Stop bit: 1.
  Flow control: Xon/Xoff. — RS232C cable max.length: 15 m.
- immediate printing interval: 1 s...1 h.
- Firmware can be updated through PC using the instrument serial port.
- Probes connections: n° 3 DIN45326 8 pole connectors
- Dimensions and weight: 245x100x50 mm - 300 gr.
- Case: ABS - Protection: rubber.

DO 9847 - CHARACTERISTICS OF THE SICRAM MODULES
When the instrument is used together with the available SICRAM modules, its accuracy and resolution are stated in the section where these modules are described.

SICRAM MODULES FOR DO 9847

TP471 Temperature measure through PRT Platinum sensor

PRT resistance values @ 0°C	25Ω, 100Ω, 500Ω
temperature range Pt25, Pt100	-200°C … +850°C
temperature range Pt500	-200°C … +500°C
Accuracy with Pt25, Pt100 sensor	±0.03°C up to 350°C
	±0.3°C up to 850°C
Accuracy with Pt500 sensor	±0.5°C up to 500°C
Resolution	0.01°C from -200°C to 350°C
	0.1°C from 350°C to 800°C
Temperature drift @20°C	0.002%/°C
Excitation current	400µA impulse, length=100ms,

time=1sTemperature measure for thermocouple with cold joint (inside ice at 0°C)

TP471D0 Temperature measure for 1 input thermocouple

TP471D1 Temperature measure for 2 input thermocouple

VP472 module to connect pyranometers or albedometers. The measurements produced during the time by a pyranometer or an albedometer can be taken, verified and stored. The signal produced by the thermopile can be read in mV or in W/m^2, the net radiation of the albedometer is read in W/m^2. The thermopile sensitivity can be set from 5000 to 30000nV/(Wm^{-2}) that is between 5 and 30µV/(Wm^{-2}).

VP473 module for reading the continuous voltage. When connected to the output of a transmitter with voltage signal it can read and take the relevant value. Measuring range: ±20Vdc. Input impedance: 1MΩ.

IP472 module for mA reading of continuous current. When connected to the output of a trasmitter with current signal, it can read and take the relevant value. Measuring range: 0…24mA. Input impedance: 25Ω.

PP471 module for measuring absolute, relative and differential pressure. It can be connected with pressure probes andseries. It measure the instantaneous value and peak value of pressure. The module is complete with 2m cable and DIN 45326 8 pole female connector.

Accuracy: ±0.05% of full scale	Peak time ≥ 5ms
Peak accuracy: ±0.5% f.s.	Peak dead band ≤ 2% f.s.

PROBES AND MODULES TECHNICAL DATA EQUIPPED WITH INSTRUMENT

Temperature probes Pt100 sensor using SICRAM module

Model	Type	Application range	Accuracy
TP472I	Immersion	-196°C…+500°C	±0.25°C (-196°C…+350°C) ±0.4°C (+350°C…+500°C)
TP472I.0	Immersion	-50°C…+400°C	±0.25°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP473P	Penetration	-50°C…+400°C	±0.25°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP473P.0	Penetration	-50°C…+400°C	±0.25°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP474C	Contact	-50°C…+400°C	±0.3°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP474C.0	Contact	-50°C…+400°C	±0.3°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP475A.0	Air	-50°C…+250°C	±0.3°C (-50°C…+250°C)
TP472I.5	Immersion	-50°C…+400°C	±0.3°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP472I.10	Immersion	-50°C…+400°C	±0.30°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP49A	Immersion	-70°C…+400°C	±0.25°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP49AC	Contact	-70°C…+400°C	±0.25°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP49AP	Penetration	-70°C…+400°C	±0.25°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP875	Globe thermometer Ø 150mm	-30°C…+120°C	±0.25°C
TP876	Globe thermometer Ø 150mm	-30°C…+120°C	±0.25°C
TP87	Immersion	-50°C…+200°C	±0.25°C
TP878 TP878.1	For solar panel	+5°C…+80°C	±0.25°C
TP879	For compost	-20°C…+120°C	±0.25°C

Common characteristics

Temperature drift @ 20°C 0.003%/°C

4 wire Pt100 and 2 wire Pt1000 Probes

Model	Type	Application range	Accuracy
TP47.100	Pt100 4 wires	-50…+400°C	Classe A
TP47.1000	Pt1000 2 wires	-50…+400°C	Classe A

Common characteristics

Temperature drift @ 20°C

Pt100	0.003%/°C
Pt1000	0.005%/°C

UNCERTAINTY AND RESOLUTION OF THE INSTRUMENT IN MEASURING WITH THERMOCOUPLES

Temperature measurement of the instrument

Measuring range Tc: K	-200…+1370°C
Measuring range Tc: J	-100…+750°C
Measuring range Tc: T	-200…+400°C
Measuring range Tc: N	-200…+1300°C
Measuring range Tc: R	+200…+1480°C
Measuring range Tc: S	+200…+1480°C
Measuring range Tc: B	+200…+1800°C
Measuring range Tc: E	-200…+750°C

Resolution	**0.05°C up to 199.95°C**
	0.1°C from 200.0°C to end scale

Instrument accuracy

Thermocouple K	±0.1°C up to 600°C
	±0.2°C above 600°C
Thermocouple J	±0.05°C up to 400°C
	±0.1°C above 400°C
Thermocouple T	±0.1°C
Thermocouple N	±0.1°C up to 600°C
	±0.2°C above 600°C
Thermocouple R	±0.25°C
Thermocouple S	±0.3°C
Thermocouple B	±0.35°C
Thermocouple E	±0.1°C up to 300°C
	±0.15°C above 300°C

Accuracy is referred to the instrument only, error due to the thermocouple or to the cold junction reference sensor is not included.

Temperature drift @20°C	0.02%/°C
Drift after 1 year	0.1°C/year

Type K Thermocouple probes

Accuracy of the thermocouple probes

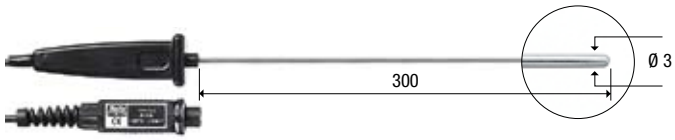
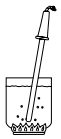
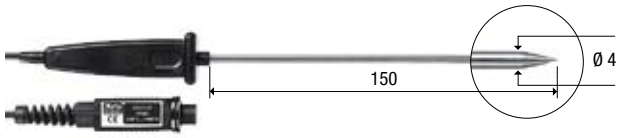
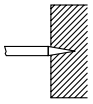
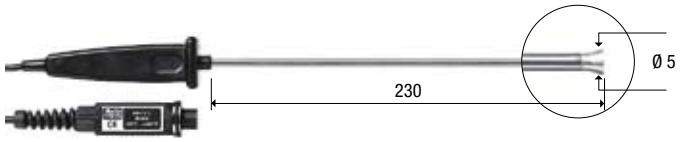
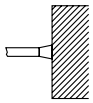
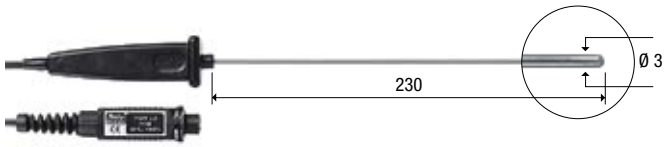
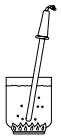
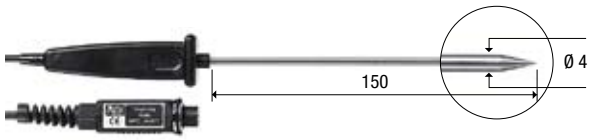
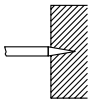
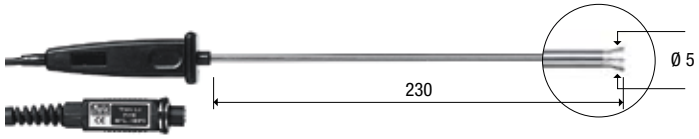
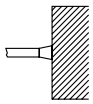
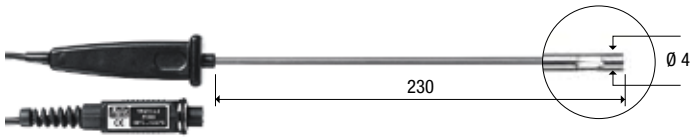
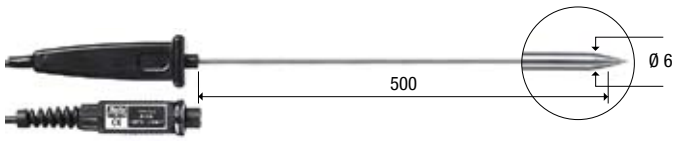
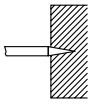
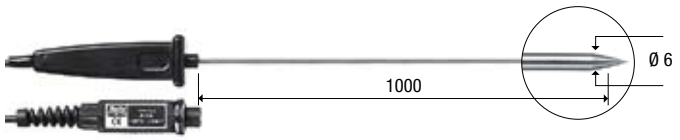
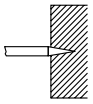
The tolerance of a type of thermocouple corresponds to the maximum acceptable departure from the e.m.f. of any thermocouple of that type, with reference junction at 0°C. The tolerance is expressed in degrees Celsius, preceded by the sign. The percentage tolerance is given by the ratio between the tolerance expressed in degrees Celsius and the measurement junction temperature, multiplied by one hundred.

Tolerance classes for thermocouples (reference junction at 0°C)

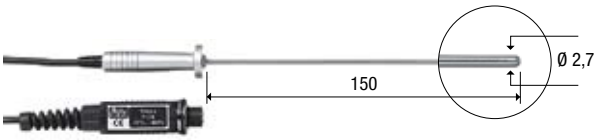
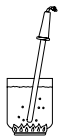
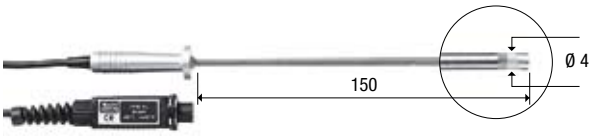
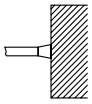
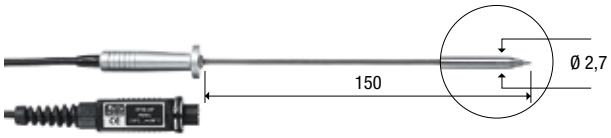
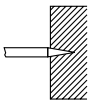
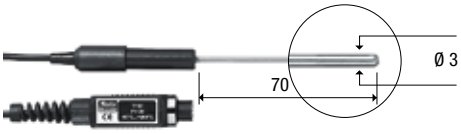
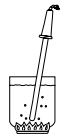
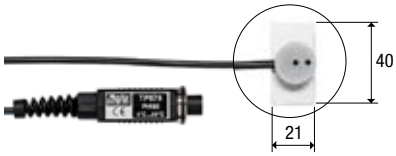
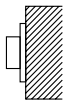
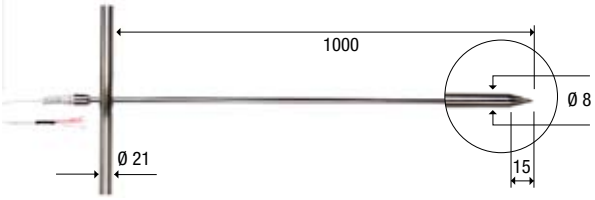
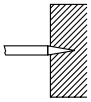
Type of Thermocouple	Tolerance Class 1	Tolerance Class 2	Tolerance Class 3 [1]
T Type	from -40 to +125°C	from -40 to +133°C	from -67 to +40°C
Temperature interval Tolerance	± 0.5°C	± 1°C	± 1°C
Temperature interval Tolerance	from 125 to 350°C	from 133 to 350°C	from -200 to -67°C
	± 0.004 · ltr	± 0.0075 · ltr	± 0.015 · ltr
E Type	from -40 to +375°C	from -40 to +333°C	from -167 to +40°C
Temperature interval Tolerance	± 1.5°C	± 2.5°C	± 2.5°C
Temperature interval Tolerance	from 375 to 800°C	from 333 to 900°C	from -200 to -167°C
	± 0.004 · ltr	± 0.0075 · ltr	± 0.015 · ltr
J Type	from -40 to +375°C	from -40 to +333°C	-
Temperature interval Tolerance	± 1.5°C	± 2.5°C	-
Temperature interval Tolerance	from 375 to 750°C	from 333 to 750°C	-
	± 0.004 · ltr	± 0.0075 · ltr	-
K Type, N Type	from -40 to +375°C	from 40 to +333°C	from -167 to +40°C
Temperature interval Tolerance	± 1.5°C	± 2.5°C	± 2.5°C
Temperature interval Tolerance	from 375 to 1000°C	from 333 to 1200°C	from -200 to -167°C
	± 0.004 · ltr	± 0.0075 · ltr	± 0.015 · ltr
R Type, S Type	from 0 to +1100°C	from 0 to +600°C	-
Temperature interval Tolerance	± 1°C	± 1.5°C	-
Temperature interval Tolerance	from 1100 to 1600°C	from 600 to 1600°C	-
	± [1 + 0.003 (t-1 100)] °C	± 0.0025 · ltr	-
B Type	-	-	from +600 to +800C
Temperature interval Tolerance	-	-	+ 4°C
Temperature interval Tolerance	-	from 600 to 1700 °C	from 800 to 1700°C
	-	± 0.0025 · ltr	± 0.005 · ltr

[1] The materials used for thermocouples are generally supplied so to comply with the production tolerances specified in the table for temperatures over -40°C. Nevertheless, these materials may not comply with the production tolerances for low temperatures reported under Class 3, for T, E, K and N thermocouples when the thermocouples have to comply at the same time with the limits of Class 3 and those of Class 1 and/or Class 2.

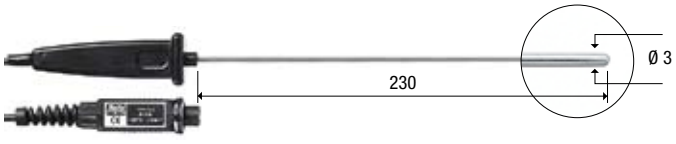
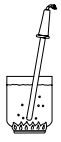
PT100 PROBES WITH SICRAM MODULE FOR PORTABLE INSTRUMENTS

CODE	°C max	τ s	DIMENSIONS	USE
TP 472 I	-196 +500	3s		
TP 473 P	-50 +400	5s		
TP 474 C	-50 +400	5s		
TP 472 I.0	-50 +400	3s		
TP 473 P.0	-50 +400	5s		
TP 474 C.0	-50 +400	5s		
TP 475 A.0	-50 +250	12s		
TP 472 I.5	-50 +400	3s		
TP 472 I.10	-50 +400	3s		

PT100 PROBES WITH SICRAM MODULE FOR PORTABLE INSTRUMENTS

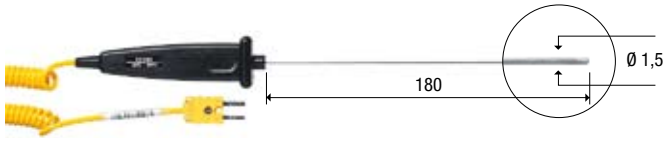
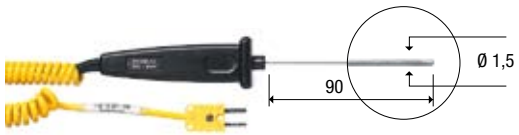
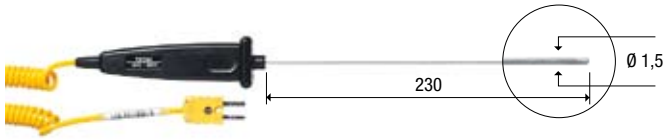
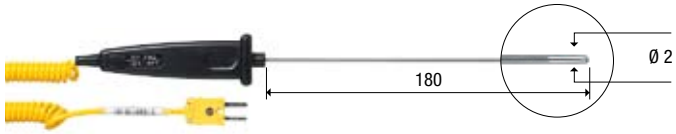
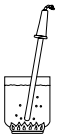
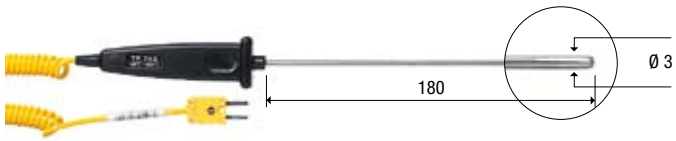
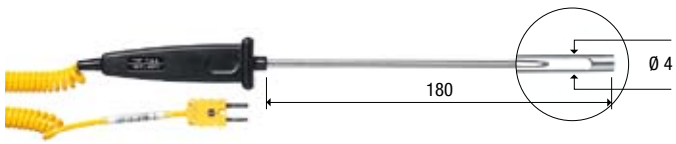
CODE	°C max	τ s	DIMENSIONS	USE
TP 49 A	-70 +400	3,5s		
TP 49 AC	-70 +400	5,5s		
TP 49 AP	-70 +400	4s		
TP 87	-50 +200	3s		
TP 878	+5 +80	60s	Contact probe for solar panels. Cable L = 2m.	
TP 878.1	+5 +80	60s	Contact probe for solar panels. Cable L = 5m.	
TP879	-20 +120	60s	Penetration probe for compost. Cable L = 2m	 
TP 875	-30 +120	15s	Globe-thermometer probe for measuring radiant heat ø150 mm. (ISO7243, ISO7726). 4 wires Pt100 Sensor cable L=2m. **Equipped with SICRAM module.**	
TP 876	-30 +120	15s	Globe-thermometer probe for measuring radiant heat ø50 mm. (ISO7243, ISO7726). 4 wires Pt100 Sensor cable L=2m. **Equipped with SICRAM module.**	

SONDE SENSORE Pt100 / Pt1000 CON MODULO TP 47

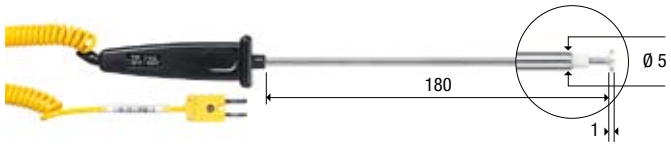
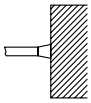
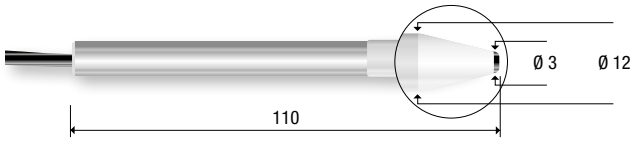
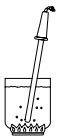
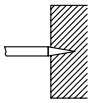
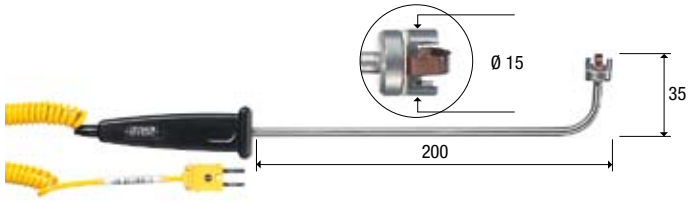
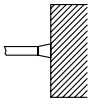
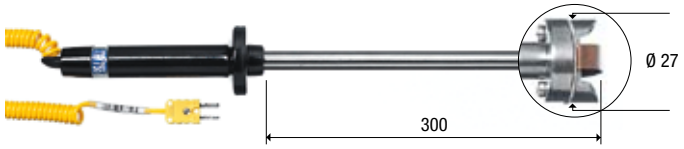
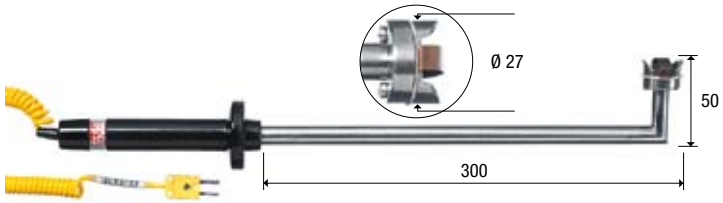
CODE	°C max	τ s	DIMENSIONS	USE
TP 47.100 (Pt100) **TP 47.1000 (Pt1000)**	-50 +400	3s		
TP 47	Only connector for connection of probes without SICRAM module: direct 3 and 4 wires Pt100, 2 wires Pt1000.			

THERMOCOUPLE PROBES FOR PORTABLE INSTRUMENTS

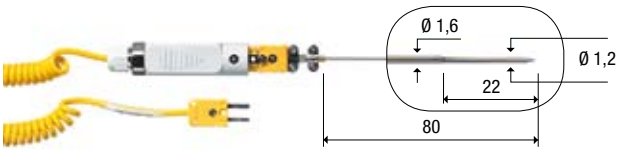
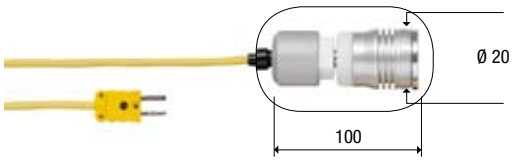
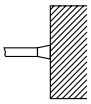
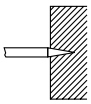
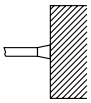
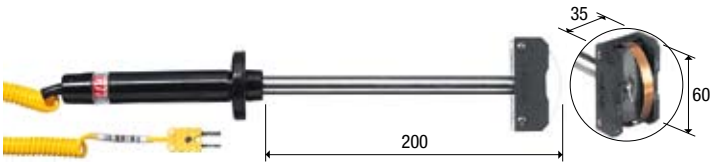
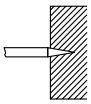
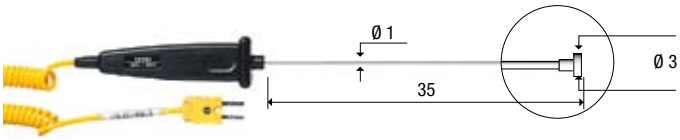
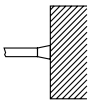
THERMOCOUPLE K TYPE PROBES (CHROMEL - ALUMEL)

CODE	°C max	τ s	DIMENSIONS	USE
TP 741	800	2s		
TP 741/1	400	2s		
TP 741/2	800	2s		
TP 742	800	2s		
TP 742/1	400	2s		
TP 742/2	800	2s		
TP 743	800	3s		
TP 744	400	4s		

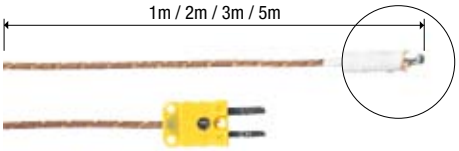
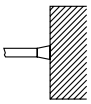
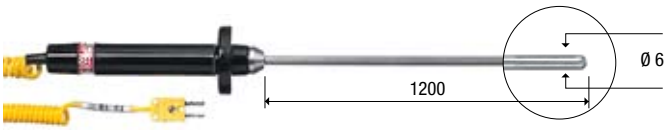
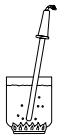
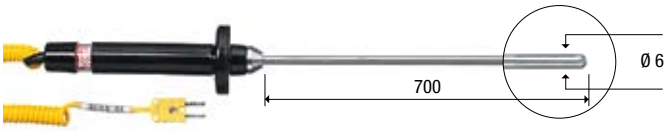
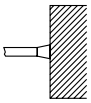
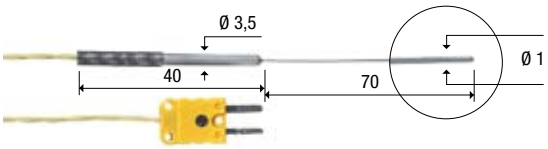
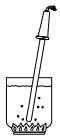
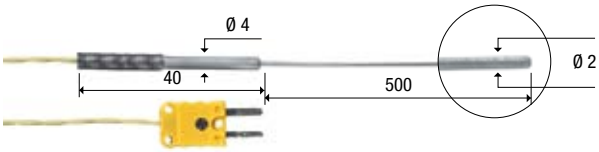
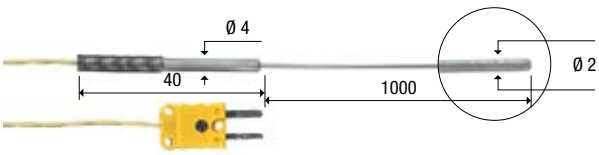
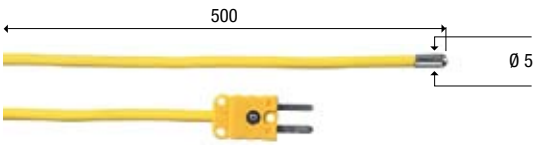
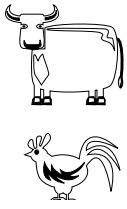
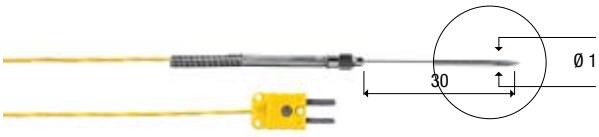
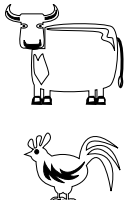
THERMOCOUPLE K TYPE PROBES (CHROMEL - ALUMEL)

CODE	°C max	τ s	DIMENSIONS	USE
TP 745	500	5s		
TP 746	250	2s		
TP 750	1000	3s		
TP 750.0	800	3s		
TP 751	200	2s		
TP 754	500	2s		
TP 754/9	500	2s		
TP 755	800	2s		
TP 755/9	800	2s		

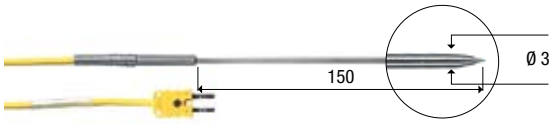
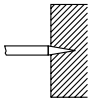
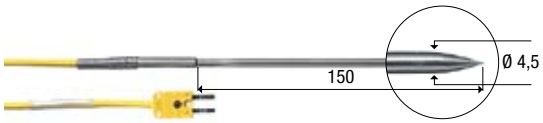
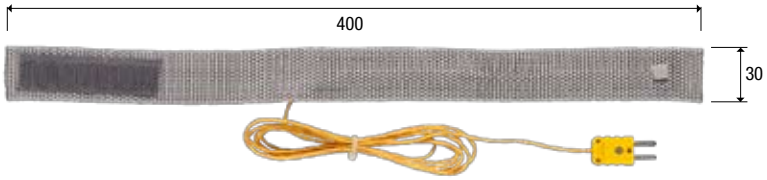
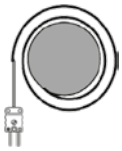
THERMOCOUPLE K TYPE PROBES (CHROMEL - ALUMEL)

CODE	°C max	τ s	DIMENSIONS	USE
TP 756	200	2s		
TP 757	180	30s	MAGNETIC PROBE FOR CONTACT MEASURE ON MAGNETIC METALLIC SURFACES 	
TP 758	400	4s		
TP 758.1	400	4s		
TP 772	400	3s		
TP 774	250	2s		
TP 776	200	2s		
TP 777	200	3s		

THERMOCOUPLE K TYPE PROBES (CHROMEL - ALUMEL)

CODE	°C max	τ s	DIMENSIONS	USE
TP 647	300	2s	SIT calibration up to 300°C. 	
TP 647/2	300	2s		
TP 647/3	300	2s		
TP 647/5	300	2s		
TP 651	1200	6s		
TP 652	1200	6s		
TP 655	180	2s		
TP 656	200	1s		
TP 656/1	1000	1s		
TP 656/2	1000	1s		
TP 657/1	100	5s		
TP 658	100	2s		

THERMOCOUPLE K TYPE PROBES (CHROMEL - ALUMEL)

CODE	°C max	τ s	DIMENSIONS	USE
TP 659	400	3s		
TP 660	400	4s		
TP 661	-60 +50	30s		
TP 662	110	120s	PROBE WITH VELCRO TAPE FOR MEASURES ON PIPES MAX 110 DIAM. 	
CM **CS**	"K" "K"			
PW	"K"			

Response time for a 63% variation ($\tau_{0.63}$)

The response time τ **s** is the reaction time of the sensor to a temperature variation, with a signal variation when measuring that corresponds to a given percentage (63%) of the variation.
Response time is referred:

For immersion probes in water at 100°C
For surface probes in contact with metals surface at 200°C
For air probe at an air temperature of 100°C

Temperature and relative humidity probes with SICRAM module

Model	Temperature sensor	Campo d'impiego		Accuracy	
		%RH	Temperature	%RH	Temp
HP472ACR	Pt100	0…100%RH	-20°C…+80°C	±2%RH (5…90%RH) ±2,5%RH (remaining range)	±0.3°C
HP572ACR	Thermocouple K	0…100%RH	-20°C…+80°C		±0.5°C
HP473ACR	Pt100	0…100%RH	-20°C…+80°C		±0.3°C
HP474ACR	Pt100	0…100%RH	-40°C…+150°C	-40°C…150°C (180°C) ±(1,5+0,02 times the displayed value)	±0.3°C
HP475ACR	Pt100	0…100%RH	-40°C…+150°C		±0.3°C
HP475AC1R	Pt100	0…100%RH	-40°C…+150°C		±0.3°C
HP477DCR	Pt100	0…100%RH	-40°C…+150°C		±0.3°C
HP478ACR	Pt100	0…100%RH	-40°C…+150°C		±0.3°C

Common characteristics

Relative Humidity

Sensor	Capacitive
Typical capacity @30%RH	300pF
Probe temperature working range	-40°C…+150°C
Working range	0 … 100%RH
Accuracy	±1,5%RH (5…90%RH), ±2,5 remaining range
Resolution	0.1%RH
Temperature drift @20°C	0.02%RH/°C
%RH response time at	10sec (10→80%RH; air speed=2m/s) constant temperature

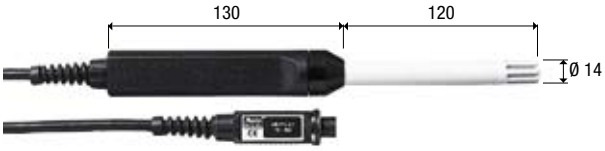
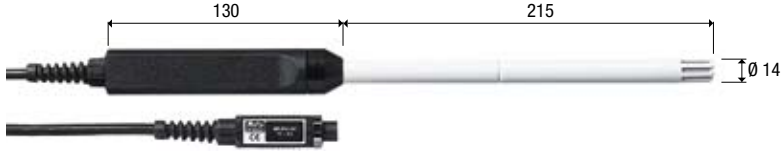
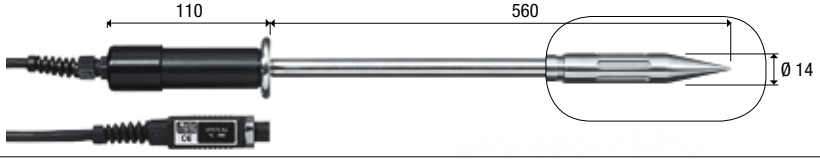
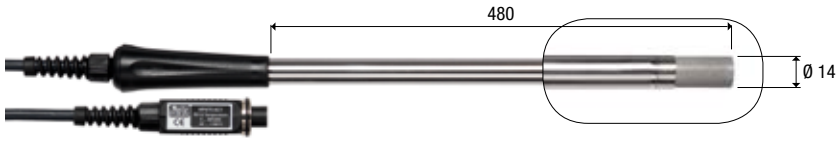
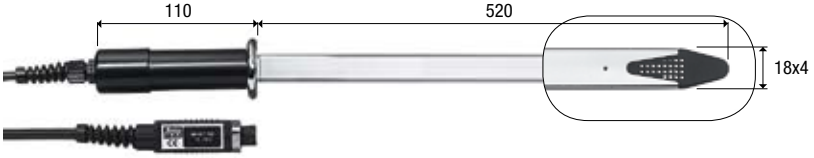
Temperature with Pt100 sensor

Resolution	0.1°C
Temperature drift @20°C	0.003%/°C

Temperature with thermocouple K-HP572AC

Resolution	0.1°C
Temperature drift @20°C	0.02%/°C

RELATIVE HUMIDITY AND TEMPERATURE PROBES

Code	Sensors	Range RH - Temp.	DIMENSIONS
HP472ACR	RH Pt100	5 ÷ 98% RH -20°C…+80°C	
HP572ACR	RH TC.K		
HP473ACR	RH Pt100		
HP474ACR		5 ÷ 98% RH -40°C…+150°C	
HP475ACR			
HP475AC1R			
HP477DCR			
HP478ACR			

PROBES FOR PRESSURE MEASUREMENT

Probes complete with SICRAM module

PP471: SICRAM module interface between instrument and pressure probes of the series TP704 and TP705.

PP472: Barometric probe, measuring range 600…1100mbar. Resolution: 0.1mbar Accuracy @ 20°C: ±0.3mbar. Temperature range: -10 … +60°C

PP473S1…S8: Differential pressure probes.

Working range	**S1**=f.s.10mbar,	**S2**=f.s.20mbar,	**S3**=f.s.50mbar,
	S4=f.s.100mbar,	**S5**=f.s.200mbar,	**S6**=f.s.500mbar,
	S7=f.s.1bar,	**S8**=f.s.2bar	
Maximum overpressure	**S1,S2,S3**=200mbar	**S4**=300mbar	**S5,S6**=1bar
	S7=3bar	**S8**=6bar	
Accuracy @ 25°C	±0.5%f.s. (10, 20, 50mbar)	±0.25%f.s. (100mbar)	±0.12% f.s. (200, 500, 1000, 2000mbar)
Temperature range	-10 … +60°C		
Fluid in contact with the membrane	non-corrosive dry gas or air		
Connection	tube Ø 5mm		

Probes to couple to the module to measure the absolute, relative or differential pressure.

TP704…/TP705…: Probes to connect to SICRAM module PP471 for measuring relative, absolute or differential pressure.

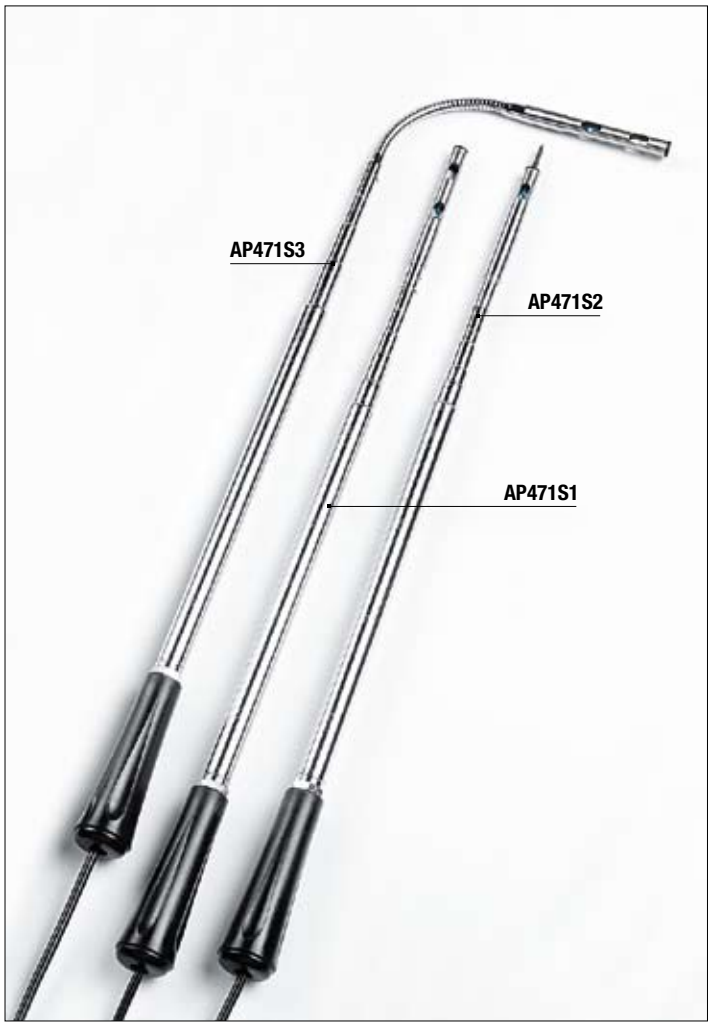
PRESSURE PROBE TABLE

Bottom scale pressure	Maximum overpressure	Resolution	ORDER CODES			Accuracy From 20 to 25°C	Working temperature	Connection
			Differential pressure	Relative pressure (compared to atmosphere)	Absolute pressure			
			NON insulated membrane	Insulated membrane	Insulated membrane			
10.0 mbar	20.0 mbar	0.01 mbar	• **TP705-10MBD**			0.5 % FSO	0..60 °C	Tube Ø 5 mm
20.0 mbar	40.0 mbar	0.01 mbar	• **TP705-20MBD**			0.5 % FSO	0..60 °C	Tube Ø 5 mm
50.0 mbar	100 mbar	0.01 mbar	**TP705-50MBD**			0.5 % FSO	0..60 °C	Tube Ø 5 mm
100 mbar	200 mbar	0.1 mbar	**TP705-100MBD**			0.25 % FSO	0..60 °C	Tube Ø 5 mm
				TP704-100MBGI		0.25 % FSO	-10..+80 °C	¼ BSP
200 mbar	400 mbar	0.1 mbar	**TP705-200MBD**			0.25 % FSO	0..60 °C	Tube Ø 5 mm
				TP704-200MBGI		0.25 % FSO	-10..+80 °C	¼ BSP
400 mbar	1000 mbar	0.1 mbar		**TP704-400MBGI**		0.25 % FSO	-10..+80 °C	¼ BSP
500 mbar	1000 mbar	0.1 mbar	**TP705-500MBD**			0.25 % FSO	0..60 °C	Tube Ø 5 mm
600 mbar	1000 mbar	0.1 mbar		**TP704-600MBGI**		0.25 % FSO	-40..125 °C	¼ BSP
1.00 bar	2.00 bar	1 mbar	**TP705-1BD**			0.25 % FSO	0..60 °C	Tube Ø 5 mm
					TP705BARO	0.25 % FSO	0..60 °C	Tube Ø 5 mm
						0.25 % FSO	-40..125 °C	¼ BSP
					TP704-1BA	0.25 % FSO	-40..120 °C	¼ BSP
2.00 bar	4.00 bar	1 mbar	**TP705-2BD**			0.25 % FSO	0..60 °C	Tube Ø 5 mm
				TP704-2BGI		0.25 % FSO	-40..+125 °C	¼ BSP
					TP704-2BAI *	0.25 % FSO	-25..+85 °C	¼ BSP
5.00 bar	10.00 bar	1 mbar		**TP704-5BGI**		0.25 % FSO	-40..+125 °C	¼ BSP
					TP704-5BAI *	0.25 % FSO	-25..+85 °C	¼ BSP
10.00 bar	20.0 bar	0.01 bar		**TP704-10BGI**		0.25 % FSO	-40..+125 °C	¼ BSP
					TP704-10BAI *	0.25 % FSO	-25..+85 °C	¼ BSP
20.0 bar	40.0 bar	0.01 bar		**TP704-20BGI**		0.25 % FSO	-40..+125 °C	¼ BSP
					TP704-20BAI *	0.25 % FSO	-25..+85 °C	¼ BSP
50.0 bar	100.0 bar	0.01 bar		**TP704-50BGI**		0.25 % FSO	-40..+125 °C	¼ BSP
					TP704-50BAI *	0.25 % FSO	-25..+85 °C	¼ BSP
100 bar	200 bar	0.1 mbar		**TP704-100BGI**		0.25 % FSO	-40..+125 °C	¼ BSP
					TP704-100BAI *	0.25 % FSO	-25..+85 °C	¼ BSP
200 bar	400 bar	0.1 mbar		**TP704-200BGI**		0.25 % FSO	-40..+125 °C	¼ BSP
					TP704-200BAI *	0.25 % FSO	-25..+85 °C	¼ BSP
500 bar	1000 bar	0.1 mbar		**TP704-500BGI**		0.25 % FSO	-40..+125 °C	¼ BSP
	700 bar	0.1 mbar			**TP704-500BAI ***	0.25 % FSO	-25..+85 °C	¼ BSP

* Ceramic diaphragm
• Only report of calibration, no SIT certificate

PROBES AND MODULES TECHNICAL DATA EQUIPPED WITH INSTRUMENT
Wind speed measurement probes
Hot-wire probes: AP471 S1 - AP471 S2 - AP471 S3 - AP471 S4

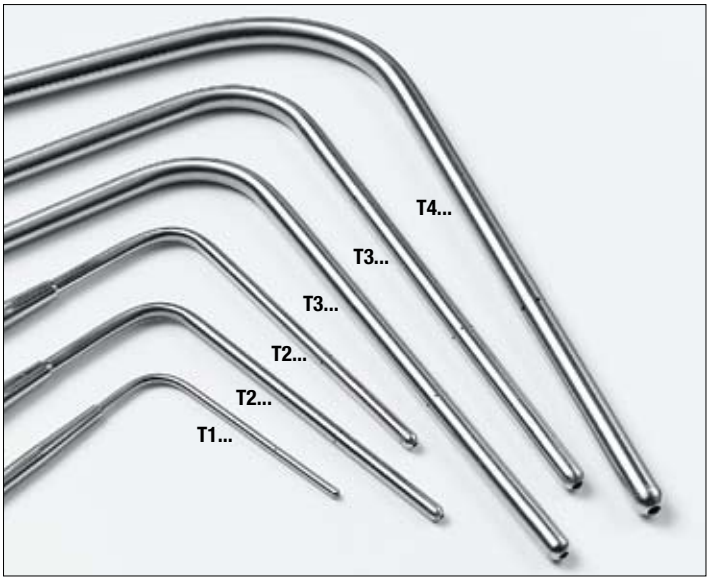
	AP471 S1 - AP471 S3	AP471 S2	AP471 S4
Type of measure	Air speed, calculated flow rate, air temperature		
Type of sensor			
Speed	NTC thermistor	Omnidirectional NTC thermistor	
Temperature	NTC thermistor	NTC thermistor	
Measurement range			
Speed	0,1…40m/s	0,1…5m/s	
Temperature	-25…+80°C	-25…+80°C	0…80°C
Measurement resolution:			
Speed	0.01 m/s 0.1 km/h 1 ft/min 0.1 mph 0.1 knot		
Temperature	0.1°C		
Measurement accuracy:			
Speed	±0.1 m/s (0…0.99 m/s)	±0.05m/s (0…0.99 m/s)	
	±0.3 m/s (1.00…9.99 m/s)	±0.15m/s (1.00…5.00 m/s)	
	±0.8 m/s (10.00…40.0 m/s)		
Temperature	±0.8°C (-10…+80°C)	±0.8°C (-10…+80°C)	
Minimum speed	0.1 m/s		
Air temperature compensation	0…80°C		
Sensor working conditions	Clean air, RH<80%		
Battery life	Approx. 20 hours @ 20 m/s with alkaline batteries	Approx. 30 hours @ 5 m/s with alkaline batteries	
Unit of Measurement			
Speed	m/s – km/h – ft/min – mph – knot		
Flow rate	l/s - m^3/s - m^3/min - m^3/h - ft^3/s - ft^3/min		
Pipeline section for flow rate calculation	0.0001…1.9999 m^2		
Cable length	~2m		



Vane probes: AP472 S1… - AP472 S2 - AP472 S4…

	AP472 S1…	AP472 S2	AP472 S4…			
			L	LT	H	HT
Type of measure	Air speed, calculated flow rate, air temperature	Air speed, calculated flow rate	Air speed, calculated flow rate.	Air speed, calculated flow rate, air temperature.	Air speed, calculated flow rate.	Air speed, calculated flow rate, air temperature.
Diameter	100mm	60mm	16mm			
Type of measurement						
Speed	Vane	Vane	Vane			
Temperature	K thermocouple	----	----	K thermo couple	----	K thermo couple
Measurement range						
Speed (m/s)	0.6…25	0.5…20	0.8…20		10…40	
Temperature (°C)	-25…+80 (*)		-25...+80 (*)			
Resolution						
Speed	0.01 m/s 0.1 km/h 1 ft/min 0.1 mph 0.1 knot					
Temperature	0.1°C	----	----	0.1°C	----	0.1°C
Accuracy						
Speed	±(0.3 m/s +1.5%f.s.)	±(0.3m/s +1.5%f.s.)	±(0.4 m/s +1.5%f.s.)			
Temperature	±0.8°C	----	----	±0.8°C	----	±0.8°C
Minimum speed	0.6m/s	0.5m/s	0.8m/s		10m/s	
Unit of Measurement						
Speed	m/s – km/h – ft/min – mph – knot					
Flow rate	l/s - m^3/s - m^3/min - m^3/h - ft^3/s - ft^3/min					
Pipeline section for flow rate calculation	0.0001…1.9999 m^2					
Cable length	~2m					

(*) The indicated value refers to the vane's working range.



Pitot tube probes: AP473 S1 - AP473 S2 - AP473 S3 - AP473 S4

	AP473 S1	AP473 S2	AP473 S3	AP473 S4
Kind of measurement	Air speed, calculated flow, differential pressure, Air temperature			
Working range				
Diff. pressure	10 mbar f.s.	20mbar f.s.	50mbar f.s.	100mbar f.s.
Speed (*)	2 … 40m/s	2 … 55m/s	2 … 90m/s	2 … 130m/s
Temperature	-200…+600°C	-200…+600°C	-200…+600°C	-200…+600°C
Resolution				
Speed m/s	0.1			
km/h	1			
ft/min	$1 \cdot 10^3$			
mph	1			
Knots	1			
Temperature	0.1°C			
Accuracy				
Speed	±0.4%f.s. of pressure		±0.3%f.s. of pressure	
Temperature	±0.8°C		±0.8°C	
Minimum speed	2 m/s			
Air temperature compensation	-200…+600°C (if K thermocouple is connected to the module)			
Unit of measurement				
Speed	m/s - km/h - ft/min - mph - Knots			
Flow rate	l/s - m^3/h - m^3/min - ft^3/s - ft^3/min			
Duct section for flow calculation	.001…1.999 m^2			

(*) A 20°C, 1013mbar and Ps negligible.

AP471S4

PHOTOMETRIC AND RADIOMETRIC PROBES

Technical characteristics of photometric and radiometric probes complete with SICRAM module equipped with the instruments

ILLUMINANCE measurement probe LP 471 PHOT				
Measurement range (lux):	0.01…199.99	…1999.9	…19999	…199.99·10^3
Resolution (lux):	0.01	0.1	1	0.01·10^3
Spectral range:	in agreement with standard photopic curve V(λ)			
Class	C (B on request)			
Calibration uncertainty:	<4%			
f'1 (in agreement with photopic response V(λ)):	<8%			
f_2 (response according to the cosine law):	<3%			
f_3 (linearity):	<1%			
f_4 (instrument reading error):	<0.5%			
f_5 (fatigue):	<0.5%			
α (temp. coefficient) f_6 (T)	<0.05%K			
Drift after 1 year:	<1%			
Functioning temperature:	0…50°C			
Reference Standards	CIE n.69 - UNI 11142			

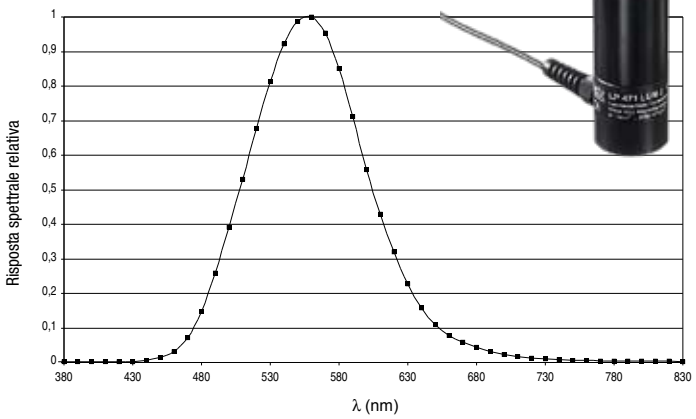
Photometric probe for **ILLUMINANCE** measurement, spectral response in agreement with standard photopic vision, diffuser for cosine correction. Measurement range: 0.01 lux…200·10^3 lux.

LP471LUM2
LP471PHOT
LP471RAD
LP471PAR
LP471UVA
LP471UVB
LP471UVC

LUMINANCE measurement probe LP 471 LUM 2				
Measurement range (cd/m^2):	0.1…1999.9	…19999	…199.99·10^3	…1999.9·10^3
Resolution (cd/m^2):	0.1	1	0.01·10^3	0.1·10^3
Optical angle:	2°			
Spectral range:	in agreement with standard photopic curve V(λ)			
Class	C			
Calibration uncertainty:	<5%			
f'1 (in agreement with photopic response V(λ)):	<8%			
f_3 (linearity):	<1%			
f_4 (instrument reading error):	<0.5%			
f_5 (fatigue):	<0.5%			
α (temp. coefficient) f_6 (T)	<0.05%K			
Drift after 1 year:	<1%			
Functioning temperature:	0…50°C			
Reference Standards	CIE n.69 - UNI 11142			

Photometric probe for **LUMINANCE** measurement, spectral response in agreement with standard photopic vision, vision angle 2°.
Measurement range: 0.1 cd/m^2…2000·10^3 cd/m^2.

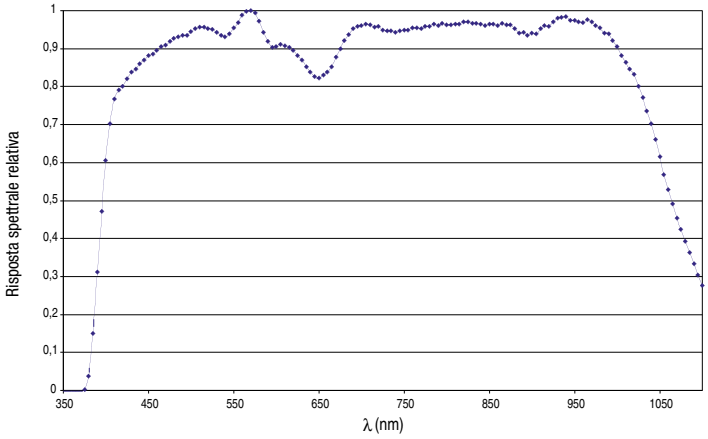
Typical response curve: LP 471 PHOT and LP471 LUM 2



IRRADIANCE measurement probe LP 471 RAD				
Measurement range (W/m^2):	0.1·10^{-3} … 999.9·10^{-3}	1.000 …19.999	20.00 …199.99	200.0 …1999.9
Resolution (W/m^2):	0.1·10^{-3}	0.001	0.01	0.1
Spectral range:	400nm…1050nm			
Calibration uncertainty:	<5%			
f'$_1$ (response according to the cosine law):	<6%			
f_3 (linearity):	<1%			
f_4 (instrument reading error):	±1digit			
f_5 (fatigue):	<0.5%			
Drift after 1 year:	<1%			
Working temperature:	0…50°C			

Radiometric probe for **IRRADIANCE** measurement in the spectral range 400nm…1050nm, diffuser for cosine correction. Measurement range: 0.1·10^{-3}W/m^2…2000 W/m^2.

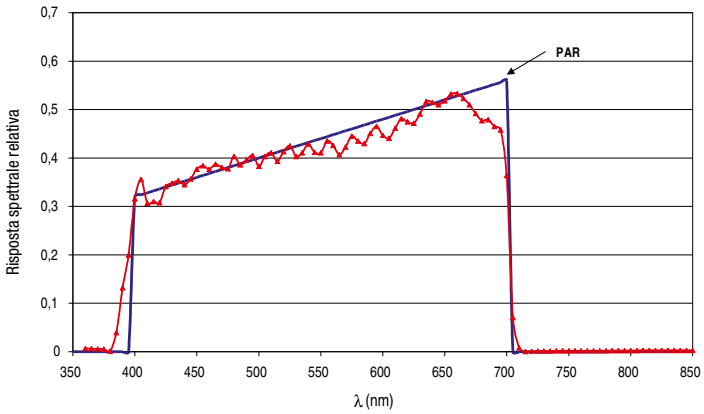
Typical response curve: LP 471 RAD



Quantum radiometric probe for the measurement of the photon flow across the chlorophyll range PAR LP 471 PAR			
Measurement range (μmolm^{-2}s^{-1}):	0.01… 199.99	200.0…1999.9	2000…10000
Resolution (μmolm^{-2}s^{-1}):	0.01	0.1	1
Spectral range:	400nm…700nm		
Calibration uncertainty:	<5%		
f'$_1$ (response according to the cosine law):	<6%		
f_3 (linearity):	<1%		
f_4 (instrument reading error):	±1digit		
f_5 (fatigue):	<0.5%		
Drift after 1 year:	<1%		
Working temperature:	0…50°C		

Quantum radiometric probe for the measurement of the photon flow across the chlorophyll range **PAR** (Photosynthetically Active Radiation 400nm…700nm), measurement in μmol/m^{2}s. Measurement range: 0.01μmol/m^{-2}s^{-1}…10·10^{3}μmol/m^{-2}s^{-1}.

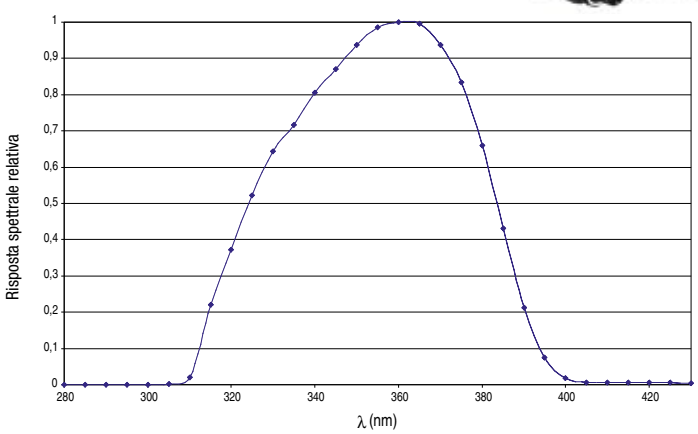
Typical response curve: LP 471 PAR



IRRADIANCE measurement probe LP 471 UVA				
Measurement range (W/m^2):	0.1·10^{-3} … 999.9·10^{-3}	1.000 …19.999	20.00 …199.99	200.0 …1999.9
Resolution (W/m^2):	0.1·10^{-3}	0.001	0.01	0.1
Spectral range:	315nm…400nm (**Peak 360nm**)			
Calibration uncertainty:	<5%			
f'$_1$ (response according to the cosine law):	<6%			
f_3 (linearity):	<1%			
f_4 (instrument reading error):	±1digit			
f_5 (fatigue):	<0.5%			
Drift after 1 year:	<2%			
Working temperature:	0…50°C			

Radiometric probe for **IRRADIANCE** measurement, in the 315nm…400nm, peak 360nm, **UVA** spectral range.
Measurement range: 0.1·10^{-3}W/m^2…2000 W/m^2.

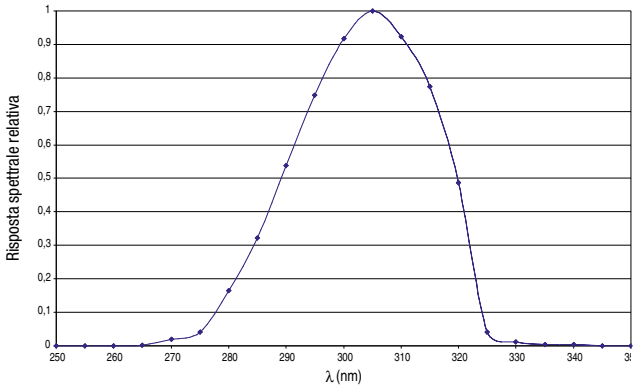
Typical response curve: LP 471 UVA



IRRADIANCE measurement probe LP 471 UVB				
Measurement range (W/m²):	0.1·10⁻³ … 999.9·10⁻³	1.000 …19.999	20.00 …199.99	200.0 …1999.9
Resolution (W/m²):	0.1·10⁻³	0.001	0.01	0.1
Spectral range:	280nm…315nm (**Peak 305nm**)			
Calibration uncertainty:	<5%			
f'_1 (response according to the cosine law):	<6%			
f_3 (linearity):	<2%			
f_4 (instrument reading error):	±1digit			
f_5 (fatigue):	<0.5%			
Drift after 1 year:	<2%			
Working temperature:	0…50°C			

Radiometric probe for **IRRADIANCE** measurement, in the spectral range 280nm…315nm, peak 305nm, **UVB.** Measurement range: 0.1·10⁻³W/m²…2000 W/m².

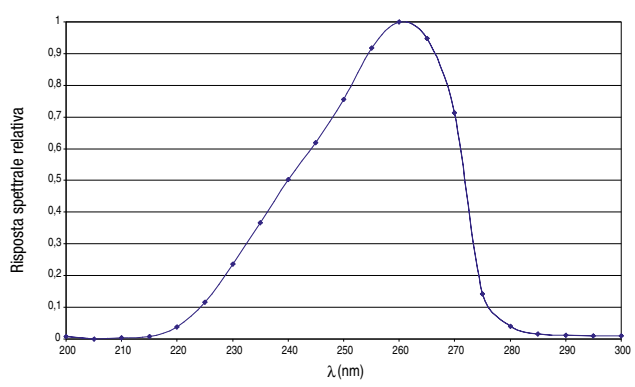
Typical response curve: LP 471 UVB



IRRADIANCE measurement probe LP 471 UVC				
Measurement range (W/m²):	0.1·10⁻³ … 999.9·10⁻³	1.000 …19.999	20.00 …199.99	200.0 …1999.9
Resolution (W/m²):	0.1·10⁻³	0.001	0.01	0.1
Spectral range:	220nm…280nm (**Peak 260nm**)			
Calibration uncertainty:	<5%			
f'_1 (response according to the cosine law):	<6%			
f_3 (linearity):	<1%			
f_4 (instrument reading error):	±1digit			
f_5 (fatigue):	<0.5%			
Drift after 1 year:	<2%			
Working temperature:	0…50°C			

Radiometric probe for **IRRADIANCE** measurement, in the spectral range 220nm…280nm, peak 260nm, **UVC**. Measurement range: 0.1·10⁻³W/m²…2000 W/m².

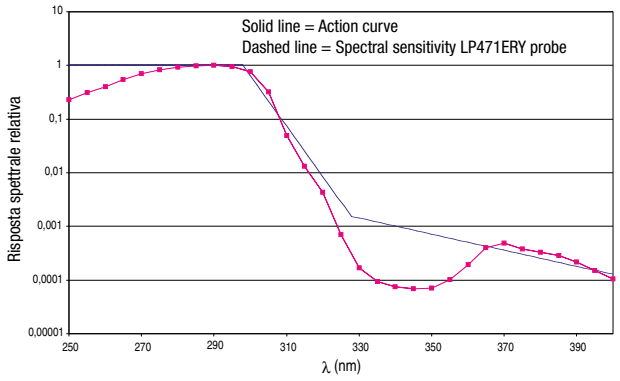
Typical response curve: LP 471 UVC



Measurement probe LP 471ERY of TOTAL EFFECTIVE IRRADIANCE (W/m²) according to the UV action curve UV (CEI EN 60335-2-27)				
Measurement range (W_{eff}/m²):	0.1·10⁻³ … 999.9·10⁻³	1.000 …19.999	20.00 …199.99	200.0 …1999.9
Resolution (W_{eff}/m²):	0.1·10⁻³	0.001	0.01	0.1
Spectral range:	UV action curve for erythema measurement (250nm…400nm)			
Calibration uncertainty:	<15%			
f_3 (linearity):	<3%			
f_4 (instrument reading error	±1digit			
f_5 (fatigue):	<0.5%			
Drift after 1 year	<2%			
Working temperature:	0…50°C			
Reference standard	CEI EN 60335-2-27			

Radiometric probe for **EFFECTIVE TOTAL IRRADIANCE** (W_{eff}/m²) according to the UV action curve (CIE EN 60335-2-27). Spectral range: 250 nm…400 nm, Measurement range: 0.1·10⁻³W_{eff} /m² … 2000 W_{eff} /m²

Typical response curve. TOTAL EFFECTIVE IRRADIANCE LP 471 ERY



The probe LP 471 ERY measures the total effective irradiance (W_{eff}/m²) according to the UV action curve (CEI EN 60335-2-27). A particular type of photodiode and a combination of special filters bring the spectral response closer to the UV action curve.
CEI EN 60335-2-27 standards estabilish a maximum allowable dose of 100J/m² for first-time exposure and an annual dose of 15000J/m².
The typical spectral response curve of LP 471 ERY is shown in the Figure together with the UV action curve.
The good accordance between the two curves enables the instrument to take reliable measurements of different types of lamps (and filters) used at present for tanning machines.
Each probe is individually calibrated at DeltaOhm photo-radiometry laboratory by means of a double monochrome. **Calibration is performed at 290 nm through a SIT calibrated reference photodiode.**

ORDERING CODES

DO 9847K: The kit is provided with multifunctional instrument, 9CPRS232 serial output cable, 4 1.5V alkaline batteries, instruction manual and carrying case. **Modules and probes have to be ordered separately .**

9CPRS232: Female/female sub D 9 pole extension cable for RS232C (null modem).

DeltaLog3: Software for downloading and PC data management.

TP471: Measures the temperature with PRT Platinum sensors

Resistance values of the PRT @ 0°C	25Ω, 100Ω, 500Ω
Measuring range Pt25, Pt100	-200°C…+850°C
Measuring range Pt500	-200°C…+500°C
Accuracy	
with Pt25, Pt100 sensor	±0.03°C till 350°C
	±0.3°C till 500°C
Accuracy with Pt500 sensor	±0.5°C till 500°C
Resolution	0.01°C from -200°C till 350°C
	0.1°C from 350°C till 850°C
Temperature drift @20°C	0.02%/°C
Excitation current	400µA impulse, length=100ms, time=1s

TP471D0: Measures the temperature with thermocouple, cold junction at 0°C inside ice.

TP471D: Measures the temperature with thermocouple, 1 input

TP741D1: Measures the temperature with thermocouple, 2 inputs

VP472: Module for connecting pyranometers or albedometers. For acquisition, verification, and storage of the values generated by a pyranometer or albedometer. The generated value can be read in mV or in W/m², the net radioation of the albedometer is read in W/m². The sensitivity can be set between 5000 and 30000nV/(W/m²), or rather between 5 and 30µV/(W/m²).

VP473: Module for reading continuous voltage. Reads and acquires values when connected to a transmitter with voltage signal. Measuring range ±20Vdc. Input impedance: 1MΩ.

IP472: Module for reading continuous current. Reads and acquires current values when connected to a transmitter with current output. Measuring range 0…24mA Input impedance: 25Ω.

PP471: Module for the measurement of absolute, relative, and differential pressure. Works with pressure probes of the series TP704 and TP705. Provides instantaneous value and pressure peak value. Includes cable L=2 and 8-pole DIN 45326 female connector.

Accuracy: ±0.05% of f.s.	Peak time: ≥ 5ms
Accuracy of the peak: ±0.5% f.s	Peak dead band: ≤ 2% f.s.

Probes complete with SICRAM module
TEMPERATURE MEASUREMENT PROBES

TP472I: Immersion probe, sensor Pt100. Stem Ø 3 mm, length 300 mm. Cable length 2 metres.

TP472I.0: Immersion probe, sensor Pt100. Stem Ø 3 mm, length 230 mm. Cable length 2 metres.

TP473P: Penetration probe, sensor Pt100. Stem Ø 4mm, length 150 mm. Cable length 2 metres.

TP473P.0: Penetration probe, sensor Pt100. Stem Ø 4mm, length 150 mm. Cable length 2 metres.

TP474C: Contact probe, sensor Pt100. Stem Ø 4mm, length 230mm, contact surface Ø 5mm. Cable length 2 metres.

TP474C.0: Contact probe, sensor Pt100. Stem Ø 4mm, length 230mm, contact surface Ø 5mm. Cable length 2 metres.

TP475A.0: Air probe, sensor Pt100. Stem Ø 4mm, length 230mm. Cable length 2 metres.

TP472I.5: Immersion probe, sensor Pt100. Stem Ø 6mm, length 500 mm. Cable length 2 metres.

TP472I.10: Immersion probe, sensor Pt100. Stem Ø 6mm, length 1,000mm. Cable length 2 metres.

TP49A: Immersion probe, Pt100 sensor. Stem Ø 2.7 mm, Length 150 mm. Cable 2 meters long. Aluminium handle.

TP49AC: Contact probe, Pt100 sensor. Stem Ø 4 mm, Length 150 mm. Cable 2 meters long. Aluminium handle.

TP49AP: Penetration probe, Pt100 sensor. Stem Ø 2.7 mm, Length 150 mm. Cable 2 meters long. Aluminium handle.

TP875: Globe thermometer Ø 150 mm with handle. Cable 2 metres

TP876: Globe thermometer Ø 50 mm with handle. Cable 2 metres.

TP87: Immersion probe, Pt100 sensor. Stem Ø 3 mm, lenght 70 mm. Cable 2 metres.

TP878: Contact probe for solar panels. Cable 2 metres.

TP878.1: Contact probe for solar panels. Cable 5 metres.

TP879: Penetration probe for compost. Stem Ø 8 mm, Length 1 m. Cable 2 meters.

Temperature probes without SICRAM module

TP47.100: Immersion probe, 4 wire direct Pt100 sensor. Stem Ø 3mm, length 230mm. 4 wire connecting cable with connector, length 2 metres.

TP47.1000: Immersion probe, 4 wire direct Pt1000 sensor. Stem Ø 3mm, length 230mm. 4 wire connecting cable with connector, length 2 metres.

TP47: Connector for probes connection: 4 wire direct Pt100.

Relative humidity and temperature probes complete with SICRAM module

HP472ACR: %RH and temperature combined probe, dimensions Ø 26x170 mm. 2 m connecting cable.

HP572ACR: %RH and temperature combined probe, **K thermocouple sensor**. Dimensions Ø 26x170 mm. 2 m connecting cable.

HP473ACR: %RH and temperature combined probe. Dimensions: handle Ø 26x130 mm, probe Ø 14x110 mm. 2m connecting cable.

HP474ACR: %RH and temperature combined probe. Dimensions: handle Ø 26x130 mm, probe Ø 14x210 mm. 2m connecting cable.

HP475ACR: %RH and temperature combined probe. 2 m connecting cable. Handle Ø 26x110 mm. Stainless-steel tube Ø 12x560 mm. Terminal tip Ø 13.5x75 mm.

HP475AC1R: %RH and temperature combined probe. 2 m connection cable. Handle Ø 26x110 mm. Stainless steel stern Ø 14x480 mm.

HP477DCR: %RH and temperature combined sword probe. 2 m connecting cable. Handle Ø 26x110 mm. Probe tube 18x4 mm, length 520 mm.

HP478ACR: %RH and temperature combined probe. Dimensions Ø 14x130 mm. 5m connection cable.

PROBES FOR PRESSURE MEASUREMENT
Probes complete with SICRAM module

PP471: SICRAM module interface between instrument and pressure probes of the series TP704 and TP705.

PP472: Barometric probe, measuring range 600…1100mbar. Resolution: 0.1mbar
Accuracy @ 20°C: ±0.3mbar. Temperature range: -10 … +60°C

PP473S1…S8: Differential pressure probes.

Working range	**S1**=f.s.10mbar,	**S2**=f.s.20mbar,	**S3**=f.s.50mbar,
	S4=f.s.100mbar,	**S5**=f.s.200mbar,	**S6**=f.s.500mbar,
	S7=f.s.1bar,	**S8**=f.s.2bar	
Maximum overpressure	**S1,S2,S3**=200mbar	**S4**=300mbar	**S5,S6**=1bar
	S7=3bar	**S8**=6bar	
Accuracy @ 25°C	±0.5%f.s. (10, 20, 50mbar)	±0.25%f.s. (100mbar)	±0.12% f.s. (200, 500, 1000, 2000mbar)
Temperature range	-10 … +60°C		
Fluid in contact with the membrane	non-corrosive dry gas or air		
Connection	tube Ø 5mm		

Probes to couple to the module to measure the absolute, relative or differential pressure.

TP704…/TP705…: Probes to connect to SICRAM module PP471 for measuring relative, absolute or differential pressure.

PROBES FOR AIR SPEED MEASUREMENTS
Probes equipped with SICRAM modules

HOT-WIRE PROBES

AP471 S1: Hot-wire telescopic probe, measuring range: 0.1…40m/s.

AP471 S2: Omni-directional hot-wire probe, measuring range: 0.1…5m/s.

AP471 S3: Hot-wire telescopic probe with terminal tip for easy position, measuring range: 0.1…40m/s.

AP471 S4: Omnidirectional hot-wire telescopic probe with base, measuring range: 0.1…5m/s. Cable length 2 metres.

Vane probes:

AP472 S1: Vane probe with thermocouple, Ø 100mm. Speed from 0.6 to 25m/s; temperature from -25 to 80°C. Cable length 2 metres.

AP472 S2: Vane probe, Ø 60mm. Measurement range: 0.5…20m/s. Cable length 2 metres.

AP472 S4L: Vane probe, Ø 16mm. speed from 0.8 to 20m/s. Cable length 2 metres.

AP472 S4LT: Vane probe with thermocouple, Ø 16mm, speed from 0.8 to 20m/s. Temperature from -25 to 80°C with thermocouple K sensor(*). Cable length 2 metres.

AP472 S4H: Vane probe, Ø 16mm speed from 10 to 40m/s. Cable length 2 metres.

AP472 S4HT: Vane probe with thermocouple, Ø 16mm speed from 10 to 40m/s. Temperature from -25 to 80°C with thermocouple K sensor(*). Cable length 2 metres.

MODULES FOR PITOT TUBES

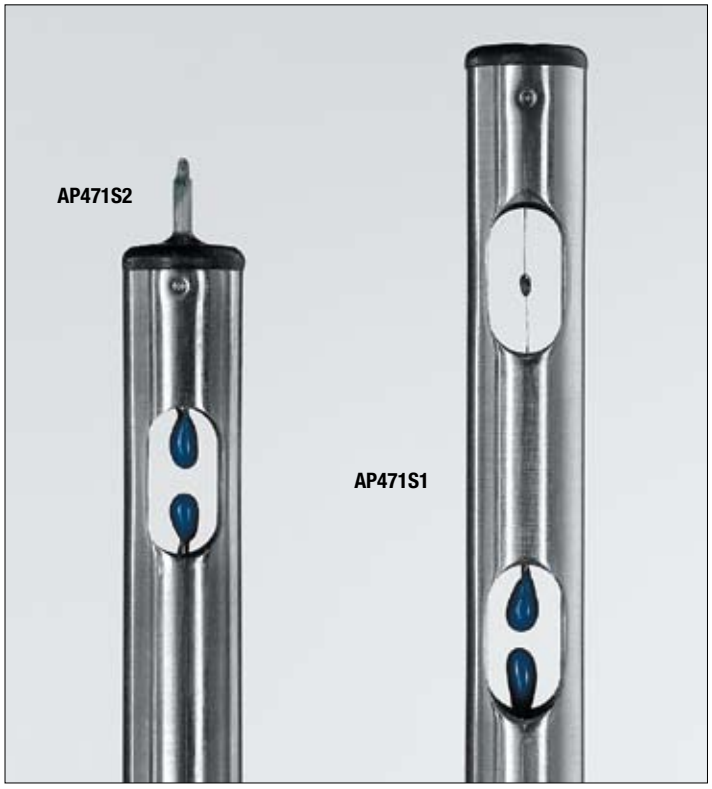
AP473 S1: Pitot tube probe, differential pressure 10mbar f.s. Air speed from 2 to 40m/s. The Pitot tube has to be ordered separately.

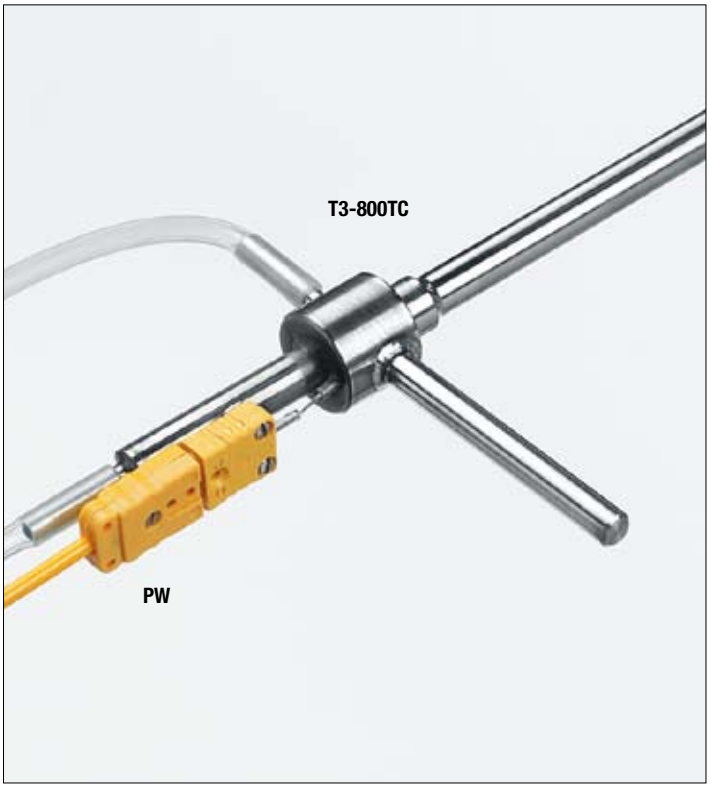
AP473 S2: Pitot tube probe**,** differential pressure 20mbar f.s. Air speed from 2 to 55m/s. The Pitot tube has to be ordered separately.

AP473 S3: Pitot tube probe, differential pressure 50mbar f.s. Air speed from 2 to 90m/s. The Pitot tube has to be ordered separately.

AP473 S4: Pitot tube probe**,** differential pressure 100mbar f.s. Air speed from 2 to 130m/s. The Pitot tube has to be ordered separately.

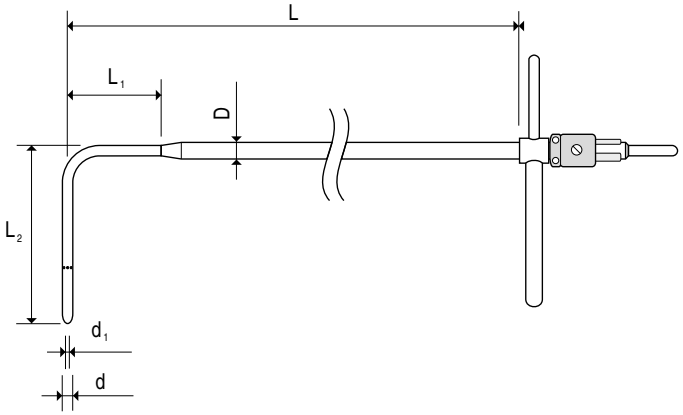
PW: Connection cable between AP473S… module and **Pitot tube**.





PITOT TUBES

Stainless steel Pitot tubes to measure air speed and temperature for models provided with 'K' thermocouple. They can be connected to the SICRAM modules AP473S1, AP473S2, AP473S3 and AP473S4



	d mm	d1 mm	D mm	L mm	L1 mm	L2 mm	Temp.°C	Thermo-couple K	Material
T1-300	3	1	6	300	30	72	0…600°C	---	AISI 316
T2-400	5	2	8	400	45	120		---	
T2-600	5	2	8	600	45	120		---	
T3-500	8	3.2	8	500	---	192		---	
T3-800	8	3.2	8	800	---	192		---	
T3-800TC	8	3.2	8	800	---	192		TC	
T4-500	10	4.0	10	500	---	240		---	
T4-800	10	4.0	10	800	---	240		---	
T4-800TC	10	4.0	10	800	---	240		TC	
T4-1000	10	4.0	10	1000	---	240		---	
T4-1000TC	10	4.0	10	1000	---	240		TC	

PROBES FOR LIGHT MEASUREMENT

Probes complete with SICRAM module

LP 471 PHOT: Photometric probe for **ILLUMINANCE** measurement complete with SICRAM module, spectral response in agreement with standard photopic vision, diffuser for cosine correction. Measurement range: 0.01 lux…$200 \cdot 10^3$ lux.

LP 471 LUM 2: Photometric probe for **LUMINANCE** measurement complete with SICRAM module, spectral response in agreement with standard photopic vision, vision angle 2°. Measurement range: 0.1 cd/m²…$2000 \cdot 10^3$ cd/m².

LP 471 PAR: Quantum radiometric probe for the measurement of the photon flow across the chlorophyll range **PAR** (Photosynthetically Active Radiation 400nm…700nm) complete with SICRAM, measurement in µmol/m²s, diffuser for cosine correction. Measurement range: 0.01µmol/m²s…$10 \cdot 10^3$µmol/m²s.

LP 471 RAD: Radiometric probe for **IRRADIANCE** measurement complete with SICRAM module; in the 400nm…1050nm spectral range, diffuser for cosine correction. Measurement range: $0.1 \cdot 10^{-3}$W/m² …2000 W/m².

LP 471 UVA: Radiometric probe for **IRRADIANCE** measurement complete with SICRAM module; in the 315nm…400nm, peak 360nm, **UVA** spectral range, quartz diffuser for cosine correction. Measurement range: $0.1 \cdot 10^{-3}$W/m²…2000 W/m².

LP 471 UVB: Radiometric probe for **IRRADIANCE** measurement complete with SICRAM module, in the 280nm…315nm, peak 305nm, **UVB** spectral range, quartz diffuser for cosine correction. Measurement range: $0.1 \cdot 10^{-3}$W/m²…2000 W/m².

LP 471 UVC: Radiometric probe for **IRRADIANCE** measurement complete with SICRAM module, in the 220nm…280nm, peak 260nm, **UVC** spectral range, quartz diffuser for cosine correction. Measurement range: $0.1 \cdot 10^{-3}$W/m²…2000 W/m².

LP 471 ERY: Radiometric probe for **TOTAL EFFECTIVE IRRADIANCE** (W_{eff}/m^2) according to the UV action curve (CEI EN 60335-2-27) complete with SICRAM module. Spectral range: 250 nm…400 nm, quartz diffuser for cosine correction. Measurement range: $0.1 \cdot 10^{-3} W_{eff}$ /m² … 2000 W_{eff} /m².

LP BL: Base with levelling device for the probes (except LP 471 LUM2).

LP BL

AP472S1

AP471S1

LP 471 LUM 2

Datalogger

- HD 32.7 — pag. 262
  8-input data logger for Pt100 probes
- HD 32.8.8 - HD 32.8.16 — pag. 266
  8 or 16-input data logger for thermocouple probes
- HD 37AB17D, HD 37B17D — pag. 271
  Data logger for temperature, humidity, CO, CO_2
- HD 206, HD 207 — pag. 273
  Mini data logger for temperature - for temperature and humidity

The qualitative level of our instruments is the result of a continuous evolving of the product itself. This way bring to slight differences between what reported on this manual and the instruments you bought. We can not completely exclude the presence of errors for which we apologise. Data, images and descriptions included in this catalogue can not be enforced legally. We reserve the right to perform any modification and correction at any time without notice.

HD 32.7
HD 32.8.8
HD 32.8.16

HD 32.7
DATALOGGER

HD32.7
8-INPUT DATA LOGGER

The **HD32.7** instrument is a rugged 8-input data logger for Pt100 temperature probes complete with SICRAM module or Pt100 4-wire probes.

- Configurable unit of measurement: °C, °F, °K.
- Flash memory, organized in 64 blocks, for a total capacity of 800,000 recordings divided among the existing inputs. The recording can be handled in two ways:
  - when the available memory is full, the collected data are overwritten starting from the oldest ones (circular memory),
  - the recording stops when the available memory is full.
- Simultaneous display of the 8 inputs.
- Maximum, minimum or average of the logged values.
- Selectable storage interval: 2, 5, 10, 15, 30 seconds, 1, 2, 5, 10, 15, 20, 30 minutes and 1 hour.
- Data logging: instantaneous or postponed, with the possibility of selecting the recording start and end time.
- Data download: RS232C, 1200...38400 baud or USB 1.1 – 2.0.
- DeltaLog9 software, for data download and processing.
- LCD backlit graphic display 128x64 pixel.
- Instrument setup through the keyboard; no connection required to the PC.
- Security password for keyboard locking.
- Power supply: 4 1.5V alkaline C-BABY type batteries, or external power supply 12VDC-1A.
- Consumption @6VDC:
  - <60µA when the instrument is off
  - <60µA in sleep mode with 8 probes connected
  - <40mA during data logging with 8 probes connected
- Use of the HD32.7 data logger: in the field for machine or equipment measurements, plant or machine testing, production check, oven mapping.

TECHNICAL SPECIFICATIONS

Number of inputs
8x 8-pole male DIN45326 connectors.

Instrument accuracy during data logging
±0.01°C ±1digit (in the range ±199.99°C)
±0.1°C ±1digit in the remaining range

Internal watch accuracy
1min/month max deviation

Unit of measurement
°C, °F, °K

Resolution
0.01°C (in the range ±199.99°C)
0.1°C in the remaining range

Display
LCD backlit graphic display 128x64 pixel.

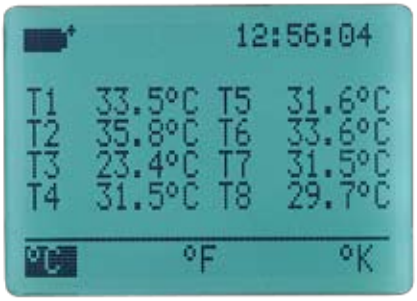
Keyboard
15 keys; it can be configured without a PC.

Keyboard locking
with password.

Memory
Divided into 64 blocks.

Storage capacity
Up to 800,000 recordings divided among the existing inputs; for example with one probe connected, 800,000 recordings, with 8 probes connected, 96,000 recordings each.

Security of stored data
Unlimited.



12 Vdc 1A USB 1.1 - 2.0 RS232C

Power supply

	4 1.5V alkaline C-BABY type batteries External power supply 12VDC-1A. Connector, external ∅ 5.5mm, internal ∅ 2.1mm.

Power absorbed @6VDC:

	<60μA when the instrument is off <60μA in sleep mode with 8 probes connected <40mA during data logging with 8 probes connected

Autonomy

	200 hours with 7800mAh alkaline batteries and 8 probes connected

Data download

	RS232C from 1200 to 38400 baud, galvanically isolated. Sub D 9-pole male connector. USB 1.1 – 2.0 galvanically isolated.

Operating conditions

Operating temperature	-5 … 50°C
Storage temperature	-25 … 65°C
Working relative humidity	0 … 90% RH without condensation
Protection degree	IP64

Instrument

Dimensions (Length x Width x Height)	220x180x50 mm
Weight	1100 g (batteries included)
Materials	ABS, polycarbonate and aluminium

Probes

All the Delta Ohm Pt100 probes complete with SICRAM module series TP47..., TP49..., TP87..., or Pt100 4-wire probes can be connected. Other sizes are available on request.

ORDER CODES

HD32.7: 8-input data logger instrument for Pt100 temperature probes complete with SICRAM module or Pt100 4-wire probes. The kit includes the HD32.7, 4 1.5V alkaline C-BABY type batteries, operating manual, DeltaLog9 software, and carrying strap. **The probes, tripod, carrying case and cables must be ordered separately.**

DeltaLog9: Additional copy of the software for data download and management on PC using Windows 98 to Vista operating systems.

HD32.7 PROBES

All the Pt100 temperature probes complete with SICRAM module or Pt100 4-wire probes can be connected to the instrument. **Other sizes are available on request.**

TECHNICAL DATA OF PROBES AND MODULES EQUIPPED WITH INSTRUMENT

Temperature probes Pt100 sensor with SICRAM module

Model	Type	Application field	Accuracy
TP472I	Immersion	-196°C…+500°C	±0.25°C (-196°C…+350°C) ±0.4°C (+350°C…+500°C)
TP472I.0	Immersion	-50°C…+400°C	±0.25°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP473P	Penetration	-50°C…+400°C	±0.25°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP473P.0	Penetration	-50°C…+400°C	±0.25°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP474C	Contact	-50°C…+400°C	±0.3°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP474C.0	Contact	-50°C…+400°C	±0.3°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP475A.0	Air	-50°C…+250°C	±0.3°C (-50°C…+250°C)
TP472I.5	Immersion	-50°C…+400°C	±0.3°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP472I.10	Immersion	-50°C…+400°C	±0.30°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP49A	Immersion	-70°C…+400°C	±0.25°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP49AC	Contact	-70°C…+400°C	±0.25°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP49AP	Penetration	-70°C…+400°C	±0.25°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP875	Globe-thermometer Ø150mm	-30°C…+120°C	±0.25°C
TP876	Globe-thermometer Ø 50mm	-30°C…+120°C	±0.25°C
TP87	Immersion	-50°C…+200°C	±0.25°C
TP878 TP878.1	Solar panels	+5°C…+80°C	±0.25°C
TP879	For compost	-20°C…+120°C	±0.25°C

Common features

Temperature drift @20°C	0.003%/°C

4 wires Pt100 and 2 wires Pt1000 Probes

Model	Type	Application field	Accuracy
TP47.100	4 wires Pt100	-50…+400°C	Class A
TP47.1000	2 wires Pt1000	-50…+400°C	Class A

Common features

Temperature drift @20°C	
Pt100	0.003%/°C
Pt1000	0.005%/°C

HD32.7 ACCESSORIES

Probes equipped with SICRAM module

TP472I: Immersion probe, Pt100sensor. Stem Ø 3 mm, length 300 mm. Cable 2 meters long.

TP472I.0: Immersion probe, Pt100sensor. Stem Ø 3 mm, length 230 mm. Cable 2 meters long.

TP473P: Penetration probe, Pt100sensor. Stem Ø 4mm, length 150 mm. Cable 2 meters long.

TP473P.0: Penetration probe, Pt100sensor. Stem Ø 4mm, length 150 mm. Cable 2 meters long.

TP474C: Contact probe, Pt100sensor. Stem Ø 4mm, length 230mm, contact surface Ø 5mm. Cable 2 meters long.

TP474C.0: Contact probe, Pt100sensor. Stem Ø 4mm, length 230mm, contact surface Ø 5mm. Cable 2 meters long.

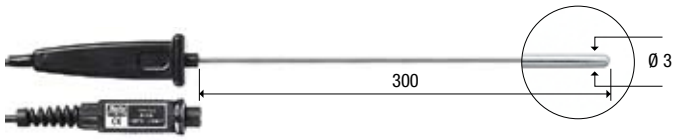
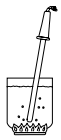
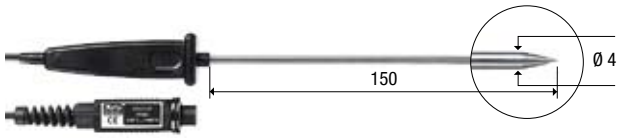
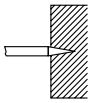
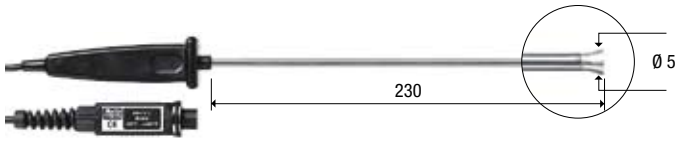
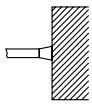
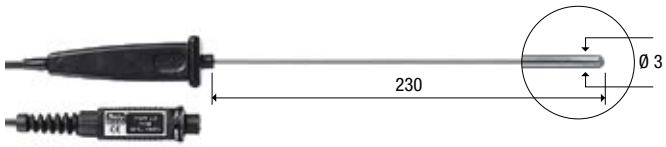
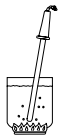
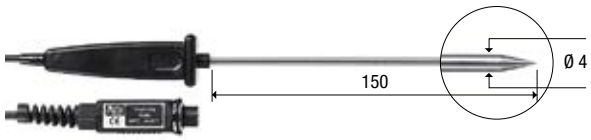
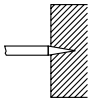
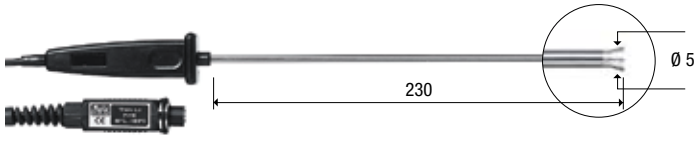
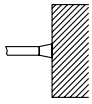
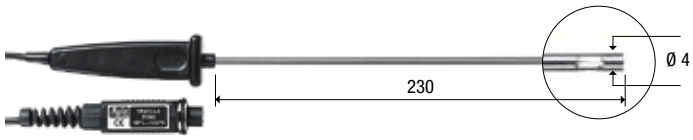
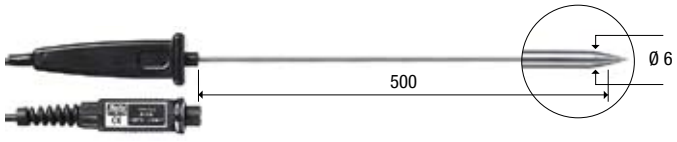
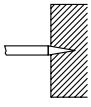
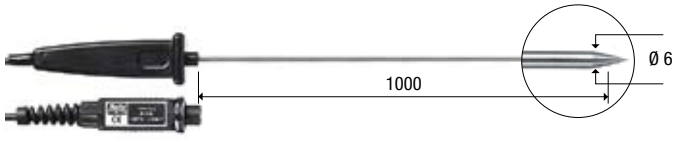
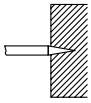
TP475A.0: Air probe, Pt100sensor. Stem Ø 4mm, length 230mm. Cable 2 meters long.

TP472I.5: Immersion probe, Pt100sensor. Stem Ø 6mm, length 500 mm. Cable 2 meters long.

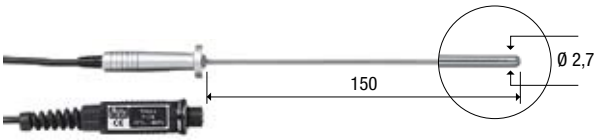
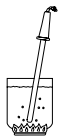
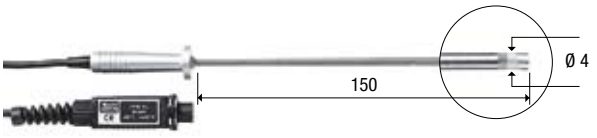
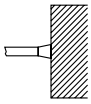
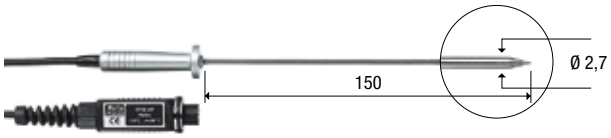
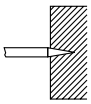
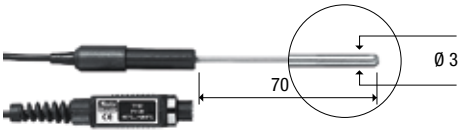
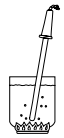
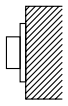
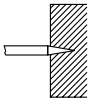
TP472I.10: Immersion probe, Pt100sensor. Stem Ø 6mm, length 1,000mm. Cable 2 meters long.
TP49A: Immersion probe, Pt100sensor. Stem Ø 2.7mm, length 150mm. Cable 2 meters long. Aluminium handle.
TP49AC: Contact probe, Pt100sensor. Stem Ø 4 mm, length 150mm. Cable 2 meters long. Aluminium handle.
TP49AP: Penetration probe, Pt100sensor. Stem Ø 2.7mm, length 150mm. Cable 2 meters long. Aluminium handle.
TP875: Globe thermometer Ø 150 mm with handle. Cable 2 meters long.
TP876: Globe thermometer Ø 50 mm with handle. Cable 2 meters long.
TP87: Immersion probe, Pt100sensor. Stem Ø 3 mm, length 70 mm. Cable 2 meters long.
TP878: Contact probe for solar panels. Cable 2 meters long.
TP878.1: Contact probe for solar panels. Cable 5 meters long
TP879: Penetration probe for compost. Stem Ø 8 mm, length 1 meter. Cable 2 meters long.

Temperature probes without SICRAM module
TP47.100: Direct 4 wires Pt100 sensor immersion probe. Stem Ø 3 mm, length 230mm. 4 wires connection cable with connector, 2 meters long.
TP47.1000: Pt1000 sensor immersion probe. Stem Ø 3 mm, length 230mm. 2 wires connection cable with connector, 2 meters long.
TP47: Only connector for probe connection without SICRAM module: direct 3 and 4 wires Pt100, 2 wires Pt1000.
9CPRS232: Connection cable with Sub D 9-pole female connectors for RS232C (null modem)
CP22: Connection cable USB 2.0 connector type A - connector type B
BAG32.2: Carrying case for the HD32.7 instrument and accessories
HD32CS: Carrying strap
SWD10: 100-240VAC/12VDC-1A stabilized mains power supply
VTRAP32: Tripod complete with 6-input head and 5 probe holders code HD3218K
HD3218K: Shaft for another probe

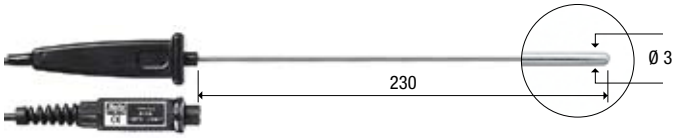
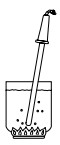
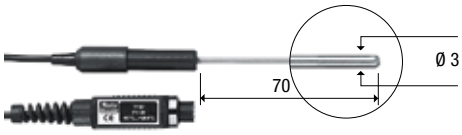
PT100 PROBES FOR PORTABLE INSTRUMENTS EQUIPPED WITH SICRAM MODULE

CODE.	°C max	τ s	DIMENSIONS	USE
TP 472 I	-196 +500	3s		
TP 473 P	-50 +400	5s		
TP 474 C	-50 +400	5s		
TP 472 I.0	-50 +400	3s		
TP 473 P.0	-50 +400	5s		
TP 474 C.0	-50 +400	5s		
TP 475 A.0	-50 +250	12s		
TP 472 I.5	-50 +400	3s		
TP 472 I.10	-50 +400	3s		

Pt100 PROBES FOR PORTABLE INSTRUMENTS EQUIPPED WITH SICRAM MODULE

CODE	°C max	τ s	DIMENSIONS	USE
TP 49 A	-70 +400	3,5s		
TP 49 AC	-70 +400	5,5s		
TP 49 AP	-70 +400	4s		
TP 87	-50 +200	3s		
TP 878	+5 +80	60s	Contact probe for solar panels. Cable L = 2m.	
TP 878.1	+5 +80	60s	Contact probe for solar panels. Cable L = 5m.	
TP879	-20 +120	60s	Penetration probe for compost. Cable L = 2m	
TP 875	-30 +120	15s	Globe-thermometer probe for measuring radiant heat ø150 mm. (ISO7243, ISO7726). 4 wires Pt100 Sensor cable L=2m. **Equipped with SICRAM module.**	
TP 876	-30 +120	15s	Globe-thermometer probe for measuring radiant heat ø50 mm. (ISO7243, ISO7726). 4 wires Pt100 Sensor cable L=2m. **Equipped with SICRAM module.**	

Pt100 / Pt1000 SENSOR PROBES WITH TP 47 MODULE

CODE	°C max	τ s	DIMENSIONS	USE
TP 47.100 (Pt100) **TP 47.1000 (Pt1000)**	-50 +400	3s		
TP 87.100 (Pt100) **TP 87.1000 (Pt1000)**	-50 +200	3s		
TP 47	Only connector for connection of probes without SICRAM module: direct 3 and 4 wires Pt100, 2 wires Pt1000.			

HD32.8.8 - HD32.8.16
8 OR 16-INPUT DATA LOGGER FOR THERMOCOUPLES

The **HD32.8.8** and **HD32.8.16** instruments are rugged data loggers. The former has 8 inputs, the latter has 16 inputs. They work with thermocouple probes type K, J, T, N, R, S, B and E with miniature connector.

- Configurable unit of measurement : °C, °F, °K.
- Flash memory, organized in 64 blocks, for a total capacity of 800,000 recordings divided among the existing inputs. The recording can be handled in two ways:
  - when the available memory is full, the collected data are overwritten starting from the oldest ones (circular memory),
  - the recording stops when the available memory is full.
- Simultaneous display of 4 inputs.
- Maximum, minimum or average of the logged values.
- Selectable storage interval: 2, 5, 10, 15, 30 seconds, 1, 2, 5, 10, 15, 20, 30 minutes and 1 hour.
- Data logging: instantaneous or postponed, with the possibility of selecting the recording start and end time.
- Data download: RS232C, 1200...38400 baud or USB 1.1 – 2.0.
- DeltaLog9 software, for data download and processing.
- LCD backlit graphic display 128x64 pixel.
- Instrument setup through the keyboard; no connection required to the PC.
- Security password for keyboard locking.
- Power supply: 4 1.5V alkaline C-BABY type batteries, external power supply 12VDC-1A or PC USB port.
- Concumption @6VDC:
  - <60µA when the instrument is off
  - <60µA in sleep mode with all probes connected
  - <40mA during data logging with all probes connected
- Use of the HD32.8.8 and HD32.8.16 data loggers: in the field for complex machine or equipment multi measurements, machine testing, pharmaceutical and food industry, oven mapping, air conditioning units, etc.

TECHNICAL SPECIFICATIONS

Number of inputs

8 for the HD32.8.8
16 for the HD32.8.16

Connection

Miniature female socket for thermocouple

Instrument accuracy and measurement range

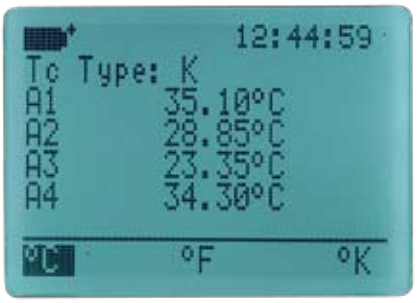
Tc: K	-200 … +1,370°C / ±0.1°C up to 600°C ±0.2°C over 600°C
Tc: J	-100 … +750°C / ±0.1°C up to 400°C ±0.2°C over 400°C
Tc: T	-200 … +400°C / ±0.1°C
Tc: N	-200 … +1,300°C / ±0.1°C up to 600°C ±0.2°C over 600°C
Tc: R	+200 … +1,480°C / ±0.3°C
Tc: S	+200 … +1,480°C / ±0.3°C
Tc: B	+200 … +1,800°C / ±0.4°C
Tc: E	-200 … +750°C / ±0.1°C up to 300°C ±0.2°C over 300°C

The accuracy refers to the instrument only. Any error due to the thermocouple or the cold junction reference sensor is not included.

Tolerance classes for thermocouples (reference junction at 0°C)

Type of thermocouple	Tolerance Class 1	Tolerance Class 2	Tolerance Class 3 [1]
Type T Temperature interval Tolerance Temperature interval Tolerance	from -40 to +125°C ± 0.5°C from 125 to 350°C ± 0.004 · ltr	from -40 to +133°C ± 1°C from 133 to 350°C ± 0.0075 · ltr	from -67 to+40°C ± 1°C from -200 to -67°C ± 0.015 · ltr
Type E Temperature interval Tolerance Temperature interval Tolerance	from -40 to +375°C ± 1.5°C from 375 to 800°C ± 0.004 · ltr	from -40 to +333°C ± 2.5°C from 333 to 900°C ± 0.0075 · ltr	from -167 to +40°C ± 2.5°C from -200 to -167°C ± 0.015 · ltr
Type J Temperature interval Tolerance Temperature interval Tolerance	from -40 to +375°C ± 1.5°C from 375 to 750°C ± 0.004 · ltr	from -40 to +333°C ± 2.5°C from 333 to 750°C ± 0.0075 · ltr	- - - -
Type K, type N Temperature interval Tolerance Temperature interval Tolerance	from -40 to +375°C ± 1.5°C from 375 to 1000°C ± 0.004 · ltr	from 40 to +333°C ± 2.5°C from 333 to 1200°C ± 0.0075 · ltr	from -167 to +40°C ± 2.5°C from -200 to -167°C ± 0.015 · ltr
Type R, type S Temperature interval Tolerance Temperature interval Tolerance	from 0 to +1100°C ± 1°C from 1100 to 1600°C ± [1 + 0.003 (t-1 100)] °C	from 0 to +600°C ± 1.5°C from 600 to 1600°C ± 0.0025 · ltr	- - - -
Type B Temperature interval Tolerance Temperature interval Tolerance	- - - -	- - from 600 to 1700 °C ± 0.0025 · ltr	from +600 to +800C + 4°C from 800 to 1700°C ± 0.005 · ltr

[1] Materials for thermocouples are generally supplied so to comply with the factory tolerances specified in the table for temperatures over -40°C. However these materials can sometimes not comply with the factory tolerances for the low temperatures reported under Class 3, for thermocouples of T, E, K and N type, when thermocouples have to comply at the same time the limits of Class 3 and Class 1 and/or Class 2.



HD 32.8.16

HD 32.8.8

Resolution

0.05°C in the range ±199.95°C
0.1°C in the remaining range

Temperature drift @20°C

0.02%/°C

Drift after 1 year

0.1°C/year

Internal watch accuracy

1min/month max deviation

Unit of measurement

°C, °F, °K

Display

LCD backlit graphic display 128x64 pixel.

Keyboard

15 keys; the instruments can be configured without a PC.

Keyboard locking function

with password.

Memory

Divided into 64 blocks.

Storage capacity

Up to 800,000 recordings divided among the existing inputs; for example with one probe connected, 800,000 recordings; with 8 probes connected, 96,000 recordings each.

Security of stored data

Unlimited.

Power supply

4 1.5V alkaline C-BABY type batteries
External power supply 12VDC-1A. Connector, external ∅ 5.5mm, internal ∅ 2.1mm.
Power supply via the PC USB port.

Power absorbed @6VDC:

<60μA when the instrument is off
<60μA in sleep mode with all probes connected
<40mA during data logging with all probes connected

Autonomy

200 hours with 7800mAh alkaline batteries, with all probes connected

Data download

RS232C from 1200 to 38400 baud, galvanically isolated. Sub D 9-pole male connector.
USB 1.1 – 2.0 galvanically isolated.

Operating conditions

Operating temperature	-5 … 50°C
Storage temperature	-25 … 65°C
Working relative humidity	0 … 90% RH without condensation
Protection degree	IP64

Instrument

Dimensions (Length x Width x Height)	220x180x50 mm
Weight	1100 g (batteries included)
Materials	ABS, polycarbonate and aluminium

Probes

All the thermocouple probes type K, J, T, N, R, S, B, and E can be connected using a male miniature connector.
In addition to the K probes available in the catalogue (pages 268-278), Delta Ohm can supply different probes on request.

ORDER CODES

HD32.8.8: 8-input data logger instrument for thermocouple types K, J, T, N, R, S, B, and E. The kit includes the HD32.8.8, 4 1.5V alkaline C-BABY type batteries, operating manual, DeltaLog9 software, carrying strap. **The probes, tripod, carrying case and cables must be ordered separately.**

HD32.8.16: 16-input data logger instrument for thermocouple types K, J, T, N, R, S, B, and E. The kit includes the HD32.8.16, 4 1.5V alkaline C-BABY type batteries, operating manual, DeltaLog9 software. **The probes, tripod, carrying case and cables must be ordered separately.**

DeltaLog9: Additional copy of the software for data download and management on PC using Windows 98 to XP operating systems.

HD32.8.8 AND HD32.8.16 PROBES

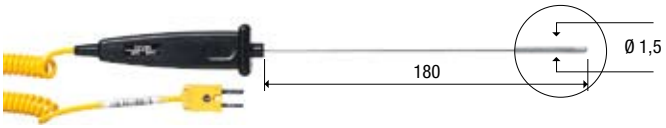
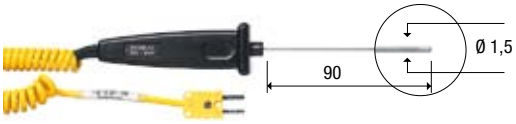
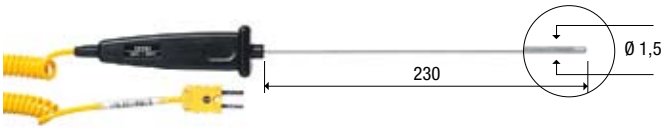
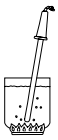
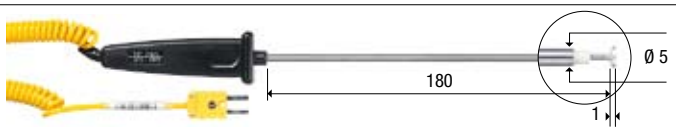
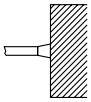
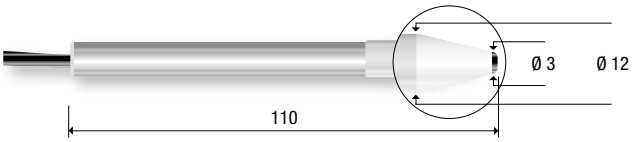
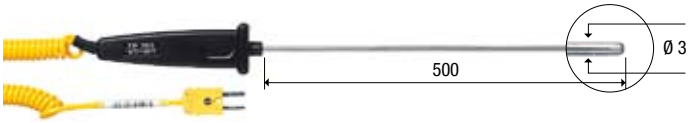
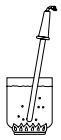
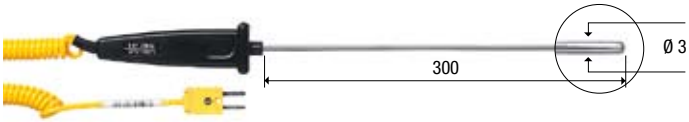
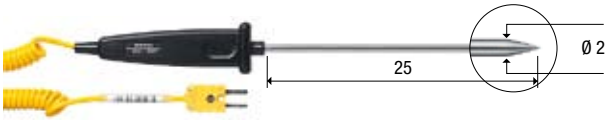
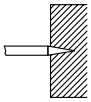
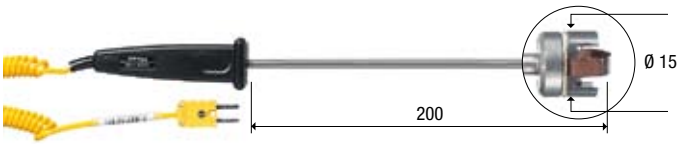
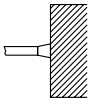
All the thermocouple types K, J, T, N, R, S, B, and E can be connected using a standard miniature connector.
Other sizes are available on request.

HD32.8.8 AND HD32.8.16 ACCESSORIES

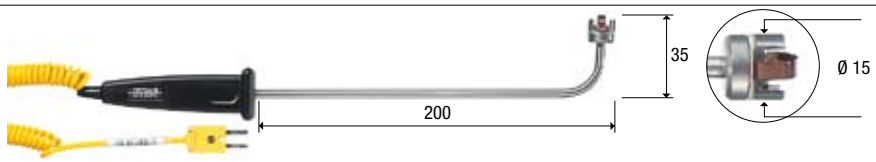
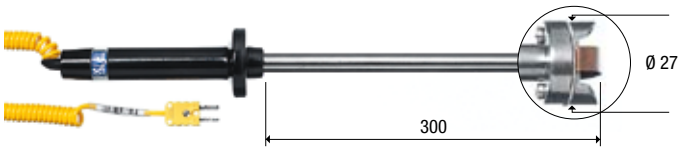
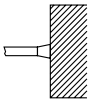
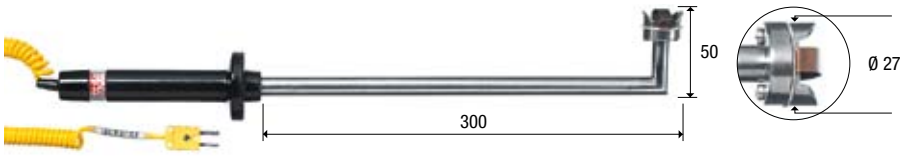
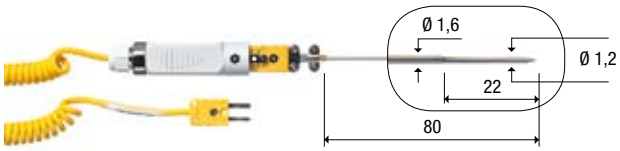
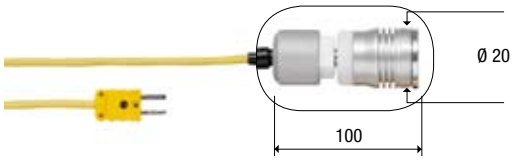
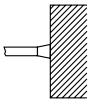
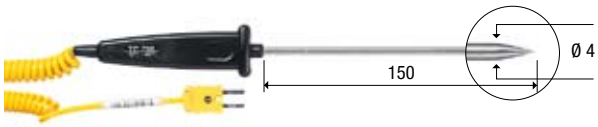
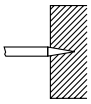
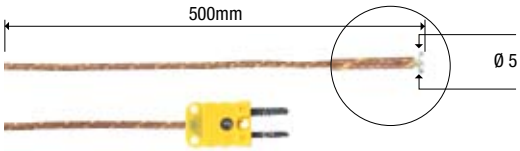
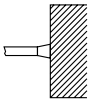
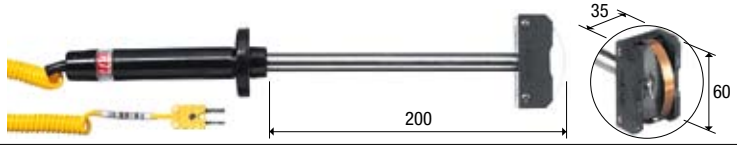
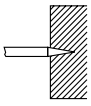
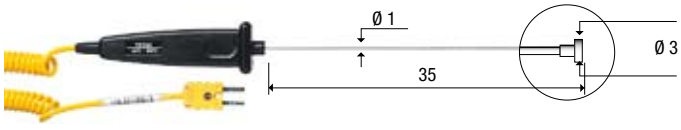
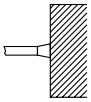
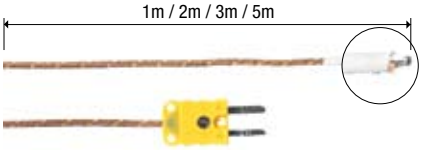
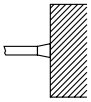
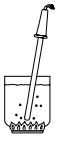
9CPRS232: Connection cable with sub D 9-pole female connectors for RS232C (null modem).
CP22: Connection cable USB 2.0 connector type A - connector type B.
BAG32.2: Carrying case for the HD32.8 instrument and accessories.
HD32CS: Carrying strap.
SWD10: 100-240VAC/12VDC-1A stabilized mains power supply.
VTRAP32: Tripod complete with 6-input head and 5 probe holders code HD3218K.
HD3218K: Shaft for another probe.
CM: Empty mignon plug-case for type K thermocouples.
CS: Flying mignon socket for type K thermocouples, see picture page 270.

THERMOCOUPLE PROBES FOR PORTABLE INSTRUMENTS

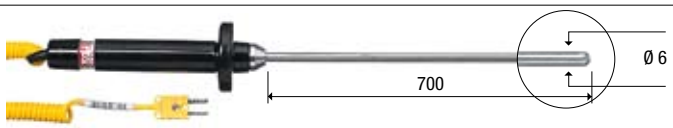
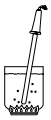
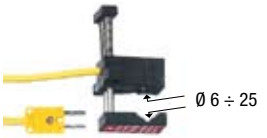
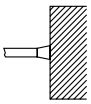
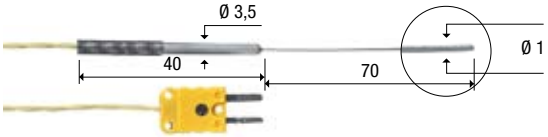
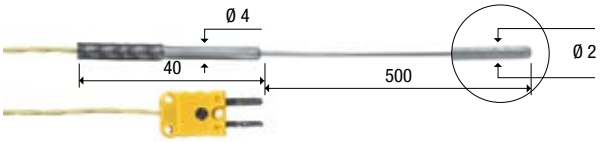
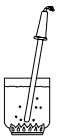
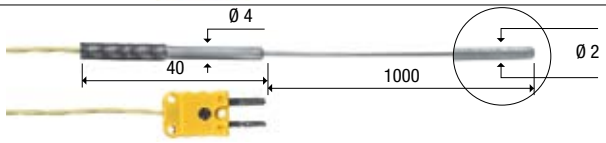
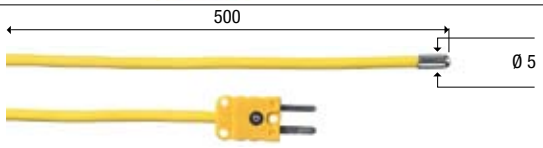
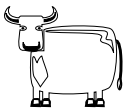
TYPE “K” (CHROMEL - ALUMEL) THERMOCOUPLE PROBES

CODE	°C max	τ s	DIMENSIONS	USE
TP 741	800	2s		
TP 741/1	400	2s		
TP 741/2	800	2s		
TP 742	800	2s		
TP 742/1	400	2s		
TP 742/2	800	2s		
TP 743	800	3s		
TP 744	400	4s		
TP 745	500	5s		
TP 746	250	2s		
TP 750	1000	3s		
TP 750.0	800	3s		
TP 751	200	2s		
TP 754	500	2s		

TYPE “K” (CHROMEL - ALUMEL) THERMOCOUPLE PROBES

CODE	°C max	τ s	DIMENSIONS	USE
TP 754/9	500	2s		
TP 755	800	2s		
TP 755/9	800	2s		
TP 756	200	2s		
TP 757	180	30s		
TP 758	400	4s		
TP 758.1	400	4s		
TP 772	400	3s		
TP 774	250	2s		
TP 776	200	2s		
TP 777	200	3s		
TP 647 **TP 647/2** **TP 647/3** **TP 647/5**	300 300 300 300	2s 2s 2s 2s	For SIT calibration up to 300°C. 	
TP 651	1200	6s		

TYPE “K” (CHROMEL - ALUMEL) THERMOCOUPLE PROBES

CODE	°C max	τ s	DIMENSIONS	USE
TP 652	1200	6s		
TP 655	180	2s		
TP 656	200	1s		
TP 656/1	1000	1s		
TP 656/2	1000	1s		
TP 657/1	100	5s		
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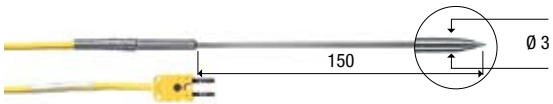
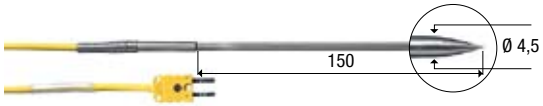
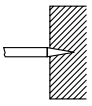
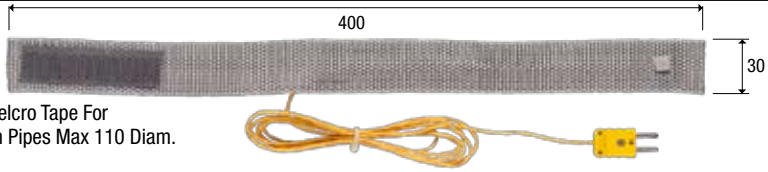
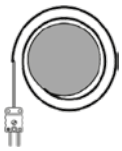
TP 659	400	3s		
TP 660	400	4s		
TP 661	-60 +50	30s		
TP 662	110	120s	 Probe With Velcro Tape For Measures On Pipes Max 110 Diam.	
CM **CS**	“K” “K”			
PW	“K”			

Response time for a 63% variation ($\tau_{0.63}$)
Response time τ **s** is the reaction time of the sensor to a temperature variation, with a variation of the measured signal to a given percentage (63%) of the variation.
Response times are referred to:
Immersion probes when into water at 100°C. • Contact probes when in contact with a metallic surface at 200°C. • Air probes at air temperature of 100°C.

HD37AB17D
HD37B17D

HD 37AB17D, HD 37B17D
DATALOGGER RELATIVE HUMIDITY - TEMPERATURE - CO - CO_2

HD37AB17D and **HD37B17D** are **data loggers** able to measure and store at the same time the following parameters:
- **RH** relative Humidity
- **T** Room Temperature
- **CO** Carbon Monoxide(**only HD37AB17D**)
- **CO_2** Carbon Dioxide

HD37AB17D and **HD37B17D** are able to investigate and monitor the quality of indoor air. Typical applications are examining the air quality in buildings where there are crowds of people (schools, hospitals, auditoriums, cafeterias, etc...) and workplaces to maximize comfort and in general to see if there are small leaks of CO, with danger of explosion or fire. This analysis allows you to adjust the air conditioning (temperature and humidity) and ventilation (air change per hour) to achieve a double objective: to achieve good air quality in accordance with ASHRAE standards and current BMI and energy savings.
HD37AB17D and **HD37B17D** are instruments set to fight the so-called of sick building syndrome.
RH (Relative Humidity) measurement is obtained with a capacitive sensor.
T temperature is measured with a high precision NTC sensor.
The sensor for the measurement of **CO** (Carbon Monoxide, **only for HD37AB17D**) consists of two electrodes in an electrochemical cell suitable for detecting the presence of carbon monoxide, lethal for humans, in residential and industrial.
The measurement of **CO_2** (carbon dioxide) is obtained with a special infrared sensor (NDIR technology: Non-Dispersive Infrared Technology) that, by using a double filter and a particular measurement technique, ensures accurate measurements and stable for a long time. The presence of a protective membrane, which is spread through the air portion, protects the sensor from dust and weather.
HD37AB17D and **HD37B17D** are data loggers capable of storing the measurements, every user preset. **HD37AB17D** and **HD37B17D** can be connected to the PC via the USB input. Instruments are supplied with **DeltaLog13 software** which manages the operations of connection to the PC, calibration of RH sensors, CO (only HD37AB17D) and CO2, setting of the operating parameters of the instrument, data transfer, presentation graphics and printing of measurements acquired or stored.
The **software DeltaLog13** is able to assess **OA %** parameter by an appropiate procedure (percentage of outside air), according to the following formula:

Using appropriate procedure, the **Software DeltaLog13** can evaluate the parameter **% OA** (percentage of external air), according to the following formula:

$$\%OA = \frac{X_r - X_s}{X_r - X_0} \cdot 100$$

whereas:
X_r = CO_2 in return air
X_s = CO_2 in the outlet air
X_0 = CO_2 in the external air

The power supply of the instrument is provided by a 2 Ni-MH **rechargeable** batteries package (code BAT-20), that that allows 8 hours of continuous working in acquisition mode.

Acquisition frequency:

frequency	samples per minute	storage capacity
3 sec.	20 samples per minute	16 hours
6 sec.	10 samples per minute	1 day 9 hours
12 sec.	5 samples per minute	2 days 12 hours
15 sec.	4 samples per minute	3 days 12 hours
30 sec.	2 samples per minute	6 days 12 hours
60 sec. = 1 minutes	1 sample per minute	13 days 12 hours
120 sec. = 2 minutes	1 sample per 2 minutes	27 days 12 hours
180 sec. = 3 minutes	1 sample per 3 minutes	41 days 12 hours
240 sec. = 4 minutes	1 sample per 5 minutes	55 days 12 hours
300 sec. = 5 minutes	1 sample per 5 minutes	69 days

Technical Features

Dimensions	275 mm x 45 mm x 40 mm
Weight	230 g (batteries included)
Materials	ABS
Mains power supply **(code SWD06)**	Batteries charger **100-240Vac/6Vdc-1A**
Batteries	Package with 2 rechargeable batteries 1.2V type AA (NiMH)
Autonomy	8 hours of continuous working in measurement mode
Current absorbed with instrument off	200µA
Instrument working temperature	-5°C ... 50°C
Working relative humidity	0%RH ... 95%RH no condensation
Temperature / Storage humidity	-25°C ... +70°C / 10%RH ... 90%RH no condensation
Safety of the stored data	Unlimited

Connections

USB interface	USB 2.0 cable B type Baudrate 460800
Batteries charger power supply (code SWD06)	2 - poles connector (positive at the centre) Output voltage: **6Vdc** Maximum current: 1600mA (9,60 VA Max).
Measuring rate	1 sample every three seconds
Storage capacity	20000 Records Every record includes the following: - date and time - measurement of the carbon dioxide (CO_2) - measurement of the carbon monoxide (CO- only HD37AB17D) - measurement of the relative humidity (RH) - measurement of the temperature (T)

Logging interval	selectable within: 3,6,12,15,30,60 seconds, 2,3,4,5 minutes. The stored values represent the average value of the samples that are stored every three seconds.
Printing interval	selectable within: 3,6,12,15,30,60 seconds, 2,3,4,5 minutes. The printed values represent the average value of the samples that are stored every three seconds.

Sensor Features

Relative Humidity RH	Capacitive sensor
Sensor protection	Net filter made of stainless steel (upon request filter P6 in AISI316 sintered 20µm or filter P7 in PTFE sintered 10µm)
Measurement range	0...100 % RH
Sensor working range	-20...+60°C
Accuracy	±2% (10÷90%RH) ±2,5% in the remaining range
Resolution	0,1%
Thermal effects	±2% on the whole temperature range
Hysteresis and repeatability	1% RH
Temperature dependence	±2% on the whole temperature range
Response time (T_{90})	< 20 sec. (air speed = 2m/sec) without filter
Long term stability	1%/year

Temperature T

Sensor type	NTC 10KΩ
Measurement range	-20...+60°C
Accuracy	±0.2°C ±0.15% of the measured
Resolution	0,1°C
Response time (T_{90})	< 30 sec. (air speed = 2m/sec)
Long term stability	0.1°C/year

Carbon monoxide CO (only HD37AB17D)

Sensor	Electro chemical cell
Measurement range	0…500ppm
Sensor working range	-5…50°C
Accuracy	±3ppm+3% of the measure value
Resolution	1ppm
Response time (T_{90})	< 50 sec.
Long term stability	5% of the measure/year
Expected life	> 5 years in normal environmental conditions

Carbon dioxide CO_2

Sensor	NDIR with a double wave length
Measurement range	0…5000 ppm
Sensor working range	-5…50°C
Accuracy	±50ppm+3% of the measurement
Resolution	1ppm
Thermal effects	0,1%f.s./°C
Response time (T_{90})	< 120 sec. (air speed = 2m/sec)
Long term stability	5% of the measure/ 5 years

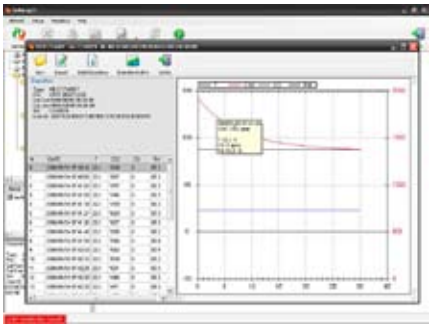
Purchasing codes

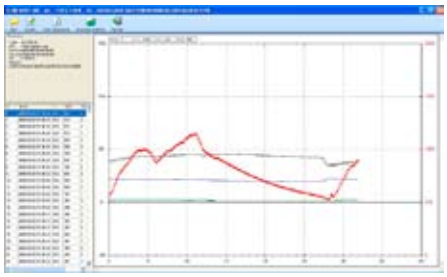
HD37AB17D: The kit consisting of: **HD37AB17D** instrument to measure CO (Carbon monoxide), CO_2 (Carbon dioxide), RH (Relative Humidity), T (Temperature), **DeltaLog13** Software, USB cable code **CP22**, **SWD06** power supply, **BAT-20** batteries pack, instruction manual, carrying case.

HD37B17D: instrument to measure CO_2 (Carbon dioxide), RH (Relative Humidity), T (Temperature), **DeltaLog13** Software, USB cable code **CP22**, **SWD06** power supply, **BAT-20** batteries pack, instruction manual, carrying case.

Accessories:

VTRAP20: Instrument tripod, maximum height 270mm.
SWD06: 100-240Vac/6Vdc-1A mains voltage power supply.
BAT-20: Replacement batteries pack for HD37AB17D and HD37B17D instruments with integrated temperature sensor.
P5: Stainless steel grid protection for probes diameter 14, thread M12×1.
P6: Sintered stainless steel 10µ grid protection, for probes diameter 14, thread M12×1.
P7: 10µ, PTFE protection for probes diameter 14, thread M12×1.
P8: Stainless steel and Pocan protection for probes diameter 14, thread M12×1.
HD75: Saturated solution for testing the Relative Humidity with 75% RH, equipped with adapter for probes diameter 14, thread M12×1.
HD33: Saturated solution for testing the Relative Humidity with 33% RH, equipped with adapter for probes diameter 14, thread M12×1.
MINICAN.12A: Cylinder of nitrogen for the calibration of CO and CO_2 at 0ppm. Volume 12 litres. **With adjustment valve**.
MINICAN.12A1: Cylinder of nitrogen for the calibration of CO and CO_2 at 0ppm. Volume 12 litres. **Without adjustment valve**.
ECO-SURE-2E CO: Spare CO sensor.
HD37.36: Kit connection pipe between instrument and MINICAN.12A for the calibration of CO.
HD37.37: Kit connection pipe between instrument and MINICAN.12A for the calibration of CO_2.





HD207…
HD227…
HD206…
HD226…

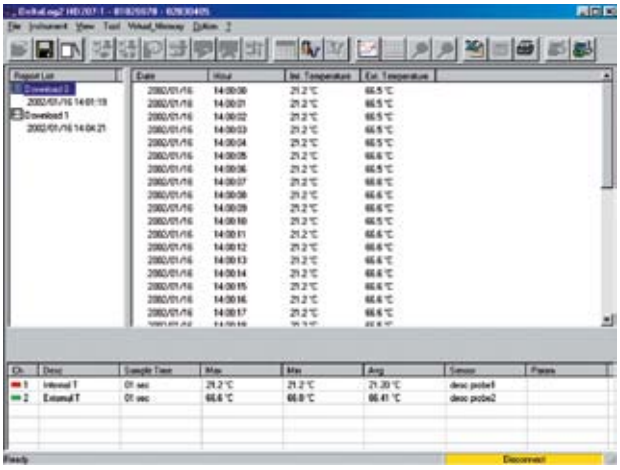
HD 207…, HD 227…, HD 206…, HD 226…
MINIDATALOGGER
TEMPERATURE - TEMPERATURE / RELATIVE HUMIDITY

HD206…/HD226… and HD207…/HD227… series data loggers are low-cost, rugged instruments, for a long-term reliable monitoring of temperature and temperature/relative humidity measurements. They are available in different versions: with or without LCD display, with temperature sensor either inside or outside the instrument housing, or with cable connection. The analysis of acquired data is made using Delta Log2 software for Windows.
The datalogger functions of Start, Stop, Configuration, Data Download and Setting of storage interval are selectable either from keyboard or from a computer. Through a computer, you can define a password to enable the access to configuration data.
Typical applications are: monitoring of temperature/humidity during transportation, storage of fresh or frozen foods, fruit, vegetable products and flowers, pharmaceuticals, sensitive and photographic products, paper, explosives, as well as laboratory activities in general.
Configuration and data download to a PC are very easy: DeltaLog2 dedicated software guides the operator step by step.
SIT calibration certificates for all versions can be issued.

Excellent protection against atmospheric agents.
Temperature and relative humidity high accuracy all over the range.
Resolution: 0.1°C, 0.1% RH.
Sampling freely selectable by the user.
Manual control of acquisition start and stop either through a pushbutton or a clock.
Fast download of stored data.
240.000 data capacity on a single channel and 80.000 data capacity on three simultaneous channels.
Flash memory for holding data storage even when the instrument is without battery or with battery low.
Battery replaceable by the user.
Indication of flat battery.
All models provide a visual indication while the instrument is acquiring.

Technical Specifications

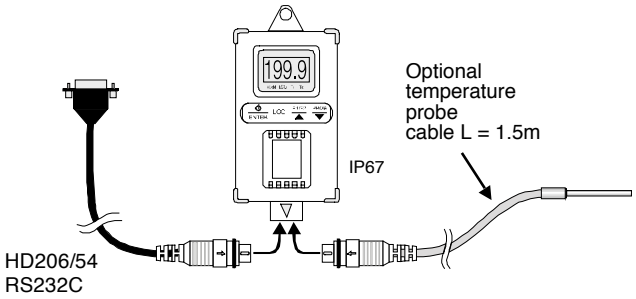
Versions with LCD Versions without LCD		HD207 HD227	HD207-1 HD227-1	HD206-1 HD226-1	HD206-2 HD226-2
Temperature sensor		NTC 10KΩ @ 25°C			
RH Sensor		---		Capacitive 150pF @23°C and 30%RH	
Sensor Location	Temperature	Internally mounted Additional temperature probe available as an option	Mounted under the front cover Additional temperature probe available as an option	Mounted under the front cover Additional temperature probe: optional for HD226-1 model, not available for HD206-1 model	Internal temperature sensor on HD226-2 model Temperature and relative humidity combined probe with cable
	Relative Humidity	---	---	Mounted under the front cover	
Measuring and Operating Range	Temperature	-30…+80°C instrument -40…+105°C probe with cable	-30…+80°C instrument -40…+105°C probe with cable	-30…+80°C instrument -40…+105°C probe with cable	-30…+80°C instrument -40…+105°C probe with cable
	Relative Humidity	---	---	5%…98%RH	5%…98%RH
Accuracy	Temperature	±0.3°C in the 0…70°C range ±0.4°C outside the above range			
	Relative Humidity	---	---	±2.5%RH	±2.5%RH
Resolution	Temperature	0.1°C	0.1°C	0.1°C	0.1°C
	Relative Humidity	---	---	0.1%RH	0.1%RH
IP Protection		67	54 instrument 67 probe with cable	54 instrument 67 probe with cable	67 instrument 54 combined probe with cable
Number of channels		1 + 1 external probe (otional)	1 + 1 external probe (otional)	2 (HD206-1) 2+1 (HD226-1)	2 (HD206-2) 2+1 (HD226-2)
Storage Capacity		240.000 measurements with one active channel 120.000 measurements per channel with two active channels 80.000 measurements per channel with three active channels			
Reading Interval		Selectable among 1, 5, 10, 15, 30sec, 1, 5, 10, 15, 30min, 1hour			
PC interface		Through a passive optoisolated RS232 serial port, 9600 bauds			
Software		DeltaLog2 – Compatible with Windows 95, 98, NT, 2000, ME and Xp.			
Display (where provided)		3½ digit LCD, low battery symbol, 4 indicators of functional modes			
LED (where provided)		LED for operating status indication (HD226… and HD227… models)			
Power Supply		3.6V – 1Ah Replaceable lithium battery			
Battery: typical life		3 years (with a measurement every 10sec)			
Dimensions / Weight		52x88x36mm / 240gr			
Housing		Polycarbonate / rubber			
Instrument Connector		8-pole female minidin			
Probe Connector		8-pole male minidin			



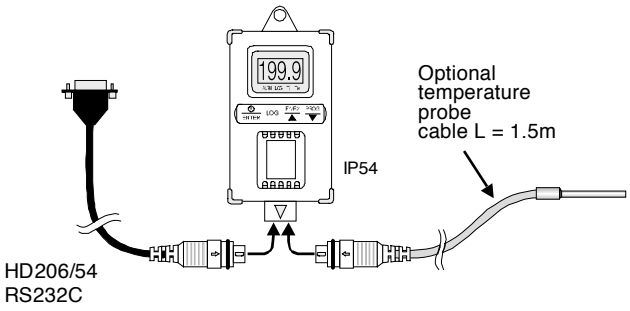
Data display in tabular form.

Models with LCD Display

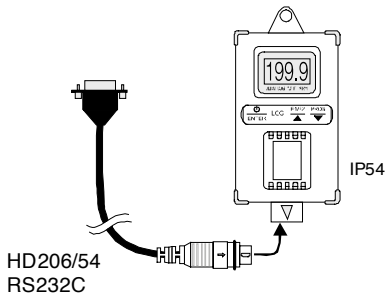
HD207 Internal temperature sensor



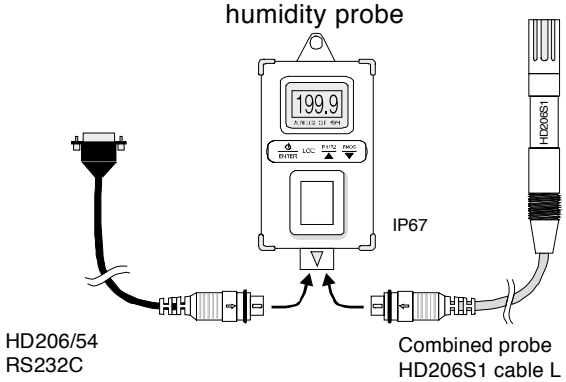
HD207-1 External temperature probe



HD206-1 External temperature and relative humidity sensor

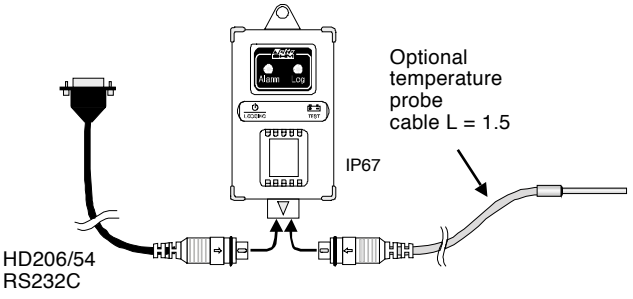


HD206-2 Temperature and relative humidity probe

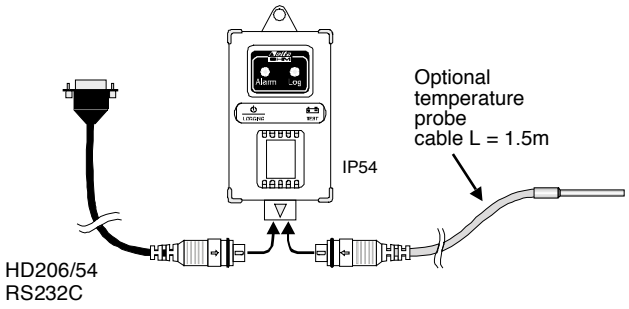


Models without LCD Display

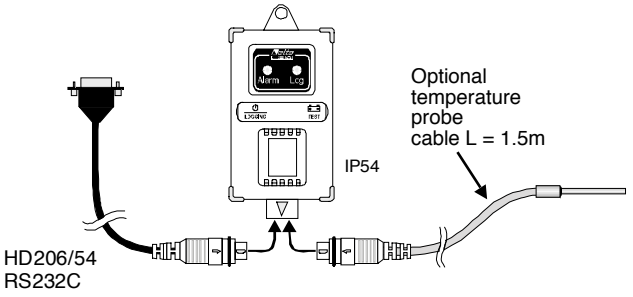
HD227 Internal temperature sensor



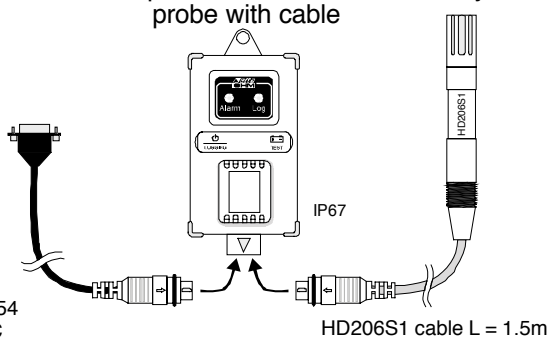
HD227-1 External temperature sensor



HD226-1 External temperature and relative humidity sensor, external temperature probe with cable



HD226-2 Internal temperature sensor and combined external temperature and relative humidity probe with cable



Ordering Code
Minidatalogger

H D 2 0 6 - 2

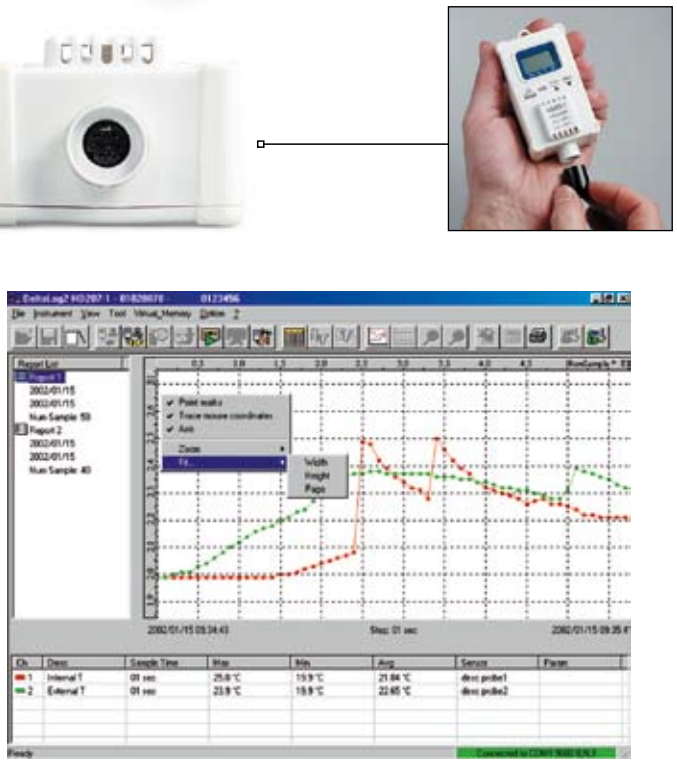
No Indication = Internal Sensor
1 = External Sensor/s
2 = Model with cable L = 1.5m

6 = Relative Humidity and Temperature Measurement
7 = Temperature Measurement

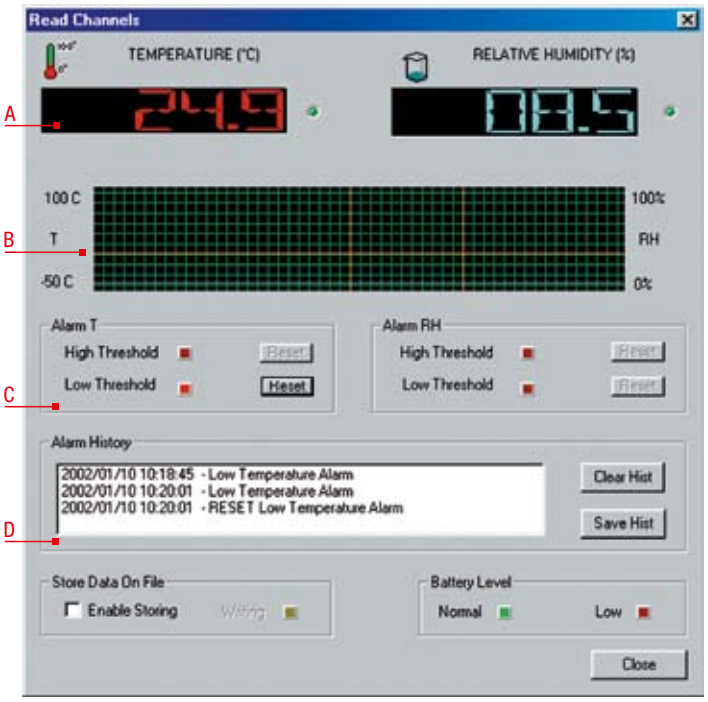
0 = LCD Display Version
2 = LED Version

Ordering Codes of Minidatalogger Probes and Accessories

TP207: immersion temperature probe with NTC sensor for measurements in liquids, powders and gas; total length: 45mm, diameter: 3mm, cable L = 1.5m, material: stainless steel.
TP207P: pointed/immersion temperature probe with NTC sensor for food industry applications; sheath length: 125mm, diameter: 4mm, cable L = 1.5m; material: stainless steel.
TP207A: temperature probe with NTC sensor for a fast measurement of the air temperature; sheath length: 125mm, diameter: 3mm, cable: L = 1.5m; material: stainless steel.
HD206S1: relative humidity/temperature combined probe, length: 109mm, diameter: 14mm; cable: L = 1.5m.
HD206/54: RS232C serial connection cable; cable: L=1.5m; 9-pole standard connector/ 8 pole minidin
HD75: Calibration saturated solution at 75%RH
HD33: Calibration saturated solution at 33%RH
DeltaLog2: Software to download and show data on PC for HD 206/226 – HD 207/227 series minidatalogger. Supplied with HD206/54 serial cable to connect the minidatalogger to a PC. Minidin 8-pole male connector and Sub D 9-pole female connector. Cable L= 1,5 m.
C.206: Cable for instruments of the series HD21…1 and hd21…2 and mini data logger to connect directly to USB in-put of PC.
BL.1: Li-SoCl2 3.6V 1Ah battery

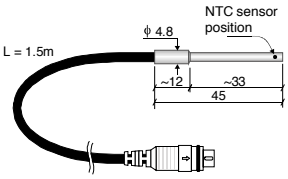
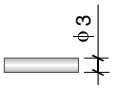


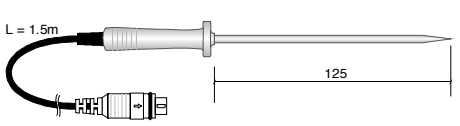
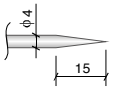
Data display in graphic form.

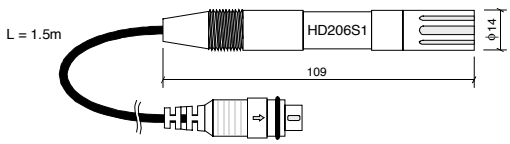


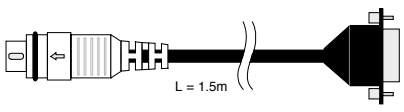
A) Measurement registered by the two input channels of the instrument.
B) Diagram of the two channels The vertical yellow lines represent the storage interval activated through the "Store Data On File" command.
C) Alarm current status. The red LED turns on when the setpoint is exceeded. Press the Reset key to clear it.
D) Alarm history: it registers all the alarms occurred since the "READ CHANNELS" window was opened.

Specifications of the minidatalogger optional probe

CODE	IMMERSION PROBE (NTC)	TERMINATION
TP207	Probe for measurements in liquids, powders and gas 	

CODE	POINTED PROBE (NTC)	TERMINATION
TP207P	Pointed/Immersion stailess steel probe for food industry applications 	

CODE	TEMPERATURE AND RELATIVE HUMIDITY COMBINED PROBE
HD206/S1	

CODE	PC - MINI DATALOGGER ←→RS232C CONNECTION CABLE
HD206/54	

Microclimate - WBGT

- HD 32.1 pag. 278
  Thermal Microclimate in compliance with ISO 7726, ISO 7730, ISO 7243, ISO 7933, ISO 11079, ISO 8996

- HD 32.2 pag. 288
  WBGT Index in compliance with ISO 7243, ISO 8996, ISO 7726

- HD 32.3 pag. 292
  WBGT PMV - PPD Index in compliance with ISO 7243, ISO 8996, ISO 7726, ISO 7730

The qualitative level of our instruments is the result of a continuous evolving of the product itself. This way bring to slight differences between what reported on this manual and the instruments you bought. We can not completely exclude the presence of errors for which we apologise. Data, images and descriptions included in this catalogue can not be enforced legally. We reserve the right to perform any modification and correction at any time without notice.

HD 32.1

HD 32.1
INSTRUMENT FOR STUDYING, MEASURING AND CONTROLLING THE MICROCLIMATE

The **Thermal Microclimate HD32.1** instrument is manufactured by **Delta Ohm Srl** and it allows studying, measuring and controlling the Microclimate in the workplace, in compliance with the following standards:

EN ISO 7726: Ergonomics of the thermal environment - Instruments for measuring physical quantities.
EN ISO 7730: Moderate Thermal Environments - Determination of the PMV and PPD indices and specification of the condition for thermal comfort.
EN ISO 27243: Hot environments. Estimation of the heat stress on working man, based on the WBGT Index (Wet bulb Globe temperature).
EN ISO 7933: Ergonomics of the thermal environment - Analytical determination and interpretation of heat stress using calculation of the predicted heat strain.
ENV ISO 11079: Evaluation of cold environments - Determination of required clothing insulation (IREQ).
EN ISO 8996: Ergonomics of the thermal environment - Determination of metabolic rate.

Thanks to specific software: Moderate environments, Hot environments, Cold environments and Discomfort, as well as specific probes, the instrument can perform the following measurements:

- Globe temperature
- Natural wet bulb temperature
- Ambient temperature
- Atmospheric pressure
- Relative Humidity
- Air velocity
- Air temperature at the height of the head (1,7m subject standing; 1,1m subject sitting).
- Air temperature at the height of the abdomen (1,1 m subject standing; 0,6m subject sitting).
- Air temperature at the height of the ankles (0,1 m).
- Temperature at the floor level.
- Net radiation temperature.
- Net radiation.
- Radiant temperature asymmetry.
- Illuminance, luminance, PAR, irradiance, CO and CO_2.

According to measurements performed, HD32.1, together with its specific software, calculates the following parameters:

- **t_r :** Mean radiant temperature
- **PMV :** Predicted Mean Vote
- **PPD :** Predicted Percentage Dissatisfied
- **DR :** Draught Rating
- **t_0 :** Operative temperature

- **IS :** Scharlau Index
- **DI :** Thom Index
- **THI :** Thermohygrometric Index
- **RSI :** Relative Strain Index
- **SSI :** New Summer Simmer Index
- **HI :** Heat Index
- **H :** Humidex Index
- **T_{eq} :** Equivalent Temperature Index

To compute the calculation of these indexes, temperature and relative humidity of the air have to be detected and the measured values to be inserted in the table “Discomfort indexes”.

- **$WBGT_{Indoor}$:** Wet bulb Globe temperature
- **$WBGT_{Outdoor}$:** Wet bulb Globe temperature in the presence of radiation
- **SW_p :** Sweat rate
- **E_p :** Predicted evaporative heat flow
- **PHS :** T_{re} - Water loss - $D_{lim\ tre}$ - $D_{limloss50}$ - $D_{limloss95}$
- **IREQ :** Required clothing insulation
- **DLE :** Duration Limit Exposure
- **RT :** Recovery time
- **WCI :** Wind chill index
- **PD_v :** Percentage Dissatisfied due to vertical temperature difference (head-ankles)
- **PD_f :** Percentage Dissatisfied due to floor temperature
- **PD_Δ :** Percentage Dissatisfied due to radiant asymmetry
- **FLD :** Average Day Light Factor

The calculation of the FLD index requires light measurement (photometric probe LP-471PHOT). Requires program “**HD32.1 prog. C**”

Three operating programs are already uploaded on the instrument and they can be used according to the analysis:

HD32.1 A operating program: Analysis of the Microclimate in moderate, hot and cold environments.
HD32.1 B operating program: Analysis of Discomfort in moderate environments.
HD32.1 C operating program: Measurement of Physical Quantities for general purposes.
The HD32.1 together with C operating program turns into a multifunction datalogger instrument displaying maximum, minimum and average values. By connecting SICRAM probes, the instrument allows measuring temperature, temperature and relative humidity, air velocity, flow, light (with photometric/radiometric, CO and CO_2 probes).

TECHNICAL SPECIFICATIONS

Instrument

Dimensions (Length x Width x Height)	220x180x50 mm
Weight	1100 g (with batteries)
Materials	ABS, Polycarbonate and Aluminium
Display	Backlit, dot matrix 128x64 dots, visible area 56x38mm

Operative conditions

Operative temperature	-5 … 50°C
Storage temperature	-25 … 65°C
Operative Relative Humidity	0 … 90% RH non condensing
Protection class	**IP64**

Instrument uncertainty

± 1 digit @ 20°C

Power supply

Mains adapter (code SWD10)	12Vdc/1A
Batteries	Four 1.5V batteries size C-BABY
Autonomy	With temperature and RH probes: 200 hours with 7800mAh alkaline batteries With hotwire probe @ 5m/s: 100 hours with 7800mAh alkaline batteries
Power absorbed (instrument off)	< 45µA

Security of stored data

Unlimited

Atmospheric pressure measurement with inbuilt sensor

Accuracy	±0.5hPa
Response time	1Hz

Temperature measurement with instrument

Pt100 measuring range	-200…+650°C
Resolution	0.01°C in the range ±199.99°C, 0.1°C outside this range
Accuracy	±0.01°C in the range ±199.99°C, ± 0.1°C outside this range
Temperature drift @20°C	0.003%/°C
Drift after 1 year	0.1°C/year

Instrument relative humidity measurement (capacitive sensor)

Measuring range	0…100%RH
Resolution	0.1%RH
Accuracy	±0.1%RH
Temperature drift @20°C	0.02%RH/°C
Drift after 1 year	0.1%RH/year

EXPLANATORY TABLES - HOW TO USE PROBES FOR MICROCLIMATIC MEASUREMENTS

DeltaLog10 Software	Operating program	Main calculated indices		Environments	Standard
DeltaLog10 BASIC	**A Prog.**	**t_a:** Air temperature **t_r:** Mean radiant temperature **PMV:** Predicted mean vote **PPD:** Predicted Percentage Dissatisfied **DR:** Draught rating **t_o:** Operative temperature	**IS:** Scharlau Index **DI:** Thom Index **THI:** Thermohygrometric Index **RSI:** Relative Strain Index **SSI:** New Summer Simmer Index **HI:** Heat Index **H:** Humidex Index **T_{eq}:** Equivalent Temperature Index To compute the calculation of these indexes, temperature and relative humidity of the air have to be detected and the measured values to be inserted in the table “Discomfort indexes”.	Moderate	EN ISO 7730
DeltaLog10 Hot environments	**A Prog.**	**WBGT:** Wet bulb globe temperature **SW_p:** Sweat rate **E_p:** Predicted evaporative heat flow **PHS:** Predicted Heat Strain Model		Severe hot	EN ISO 27243 EN ISO 7933
DeltaLog10 Cold Environments	**A Prog.**	**IREQ:** Required clothing insulation **DLE:** Duration limit exposure **RT:** Recovery time **WCI:** Wind chill index		Severe cold	EN ISO 11079
DeltaLog10 Analysis of Discomfort	**B Prog.**	**PD_v:** Percentage Dissatisfied due to vertical temperature difference (head-ankles). **PD_f:** Percentage Dissatisfied due to floor temperature **PD_Δ:** Percentage Dissatisfied due to radiant asymmetry		Moderate	EN ISO 7730
DeltaLog10 BASIC	**C Prog.**	**t_a:** Air temperature **RH-t:** Humidity-temperature **V_a - t:** Air velocity, temperature and flow **Lux:** Illuminance **cd/m²:** Luminance **µW/m²:** Irradiance **W/m²:** Irradiance **µmol/m²s:** PAR **ppm:** CO and CO_2	**FLD:** Average Day Light Factor The calculation of the FLD index requires light measurement (photometric probe LP471PHOT). Requires program “HD32.1 prog. C”	General purposes	

Connections

Input for probes with SICRAM module	8 male 8-pole DIN 45326 connectors

RS232C Serial interface

Type	Galvanically isolated RS232C
Baud rate	Configurable between 1200 and 38400 baud
Data Bit	8
Parity	None
Stop Bit	1
Flow control	Xon/Xoff
Serial cable length	Max 15m

USB Interface

Type	1.1 - 2.0 galvanically isolated

Memory	divided in 64 blocks

Storage capacity *67600 storages of 8 inputs each*

Storage internal

to select between: 15, 30 seconds,
1, 2, 5, 10, 15, 20, 30 minutes and 1 hour

Printing internal

to select between: 15, 30 seconds,
1, 2, 5, 10, 15, 20, 30 minutes and 1 hour

EMC standards

Safety	EN61000-4-2, EN61010-1 level 3
Electrostatic discharge	EN61000-4-2 level 3
Electrical Fast Transients	EN61000-4-4 level 3, EN61000-4-5 level 3
Voltage variations	EN61000-4-11
Electromagnetic interference susceptibility IEC1000-4-3	
Electromagnetic interference emission	EN55020 class B

The following table explains how to use the operating programs and the different software applications available.
A series of probes specially designed for different applications completes the instrument.
Delta Ohm is SIT Centre no. 124. Therefore, it can calibrate the probes employed and issue their SIT certificates.

Table of probes for HD32.1 A operating program: Microclimatic Analysis

TP3207	Dry bulb temperature probe.
TP3275	Globe temperature probe Ø 150mm (alternatively TP3276).
TP3276	Globe temperature probe Ø 50mm (alternatively TP3275).
HP3217DM	Two-sensor probe for measuring natural wet bulb temperature and dry bulb temperature (alternatively: HP3201 and TP3207).
AP3203	Omnidirectional hotwire probe (0°C…80°C)
AP3203-F	Omnidirectional hotwire probe (-30°C…+30°C)
HP3201	Natural wet bulb temperature probe.
HP3217R	Combined temperature and relative humidity probe.

The following table lists all the necessary probes for determining the microclimatic indices.
The following indices are obtained by using the **DeltaLog10 BASIC** software**:**
Each line shows the combination of probes to use for calculating the indices

	TP3207	TP3275	TP3276	AP3203	AP3203-F	HP3201	HP3217R	HP3217DM
t_a: Air temperature.	•							
								•
							•	
t_r: Mean radiant temperature.	•	•		•	•			
	•		•	•	•			
		•		•	•			•
			•	•	•			•
		•		•	•		•	
			•	•	•		•	
PMV: Predicted mean vote. **PPD:** Predicted Percentage Dissatisfied	•	•		•	•		•	
	•		•	•	•		•	
		•		•	•		•	•
			•	•	•		•	•
		•		•	•		•	
			•	•	•		•	
DR: Draught rating.	•			•	•			
				•	•			•
				•	•		•	
t_o: Operative temperature.	•	•		•	•			
	•		•	•	•			
		•		•	•			•
			•	•	•			•
		•		•	•		•	
			•	•	•		•	
T_{eq}: Equivalent temperature. (necessary for measuring: **atmospheric pressure**)	•						•	
							•	
							•	•
IS : Scharlau Index							•	
DI : Thom Index							•	
THI : Thermohygrometric Index							•	
RSI : Relative Strain Index							•	
SSI : New Summer Simmer Index							•	
HI : Heat Index							•	
H : Humidex Index							•	
T_{eq} : Equivalent Temperature Index							•	
To compute the calculation of these indexes, temperature and relative humidity of the air have to be detected and the measured values to be inserted in the table “Discomfort indexes”								

The following indices are obtained by using the **DeltaLog10 Hot environments** software**:**
Each line shows the combination of probes to use for calculating the indices

		TP3207	TP3275	TP3276	AP3203	HP3201	HP3217R	HP3217DM
WBGT Indoor: Wet bulb globe temperature			•			•		
				•		•		
WBGT Outdoor: Wet bulb globe temperature in the presence of radiation		•	•			•		
		•		•		•		
			•			•		•
				•		•		•
			•			•	•	
				•		•	•	
SW_P: Sweat rate **E_P:** Predicted evaporative heat flow		•	•		•		•	
		•		•	•		•	
			•		•		•	•
				•	•		•	•
			•		•		•	
				•	•		•	
PHS	(1) T_{re}	•	•		•		•	
	Water loss	•		•	•		•	
	$D_{lim\ tre}$		•		•		•	•
	$D_{limloss50}$			•	•		•	•
	$D_{limloss95}$		•		•		•	
				•	•		•	

(1) T_{re}**:** Predicted rectal temperature
$D_{lim\ tre}$**:** Maximum allowable exposure duration for heat storage
$D_{limloss50}$**:** Maximum allowable exposure duration for water loss, standard subject
$D_{limloss95}$**:** Maximum allowable exposure duration for water loss, 95% of the working population

The following indices are obtained by using the **DeltaLog10 Cold environments** software**:**

Each line shows the combination of probes to use for calculating the indices

			TP3207	TP3275	TP3276	AP3203-F [3]	HP3201	HP3217	HP3217DM
[2]	**IREQ:**	Required clothing insulation	•	•		•		•	
	DLE:	Duration limit exposure	•		•	•		•	
	RT:	Recovery time		•		•		•	•
	WCI:	Wind chill index			•	•		•	•
				•		•		•	
						•		•	
			•			•			
						•			•

[2] **Using IREQ, DLE, RT, WCI it is possible to calculate:**

- Ratio of surface area of the clothed body to the surface area of the nude body
- Mean skin temperature
- Fraction of wet skin
- Total convective heat conduction
- Total radiative heat conduction
- Partial water pressure at ambient temperature
- Surface temperature of clothing
- Evaporative resistance of limiting layer and clothing

- Heat exchange by evaporation
- Respiratory heat exchange by convection and evaporation
- Heat exchange by radiation
- Heat exchange by convection
- Duration limit exposure
- Required clothing insulation
- Intrinsic clothing insulation

[3] **AP3203: 0°C…+80°C**
AP3203-F: -30°C…+30°C

Table of probes for HD32.1 B operating program: Analysis of Discomfort

TP3227K	Temperature probe composed of 2 independent probes, temperature of the head and abdomen.
TP3227PC	Temperature probe composed of 2 independent probes, temperature of the ankles and the floor.
TP3207P	Temperature probe Pt100 sensor, floor temperature.
TP3207TR	Probe for measuring radiant temperature (net-radiometer)

The following table lists all the necessary probe for determining the microclimatic indices.
The following indices are obtained by using the **DeltaLog10 Analysis of Discomfort** software**:**

Each line shows the combination of probes to use for calculating the indices

		TP3227K	TP3227PC	TP3207P	TP3207TR	LP 471 Phot
PD_V:	Percentage Dissatisfied with vertical temperature difference (head-ankles).	•	•			
PD_F:	Percentage Dissatisfied with floor temperature.		•			
				•		
PD_A:	Percentage Dissatisfied with radiant asymmetry.				•	
FLD:	Average Day Light Factor Requires HD32.1 program C					•

ORDERING CODES

HD32.1 Kit basic: It is composed of **HD32.1 instrument, A operating program: Analysis of the Microclimate,** four 1.5V alkaline batteries size C-BABY, instruction manual. The instrument includes atmospheric pressure sensor.
DeltaLog10 Basic moderate environments Software (for operating systems from Windows 98 to Windows Vista).

DeltaLog10 Hot environments Software: The use of this software requires the **complete HD32.1 basic Kit.**

DeltaLog10 Cold environments Software: The use of this software requires the **complete HD32.1 basic Kit.**

DeltaLog10 Analysis of discomfort Software: The use of this software requires the **B operating program: Analysis of discomfort** and the **complete HD32.1 basic Kit.**

DeltaLog10 Physical Quantities Software: The use of this software requires the **C operating program: Physical quantities** and the **complete HD32.1 basic Kit.**

HD32.1 Program B - Discomfort Analysis: HD32.1 program for discomfort measurements in moderate environments. Requires the software DeltaLog10 Discomfort Analysis.

HD32.1 Program C - Physical Quantities: HD32.1 program for the measurements of temperature, relative humidity, light, air speed, concentration of CO and CO^2. Requires the software DeltaLog10 Discomfort Analysis.

Probes, holder, case and cables must be ordered separately.

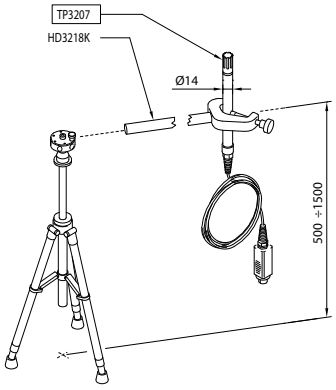
ACCESSORIES:

VTRAP32: Tripod equipped with 6-input head and 4 probe holders code **HD3218K**
9CPRS232: Connection cable 9 - pole Sub-D female connector for RS232C.
CP22: USB 2.0 connection cable connector type A - connector type B.
BAG32: Carrying case for the HD32 and its accessories.
SWD10: 100-240Vac/12Vdc-1A Stabilized mains power supply.
HD3218K: Probe shaft
AM32: Two-clamp shaft for two probes
AQC: 200cc. distilled water and 3 braids for HP3201 or HP3217DM probes.

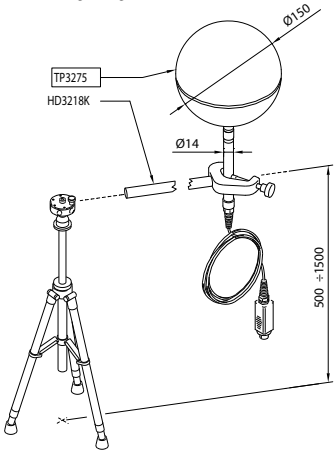
Delta Ohm metrological laboratories are accredited by SIT in Temperature, Humidity, Pressure, Photometry/Radiometry, Acoustics and Air velocity. Probes can be supplied with SIT calibration certificate on request.

PROBES FOR OPERATING PROGRAMS:
A: Microclimatic Analysis
B: Analysis of Discomfort

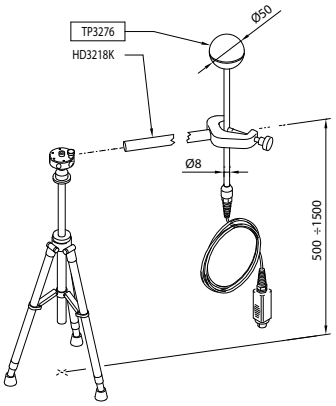
TP3207: Temperature probe, Pt100 sensor. Probe stem Ø 14mm, length 140 mm. Cable length 2 metres. Equipped with SICRAM module.
Used for calculating the following indices: **IREQ,WCI, DLE, RT, PMV, PPD, WBGT, SR**. Used for calculating Mean radiant temperature.
Measuring range: -40°C…+100°C



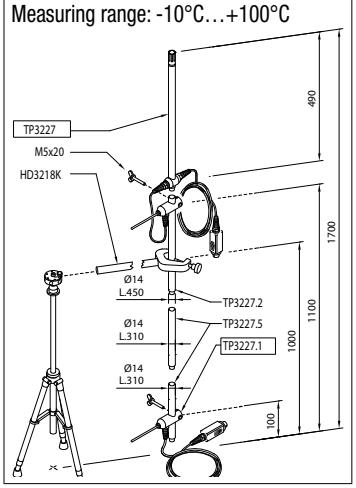
TP3275: Globe temperature probe, Pt100 sensor, globe Ø 150 mm.
Stem Ø 14 mm, length 110 mm. Cable length 2 metres. Equipped with SICRAM module.
Used for measuring: **Mean radiant temperature, WBGT**.
Measuring range: -10°C…+100°C



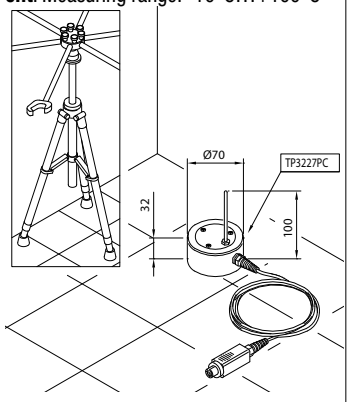
TP3276: Globe temperature probe, Pt100 sensor, globe Ø 50 mm.
Stem Ø 8 mm, length 110 mm. Cable length 2 metres. Equipped with SICRAM module. Used for measuring: **Mean radiant temperature, WBGT**.
Measuring range: -10°C…+100°C



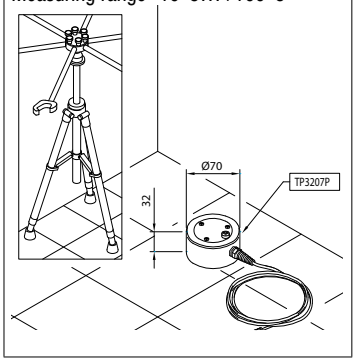
TP3227K: Temperature probe composed of 2 independent probes, Pt100 sensor. Stem diameter Ø 14 mm, length 500 mm. Cable length 2 metres. Equipped with double SICRAM module and TP3227.2 extension shaft Ø 14 mm, length 450 mm. Used for measuring **local discomfort due to vertical thermal gradient**. It can be used for studying subjects sitting or standing. The height of one probe can be regulated.
Measuring range: -10°C…+100°C



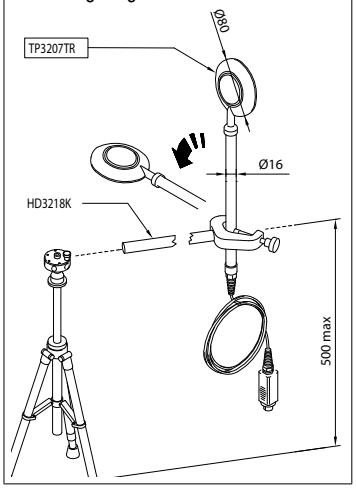
TP3227PC: Temperature probe composed of 2 independent probes, Pt100 sensor, one for measuring floor temperature (diameter Ø 70 mm, height 30 mm), the other for measuring temperature at the height of the ankles (diameter Ø 3 mm, height 100 mm). Cable length 2 metres. Equipped with double SICRAM module. Used for measuring **local discomfort due to vertical thermal gradient**. Measuring range: -10°C…+100°C



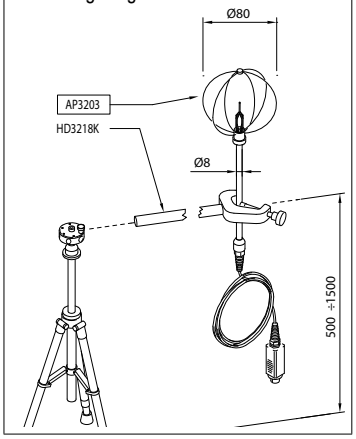
TP3207P: Pt100 sensor temperature probe, for measuring floor temperature (diameter Ø 70 mm, height 30 mm). Cable 2 meters long. Equipped with SICRAM module. Used for the assessment of dissatisfied people to floor temperature due to radiant asymmetry.
Measuring range -10°C…+100°C



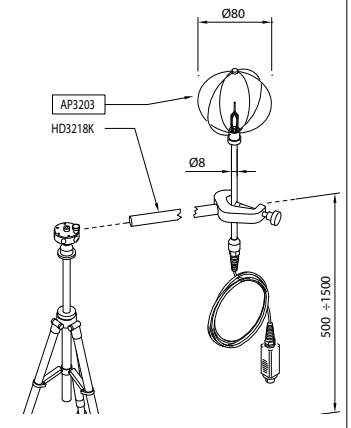
TP3207TR: Probe for measuring radiant temperature. Probe stem Ø 16 mm, length 250 mm. Cable length 2 metres. Equipped with SICRAM module.
Used for the **evaluation of dissatisfied people due to radiant asymmetry**.
Measuring range: 0°C…+60°C



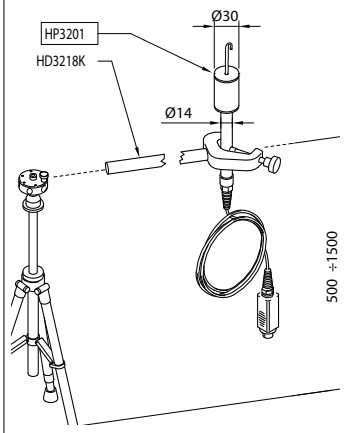
AP3203: Omnidirectional hotwire probe. Measuring range: air velocity 0÷5 m/s. Probe stem Ø 14 mm, length 110 mm. Cable length 2 metres. Equipped with SICRAM module.
Used for calculating the following indices: **IREQ,WCI, DLE, RT, PMV, PPD, SR**. Used for calculating Mean radiant temperature.
Measuring range: 0°C…+80°C



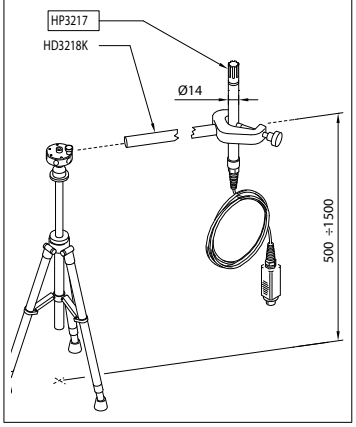
AP3203-F: Omnidirectional hotwire probe. Measuring range: air velocity 0÷5 m/s. Probe stem Ø 14 mm, length 110 mm. Cable length 2 metres. Equipped with SICRAM module.
Used for calculating the following indices: **IREQ,WCI, DLE, RT, PMV, PPD, SR**. Used for calculating Mean radiant temperature.
Measuring range: -30°C…+30°C



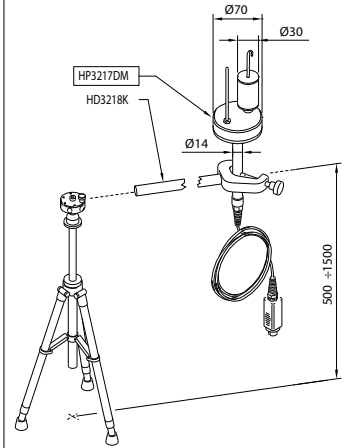
HP3201: Natural wet bulb probe. Pt100 sensor. Probe stem Ø 14 mm, length 110 mm. Cable length 2 metres. Equipped with SICRAM module, spare braid and 50cc. distilled water.
Used for measuring: **WBGT**.
Measuring range: 4°C…+80°C



HHP3217R: Combined temperature and relative humidity probe. Capacitive RH sensor, Pt100 temperature sensor. Probe stem Ø 14 mm, length 110 mm. Cable length 2 metres. Equipped with SICRAM module.
Used for calculating the following indices: **IREQ,WCI, DLE, RT, PMV, PPD, SR**.
Measuring range: 40°C…+100°C



HP3217DM: Double natural wet bulb probe and temperature probe (dry bulb). Probe stem Ø 14 mm, length 110 mm. Cable length 2 metres. Equipped with double SICRAM module, spare braid and 50cc. distilled water.
Measuring range: 4°C…+80°C



TECHNICAL DATA OF PROBES AND MODULES EQUIPPED WITH INSTRUMENT
Temperature probes Pt100 sensor with SICRAM module

Model	Type	App. range	Accuracy
TP472I	Immersion	-196°C…+500°C	±0.25°C (-196°C…+350°C) ±0.4°C (+350°C…+500°C)
TP472I.0	Immersion	-50°C…+400°C	±0.25°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP473P	Penetration	-50°C…+400°C	±0.25°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP473P.0	Penetration	-50°C…+400°C	±0.25°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP474C	Contact	-50°C…+400°C	±0.3°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP474C.0	Contact	-50°C…+400°C	±0.3°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP475A.0	Air	-50°C…+250°C	±0.3°C (-50°C…+250°C)
TP472I.5	Immersion	-50°C…+400°C	±0.3°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP472I.10	Immersion	-50°C…+400°C	±0.30°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP49A	Immersion	-70°C…+400°C	±0.25°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP49AC	Contact	-70°C…+400°C	±0.25°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP49AP	Penetration	-70°C…+400°C	±0.25°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP875	Globethermometer Ø 150mm	-30°C…+120°C	±0.25°C
TP876	Globethermometer Ø 50mm	-30°C…+120°C	±0.25°C
TP87	Immersion	-50°C…+200°C	±0.25°C
TP878 TP878.1	For solar panels	+5°C…+80°C	±0.25°C
TP879	For compost	-20°C…+120°C	±0.25°C

Common characteristics
Temperature drift @ 20°C 0.003%/°C

4 wire Pt100 and 2 wire Pt1000 Probes

Model	Type	Application range	Accuracy
TP47.100	Pt100 4 wires	-50…+400°C	Class A
TP47.1000	Pt1000 2 wires	-50…+400°C	Class A

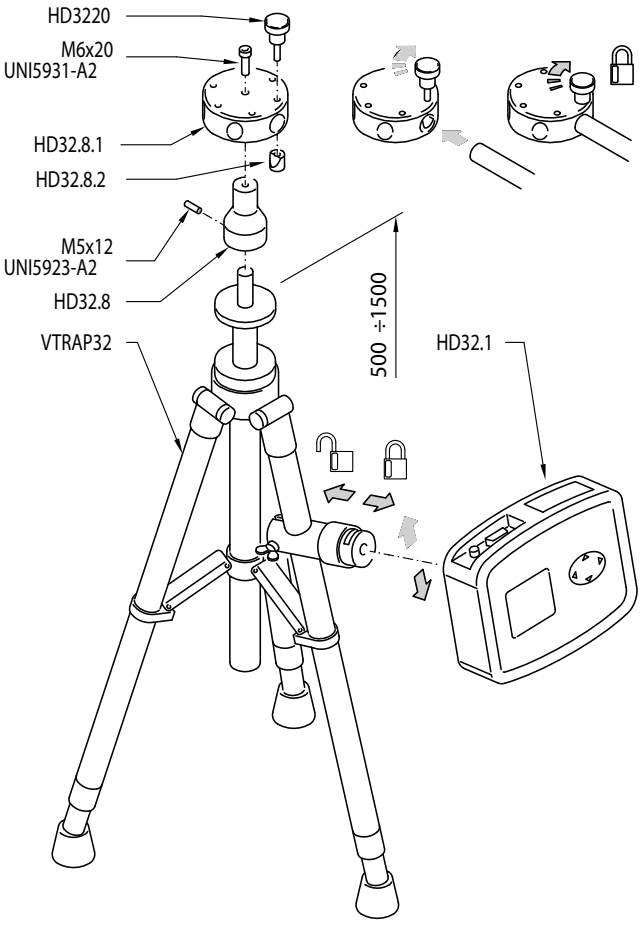
Common characteristics
Temperature drift @ 20°C
Pt100 0.003%/°C
Pt1000 0.005%/°C

Probes equipped with SICRAM module

TP472I: Immersion probe, Pt100sensor. Stem Ø 3 mm, length 300 mm. Cable 2 meters long.
TP472I.0: Immersion probe, Pt100sensor. Stem Ø 3 mm, length 230 mm. Cable 2 meters long.
TP473P: Penetration probe, Pt100sensor. Stem Ø 4mm, length 150 mm. Cable 2 meters long.
TP473P.0: Penetration probe, Pt100sensor. Stem Ø 4mm, length 150 mm. Cable 2 meters long.
TP474C: Contact probe, Pt100sensor. Stem Ø 4mm, length 230mm, contact surface Ø 5mm. Cable 2 meters long.
TP474C.0: Contact probe, Pt100sensor. Stem Ø 4mm, length 230mm, contact surface Ø 5mm. Cable 2 meters long.
TP475A.0: Air probe, Pt100sensor. Stem Ø 4mm, length 230mm. Cable 2 meters long.
TP472I.5: Immersion probe, Pt100sensor. Stem Ø 6mm, length 500 mm. Cable 2 meters long.
TP472I.10: Immersion probe, Pt100sensor. Stem Ø 6mm, length 1,000mm. Cable 2 meters long.
TP49A: Immersion probe, Pt100sensor. Stem Ø 2.7mm, length 150mm. Cable 2 meters long. Aluminium handle.
TP49AC: Contact probe, Pt100sensor. Stem Ø 4 mm, length 150mm. Cable 2 meters long. Aluminium handle.
TP49AP: Penetration probe, Pt100sensor. Stem Ø 2.7mm, length 150mm. Cable 2 meters long. Aluminium handle.
TP875: Globe thermometer Ø 150 mm with handle. Cable 2 meters long.
TP876: Globe thermometer Ø 50 mm with handle. Cable 2 meters long.
TP87: Immersion probe, Pt100sensor. Stem Ø 3 mm, length 70 mm. Cable 2 meters long.
TP878: Contact probe for solar panels. Cable 2 meters long.
TP878.1: Contact probe for solar panels. Cable 5 meters long
TP879: Penetration probe for compost. Stem Ø 8 mm, length 1 meter. Cable 2 meters long.

Temperature probes without SICRAM module

TP47.100: Direct 4 wires Pt100 sensor immersion probe. Stem Ø 3 mm, length 230mm. 4 wires connection cable with connector, 2 meters long.
TP47.1000: Pt1000 sensor immersion probe. Stem Ø 3 mm, length 230mm. 2 wires connection cable with connector, 2 meters long.
TP47: Only connector for probe connection without SICRAM module: direct 3 and 4 wires Pt100, 2 wires Pt1000.



TP3206

AP3203
AP3203-F

TP3207TR

HP3201

Relative humidity and temperature probes using SICRAM module

Model	Temperature sensor	Working range		Accuracy	
		%RH	Temperature	%RH	Temp
HP472ACR	Pt100	0…100%RH	-20°C…+80°C	0°C…40°C ±1,5%RH (5…90%RH) ±2,5%RH (90…100%RH)	±0.3°C
HP572ACR	Thermocouple K	0…100%RH	-20°C…+80°C		±0.5°C
HP473ACR	Pt100	0…100%RH	-20°C…+80°C		±0.3°C
HP474ACR	Pt100	0…100%RH	-40°C…+150°C	-40°C…150°C (180°C) ±(1,5+0,02 times the displayed value)	±0.3°C
HP475ACR	Pt100	0…100%RH	-40°C…+150°C		±0.3°C
HP475AC1R	Pt100	0…100%RH	-40°C…+150°C		±0.3°C
HP477DCR	Pt100	0…100%RH	-40°C…+150°C		±0.3°C
HP478ACR	Pt100	0…100%RH	-40°C…+150°C		±0.3°C

Common characteristics
Relative humidity

Sensor	Capacitive
Typical capacity @30%RH	300pF
Temperature drift @ 20°C	0.02%RH/°C
Response time %RH at constant temperature	10sec (10÷80%RH; air speed=2m/s, at constant temperature)

Temperature with Pt100 sensor

Temperature drift @ 20°C	0.003%/°C

Temperature with thermocouple K - HP572AC

Resolution	0.1°C
Temperature drift @ 20°C	0.02%/°C

Relative humidity and temperature probes complete with SICRAM module

HP472ACR: %RH and temperature combined probe, dimensions Ø 26x170 mm. 2 m connecting cable.

HP572ACR: %RH and temperature combined probe, **K thermocouple sensor**. Dimensions Ø 26x170 mm. 2 m connecting cable.

HP473ACR: %RH and temperature combined probe. Dimensions: handle Ø 26x130 mm, probe Ø 14x110 mm. 2m connecting cable.

HP474ACR: %RH and temperature combined probe. Dimensions: handle Ø 26x130 mm, probe Ø 14x210 mm. 2m connecting cable.

HP475ACR: %RH and temperature combined probe. 2 m connecting cable. Handle Ø 26x110 mm. Stainless-steel tube Ø 12x560 mm. Terminal tip Ø 13.5x75 mm.

HP475AC1R: %RH and temperature combined probe. 2 m connection cable. Handle Ø 26x110 mm. Stainless steel stem Ø 14x480 mm.

HP477DCR: %RH and temperature combined sword probe. 2 m connecting cable. Handle Ø 26x110 mm. Probe tube 18x4 mm, length 520 mm.

HP478ACR: %RH and temperature combined probe. Dimensions Ø 14x130 mm. 5m connection cable.

PROBES AND MODULES TECHNICAL DATA EQUIPPED WITH INSTRUMENT

Wind speed measurement probes

Hot-wire probes: AP471 S1 - AP471 S2 - AP471 S3 - AP471 S4 - AP471 S5

	AP471 S1 - AP471 S3	AP471 S2	AP471 S4 AP471 S5
Type of measure	Air speed, calculated flow rate, air temperature		
Type of sensor			
Speed	NTC thermistor	Omnidirectional NTC thermistor	
Temperature	NTC thermistor	NTC thermistor	
Measurement range			
Speed	0,1…40m/s	0,1…5m/s	
Temperature	-25…+80°C	-25…+80°C	0…80°C
Measurement resolution:			
Speed	0.01 m/s 0.1 km/h 1 ft/min 0.1 mph 0.1 knot		
Temperature	0.1°C		
Measurement accuracy:			
Speed	±0.1 m/s (0…0.99 m/s)	±0.05m/s (0…0.99 m/s)	
	±0.3 m/s (1.00…9.99 m/s)	±0.15m/s (1.00…5.00 m/s)	
	±0.8 m/s (10.00…40.0 m/s)		
Temperature	±0.8°C (-10…+80°C)	±0.8°C (-10…+80°C)	
Minimum speed	0.1 m/s		
Air temperature compensation	0…80°C		
Sensor working conditions	Clean air, RH<80%		
Battery life	Approx. 20 hours @ 20 m/s with alkaline batteries	Approx. 30 hours @ 5 m/s with alkaline batteries	
Unit of Measurement			
Speed	m/s – km/h – ft/min – mph – knot		
Flow rate	l/s - m^3/s - m^3/min - m^3/h - ft^3/s - ft^3/min		
Pipeline section for flow rate calculation	0.0001…1.9999 m^2		
Cable length	~2m		

Vane probes: AP472 S1… - AP472 S2 - AP472 S4…

	AP472 S1…	AP472 S2	AP472 S4…			
			L	LT	H	HT
Type of measure	Air speed, calculated flow rate, air temperature	Air speed, calculated flow rate	Air speed, calculated flow rate.	Air speed, calculated flow rate, air temperature.	Air speed, calculated flow rate.	Air speed, calculated flow rate, air temperature.
Diameter	100mm	60mm	16mm			
Type of measurement						
Speed	Vane	Vane	Vane			
Temperature	K thermocouple	----	----	K thermo couple	----	K thermo couple
Measurement range						
Speed (m/s)	0.6…25	0.5…20	0.8…20		10…40	
Temperature (°C)	-25…+80 (*)		-25...+80 (*)			
Resolution						
Speed	0.01 m/s 0.1 km/h 1 ft/min 0.1 mph 0.1 knot					
Temperature	0.1°C	----	----	0.1°C	----	0.1°C
Accuracy						
Speed	±(0.3 m/s +1.5%f.s.)	±(0.3m/s +1.5%f.s.)	±(0.4 m/s +1.5%f.s.)			
Temperature	±0.8°C	----	----	±0.8°C	----	±0.8°C
Minimum speed	0.6m/s	0.5m/s	0.8m/s		10m/s	
Unit of Measurement						
Speed	m/s – km/h – ft/min – mph – knot					
Flow rate	l/s - m^3/s - m^3/min - m^3/h - ft^3/s - ft^3/min					
Pipeline section for flow rate calculation	0.0001…1.9999 m^2					
Cable length	~2m					

(*) The indicated value refers to the vane's working range.

Probes complete with SICRAM module
AIR speed measurement probes

Hot-wire PROBES:

AP471 S1: Hot-wire telescopic probe, measuring range: 0.1…40m/s. Cable length 2 metres.

AP471 S2: Omnidirectional hot-wire probe, measuring range: 0.1…5m/s. Cable length 2 metres.

AP471 S3: Hot-wire telescopic probe with terminal tip for easy position, measuring range: 0.1…40m/s. Cable length 2 metres.

AP471 S4: Omnidirectional hot-wire telescopic probe with base, measuring range: 0.1…5m/s. Cable length 2 metres.

AP471 S5: Omnidirectional hot-wire telescopic probe, measuring range: 0.1…5m/s. Cable length 2 metres.

Vane probes:

AP472 S1L: Vane probe with thermocouple, Ø 100mm. Speed from 0.6 to 25m/s; temperature from -25 to 80°C. Cable length 2 metres.

AP472 S2: Vane probe, Ø 60mm. Speed from 0.5 to 20m/s. Cable length 2 metres.

AP472 S4L: Vane probe, Ø 16mm. Speed from 0.8 to 20m/s. Cable length 2 metres.

AP472 S4LT: Vane probe with thermocouple, Ø 16mm, speed from 0.8 to 20m/s. Temperature from -25 to 80°C with thermocouple K sensor. Cable length 2 metres.

AP472 S4H: Vane probe, Ø 16mm speed from 10 to 40m/s. Cable length 2 metres.

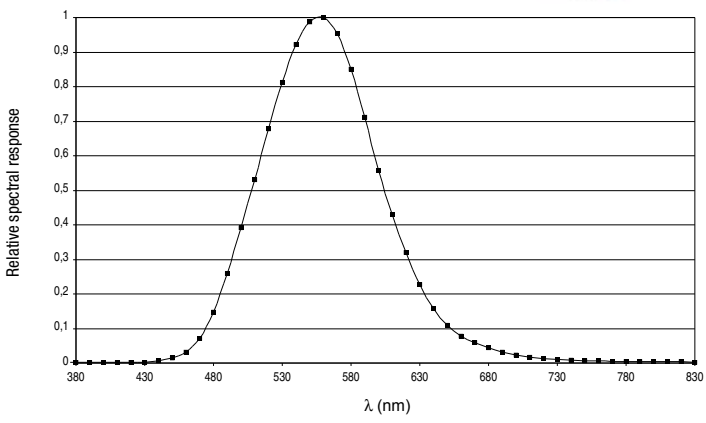
AP472 S4HT: Vane probe with thermocouple, Ø 16mm speed from 10 to 50m/s. Temperature from -25 to 80°C with thermocouple K sensor(*). Cable length 2 metres.

Technical characteristics of photometric and radiometric probes complete with SICRAM module equipped with the instruments

ILLUMINANCE measurement probe LP 471 PHOT				
Measurement range (lux):	0.01…199.99	…1999.9	…19999	…199.99·10³
Resolution (lux):	0.01	0.1	1	0.01·10³
Spectral range:	in agreement with standard photopic curve V(λ)			
Class	C (B on request)			
Calibration uncertainty:	<4%			
f'1 (in agreement with photopic response V(λ)):	<8%			
f_2 (response according to the cosine law):	<3%			
f_3 (linearity):	<1%			
f_4 (instrument reading error):	<0.5%			
f_5 (fatigue):	<0.5%			
α (temp. coefficient) f_6 (T)	<0.05%K			
Drift after 1 year:	<1%			
Functioning temperature:	0…50°C			
Reference Standards	CIE n.69 - UNI 11142			

Photometric probe for **ILLUMINANCE** measurement, spectral response in agreement with standard photopic vision, diffuser for cosine correction.
Measurement range: 0.01 lux…200·10³ lux.
CIE69, UNI11142

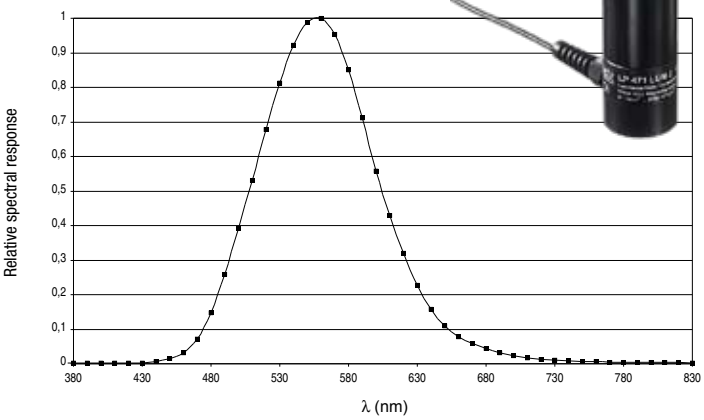
Typical response curve: LP 471 PHOT



LUMINANCE measurement probe LP 471 LUM 2				
Measurement range (cd/m²):	0.1…1999.9	…19999	…199.99·10³	…1999.9·10³
Resolution (cd/m²):	0.1	1	0.01·10³	0.1·10³
Optical angle:	2°			
Spectral range:	in agreement with standard photopic curve V(λ)			
Class	C			
Calibration uncertainty:	<5%			
f'1 (in agreement with photopic response V(λ)):	<8%			
f_3 (linearity):	<1%			
f_4 (instrument reading error):	<0.5%			
f_5 (fatigue):	<0.5%			
α (temp. coefficient) f_6 (T)	<0.05%K			
Drift after 1 year:	<1%			
Functioning temperature:	0…50°C			
Reference Standards	CIE n.69 - UNI 11142			

Photometric probe for **LUMINANCE** measurement, spectral response in agreement with standard photopic vision, vision angle 2°.
Measurement range: 0.1 cd/m²…2000·10³ cd/m².

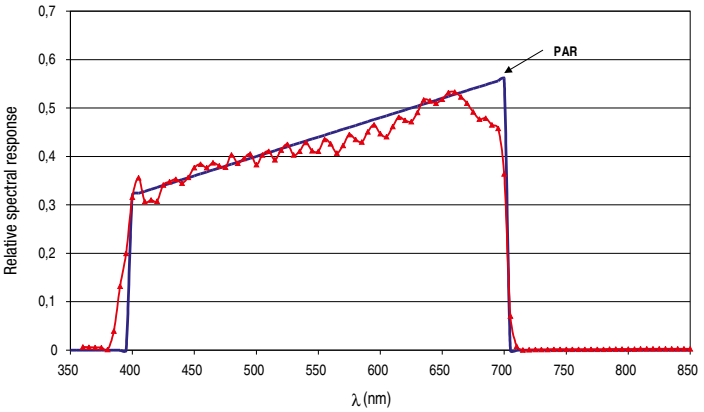
Typical response curve: LP 471 LUM2



Quantum radiometric probe for the measurement of the photon flow across the chlorophyll range PAR LP 471 PAR			
Measurement range (μmol/m⁻²s⁻¹):	0.01… 199.99	200.0…1999.9	2000…10000
Resolution (μmol/m⁻²s⁻¹):	0.01	0.1	1
Spectral range:	400nm…700nm		
Calibration uncertainty:	<5%		
f_3 (linearity):	<1%		
f_4 (instrument reading error):	±1digit		
f_5 (fatigue):	<0.5%		
Drift after 1 year:	<1%		
Working temperature:	0…50°C		

Quantum radiometric probe for the measurement of the photon flow across the chlorophyll range **PAR** (Photosynthetically Active Radiation 400nm…700nm), measurement in μmol/m²s. Measurement range: 0.01μmol/m⁻²s⁻¹…10·10³μmol/m⁻²s⁻¹.

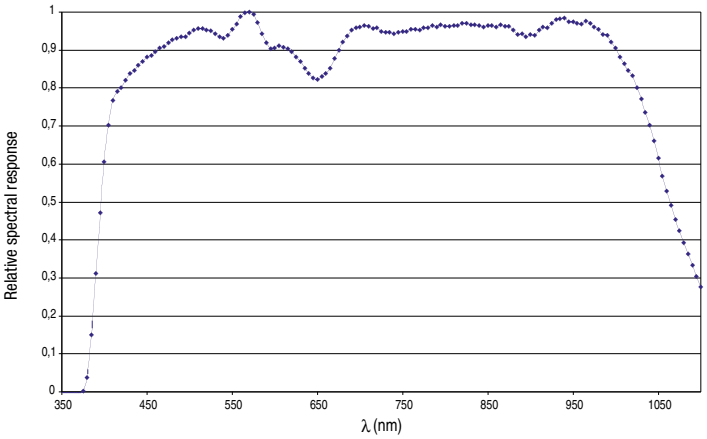
Typical response curve: LP 471 PAR



IRRADIANCE measurement probe LP 471 RAD				
Measurement range (W/m²):	0.1·10⁻³ … 999.9·10⁻³	1.000 …19.999	20.00 …199.99	200.0 …1999.9
Resolution (W/m²):	0.1·10⁻³	0.001	0.01	0.1
Spectral range:	400nm…1050nm			
Calibration uncertainty:	<5%			
f_3 (linearity):	<1%			
f_4 (instrument reading error):	±1digit			
f_5 (fatigue):	<0.5%			
Drift after 1 year:	<1%			
Working temperature:	0…50°C			

Radiometric probe for **IRRADIANCE** measurement in the spectral range 400nm…1050nm, diffuser for cosine correction. Measurement range: 0.1·10⁻³W/m² …2000 W/m².

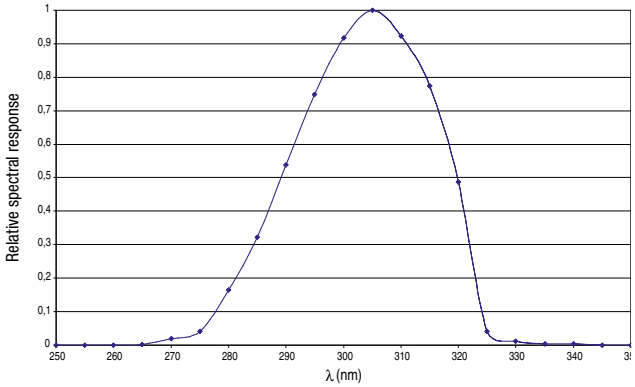
Typical response curve: LP 471 RAD



IRRADIANCE measurement probe LP 471 UVB				
Measurement range (W/m²):	0.1·10⁻³ … 999.9·10⁻³	1.000 …19.999	20.00 …199.99	200.0 …1999.9
Resolution (W/m²):	0.1·10⁻³	0.001	0.01	0.1
Spectral range:	280nm…315nm (Peak 305nm)			
Calibration uncertainty:	<5%			
f_3 (linearity):	<2%			
f_4 (instrument reading error):	±1digit			
f_5 (fatigue):	<0.5%			
Drift after 1 year:	<2%			
Working temperature:	0…50°C			

Radiometric probe for **IRRADIANCE** measurement, in the spectral range 280nm…315nm, peak 305nm, **UVB.** Measurement range: 0.1·10⁻³W/m²…2000 W/m².

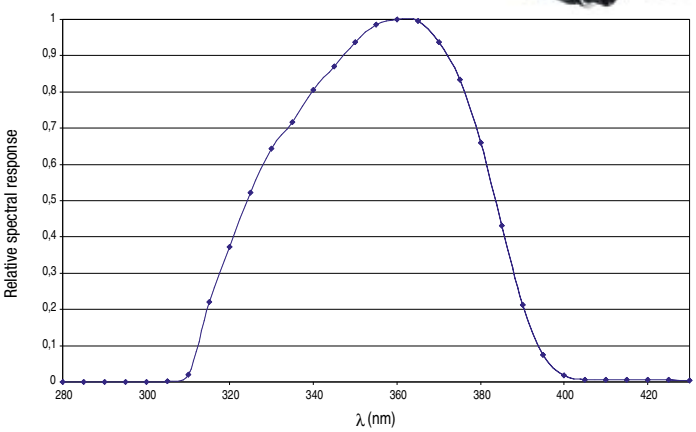
Typical response curve: LP 471 UVB



IRRADIANCE measurement probe LP 471 UVA				
Measurement range (W/m²):	0.1·10⁻³ … 999.9·10⁻³	1.000 …19.999	20.00 …199.99	200.0 …1999.9
Resolution (W/m²):	0.1·10⁻³	0.001	0.01	0.1
Spectral range:	315nm…400nm (Peak 360nm)			
Calibration uncertainty:	<5%			
f_3 (linearity):	<1%			
f_4 (instrument reading error):	±1digit			
f_5 (fatigue):	<0.5%			
Drift after 1 year:	<2%			
Working temperature:	0…50°C			

Radiometric probe for **IRRADIANCE** measurement, in the 315nm…400nm, peak 360nm, **UVA** spectral range. Measurement range: 0.1·10⁻³W/m²…2000 W/m².

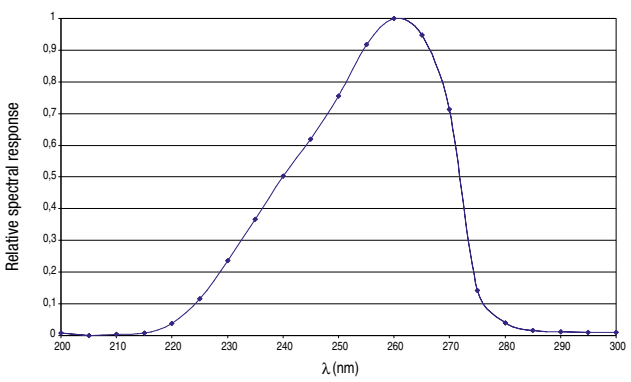
Typical response curve: LP 471 UVA



IRRADIANCE measurement probe LP 471 UVC				
Measurement range (W/m²):	0.1·10⁻³ … 999.9·10⁻³	1.000 …19.999	20.00 …199.99	200.0 …1999.9
Resolution (W/m²):	0.1·10⁻³	0.001	0.01	0.1
Spectral range:	220nm…280nm (Peak 260nm)			
Calibration uncertainty:	<5%			
f_3 (linearity):	<1%			
f_4 (instrument reading error):	±1digit			
f_5 (fatigue):	<0.5%			
Drift after 1 year:	<2%			
Working temperature:	0…50°C			

Radiometric probe for **IRRADIANCE** measurement, in the spectral range 220nm…280nm, peak 260nm, **UVC**. Measurement range: 0.1·10⁻³W/m²…2000 W/m².

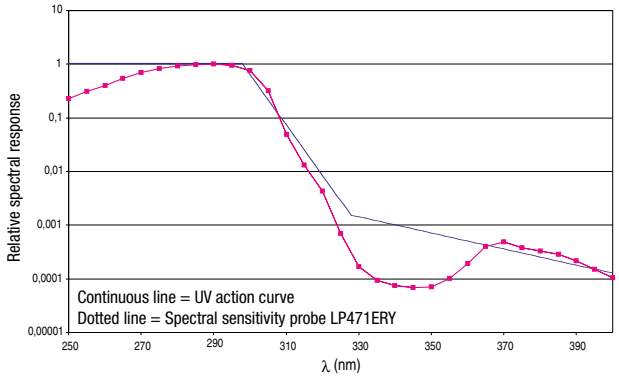
Typical response curve: LP 471 UVC



Measurement probe LP 471ERY of TOTAL EFFECTIVE IRRADIANCE (W/m²) according to the UV action curve UV (CEI EN 60335-2-27)				
Measurement range (W_{eff}/m²):	$0.1 \cdot 10^{-3}$ … $999.9 \cdot 10^{-3}$	1.000 …19.999	20.00 …199.99	200.0 …1999.9
Resolution (W_{eff}/m²):	$0.1 \cdot 10^{-3}$	0.001	0.01	0.1
Spectral range:	UV action curve for erythema measurement (250nm…400nm)			
Calibration uncertainty:	<15%			
f_3 (linearity):	<3%			
f_4 (instrument reading error	±1digit			
f_5 (fatigue):	<0.5%			
Drift after 1 year	<2%			
Working temperature:	0…50°C			
Reference standard	CEI EN 60335-2-27			

Radiometric probe for **EFFECTIVE TOTAL IRRADIANCE** (W_{eff}/m²) according to the UV action curve (CIE EN 60335-2-27). Spectral range: 250 nm…400 nm, Measurement range: $0.1 \cdot 10^{-3} W_{eff}$ /m² … 2000 W_{eff} /m²

Typical response curve: LP 471 ERY



The probe LP 471 ERY measures the effective total irradiance (W_{eff}/m²) according to the UV action curve (CEI EN 60335-2-27). A particular type of photodiode and a combination of special filters bring the spectral response closer to the UV action curve. CEI EN 60335-2-27 standards estabilish a maximum allowable dose of 100J/m² for first-time exposure and an annual dose of 15000J/m². The typical spectral response curve of LP 471 ERY is shown in the Figure together with the UV action curve. The good accordance between the two curves enables the instrument to take reliable measurements of different types of lamps (and filters) used at present for tonning machines.

Probes complete with SICRAM module

LP 471 PHOT: Photometric probe for **ILLUMINANCE** measurement complete with SICRAM module, spectral response in agreement with standard photopic vision, diffuser for cosine correction. Measurement range: 0.01 lux…$200 \cdot 10^3$ lux.

LP 471 LUM 2: Photometric probe for **LUMINANCE** measurement complete with SICRAM module, spectral response in agreement with standard photopic vision, vision angle 2°. Measurement range: 0.1 cd/m²…$2000 \cdot 10^3$ cd/m².

LP 471 PAR: Quantum radiometric probe for the measurement of the photon flow across the chlorophyll range **PAR** (Photosynthetically Active Radiation 400nm…700nm) complete with SICRAM, measurement in µmol/m⁻²s⁻¹, diffuser for cosine correction. Measurement range: $0.01 \mu mol/m^{-2}s^{-1} \ldots 10 \cdot 10^3 \mu mol/m^{-2}s^{-1}$.

LP 471 RAD: Radiometric probe for **IRRADIANCE** measurement complete with SICRAM module; in the 400nm…1050nm spectral range, diffuser for cosine correction. Measurement range: $0.1 \cdot 10^{-3}$W/m² …2000 W/m².

LP 471 UVA: Radiometric probe for **IRRADIANCE** measurement complete with SICRAM module; in the 315nm…400nm, peak 360nm, **UVA** spectral range, quartz diffuser for cosine correction. Measurement range: $0.1 \cdot 10^{-3}$W/m²…2000 W/m².

LP 471 UVB: Radiometric probe for **IRRADIANCE** measurement complete with SICRAM module, in the 280nm…315nm, peak 305nm, **UVB** spectral range, quartz diffuser for cosine correction. Measurement range: $0.1 \cdot 10^{-3}$W/m²…2000 W/m².

LP 471 UVC: Radiometric probe for **IRRADIANCE** measurement complete with SICRAM module, in the 220nm…280nm, peak 260nm, **UVC** spectral range, quartz diffuser for cosine correction. Measurement range: $0.1 \cdot 10^{-3}$W/m²…2000 W/m².

LP 471 ERY: Radiometric probe for **EFFECTIVE TOTAL IRRADIANCE** (W_{eff}/m²) according to the UV action curve (CEI EN 60335-2-27) complete with SICRAM module. Spectral range: 250 nm…400 nm, quartz diffuser for cosine correction. Measurement range: $0.1 \cdot 10^{-3} W_{eff}$ /m² … 2000 W_{eff} /m².

LP BL: Base with levelling device (except LP 471 LUM 2).

CO and CO_2 probes equipped with SICRAM module

HD320A2: Carbon monoxide (CO) probe, fullscale 500ppm. 2m cable. Complete with SICRAM module.

HD320B2: CO_2 probe, fullscale 500 ppm. Ø 14 mm, total length 200 mm. 2 m cable. Complete with SICRAM module.

HD320AS2

HD320A HD320B

HD32.2
WBGT Index

HD 32.2
INSTRUMENT FOR THE ANALYSIS OF THE WBGT INDEX

HD32.2 – WBGT Index is an instrument made by **Delta Ohm srl** for the analysis of **WBGT index** (Wet Bulb Glob Temperature: wet bulb temperature and globe thermometer temperature) in presence or in absence of solar radiation.

Reference Regulations:

ISO 7243: Hot environments. Estimation of the heat stress on working man, based on WBGT index (wet bulb temperature and Globe thermometer).

ISO 8996: Ergonomics of the thermal environment – Determination of the energy metabolism.

ISO 7726: Ergonomics of the thermal environment – Instruments for measuring physical quantities.

The instrument is provided with three inputs for probes with SICRAM module: the SICRAM module interface between the instrument and sensor connected and communicate the sensor parameters and calibration data to the instrument.

All SICRAM probes can be plugged into any of the inputs: they are automatically recognized upon turning the Instrument on.

The **main features** of the instrument are:

- **Logging:** data acquisition and logging to the integral instrument memory. Storage capacity: **64 different logging sections,** sample interval, user selectable.
- You can set the automatic logging start with **auto-start** function(**Start/Stop time**).
- The **measurement unit** of the temperature: °C, °F, °K.
- **Date and time** of the instrument.
- The display of **maximum, minimum, medium** statistic parameters and their deletion.
- The data transfer speed via the RS232 serial port.

HD32.2 instrument can detect simultaneously the following quantities:

- Globe thermometer temperature **Tg**.
- Wet bulb temperature with natural ventilation Tn.
- Environment temperature **T**.

Starting from the detected values, HD32.2 can calculate:

- **WBGT(in)** index (Wet Bulb Glob Temperature: wet bulb temperature and Globe thermometer) in absence of solar radiation.
- **WBGT(out)** index (Wet Bulb Glob Temperature wet bulb temperature and Globe thermometer) in presence of solar radiation.

WBGT

WBGT (Wet Bulb Globe Temperature – Wet bulb temperature and globe thermometer) is one of the indexes used to determinate the occupational heat exposure.

It represents the value, related to the metabolic expenditure linked to a specific work activity, that causes a thermal stress when exceeded.

WBGT index combines the temperature measurement of wet bulb with natural ventilation $\mathbf{t_{nw}}$ with the globe thermometer $\mathbf{t_g}$ and, in some situations, with the air temperature $\mathbf{t_a}$.

The calculation formula is the following:

- inside and outside a buildings in absence of solar radiation:

$$WBGT_{\text{close environments}} = 0{,}7\, t_{nw} + 0{,}3\, t_g$$

- outside a building in presence of solar radiation:

$$WBGT_{\text{outside environments}} = 0{,}7\, t_{nw} + 0{,}2\, t_g + 0{,}1\, t_a$$

where:

t_{nw} = natural wet bulb;
t_g = globe thermometer temperature;
t_a = air temperature.

The measured data should be compared with the limit values prescribed by the regulations;

when exceeded you have to

- reduce directly the thermal stress on the examined work place;
- proceed to a detailed analysis of the thermal stress.

In order to measure the WBGT index, the following probes should be connected:

- **Natural wet bulb HP3201.2 (HP3201).**
- **TP3276.2 Globe thermometer probe (TP3276 or TP3275).**
- **TP3207.2 (TP3207) Dry bulb temperature, if the measurement is performed in presence of solar radiation.**

In order to measure the WBGT index, you should refer to the following regulations:

- **ISO 7726**
- **ISO 7243**
- **ISO 8996**

Technical features

Instrument

Dimensions (Length x Width x Height)	185x90x40 mm
Weight	470 g (batteries included)
Materials	ABS, rubber
Display	back light, with dot-matrix 160x160 points, visible area 52x42mm

Working conditions

Working temperature	-5 … 50°C
Storage temperature	-25 … 65°C
Working relative humidity	0 … 90% RH no condensation

Protection Degree	**IP67**
Instrument uncertainty	± 1 digit @ 20°C

Power supply

Mains power supply (code SWD10)	12Vdc/1A
Batteries	4 batteries 1.5V type AA
Autonomy batteries	200 hours with 1800mAh alkaline
Power absorbed with instrument off	< 45µA
Safety of the stored data	unlimited

Example of immediate data print, obtained with HD40.1 printer.

```
========================
  ISO 7243 WBGT Index
========================
Model HD32.2 WBGT Index
Firm.Ver.=01.00
Firm.Date=2008/12/05
SN=12345678
ID=0000000000000000
----------------------
Probe ch.1 description
Type: Pt100
Data cal.:2008/10/01
Serial N.:08109450
----------------------
Probe ch.2 description
Type: Pt100 Tg 50
Data cal.:2008/10/01
Serial N.:08109452
----------------------
Probe ch.3 description
Type: Pt100 Tw
Data cal.:2008/10/01
Serial N.:08109454
========================
Date=2008/11/21 15:00:00
Tnw             21.2 °C
Tg              24.9 °C
Ta              31.3 °C
WBGT (i)        22.3 °C
WBGT (o)        23.0 °C
========================
Notes:
========================
```

NOTES

Reference regulation

Instrument Model
Instrument firmware version
Instrument firmware date
Instrument Serial Number
Identification Code

Description of the probe connected to input 1

Description of the probe connected to input 2

Description of the probe connected to input 3

Date and time
Natural wet buld
Globe thermometer ventilation
Dry bulb temperature
WBGT in absence of direct solar radiation
WBGT in presence of direct solar radiation

TP3207.2 (TP3207) Temperature probe

Sensor type:	Pt100 with thin-film
Accuracy:	Class 1/3 DIN
Measurement range:	-40 ÷ 100 °C
Resolution:	0.1°C
Temperature drift @20°C:	0.003%/°C
Drift after 1 year:	0.1°C/year
Connection:	4 wires plus SICRAM module
Connector:	8 female poles DIN45326
Dimensions:	Ø=14 mm L= 150 mm
Response time T_{95}:	15 minutes

TP3276.2 Globe thermometer probe Ø=50 mm (Ø=150mm TP3275)

Sensor type:	Pt100
Accuracy:	Class 1/3 DIN
Measurement range:	-10 ÷ 100 °C
Resolution:	0.1°C
Temperature drift @20°C:	0.003%/°C
Drift after 1 year:	0.1°C/year
Connection:	4 wires plus SICRAM module
Connector:	8 female poles DIN45326
Stem dimensions:	Ø=8 mm L= 170 mm
Response time T_{95}:	15 minutes

HP3201.2 (HP3201) Natural ventilation wet bulb

Sensor type:	Pt100
Accuracy:	Class A
Measurement range:	4 °C ÷ 80 °C
Resolution:	0.1°C
Temperature drift @20°C:	0.003%/°C
Drift after 1 year:	0.1°C/year
Connection:	4 wires plus SICRAM module
Connector:	8 female poles DIN45326
Stem dimensions:	Ø=14 mm L= 170 mm
Braid length:	10 cm. at least
Tank capacity:	15 cc.
Tank autonomy:	96 hours with RH=50%, t = 23°C
Response time T_{95}:	15 minutes

Connections

Input for probes with SICRAM module 3
Connectors 8 male poles DIN 45326

Serial Interface:

Pin:	M12-8 poles.
Type:	RS232C (EIA/TIA574) or USB 1.1 o 2.0 not insulated
Baud rate:	from 1200 to 38400 baud. with USB baud=460800
Data bit:	8
Parity:	None
Stop bit:	1
Flow control:	Xon-Xoff
Cable length:	max 15m
Memory	divided in 64 blocks.
Storage capacity	67600 memorizations for each of the 3 inputs.
Logging interval	selectable among: 15, 30 seconds, 1, 2, 5, 10, 15, 20, 30 minutes and 1 hour.

Logging interval	Storage capacity
15 seconds	Approx. 11 days and 17 hours
30 seconds	Approx. 23 days and 11 hours
1 minute	Approx. 46 days and 22 hours
2 minutes	Approx. 93 days and 21 hours
5 minutes	Approx. 234 days and 17 hours
10 minutes	Approx. 1 year and 104 days
15 minutes	Approx. 1 year and 339 days
20 minutes	Approx. 2 years and 208 days
30 minutes	Approx. 3 years and 313 days
1 hour	Approx. 7 years and 261 days

Ordering codes

HD32.2 consisting of:

- **HD32.2 WBGT Index instrument**, 4 alkaline batteries from 1.5V type AA, instruction manual, case. **DeltaLog10 Software Warm environments: WBGT analysis. Probes and cables have to be ordered separately.**

Required probes for the measurement of **WBGT**:

- **TP3207.2** Probe of dry bulb temperature.
- **TP3276.2** Globe thermometer probe.
- **TP3201.2** Natural ventilation wet bulb

HD32.2A consisting of:

- **HD32.2 WBGT Index instrument**, 4 alkaline batteries from 1.5V type AA, instruction manual, case. **DeltaLog10 Software Warm environments: WBGT analysis. Probes and cables have to be ordered separately.**

Required probes for the measurement of **WBGT version A**:

- **TP3207** Dry bulb temperature.
- **TP3275** Globe thermometer probe.
- **TP3201** Natural ventilation wet bulb.

AP3203.2 **HP3217.2** **TP3276.2**

HP3201.2 **TP3276.2** **TP3207.2**

Probes for HD32.2 WBGT Index:

TP3207.2: Temperature probe with Pt100 sensor. Probe stem Ø 14mm, length 150 mm. Equipped with SICRAM module.

TP3276.2: Globe thermometer probe with Pt100 sensor, globe Ø 50 mm. Stem Ø 8 mm, length 170 mm. Equipped with SICRAM module.

HP3201.2: Natural wet bulb. Pt100 sensor. Probe stem Ø 14 mm, length 170 mm. Equipped with SICRAM module, spare parts of the braid and case of 50cc. distilled water.

Probes for HD32.2 version A:

TP3207: Temperature probe with Pt100 sensor. Probe stem Ø 14mm, length 140 mm. Cable length 2m. Equipped with SICRAM module. Used for the calculation of the indicies: **IREQ,WCI, DLE, RT, PMV, PPD, WBGT, SR**. Used for calculating Mean radiant temperature.

TP3275: Globe thermometer probe with Pt100 sensor, globe Ø 150 mm. Stem Ø 14 mm, length 110 mm. Cable length 2m. Equipped with SICRAM module. Used for calculating Mean radiant temperature and WBGT.

HP3201.2: Natural ventilation wet bulb. Pt100 sensor. Probe stem Ø 14 mm, length 110 mm. Cable length 2m. Equipped with SICRAM module, spare braids and 50cc of distilled water. Used for the measurement for WBGT calculation.

Accessories:

VTRAP30: Tripod to suit HD32.2 instrument with a maximum height of 280 mm

HD2110/RS: Connection cable with M12 connector from the instrument side and with SubD female connector 9 poles for RS232C from PC side.

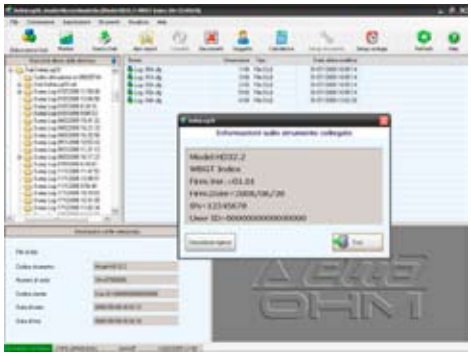
HD2110/USB: Connection cable with M12 connector from the instrument, USB 2.0 connector from PC side.

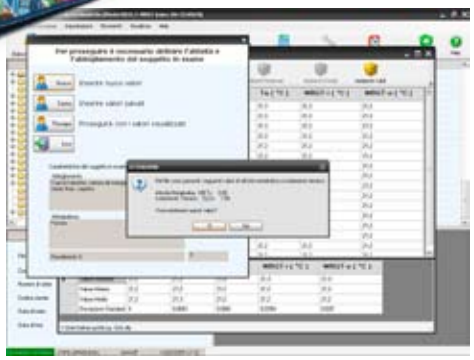
SWD10: 100-240Vac/12Vdc-1A mains voltage stabilized power supply.

AQC: 200cc. of distilled water and n° 3 braids for HP3201 or HP3217DM probes

BAT.40: Spare battery pack for HD40.1 and HD40.2 printer with built-in temperature sensor.

RCT: The kit includes 4 thermal paper rolls, wide 57mm, diameter 32mm.





HD32.3
WBGT-PMV-PPD

HD 32.3
INSTRUMENT FOR THE ANALYSIS OF THE INDICES: WBGT - PMV - PPD

HD32.3 – WBGT - PMV Index is an instrument made by **Delta Ohm Srl** for:
- Analysis of hot environments using **WBGT** index (Wet Bulb Glob Temperature: wet bulb temperature and Globe thermometer) in presence or absence of solar radiation.
- Analysis of the moderate warm environments using **PMV** index (Predicted Mean Vote) and **PPD** index (Predicted Percentage of Dissatisfied).

Reference Rules:

ISO 7243: Hot environments. Estimation of the heat stress on working man, based on WBGT index (wet bulb globe Thermometer).

ISO 8996: Ergonomics of the thermal environment. Determination of metabolic rate.

ISO 7726: Ergonomics of the thermal environment – Instruments for measuring physical quantities.

ISO 7730: Moderate thermal environments. Determination of PMV and PPD index and specification of the condition for thermal comfort.

The instrument is provided with three inputs for probes with SICRAM module: the SICRAM module interface between the instrument and sensor connected and communicate the sensor parameters and calibration data to the instrument.

All SICRAM probes can be plugged into any of the inputs: they are automatically recognized upon turning on the instrument.

The **main features** of the instrument are:
- **Logging:** data acquisition and logging In the integral instrument memory. Storage capacity: **64 different logging sections, sample interval, user selectable.**
- Start and stop can be set automatically with the **auto-start function**,
- Selectable **measurement unit** of the temperature: °C, °F, °K.
- **Date** and **time** of the instrument.
- The display of **maximum, minimum, medium** statistic parameters and their deletion.
- The transfer speed of data via RS232 serial port.

HD32.3 instrument can detect simultaneously the following quantities:
- Globe thermometer temperature **Tg** with **TP3276.2 (or TP3775)** probe.
- Natural wet bulb temperature **Tn** with **HP3201.2 (or HP3201)** probe.
- Environment temperature **T** with **TP3207.2** probe.
- Relative humidity **RH** and environment temperature **T** with **HP3217.2 (or TP3217)** probe.
- Air speed **Va** with **AP3203.2** probe.

Starting from the measured values, HD32.3 can **calculate** and **display,** with **TP3207.2R (or TP3207), HP3276.2 (or TP3775),** and **HP3201.2 (or HP3201)** probes, the following indexes:
- **WBGT (in)** Index (Wet Bulb Glob Temperature: wet bulb temperature and globe thermometer) in absence of solar radiation.
- **WBGT (out)** Index (Wet Bulb Glob Temperature: wet bulb temperature and globe thermometer) in presence of solar radiation.

Starting from the measured values, the HD32.3 instrument can **calculate** and **display,** with **TP3217.2 (or TP3217), HP3276.2 (or HP3275),** and **AP3203.2 (or AP3203)** probes, the following indexes:
- Medium radiant temperature **Tr**.
- **PMV** Index (Predicted Mean Vote).
- **PPD** Index (Predicted Percentage of Dissatisfied).

WBGT

WBGT (Wet Bulb Globe Temperature – wet bulb and globe temperature) is one of the indexes used to determinate the occupational heat exposure.

It represents the value, related to the metabolic expenditure linked to a specific work activity, that causes a thermal stress when exceeded.

WBGT index combines the measurement of wet bulb temperature $\mathbf{t_{nw}}$ with natural ventilation with the globe thermometer temperature $\mathbf{t_g}$ and, in some situations, with the air temperature $\mathbf{t_a}$.

The calculation formula is the following:
- inside and outside the buildings in absence of solar radiation:

$$WBGT_{close\ environments} = 0{,}7\ t_{nw} + 0{,}3\ t_g$$

- outside the buildings in presence of solar radiation:

$$WBGT_{outside\ environments} = 0{,}7\ t_{nw} + 0{,}2\ t_g + 0{,}1\ t_a$$

where:

t_{nw} = wet bulb temperature with natural ventilation;

t_g = globe thermometer temperature;

t_a = air temperature.

The measured data should be compared with the limit values prescribed by the regulations;

when exceeded you have to
- reduce directly the thermal stress on the examined work place;
- proceed to a detailed analysis of the thermal stress.

In order to measure the WBGT index, the following probes should be connected:
- **Natural wet bulb HP3201.2 (or HP3201).**
- **TP3276.2 (or TP3275) Globe thermometer probe.**
- **TP3207.2 (or TP3207) Dry bulb temperature, of the measurement is performed in presence of solar radiation.**

In order to measure the WBGT index, you should refer to the following regulations:
- **ISO 7726**
- **ISO 7243**
- **ISO 8996**

PMV - PPD

Human thermal comfort is defined by ASHRAE (American Society of Heating, Refrigerating and Air Conditioning Engineers INC) as the state of mind that expresses satisfaction with the surrounding living or working environment.

The evaluation of this subjective condition can be objectified and quantified using integrated index that consider the micro climatic environment parameters (Ta, Tr, Va, rh), and the work-related energy metabolic expenditure MET, and the typology of clothing (thermal insulation CLO) commonly used.

Among these indexes, the most precise one reflecting the influence of the above mentioned physical and physiological variables on thermal comfort is **PMV** (Predicted Mean Vote).

Synthetically, it comes from the equation of the thermal balance whose result is compared to a scale of psycho - physical health and expresses the average opinion (average foreseen vote) about the thermal sensations of a group of subjects.

From PMV is derived a second index called **PPD** (Predicted Percentage of Dissatisfied) that quantifies the percentage of subjects who will be dissatisfied with some micro climatic conditions.
ISO 7730 regulations suggests PMV use in presence of following variables that influence the thermal balance:

- Metabolic expenditure = 1 ÷ 4 met
- Thermal resistance of clothing = 0 ÷ 2 clo
- Dry bulb temperature = 10 ÷ 30°C
- Medium radiant temperature = 10 ÷ 40°C
- Air speed = 0 ÷ 1 m/sec
- Water vapour pressure = 0 ÷ 2,7 kpa

PMV is a particularly suitable index for the evaluation of **work places with moderate microclimate** such as houses, schools, offices, research laboratories, hospitals, and is useful to predict the number of people likely to feel uncomfortably warm or cool.
According to ISO 7730 PMV values range between + 0,5 and - 0,5, provides comfort conditions corresponding to a percentage of dissatisfied (PPD) lower than 10%. (see table below).

HD40.1

AP3203.2

TP3276.2

HP3217.2

RS232
USB

HP32.3

Example of immediate data printing of PMV, obtained with HD40.1 printer

```
========================
  ISO 7730  PMV Index
========================
Model HD32.3 WBGT - PMV
Firm.Ver.=01.00
Firm.Date=2008/12/05
SN=12345678
ID=0000000000000000
----------------------
Probe ch.1 description
Type: Hot wire
Data cal.:2008/10/15
Serial N.:08109460
----------------------
Probe ch.2 description
Type: Pt100 Tg 50
Data cal.:2008/10/01
Serial N.:08109452
----------------------
Probe ch.3 description
Type: RH
Data cal.:2008/10/15
Serial N.:08109464
========================
Date=2008/11/21 15:00:00
Va              0.00 m/s
Tg              22.0 °C
Ta              22.0 °C
RH              39.1  %
MET             1.20
CLO             1.00
PMV             0.10
PPD             5.10  %
========================
```

NOTES

Reference regulation

Instrument model
Version of the instrument firmware
Date of the instrument firmware
Serial number of the instrument
Identification Code

Description of the probe connected to input 1

Description of the probe connected to input 2

Description of the probe connected to input 3

Date and time
Air speed
Globe thermometer temperature
Dry bulb temperature
Relative humidity
Metabolic expenditure
Resistance of clothing
PMV – Predicted Mean Vote
PPD – Predicted Percentage of Dissatisfied

Table 1: valuation scale of the thermal environment

PMV	PPD %	EVALUATION THERMAL ENVIRONMENT
+3	100	Hot
+2	75,7	Warm
+1	26,4	Slightly warm
+0,85	**20**	**Acceptable thermal condition**
-0,5 < PMV < +0,5	**< 10**	**Comfortable**
-0,85	**20**	**Acceptable thermal condition**
-1	26,8	Cool
-2	76,4	Cold
-3	100	Extremely cold

To calculate PMV and PPD indices, it's necessary to know:
- the working load (energy expenditure);
- the clothing thermal insulation.

Average radiant temperature T_r

The average radiant temperature is defined as the temperature of thermally uniform simulated environment that would exchange with a man the same thermal radiation power exchanged in the real environment.
In order to evaluate the average radiant temperature, it is necessary to measure: **the globe thermometer temperature, the air temperature, and the air speed measured close to the globe thermometer.**

TECHNICAL FEATURES

Instrument

Dimensions (Length x Width x Height)	185x90x40 mm
Weight	470 g (batteries included)
Materials	ABS, rubber
Display	Back light, dot-matrix 160x160 points, visible area 52x42mm

Working Conditions

Working temperature	-5 … 50°C
Storage temperature	-25 … 65°C
Working relative humidity	0 … 90% RH no condensation
Protection Degree	**IP67**
Instrument uncertainty	± 1 digit @ 20°C

Power supply

Mains power supply (cod. SWD10)	12Vdc/1A
Batteries	4 batteries 1.5V type AA
Autonomy	200 hours with 1800mAh alkaline batteries
Power absorbed with instrument off	< 45µA
Safety of the stored data	Unlimited

TP3207.2 (TP3207) temperature probe

Sensor type:	Pt100 with thin film
Accuracy:	Class 1/3 DIN
Measurement range:	-40 ÷ 100 °C
Resolution:	0.1°C
Temperature drift @20°C:	0.003%/°C
Drift after 1 year:	0.1°C/year
Connection:	4 wires plus SICRAM module
Connector:	8 female poles DIN45326
Dimensions:	Ø=14 mm L= 150 mm
Response time T_{95}:	15 minutes

TP3276.2 globe thermometer probe Ø=50 mm (Ø=150 mm TP3275)

Sensor type:	Pt100
Accuracy:	Class 1/3 DIN
Measurement range:	-10 ÷ 100 °C
Resolution:	0.1°C
Temperature drift @20°C:	0.003%/°C
Drift after 1 year:	0.1°C/year
Connection:	4 wires plus SICRAM module
Connector:	8 female poles DIN45326
Stem dimension:	Ø=8 mm L= 170 mm
Response time T_{95}:	15 minutes

HP3201.2 (HD3201) Natural wet bulb

Sensor type:	Pt100
Accuracy:	Class A with platinum wire
Measurement range:	4 °C ÷ 80 °C
Resolution:	0.1°C
Temperature drift @20°C:	0.003%/°C
Drift after 1 year:	0.1°C/year
Connection:	4 wires plus SICRAM Module
Connector:	8 female poles DIN45326
Stem dimension:	Ø=14 mm L= 170 mm
Braid length:	10 cm. at least
Tank capacity:	15 cc.
Tank autonomy:	96 hours with RH=50%, t = 23°C
Response time T_{95}:	15 minutes

HP3217.2 (HP3217R) Combined temperature and relative humidity probe

Sensor type:	Pt100 with thin film for temperature Capacitive sensor for relative humidity
Temperature accuracy:	1/3 DIN
Relative humidity accuracy:	± 2%RH (15 ÷ 90 %RH) @ 20°C ± 2.5%RH remaining range
Measuring range:	temperature: -10 °C ÷ 80 °C relative humidity: 5% ÷ 98% RH
Connection:	4 wires plus SICRAM Module
Connector:	8 female poles DIN45326
Dimensions:	Ø=14 mm L= 150 mm
Response time T_{95}:	15 minutes
Resolution:	0.1%RH, 0.1% °C

AP3203.2 (AP3203) *Omnidirectional hot wire probe*

Sensor type:	NTC 10kohm
Accuracy:	± 0.05 m/s (0÷1 m/s) ± 0.15 m/s (1÷5 m/s)
Measuring range:	0÷5 m/s 0 °C ÷ 80 °C
Connection:	7 wires plus SICRAM Module
Connector:	8 female poles DIN45326
Stem dimension:	Ø=8 mm L= 230 mm
Protection dimension:	Ø=80 mm
Resolution:	0.01 m/s
Temperature drift @20°C:	0.06% /°C
Drift after 1 year:	0.12 °C/years

Connections

Input for SICRAM module probes	3 Connectors 8 male poles DIN 45326
Serial interface:	
Pin:	M12-8 poles.
Type:	RS232C (EIA/TIA574) or USB 1.1 o 2.0 no isolated

Baud rate:	from 1200 to 38400 baud. with USB baud=460800
Data bit:	8
Parity:	None
Stop Bit:	1
Flow Control:	Xon-Xoff
Cable length:	max 15m
Memory	divided in 64 blocks.
Storage capacity	67600 memorizations for each of 3 inputs.
Logging interval	selectable among: 15, 30 seconds, 1, 2, 5, 10, 15, 20, 30 minutes and 1 hour.

Logging interval	Storage capacity
15 seconds	Approx. 11 days and 17 hours
30 seconds	Approx. 23 days and 11 hours
1 minute	Approx. 46 days and 22 hours
2 minutes	Approx. 93 days and 21 hours
5 minutes	Approx. 234 days and 17 hours
10 minutes	Approx. 1 year and 104 days
15 minutes	Approx. 1 year and 339 days
20 minutes	Approx. 2 years and 208 days
30 minutes	Approx. 3 years and 313 days
1 hour	Approx. 7 years and 261 days

ORDERING CODES

HD32.3 is composed of:

• Instrument HD32.3, 4 alkaline batteries 1.5V type AA, instruction manual, case. **DeltaLog10 Software for the analysis of WBGT and PMV indexes. Probes and cables have to be ordered separately.**

HD32.3A is composed of:

• Instrument HD32.3, 4 alkaline batteries 1.5V type AA, instruction manual, case. **DeltaLog10 Software for the analysis of WBGT and PMV indexes. Probes and cables have to be ordered separately.**

The **probes** required for **WBGT** measurement are:

• **TP3207.2 (TP3207)** Dry bulb temperature probe.
• **TP3276.2 (TP3275)** Globe thermometer probe.
• **HP3201.2 (HP3201) Natural w**et bulb temperature probe with natural ventilation.

The **probes** required for **PMV** measurement are:

• **HP3217.2 (HP3217R)** Combined e temperature and relative humidity probe
• **AP3203.2 (AP3203)** Omni-directional hot wire probe.
• **TP3276.2 (TP3275)** Globe thermometer probe.

Probes for HD32.3

TP3207.2: Temperature probe with Pt100 sensor. Probe stem Ø 14mm, length 150mm. Equipped with SICRAM module. **Used for WBGT measurement.**
TP3276.2: Globe thermometer sensor Pt100, globe Ø 50 mm. Stem Ø 8 mm, length 170 mm. Equipped with SICRAM module. **Used for WBGT and PMV measurements.**

HP3201.2: Natural wet bulb. Pt100 sensor. Probe stem Ø 14 mm, length 170 mm. Equipped with SICRAM module, spares of braid and 50 cc of distilled water. **Used for WBGT measurement.**

HP3217.2: Combined temperature and relative humidity probe. Capacitive RH sensor, Pt100 temperature sensor. Probe stem Ø 14 mm, length 150 mm. Equipped with SICRAM module. **Used for PMW measurement.**

AP3203.2: Omni-directional hot wire probe. Measuring range: air speed 0÷5 m/s, temperature 0÷100 °C. Probe stem Ø 8 mm, length 230 mm. Equipped with SICRAM module. **Used for PMW and PPD measurement.**

Probes for HD32.3 version A:

TP3207: Temperature probe with Pt100 sensor. Probe stem Ø 14mm, length 150mm. Cable 2m long. Equipped with SICRAM module. **Used for the calculation of the following indices:**
IREQ, WCI, DLE, RT, PMV, PPD, WBGT, SR.

TP3275: Globe thermometer sensor Pt100, globe Ø 150 mm. Stem Ø 14 mm, length 110 mm. Cable 2m long. Equipped with SICRAM module. **Used for Mean radiant temperature, WBGT.**

HP3201: Natural wet bulb. Pt100 sensor. Probe stem Ø 14 mm, length 110 mm. Equipped with SICRAM module, spare braid and 50 cc of distilled water. **Used for WBGT measurement.**

HP3217R: Combined temperature and relative humidity probe. Capacitive RH sensor, Pt100 temperature sensor. Probe stem Ø 14 mm, length 150 mm. Equipped with SICRAM module. **Used for PMW and PPD measurement.**

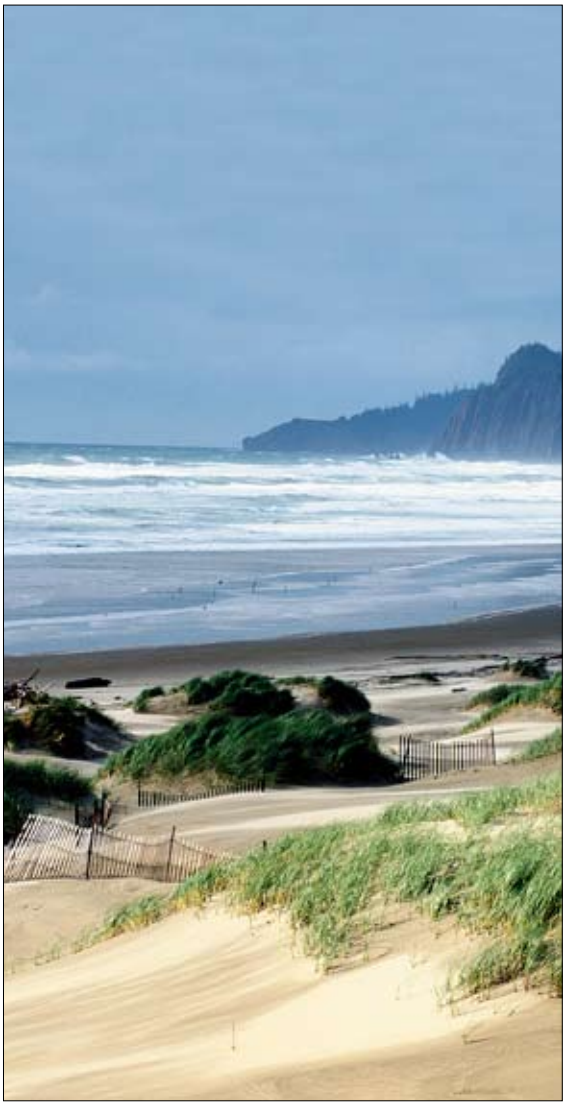
AP3203: Omni-directional hot wire probe. Measuring range: air speed 0÷5 m/s, temperature 0÷100 °C. Probe stem Ø 8 mm, length 230 mm. Equipped with SICRAM module. **Used for PMW and PPD measurement.**

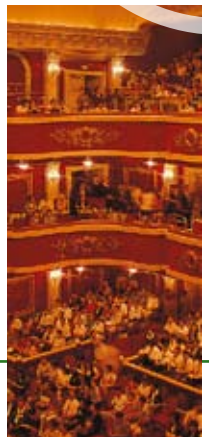
Accessories:

VTRAP30: Tripod to suit HD32.3 instrument with a maximum height of 280 mm
HD2110/RS: Connection cable with M12 connector from the instrument side and with SubD female connector 9 poles for RS232C from PC side.
HD2110/USB: Connection cable with M12 connector from the instrument, USB 2.0 connector from PC side.
SWD10: 100-240Vac/12Vdc-1A mains voltage stabilized power supply.
AQC: 200cc. of distilled water and n° 3 braids for HP3201 or HP3217DM probes
HD40.1: printer (uses **HD2110/RS** cable)
BAT.40: Spare battery pack for HD40.1 and HD40.2 printer with built-in temperature sensor.
RCT: The kit includes 4 thermal paper rolls, wide 57mm, diameter 32mm.

TP3275

AP3203





Environmental Analysis

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HD 9408T BARO
HD 9408TR BARO
HD 9908T BARO

HD 9408T BARO, HD 9408TR BARO, HD 9908T BARO BAROMETRIC TRANSMITTERS

HD 9408T BARO, HD 9408TR BARO and **HD 9908T BARO** are analog output electronic barometers. They use a piezoresistive sensor element which gives extremely accurate and stable measurement of the atmospheric pressure and assures excellent repeatability, low hysteresis and very good temperature stability. The output signal of the sensor is conditioned to provide a voltage or a current output linearly proportional to the barometric pressure. The transmitters are ready as they have been calibrated at the factory. A zero adjustments potentiometer is available for offset to station elevation.
HD9408T BARO requires a continuous dc power supply, its low power consumption (< 4 mA) makes it ideal for portable and remote battery or solar powered applications. It is available in different kinds of analog output: 0-1 Vdc, 0-5 Vdc (1-5 Vdc, 1-6 Vdc on request) or 4-20 mA (two wires).
HD 9408TR BARO offers superior temperature performance: the internal circuitry allows the sensor to work at constant temperature so that it achieves accurate temperature compensation over the whole range from -40°C to +60°C.
HD 9408TR BARO requires a continuous dc power supply and a differential cabling connection to achieve best results. It is available in different output versions: 0÷1 Vdc, 0÷5 Vdc (1÷5 Vdc, 1÷6 Vdc on request).
HD 9908T BARO, unlike the other models, is equipped with a display showing the pressure measurements, an analog output 0÷20 mA, 4÷20 mA, 0÷1 V and 0÷5 V (0÷10 V on request) configurable by the customer and with an ON/OFF relay output with programmable alarm threshold.
HD 9908T BARO requires a 24 Vac (or 220 Vac on request) power supply.

HD 9408T BARO, HD 9408TR BARO and **HD 9908T BARO** are low cost and excellent performance solutions for meteorological applications, environmental monitoring systems, metrological and environmental data logging, altitude applications, barometric pressure compensation in the performance of internal combustion engine, cleanroom barometric pressure compensation, testing of vehicle emissions.

HOUSING AND INSTALLATION

In all models the sensor electronics are housed in a sturdy MACROLON with IP67 protection. Opening the lid holes are available that allow you to secure the base of the transmitter directly to a panel or a wall. The measurement accuracy is independent of the position of the transmitter. However, it is advisable to mount the transmitter so that the sensor is facing down to reduce dust and dirt on the filter. If the installation is in an open environment is recommended to use a special static port to minimize errors caused by the wind flow on the input pressure.

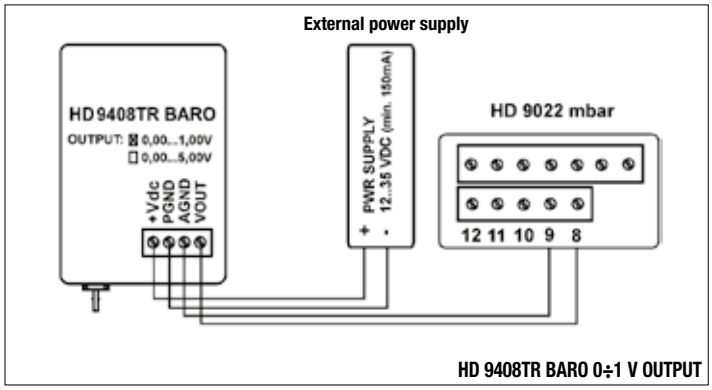
CONNECTION DIAGRAM AND OPERATION

- Make the power connections for the HD 9908T BARO.
- Make the connections for the relay output, the relay contact is free.
- Select the analog output 0÷20 mA, 4÷20 mA, 0÷1 V, 0÷5 V by means of the jumper.
- Switch on the instrument, press the PUSH button and turn the SET trimmer to set the desired threshold value between 800 and 1100 mbar; the set value is shown on the LCD display.
- Using the trimmer i ⎍⎍, set the desired HYS (=hysteresis) value between 5 and 50 mbar.
- The instrument will now indicate the barometric pressure; HI led, LO led or ALARM led and ALARM relay will switch on if one the following cases occurs (see table 1).

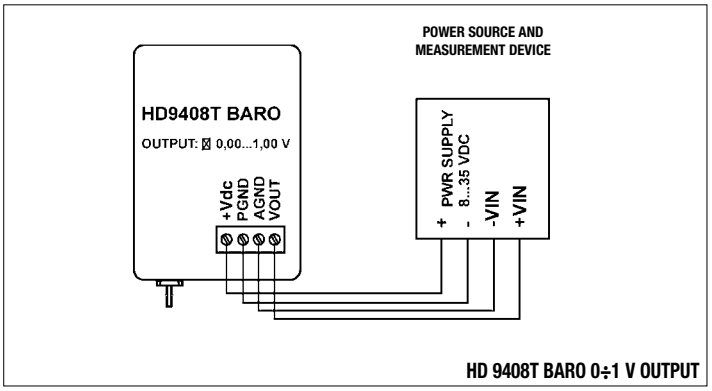
NOTE: the ALARM led comes on to indicate that the relay is energized and the contact is closed.

- **Once installation is completed, check that the cover is tightly closed; the same applies to the grommets.**

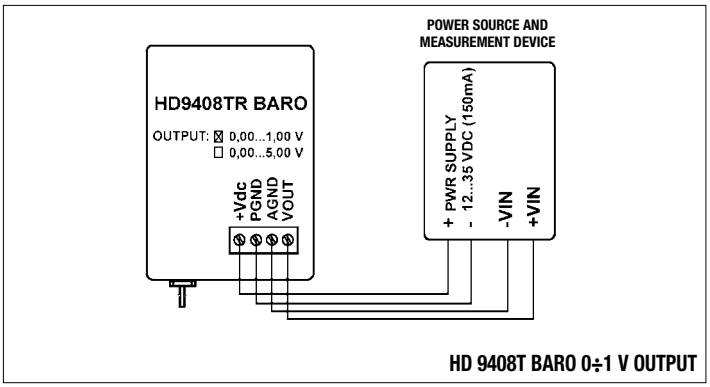
TABLE 1	HI	LO	ALARME LED
MISURA > SET, MISURA < SET + HYS	ON	OFF	OFF
MISURA > SET, MISURA > SET + HYS	ON	OFF	ON
MISURA < SET, MISURA > SET - HYS	OFF	ON	OFF
MISURA < SET, MISURA < SET - HYS	OFF	ON	ON



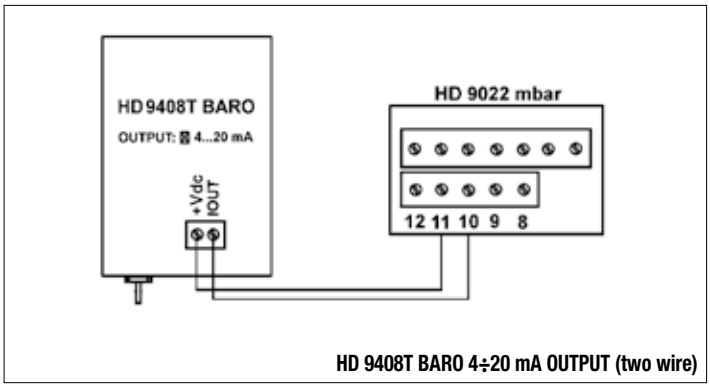
HD 9408TR BARO 0÷1 V OUTPUT



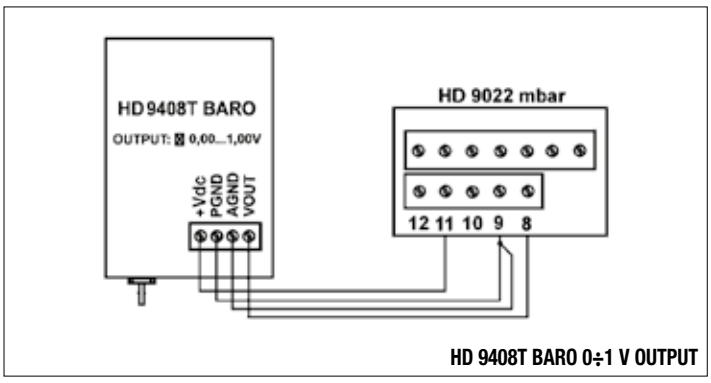
HD 9408T BARO 0÷1 V OUTPUT



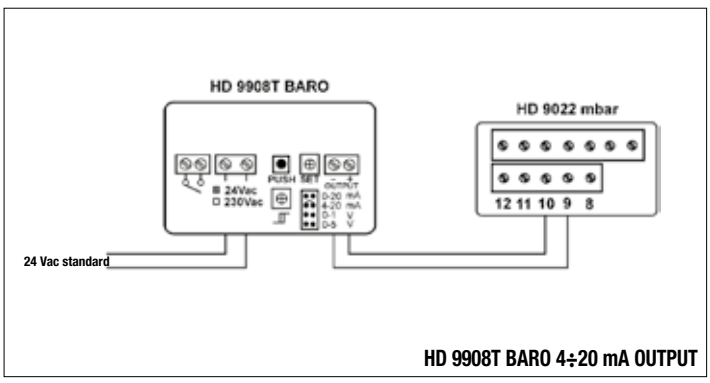
HD 9408T BARO 0÷1 V OUTPUT



HD 9408T BARO 4÷20 mA OUTPUT (two wire)



HD 9408T BARO 0÷1 V OUTPUT



HD 9908T BARO 4÷20 mA OUTPUT

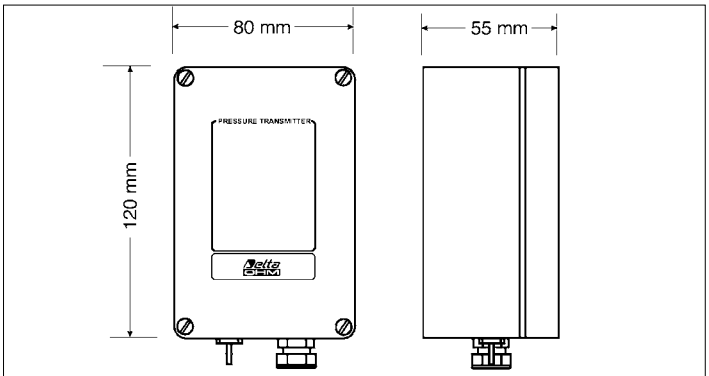
	HD9408T BARO	HD9408TR BARO	HD9908T BARO
Sensor type	Piezoresistive diaphragm		
Measuring range	800 ÷ 1100 mbar / 600 ÷ 1100 mbar on request		
Analog output	0 ÷ 1 Vdc standard; 0 ÷ 5 Vdc, 1 ÷ 5 Vdc, 1 ÷ 6 Vdc and 4 ÷ 20 mA (two wires) on request	0 ÷ 1 Vdc standard; 0 ÷ 5 Vdc, 1 ÷ 5 Vdc and 1 ÷ 6 Vdc on request	0 ÷ 20 mA, 4 ÷ 20 mA, 0 ÷ 1 V and 0 ÷ 5 V (0 ÷ 10 V on request), configurable by means of a jumper.
Accuracy	± 0.5 mbar, @ 20°C	± 0.5 mbar, @ 20°C	Display: ± 1 mbar, @20°C Analog output: ± 0,8 mbar, @ 20°C
Resolution	Infinite	Infinite	Display: Analog output: 1 mbar Infinite
Thermal effects	< 1% F.S., zero; <1% F.S., span over –20°C to +60°C (-4° to 140°F)	± 0.8 mbar over –40°C to +60°C (-40° to 40°F)	< 1% F.S. zero, <1% F.S. span over –20°C to +60°C (-4° to 140°F)
Long term stability	< 0.25 % F.S. over 6 months at 20°C	< 0.2 % F.S. over 6 months at 20°C	< 0.25 % F.S. over 6 months at 20°C
Turn on time	1 sec. to 99% of full scale reading	5 min @ 24 Vdc supply to 99% of full scale reading	5 sec. to 99% of full scale reading
Response time	< 200 msec. to reach full accuracy after a pressure step		
Relay contact output	Absent	Absent	3A/220 Vac resistive load
Set point	Absent	Absent	Configurable from 800 to 1100 mbar
Supply Voltage	8 ÷ 35 Vdc	12 ÷ 35 Vdc	24 Vac ±10% (230 Vac on request)
Supply current	< 4 mA	25 mA @ 20°C, 24 Vdc (warm-up 120 mA)	1VA
Operating Temperature	-30 ÷ +60°C	-40 ÷ +60°C	-20 ÷ +60°C
Media ompatibility	Air and dry gases only		
Overload pressure	30 psi		

ORDERING CODE

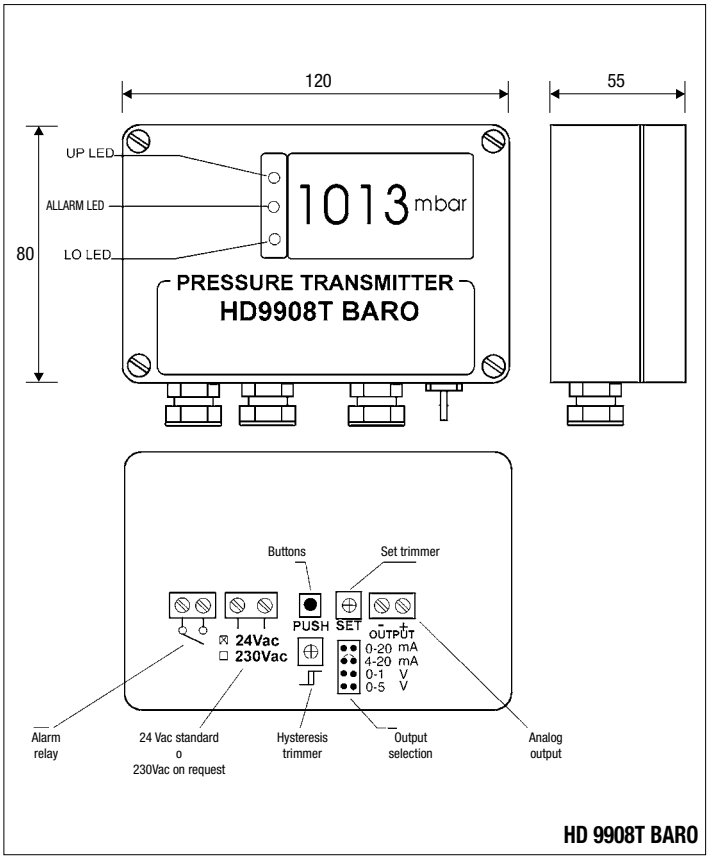
HD9408T BARO 800÷1100mbar barometric transmitter output 0÷1Vdc. Upon request output: 0÷5Vdc, 1÷5Vdc, 1÷6Vdc, 4÷20mA. Working temperature range -30°C ÷ +60°C.

HD9408TR BARO 800÷1100mbar barometric transmitter output 0÷1Vdc. Upon request output 0÷5Vdc, 1÷5Vdc. Temperature working range –40°C ÷ +60°C, heaters sensor

HD9908T BARO 800÷1100mbar digital barometric transmitter with LCD indication. Outputs: 0÷20mA, 4÷20mA, 0÷1Vdc, 0÷5Vdc. Working temperature range -20°C ÷ +60°C.

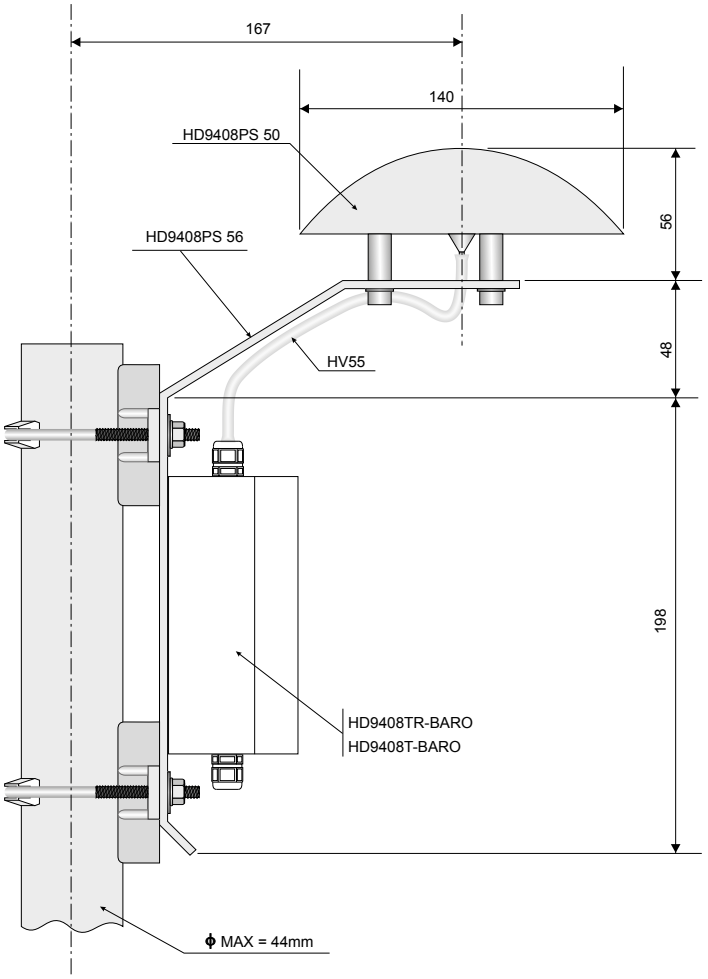


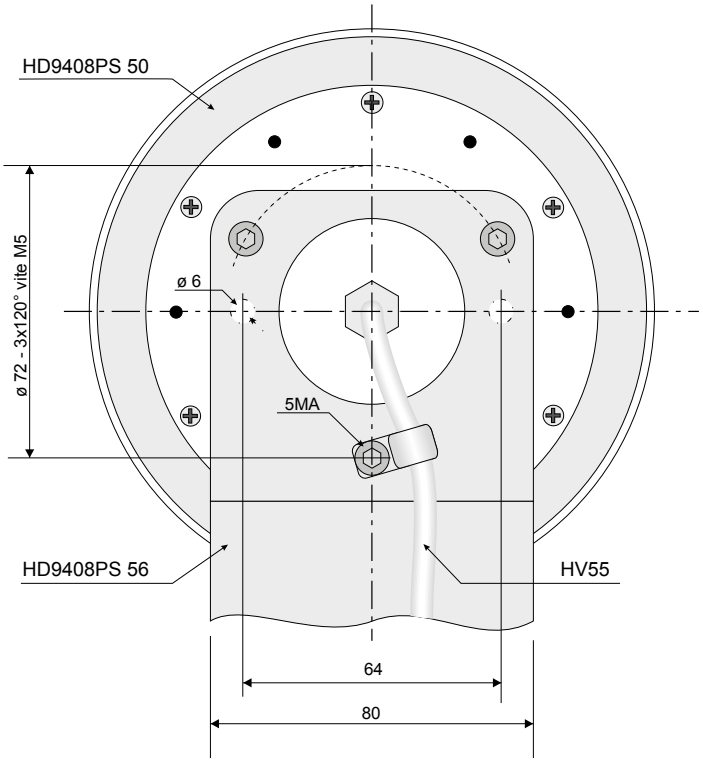
HD 9408T BARO, HD 9408TR BARO



HD 9908T BARO

HD9408PS 50





HD9408PS 50
STATIC PORT FOR BAROMETRIC MEASUREMENTS

The measurement of the barometric pressure in free field can give incorrect values of hundred pascal fluctuation and wind direction. With the static port for barometric measurements, HD9408PS 50 can minimize these errors because, in addition to act as a filter (brake) against the dynamic pressure of the wind, the barometer can operate correctly even in the presence of snow or ice and comply with the recommendations of the WMO (World Meteorological Organization). The materials used for the construction of the static are UV resistant and can operate in temperatures between -40°C and +80°C.

INSTALLATION AND CONNECTION

Installation is simple: it must be installed away from buildings, trees or any other source which can disrupt the flow of wind. To install the bracket is available HD9408PS 56 and three stainless steel screws M5x16 Acc. The connection of the static to the barometer, for example, HD9408T or HD9408TR, is made with a special tube HV55 (internal diameter of 3mm, 6mm outer diameter) and UV resistant to climate changes. Maintenance or cleaning is minimal. The plastic parts are manufactured by BASF LURAN S777K. Clean using non aggressive detergents compatible with the material.

TECHNICAL SPECIFICATIONS

According to reccomendations the of WMO, the deviation allowed measurement of wind speed 20meters/second is equal to 0.3mbar, corresponding to 300 Pascal. The HD9408PS 50 static port for barometric measurements falls within that value. The following tables show the values obtained from the tests performed in the wind tunnel.

Error due to the dynamic pressure	Lower than 0.3mbar @20°C
Working temperature	-40°C… +80°C
Connection pipe (for a tube with inside ø : 3mm, outside ø: 6mm)	Ø 3.4 mm
Weight of the static port. - Weight of the static port equipped with the bracket	200 gr, 570 gr
Total weight and static port and bracket	570 gr

ORDERING CODE

HD9408PS 50K Kit consits of by static port, pole mounting bracket and HV55 tube

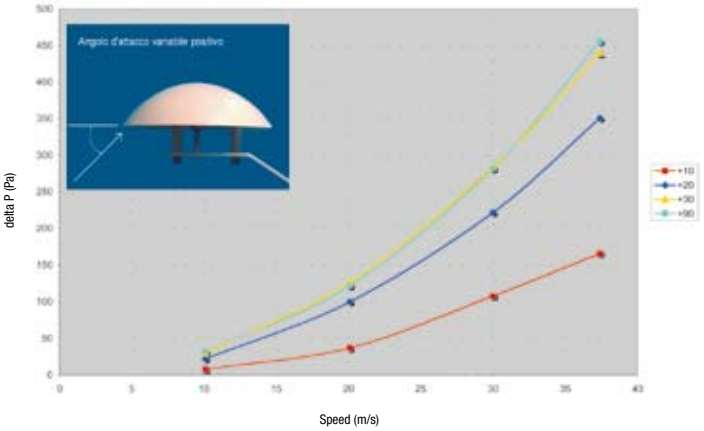
HD9408PS 50 Static port for barometric measurements equipped with the HV55 tube

HD9408PS 56 Mounting bracket for static port, barometer fastening, pole anchor

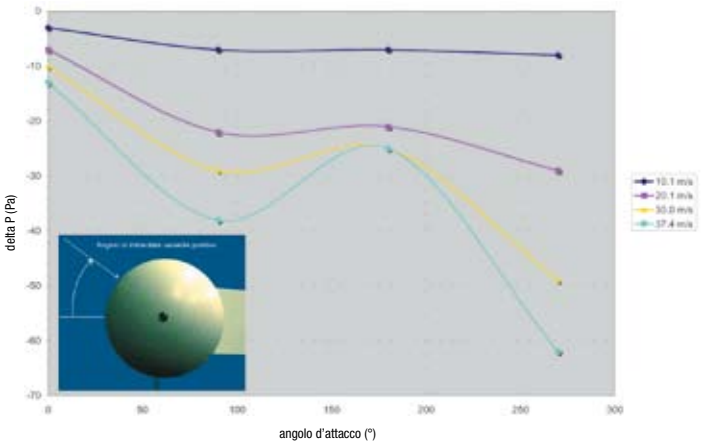
HV55 HV55 UV- and temperature-resistant silicone tube, inside Ø : 3mm, outside Ø : 6mm, L=400mm

TESTS MADE IN THE WIND TUNNEL

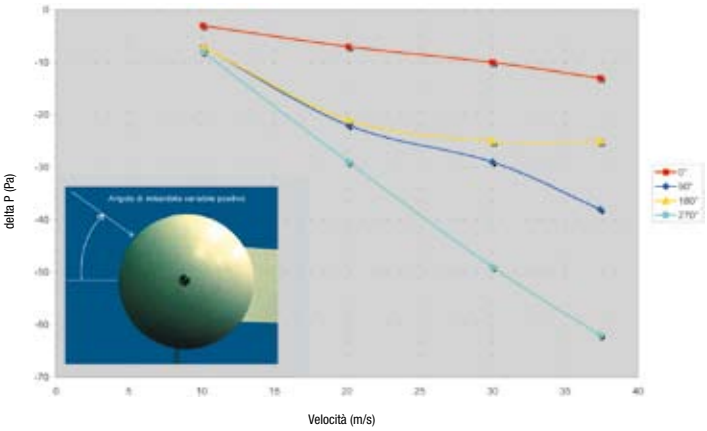
Static port put in front of the wind tunnel



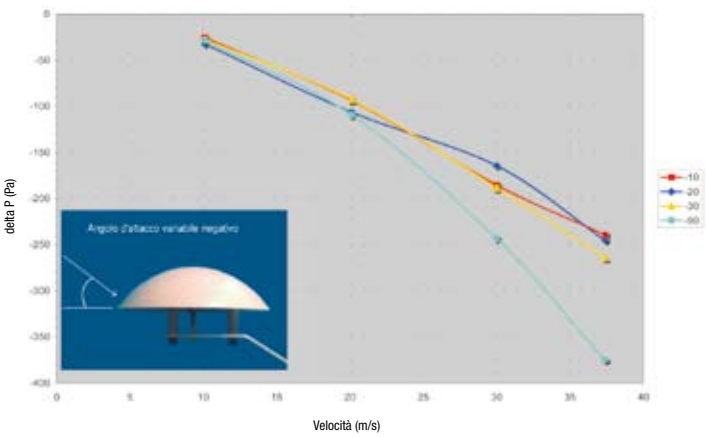
ΔP according to the yaw angle β (join angle α = 0°)



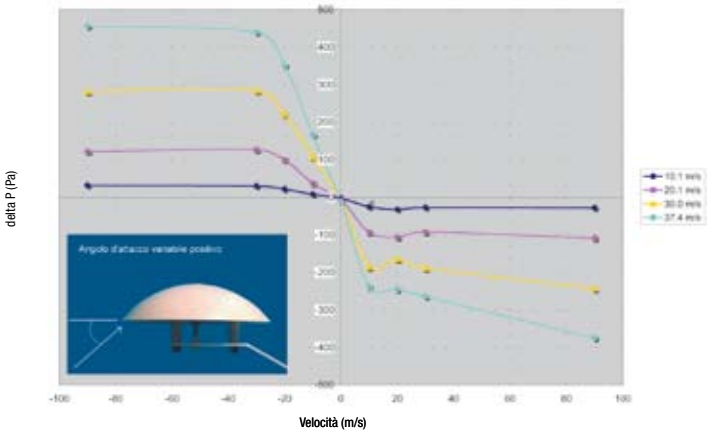
ΔP according to the join angle α (yaw angle β = 0°)



ΔP according to the α join angle (yaw angle β = 0°)



ΔP according to the β yaw angle



ΔP according to the α join angle

HD 9008TRR
HD 9009TRR
HD 9007

HD 9008TRR, HD 9009TRR, HD 9007
TEMPERATURE AND HUMIDITY TRANSMITTERS, MULTIPLATE RADIATION SHIELD

CHARACTERISTICS

The HD9008TRR and HD9009TRR are single block RH and temperature microprocessor transmitters, temperature configurable. The HD9008TRR is a passive transmitter with a 4…20mA output and 10…30Vdc power supply; the HD9009TRR is a transmitter with a 0…1V standard voltage output (other outputs available on demand) and 10…30Vdc power supply. Sensors are mounted at the end of a plastic tube: a capacitive humidity sensor and a Platinum temperature sensor (100Ω @0°C).

The instrument can be reprogrammed by means of a key, and no jumper or potentiometer actions are required. The humidity input can be recalibrated by using two saturated solutions: the first one at 75%, the second one at 33%; the 0%RH…100%RH relative humidity range is fixed, 4mA (or 0Vdc) correspond to 0%RH, 20mA (or 1Vdc) equal 100%RH.

Temperature standard configuration is –40…+80°C, corresponding to 4…20mA and 0…1Vdc, respectively.

The user can configure the temperature output in ranges different from the standard one by means of a Pt100 simulator or of a set of fixed resistances, provided that it is included in the -40°C…+80°C range with a minimum amplitude of 25°C. Two LEDs give alarm indications (temperature exceeding set range, sensor breakage or short-circuit) and help the operator when programming.

An out-of-standard temperature operating range can be requested when placing the order.

Important Warning: *probes work in the -40°C…+80°C temperature range. Outside this range data are not correct; electronics is designed to operate in this range.*

SENSORS

The humidity sensor is a condenser which dielectric is made up by an hygroscopic polymer. As water dielectric constant is approximately 80, you'll get a strong change in capacity as the humidity content of this polymer changes. The advantages of this kind of sensor are: good linearity, insensitivity to temperature changes, fast response time and long-lasting life. The sensor temporary looses its accuracy if some condensation develops on its surface (the transmitted value is higher than the real one because of an increase in effective capacity).

The temperature sensor is a Platinum resistance thermometer (100Ω @0°C). The Pt100 resistance variation is transformed into a current or voltage signal, linear to temperature.

SIGNAL TRANSMISSION

The electronic circuit design provides the signal to increase linearly as humidity and temperature raise.

In presence of cables transmitting high currents or machines causing electromagnetic noises, the transmitter connection cables have to be placed in a separate raceway, or far from them, to prevent these noises. It is recommended to use a shielded cable for the connections of instruments having a voltage output (HD9009TRR).

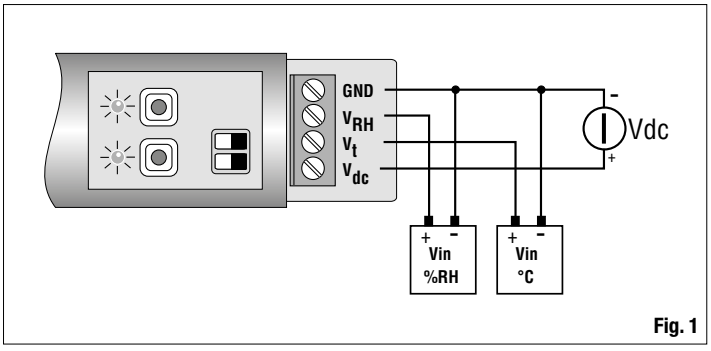


Fig. 1

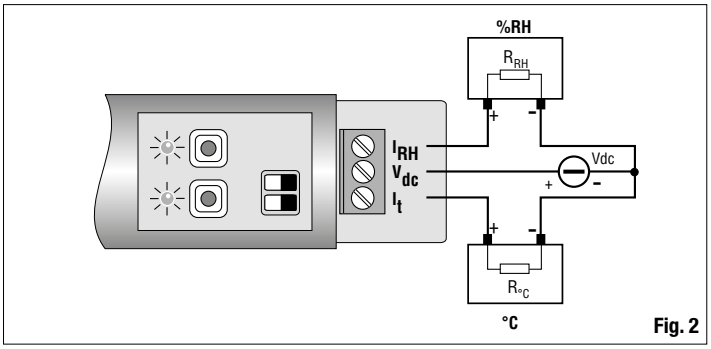


Fig. 2

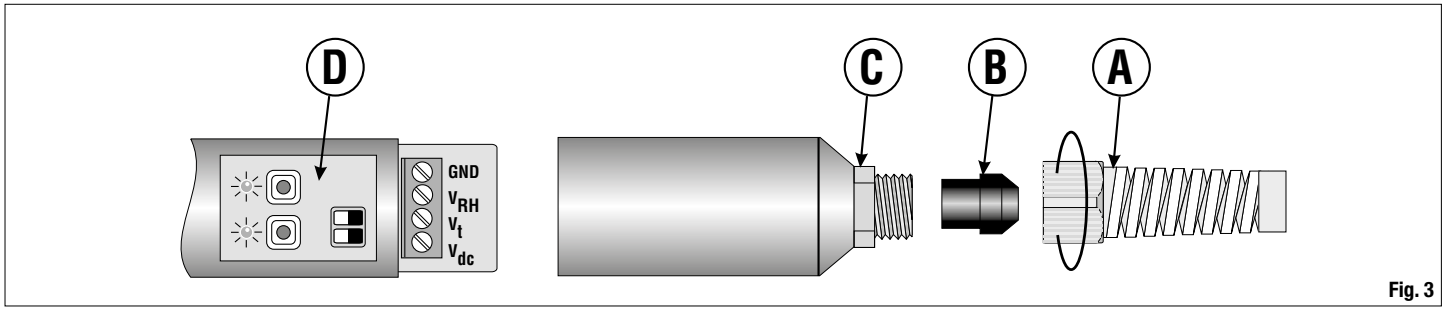


Fig. 3

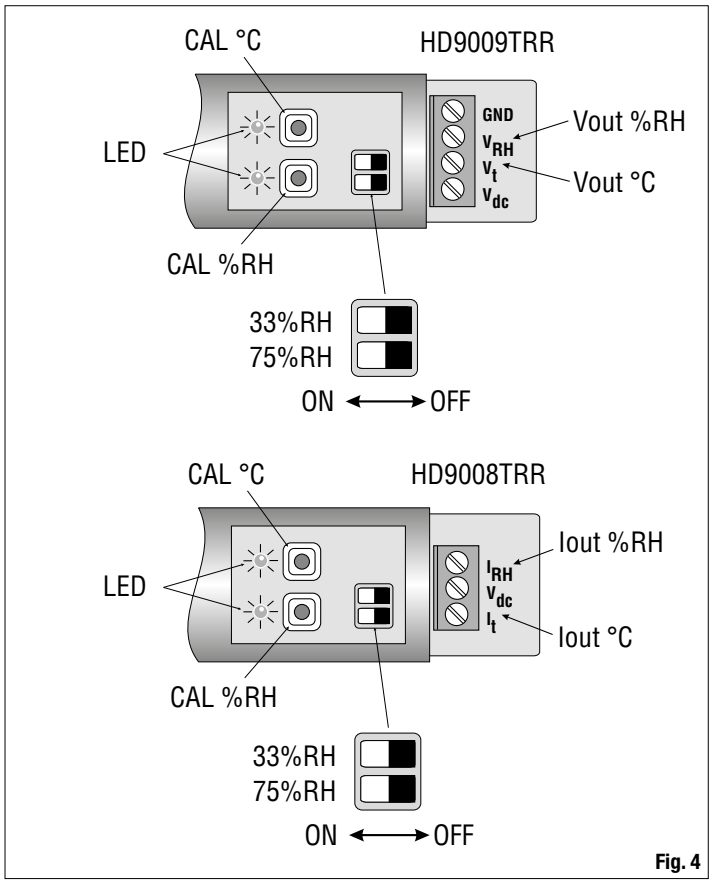


Fig. 4

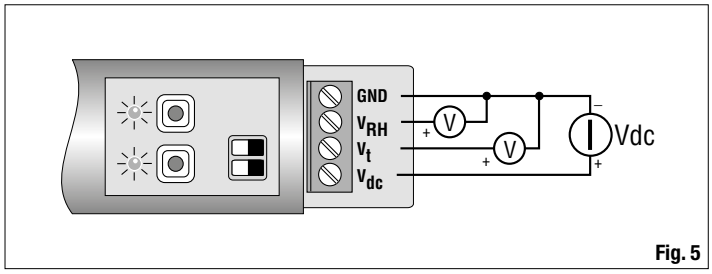


Fig. 5

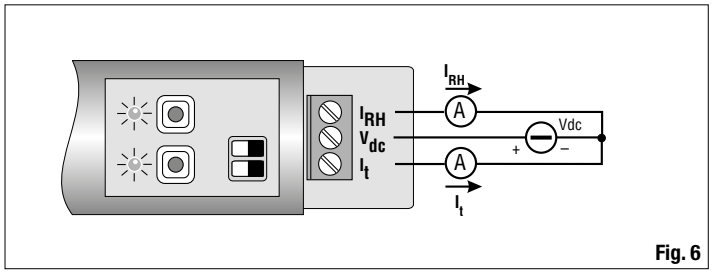


Fig. 6

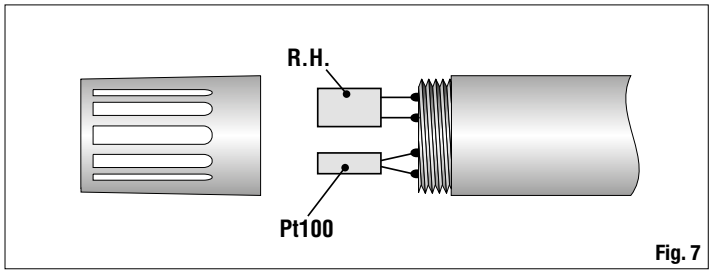


Fig. 7

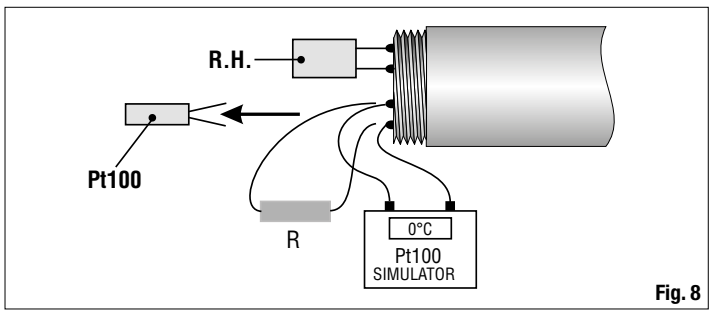


Fig. 8

INSTALLATION AND ASSEMBLY

Figures 1 and 2 show the connection diagram of the two models. R_{RH} and $R_{°C}$ represent the current input of any device connected to the 4…20mA loop, that is: an indicator, a controller, a data logger or a recorder. In figure 2, "Vin%RH and Vin°C" symbols have the same meaning.

Accuracy in measuring does not depend on the transmitter position. However, it is suggested to install the transmitter with the sensor faced downwards (where possible) to reduce dust deposit on the sensor protection filter. The transmitter shall not be mounted next to doors, in draughtiness, in areas with scarce air circulation, or near a heat source, as heating air involves a decrease of relative humidity (the quantity of available water vapour being equal).

Protection degree: IP54.

Ensure that the sensor is compatible with the atmosphere where it is installed.

Follow these procedures to access the transmitter terminal board (see fig.3): Unscrew grommet "A", take off rubber bulb "B" and unscrew bottom "C". Insert the cable through A, B and C elements and connect it to the terminal board. Hold the cable firmly while screwing grommet "A" to avoid twisting.

PROGRAMMING

HD9008TRR and HD9009TRR relative RH and temperature transmitters are factory calibrated. The HD9008TRR is provided with a 4…20mA current output, while the HD9009TR with a 0…Vdc voltage output.

In the HD9008TRR standard configuration, 4mA correspond to 0%RH and –40°C, while 20mA equal 100%RH and +80°C.

In the HD9009TRR one, 0Vdc corresponds to 0%RH and –40°C, while 1Vdc equals 100%RH and +80°C.

The user can re-calibrate the RH probe holding the 0%…100%RH range and setting a different range for temperature, as long as it is within –40 and +80°C limits.

Figure 4 shows the transmitter programming elements.

Humidity Sensor Calibration

The following accessories are needed.

HD9008TRR model: a 10…30Vdc continuous voltage power supply, a precision ammeter with a 0…25mA min. range.

HD9009TRR: a 10…30Vdc continuous voltage power supply, a precision voltmeter with a 0…1Vdc min. range.

The calibration of the humidity sensor is carried out at two fixed points: at 75.4%RH – **always as first point** – and at 33%RH – second point.

Procedure:

1. To access the panel board, unscrew grommet "A" (see fig. 3) and hold the cable firmly to avoid twisting. Take off the rubber bulb and unscrew the bottom of the instrument.
2. Connect the wires to provide the instrument with power supply, as shown in the connection diagrams (Fig. 5: HD9008TR and Fig.6: HD9009TR).
3. Insert the probe in the container with the saturate solution at 75%RH and wait **30 minutes at least.** Probes and solutions have to be at the same temperature.
4. Turn 75%RH dip-switch on ON.
5. Press the CAL%RH little key and **hold it down for 5 seconds, at least,** until the corresponding LED does not flash. Now the little key can be released: the LED will remain on. A built-in sensor compensates the temperature difference of the solution compared with 20°C.
6. Turn the 75%RH dip-switch on OFF.
7. Put the probe in the container with the saturate solution at 33%RH and **wait for 30 minutes, at least.** Probes and solutions have to be at the same temperature.
8. Turn the 33%RH dip-switch on ON.
9. Press the CAL%RH small key and **hold it down for 5 seconds, at least,** until the corresponding LED is not off. Now the little key can be released.
   If the solution is at 20°C, the output will equal 9.28mA (in HD9008TRR model) and 0.330V (in HD9009TRR model).
10. Turn the 33%RH dip-switch on OFF again.
11. Re-close the instrument: re-screw the bottom, put the rubber bulb again at its place and screw the grommet: hold the cable firmly to avoid twisting it.
12. The calibration of the RH probe is finished.

Important Note: the first calibration point has to be always at 75%RH

Programming of Temperature Operating Range

The following accessories are needed.

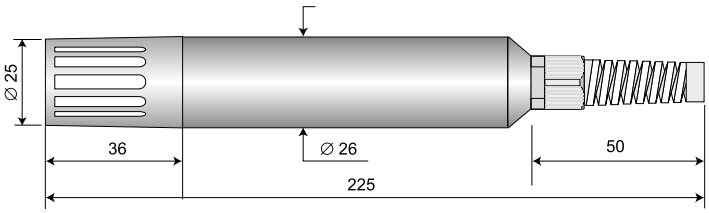
For HD9008TRR: a 7…30Vdc continuous voltage power supply, a precision ammeter with 0…25mA minimum range.

For HD9009TRR: a 7…30Vdc continuous voltage power supply, a precision voltmeter with 0…1Vdc minimum range.

Pt100 simulator or a set of precision resistances.

Procedure:

1. To access the panel board, unscrew grommet "A" (see figure 3) and hold the cable firmly to avoid twisting. Take the rubber bulb off and unscrew the bottom of the instrument.
2. Unscrew the sensor protection filter.
3. Unsolder the Pt100 sensor (the narrowest one) and in place of it, solder the output wires or those of a Pt100 simulator or of a precision resistance, as shown in figures 7 and 8. Then wait a few seconds for the junction to get cold.
4. Set the Pt100 simulator at the temperature corresponding to the scale upper value. For example, if you want to configure the –10°C…+80°C range, the simulator has to be set at –10°C; the equivalent resistance value will be 96.09Ω. If the calibration is carried out with a fixed resistance, connect a 96.09Ω fixed resistance to the terminals to which the sensor was soldered.
5. Wait 10 seconds until the measurement becomes steady, **press the "CAL °C" key** (calibration) **and hold it down for min. 5 seconds,** until the LED first flashes (once) and then remains on.
6. Set the Pt100 simulator at the temperature value provided for the full scale. According to the above example, the simulator will be set at +80°C; the equivalent resistance value will be 130.89Ω; if the calibration is carried out with a fixed resistance, a 130.89Ω fixed resistance will have to be connected to the terminals to which the sensor was soldered.
7. Wait 10 seconds until the measurement becomes steady, **press the "CAL °C" key** (calibration) **and hold it down for min. 5 seconds,** until the LED is off. **When you release the key,** the LED will flash twice to confirm that programming took place. Now the procedure is over.
8. Check that the configuration corresponds to the requested specifications, by setting the simulator (or connecting the precision resistances) at the values corresponding to the upper and full scale value and by checking the output with the ammeter (HD9008TRR) or with the voltmeter (HD9009TRR).
9. Solder again the temperature sensor.
10. Insert again the sensor protection filter, screw the bottom, put the rubber bulb again at its place and screw the grommet holding the cable firmly to avoid twisting.
11. The temperature output programming is over.



Saturate reference solutions are available for RH calibration. Calibration is suggested every 12/18 months for instruments with continuous operation, according to the environment they are working in. **Check that the sensor and the atmosphere where it is employed be compatible, above all in case of aggressive environments** (they might corrode the sensor).

TECHNICAL DATA		HD9008TRR	HD9009TRR
Electronics Working Temperature		-40…+80°C	
Sensor Working Temperature		-40…+80°C	
Transmitter Power Supply		10...30Vdc (4…20mA)	10…30Vdc (2mA)
Capacity		300 pF typ.	
HUMIDITY	Measuring Range	5…98%RH	
	Accuracy at 20°C	±2%RH (10…90%RH) ±2.5%RH (for the remaining range values)	
	Response time at 63% of final variation	3 min. with filter; 6s without filter no thermal shock	
	Output Signal	0%RH = 4.0mA 100%RH = 20.0mA	0%RH = 0.00 Vdc 100%RH = 1.00 Vdc (*)
	Load Resistance	$R_{Lmax} = \frac{(Vdc - 10)}{22mA}$	R_{inMIN}=10KΩ
TEMPERATURE	Measuring Range – Standard Configuration - (**)	-40…+80°C	-40…+80°C
	Accuracy	±0.15°C ±0.1% of measurement	
	Response time at 63% of final variation	3 min. with filter; 6 s without filter	
	Output Signal	-40°C = 4.0mA +80°C = 20.0mA	-40°C = 0.00 Vdc +80°C= 1.00 Vdc (*)
	Load Resistance	$R_{Lmax} = \frac{(Vdc - 10)}{22mA}$	R_{inMIN}=10KΩ
Dimensions		Ø 26 x 225mm	
Cable Dimensions			
Maximum Length (***)		200m	10m
Wire Min. Section		20 AWG - 0.5mm²	20 AWG - 0.5mm²
Cable Max. Diameter		Ø5mm	Ø5mm

(*) For HD9009TRR models, 0…5Vdc, 1…5Vdc, 1…6Vdc, 0…10Vdc voltage outputs can be provided on ordering.

(**) Out-of-standard measuring ranges have to be requested when ordering or have to be re-programmed with a Pt100 simulator.

(***)Use screened cables.

ORDERING CODES

HD9008TRR: dual passive RH and temperature microprocessor transmitter 4…20mA outputs in 0…100%RH and -40…+80°C ranges.

HD9009TRR: dual RH and temperature microprocessor transmitter. 0…1V output in 0…100%RH and -40…+80°C ranges.

HD9007 A1: 12-ring protection L=190 mm complete with mounting brackets.

HD9007 A2: 16-ring protection L=240 mm complete with mounting brackets.

HD75: saturated salt solution 75% R.H. with adapter M 24x1,5

HD33: saturated salt solution 33% R.H. with adapter M 24x1,5

HD9008.21.1: holder for vertical sensor, wall distance 250mm, hole Ø 26.

HD9008.21.2: holder for vertical sensor, wall distance 125mm, hole Ø 26.

HD9007
MULTIPLATE RADIATION SHIELD

Characteristics

Luran S777K (BASF) antistatic UV-resistant thermoplastic material with low thermal conductivity and high reflection.

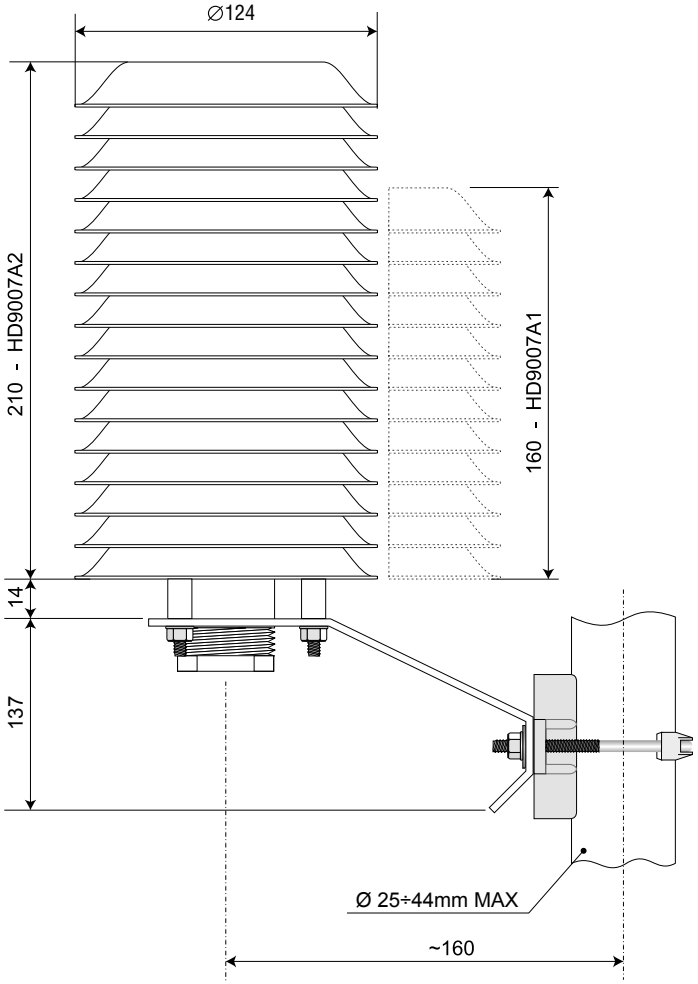
White power-painted, anticorodal aluminium support bracket. Stainless steel U-bar mounting bracket for shafts from 25 to 44mm.

Dimensions: external Ø : 130 mm.

Height, excluding bracket: HD9007 A1: 190 mm, weight: 640 gr.
HD9007 A2: 240 mm, weight: 760 gr.

Sensor fixing ring nuts: Ø 27 mm, Ø 25 mm on demand when ordering.

HD9007 ring-shield is suitable to protect temperature and RH/temperature sensors used in weather stations from solar radiations, rain and wind.



- the sensor Pt100 (100Ω at 0 ° C) 1/3DIN wire used is accurate and stable over time, it is possible to extract for periodic calibration
- the support structure of the sensor has low thermal conductivity
- power the electric motor is 12Vdc, 35mA maximum current
- the construction of the screen is plastic Luran S777K UV resistant
- support of the probe is expected to be installed on poles for weather stations

Features

- intake by electric motor
- suction flow: 422 l / min, 35Pa
- Power: 12Vdc - 25mA nominal
- Expected life: 12,000 hours (MTTF)
- working temperature: -20…+65°C
- dimensions: 270mm diameter, 245mm overall height
- M12 male connector for probe connection
- support rod: diam.16mm, lungh.580mm, complete with bracket on pole diameter 25 ÷ 44mm maximum
- cable: 8-wire Pt100 sensor for feeding the engine. Cable CPM12AA8 ... to request 2 meters, 5 meters, 10 meters.

PURCHASING CODES

HD 9006: Aspirated air temperature sensor with radiation shield. Power 12Vdc, 35mA max, length 580mm.

CPM12.AA8.2: 8-pin cable for Pt100 sensor and motor. On the one hand to 8 pin female connector on the other thread open. Length 2 meters.

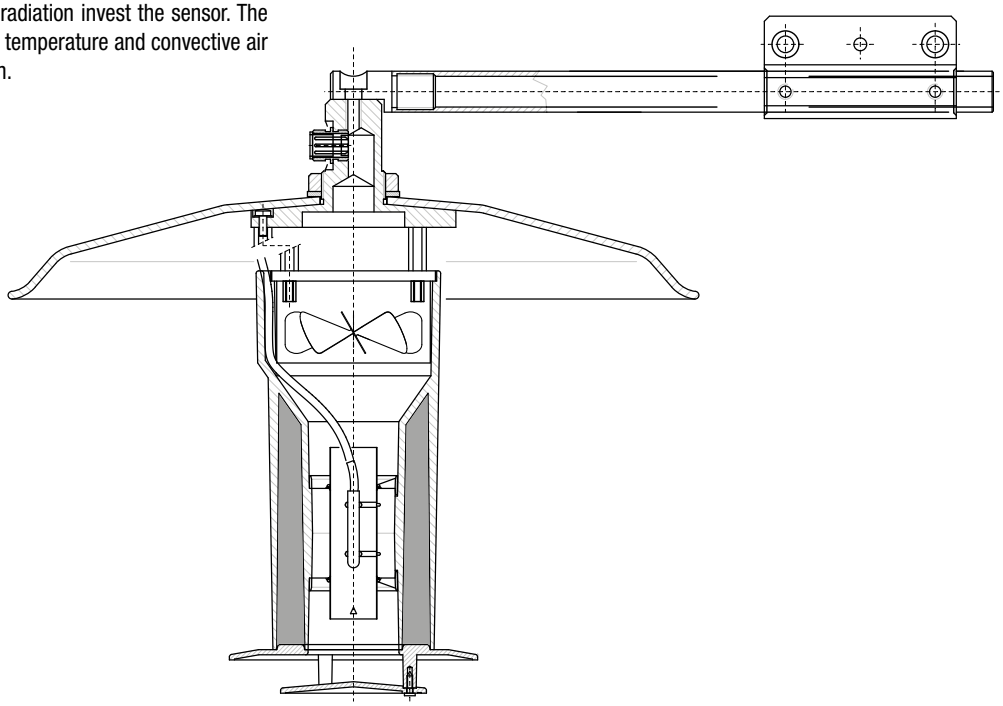
CPM12.AA8.5: 8-pin cable for Pt100 sensor and motor. On the one hand to 8 pin female connector on the other thread open. Length 5 meters.

CPM12.AA8.10: 8-pin cable for Pt100 sensor and motor. On the one hand to 8 pin female connector on the other thread open. 10 m.

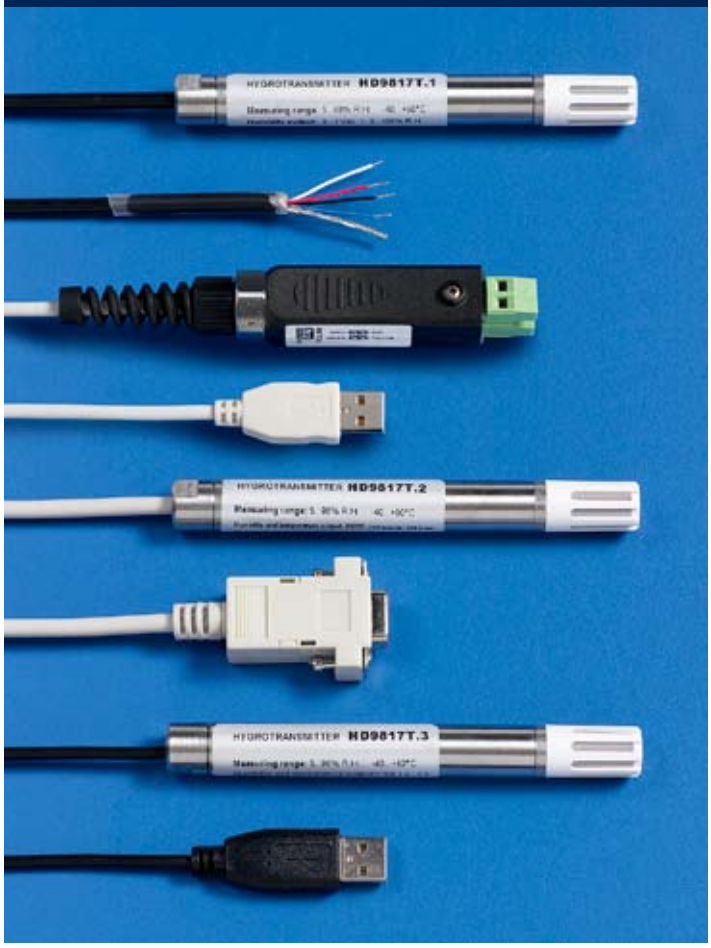
HD 9006.13: Flange for mounting to poles with diameters from 25 to 44mm.

HD 9006
ASPIRATED AIR TEMPERATURE PROBE WITH PROTECTION SCREEN

Temperature measurement in air is also influenced by temperature as well as light and terrestrial radiation. An appropriate screen and air intake with an electric motor detects the air temperature without the measure is influenced by solar radiation and terrestrial heat by the Convention of the screen.
The position sensor inside the screen is such that radiation invest the sensor. The screen is constructed so as to minimize the error of temperature and convective air flow is such as to prevent stagnation or stratification.
The advantages of radiation shield:
- reduces the measurement error



HD 9817T1R
HD 9817T2R
HD 9817T3R



HD 9817T1R, HD 9817T2R, HD 9817T3R TEMPERATURE AND HUMIDITY TRANSMITTERS WITH ANALOGUE OR DIGITAL OUTPUT

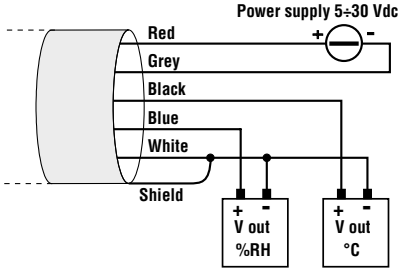
Dual relative humidity and temperature transmitter for HVAC applications, environmental monitoring, pharmaceutical storage, food transport, greenhouse automation, etc. Equipped with an IP65 stainless steel AISI 304 housing, it is suitable even for severe environments; besides, its ultra-compact dimensions (∅ 14 x 133 mm) and wide range of outputs (analogue 0...1V or digital RS232C, USB 1.1-2.0) make it ideal for integrating into a variety of OEM applications. It is supplied with the HD9817TC software for reading measurements and calibrating the relative humidity sensor.

Versions, outputs and connections

	HD9817T1	HD9817T1.1	HD9817T2	HD9817T3
Output	0...1V = 0…100%RH 0...1V = –40…+60°C (-20…+80°C on request)		RS232C non insulated, 2400 baud rate	USB 1.1-2.0 non insulated
Temperature sensor	Pt100	NTC 10kΩ	Pt100	Pt100
Load resistance	R_L > 10kΩ			
Cable Connection	L=1,5m (7 wires + shield)		L= 2m DB9 female connector	L= 2m USB connector type A

Connections

HD9817T1 and HD9817T1.1 models with 0...1Vdc analogue output.



The instrument is equipped with a 7 wire + shield cable.
The **Yellow** and **Green** wires are used during calibration only for PC connection through the HD9817T.1CAL interface module (see the paragraph about the RH sensor calibration).
Power is supplied to the **Red** (+) and **Grey** (-) wires.
The output signal voltage is taken from:
- **Black** (+) and **White** (-) wires for temperature,
- **Blue** (+) and **White** (-) wires for relative humidity.

The **shield** must be connected to the White wire.

HD9817T2 model with RS232C output and HD9817T3 model with USB output.

The HD9817T2 cable ends in a RS232C 9-pole subD female connector, while the HD9817T3 cable ends in a USB type A connector.
The following set of commands is available for both instruments.

Command	Response	Description
G0	HD9817T_Pt100_RH_RS232	Model
G3	Firm.Ver.=01-00	Firmware version
HAnn.n	&	75% calibration point where nn.n stands for the actual humidity value
HBnn.n	&	33% calibration point where nn.n stands for the actual humidity value
S0	0072.7 I 063.9	It sends the current measurement (tttt.t I hhh.h) t = temperature h = RH
U0	&	International System of units
U1	&	Imperial units

Note for HD9817T3 model with USB ouput

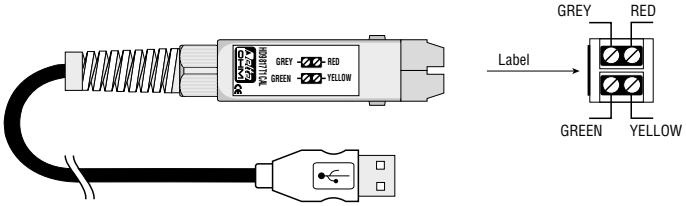
This model requires that you install USB drivers first in order to ensure a correct PC connection: **don't connect the instrument to your PC before installing the drivers**. For further details, see the guide in the CDRom which is supplied with the instrument.

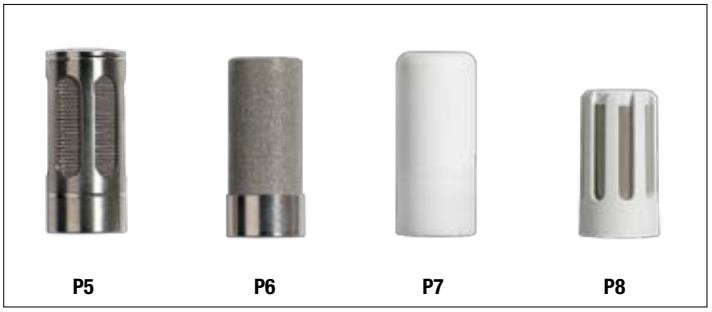
Relative humidity calibration

The instruments are supplied factory calibrated and ready to use. The CDRom supplied with the instruments includes a relative humidity calibration procedure. The online help describes this procedure in detail.
No procedure exists for temperature calibration.
To connect HD9817T1 and HD9817T1.1 models to your PC, use the HD9817T.1CAL interface module: the module is equipped with a USB type A connector for your PC USB port connection as well as a 4-pole terminal board to connect the transmitter.
Before connecting the module to your PC, you need to install the USB drivers: **don't connect the module to your PC before installing the drivers**. For further details, see the guide in the CDRom which is supplied with the instrument.

Please connect the **Red** (power supply positive), **Grey** (power supply negative), **Yellow** (Tx) and **Green** (Rx) wires as shown in the figure below.

The terminal board is seen from above: in order to direct the clamps correctly, make sure that the label on the side of the module is placed as shown in the figure below.

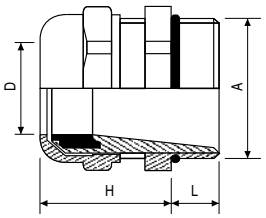




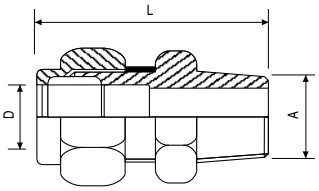
Installation notes

To fix the probe in a ventilation duct, pipe ,etc. you can use, for example, the HD9008.31.12 flange, a PG16 metal cable gland (∅10…14mm) or a 3/8" universal biconical connection.

HD9008.31 Flange



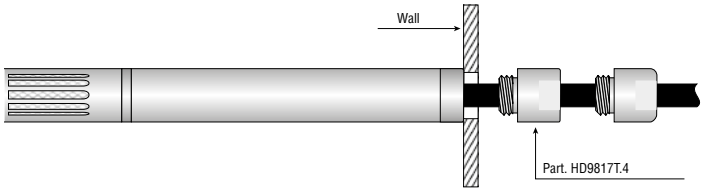
PG16.12 Metal cable gland
D = 10…14mm
L = 6.5mm
H = 23mm
A = PG16



Universal biconical connector
L = 35mm
D = 14mm
A = 3/8"

For wall-mounted installation, the HD9008.21.1 (distance from wall 250mm) and HD9008.21.2 (distance from wall 125mm) supports are available. Both require the HD9008.26/14 adapter.

For direct wall mounting on a metal support, the HD9817T.4 part is available as shown in the figure below (for HD9817T1 and HD9817T1.1 versions only).



The wall can be 2mm thick at most while the hole in the wall can be 10.5mm.

Electrical connection

HD9817T1 and HD9817T1.1 models

Power supply

The power supply voltage must be as per the electrical specifications (5...30Vdc) between the wires:
Red = (+) power supply positive
Grey = (-) power supply negative.

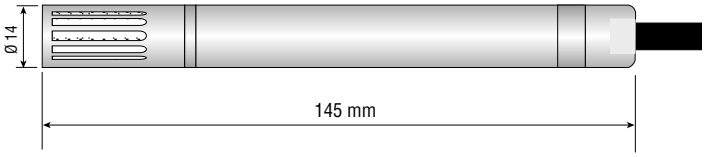
Analogue output

The voltage output signals are taken from the following wires:
Blue = (+)%RH output positive
Black = (+)Temperature output positive
White = (-) ground. Common reference between %RH and Temperature outputs.
Shield = the braid is connected to the common ground (White wire).

HD9817T2 and HD9817T3 models

These models are powered directly from your PC port and no external power supply is required.

HD9817T… Dimensions



Technical data		
HD9817T1R - HD9817T1.1- HD9817T2 - HD9817T3		
Relative humidity	Sensor	Capacitive
	Sensor protection	P8, stainless steel grid and PTFE, 20µ
	Measuring range	0..100%RH
	Sensor working range	-40…+80°C
	Accuracy	±2% (10…90%RH), ±2,5% in the remaining range
	Temperature dependence	2% on the whole temperature range
	Hysteresis and repeatability	1%RH
	Long term stability	1%/year
Temperature	Sensor type	Pt100 1/3 DIN (on request, NTC 10kΩ: code HD9817T1.1
	Measuring range	-40...+60°C
	Accuracy	±0.2°C ±0.15% of the measured value
	Long term stability	0.2°C/year
General	Power voltage	5…30Vdc
	Consumption	Typically 2mA
	Max. operating temperature	-40…+80°C (for short periods)
	Operating humidity	0…100%RH
Housing	Dimensions	Ø14x138mm
	Degree of protection	IP65

Order codes

HD9817T1R: Dual relative humidity and temperature transmitter, Pt100 sensor. 0...1Vdc analogue outputs. Temperature measuring range -40...+60°C (-20…+80°C on request). Power supply 5...30Vdc. AISI 304 housing. Probe protection class IP65. Dimensions ∅14x133mm. Output with cable L=1,5m (7 wires + shield). Max. working temperature -40°+80°C. **Supplied with HD9817TC software.**

HD9817T1.1R: Dual relative humidity and temperature transmitter, NTC sensor 10kΩ. 0...1Vdc analogue outputs. Temperature measuring range -40...+60°C (-20…+80°C on request). Power supply 5...30Vdc. AISI 304 housing. Probe protection class IP65. Dimensions ∅14x133mm. Output with cable L=1,5m (7 wires + shield). Max. working temperature -40°+80°C. **Supplied with HD9817TC software.**

HD9817T2R: Dual relative humidity and temperature transmitter, Pt100 sensor. RS232C digital output. Temperature measuring range -40...+60°C (-20…+80°C on request). Powered directly from your PC RS232C port. AISI 304 housing. Probe protection class IP65. Dimensions ∅14x133mm. Output with cable L= 2m with DB9 female connector. Max. working temperature -40°+80°C. **Supplied with HD9817TC software.**

HD9817T3R: Dual relative humidity and temperature transmitter, Pt100 sensor. USB1.1-2.0 digital output. Temperature measuring range -40...+60°C (-20…+80°C on request). Powered directly from your PC USB port. AISI 304 housing. Probe protection class IP65. Dimensions ∅14x133mm. Output with cable L= 2m with USB type A connector. Max. working temperature -40°+80°C. **Supplied with HD9817TC software.**

HD9817T.4: Wall-mounting adapter. Only for HD9817T1 and HD9817T1.1 on request.

HD9817T1CAL: USB interface module for connecting HD9817T1 and HD9817T1.1 transmitters to your PC USB port as well as calibrating or checking the humidity sensor. USB connector type A, cable L=1.5m. Connection through 4-pole terminal board.

HD75: saturated salt solution 75% R.H. thread M 12x1.

HD33: saturated salt solution 33% R.H. thread M 12x1.

HD9008.21.1: holder for vertical sensor, wall distance 250mm, hole Ø 26. Adapter is required HD9008.26.14

HD9008.21.2: holder for vertical sensor, wall distance 125mm, hole Ø 26. Adapter is required HD9008.26.14

HD9008.26/14: holders for Ø 26 and Ø 14mm holes, for HD9008.21.1 and HD9008.21.2

HD9008.31: flange with sensor block Ø 14mm for duct sensorsTC and TO series.

P5: 20µ stainless steel grid protection for probes Ø 14mm, thread M 12x1.

P6: 20µ sintered stainless steel protection for probes Ø 14mm, thread M 12x1.

P7: 10µ PTFE protection for probes Ø 14mm, thread M 12x1.

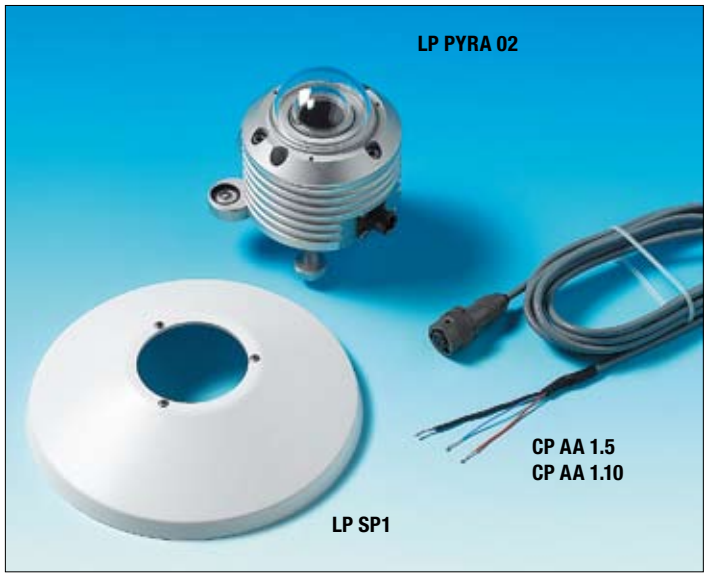
P8: 20µ stainless steel and Pocan grid protection, thread M 12x1.

LP PYRA 02
LP PYRA 03
LP PYRA 12

LP PYRA 02 - LP PYRA 03 - LP PYRA 12 PYRANOMETERS

Delta Ohm manufactures First Class **LP PYRA 02** and **LP PYRA 12** and Second Class **LP PYRA 03** pyranometers which fully comply with ISO 9060 standards, and meet the requirements defined by the World Meteorological Organization (WMO). These are strong and reliable ground-based instruments, especially designed to be used under all weather conditions. They are suitable for installation on the field.

Recommended use: atmospheric research, weather stations, climatology, energy saving research, productive efficiency test of photovoltaic plants, etc…



LP PYRA 02

Pyranometers LP PYRA 02 and LP PYRA 03 are well suited for the measurement of incoming global solar radiation (0.3µm ÷ 3µm spectral range). LP PYRA 12 shadow ring is designed to shield the instrument sensor from direct radiation; by that, an exact measurement of the diffuse sky radiation is possible.
No power supply is needed; pyranometers generate a voltage which is usually equal to:

$$10 \frac{mV}{kW \bullet m^{-2}}$$

Every pyranometer is calibrated separately and is supplied standard with a WRR (World Radiometric Reference) Report of Calibration.

Technical Specification	LP PYRA 02 / LP PYRA 12*	LP PYRA 03
Typical sensitivity	10 µV/(W/m²)	
Impedance	33 Ω ÷ 45 Ω	
Measuring range	0 ÷ 2000 W/m²	
Viewing field	2π sr	
Spectral field	305 nm ÷ 2800 nm W/m² (50%)	
Operating temperature	-40 °C ÷ 80 °C	
Weight	0.90 Kg	0. 45 Kg
ISO 9060 Specifications		
Response time 95%	< 28 sec	< 30sec
Zero Off-set		
a) Response to thermal radiation (200Wm⁻²)	15 W/m²	25 W/m²
b) Response to temperature change 5K/h	<|± 4|W/m²	<|± 6|W/m²
3a) Non stability over 1 year	<|± 1.5|%	<|± 2.5|%
3b) Non linearity	<|± 1|%	<|± 2|%
3c) Cosine response	<|±18|W/m²	<|±22|W/m²
3d) Spectral selectivity	<|±5|%	<|±7|%
3e) Response with regard to temperature	< 4 %	< 8 %
3f) Tilt response	<|± 2|%	<|± 4|%
Shadow ring for LP PYRA 12		
Weight		5.90 Kg
Diameter		570 mm
Height		54 mm
Basis diameter		300 mm

ORDERING CODE

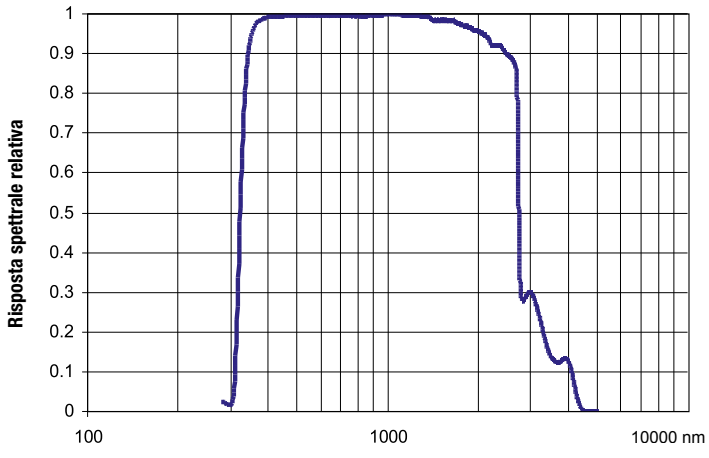
LP PYRA 02: First class pyranometer according to ISO 9060. Complete with: shade disk LP SP1, desiccant sachet with silica-gel crystals, 2 cartridges, spirit level, 4-pole flying connector and Report of Calibration. Typical sensitivity 10µV/(W/m$_2$).**Connection cable has to be ordered separately**.

LP PYRA 02AC: First class pyranometer according to ISO 9060. Complete with shade disk LP SP 1, desiccant sachet with silica-gel crystals, 2 cartridges, spirit level, 4-pole flying connector and Report of Calibration. **Connection cable has to be ordered separately. Current output 4…20mA**. 4mA = 0W/m², 20mA = 2000W/m². Power supply: 10…30Vdc.

LP PYRA 02AV: First class pyranometer according to ISO 9060. Complete with shade disk LP SP 1, desiccant sachet with silica-gel crystals, 2 cartridges, spirit level, 4-pole flying connector and Report of Calibration .Connection cable has to ordered separately. **Voltage output 0…1Vdc, 0…5Vdc, 0…10Vdc**. 0V = W/m², 1/5/10Vdc = 2000W/m². Power supply: 10…30Vdc (15…30Vdc for models with output 0…10Vdc).

LP S1: Mounting kit for LP PYRA 02: bracket for attachment to a mast, including fasteners and leveling screws.

LP SP1: Shade disk for LP PYRA 02



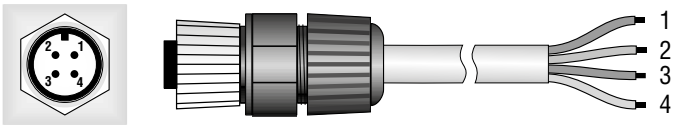
Risposta spettrale tipica dei Piranometri

LP SG: Drying cartridge with silicagel crystals, complete with O-ring.
LP G: Pack of 5 cartridges of silicagel.
LP PYRA 03: Second class pyranometer according to ISO 9060. Complete with spirit level, 4-pole flying connector and Report of Calibration. Typical sensitivity 10µV/(W/m_2). **Connection cable has to be ordered separately.**
LP PYRA 03AC: Second class pyranometer according to ISO 9060. Complete with spirit level, 4-pole flying connector and Report of Calibration. Typical sensitivity 10µV/(W/m_2). **Connection cable has to ordered separately**. **Current output 4…20mA**. 4mA = 0W/m^2, 20mA = 2000W/m^2. Power supply: 10…30Vdc.
LP PYRA 03AV: Second class pyranometer according to ISO 9060. Complete with spirit level, 4-pole flying connector and Report of Calibration. Typical sensitivity 10µV/(W/m_2). **Connection cable has to ordered separately**. **Voltage output 0…1Vdc, 0…5Vdc, 0…10Vdc**. 0V = W/m^2, 1/5/10Vdc = 2000W/m^2. Power supply: 10…30Vdc (15…30Vdc for models with output 0…10Vdc).
LP S2: Mounting kit: spirit level and stud for mounting LP PYRA 03 on a support which is also part of the kit. Fasteners, shade disk LP SP2 are included.
LP SP2: Shade disk.
LP PYRA 12: First Class Pyranometer (LP PYRA 02) according to ISO 9060. Complete with shade disk, shadow ring for diffuse radiation, drying cartridge for silicagel crystals, 2 silicagel cartridges and Report of Calibration. Typical sensitivity 10µV/(W/m_2). **Connecting cable has to be ordered separately**.
LP PYRA 12AC: First Class Pyranometer (LP PYRA 02) according to ISO 9060. Complete with shade disk, shadow ring for diffuse radiation, drying cartridge for silicagel crystals, 2 silicagel cartridges and Report of Calibration. Typical sensitivity 10µV/(W/m_2). **Connection cable has to ordered separately**. **Current output 4…20mA**. 4mA = 0W/m^2, 20mA = 2000W/m^2. Power supply: 10…30Vdc.
LP PYRA 12AV: First Class Pyranometer (LP PYRA 02) according to ISO 9060. Complete with shade disk, shadow ring for diffuse radiation, drying cartridge for silicagel crystals, 2 silicagel cartridges and Report of Calibration. Typical sensitivity 10µV/(W/m_2). **Connection cable has to ordered separately**. **Voltage output 0…1Vdc, 0…5Vdc, 0…10Vdc**. 0V = W/m^2, 1/5/10Vdc = 2000W/m^2. Power supply: 10…30Vdc (15…30Vdc for models with output 0…10Vdc).
CP AA 2.5: Flying 7-pole connector, complete with UV-resistant cable L=5m. For the instruments LP PYRA 05- LP PYRA 06 - LP UVB 02.
CP AA 2.10: Flying 7-pole connector, complete with UV-resistant cable L=10m. For the instruments LP PYRA 05- LP PYRA 06 - LP UVB 02.

ORDER CODE:
HD978TR3: Configurable signal converter amplifier with 4÷20mA (20÷4mA) output. Input measuring range -10..+60mV. Default setting 0÷20mV.
Minimum measuring range 2mV.
HD978TR4: Configurable signal converter amplifier with 0÷10 (10÷0Vdc) output. Input measuring range -10..+60mV. Default setting 0÷20mV.
Minimum measuring range 2mV.
HD978TR5: Wall configurable, signal converter amplifier with 4÷20mA (20÷4mA) output. Input measuring range –10...+60mV. Default settings 0÷20mV. Minimum measuring range 2mV.
HD978TR6: Wall configurable, signal converter amplifier with 0÷10 (10÷0Vdc) output. Input measuring range –10...+60mV. Default settings 0÷20mV. Minimum measuring range 2mV.

HD978TR3, HD978TR4, HD978TR5, HD978TR6

WIRING DIAGRAM LP PYRA 02 - LP PYRA 03 - LP PYRA 12



Fixed 4-pole plug M12 **Flying 4-pole M12 socket**

LP PYRA 02 - LP PYRA 03 - LP PYRA 12

Connector	Function	Color
1	Positive signal (+)	Red
2	Negative signal (-)	Blue
3	Not connected (LP PYRA 03) Container (LP PYRA 02 - LP PYRA 12)	White
4	Shield (⏚)	Black

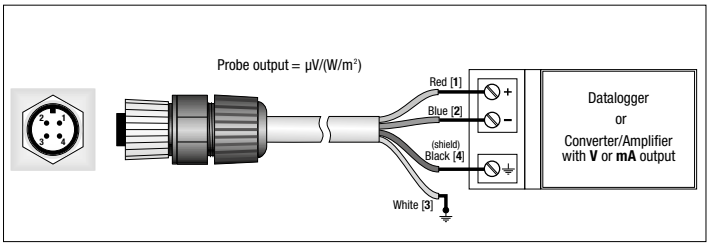
LP PYRA 02AC - LP PYRA 03AC - LP PYRA 12AC

Connector	Function	Color
1	Positive signal (+)	Red
2	Negative signal (-), -Vdc	Blue
3	Not connected (LP PYRA 03) Container (LP PYRA 02 - LP PYRA 12)	White
4	Shield (⏚)	Black

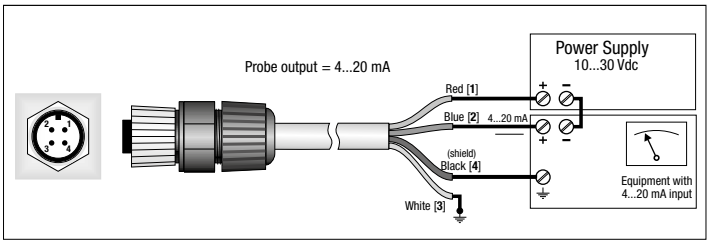
LP PYRA 02AV - LP PYRA 03AV - LP PYRA 12AV

Connector	Function	Color
1	(+) Vout	Red
2	(-) Vout e (-) Vcc	Blue
3	(+) Vcc	White
4	Shield (⏚)	Black

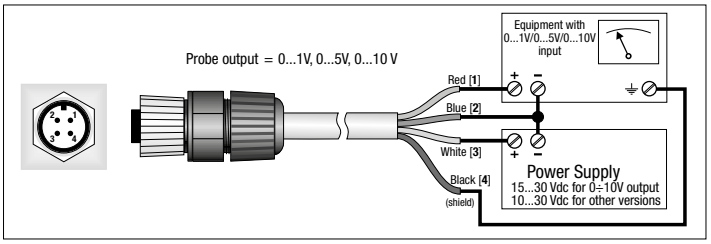
LP PYRA 02 - LP PYRA 03 - LP PYRA 12 CONNECTION DIAGRAMMS



LP PYRA 02 AC



LP PYRA 02 AV



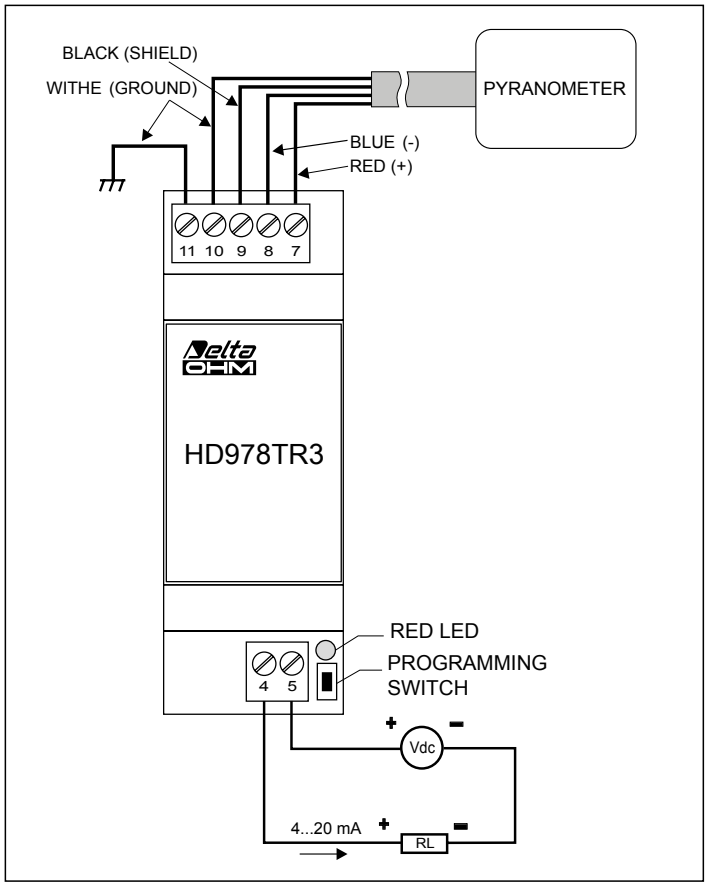


Fig.5 Connection diagram of the HD978TR3 to a pyranometer.

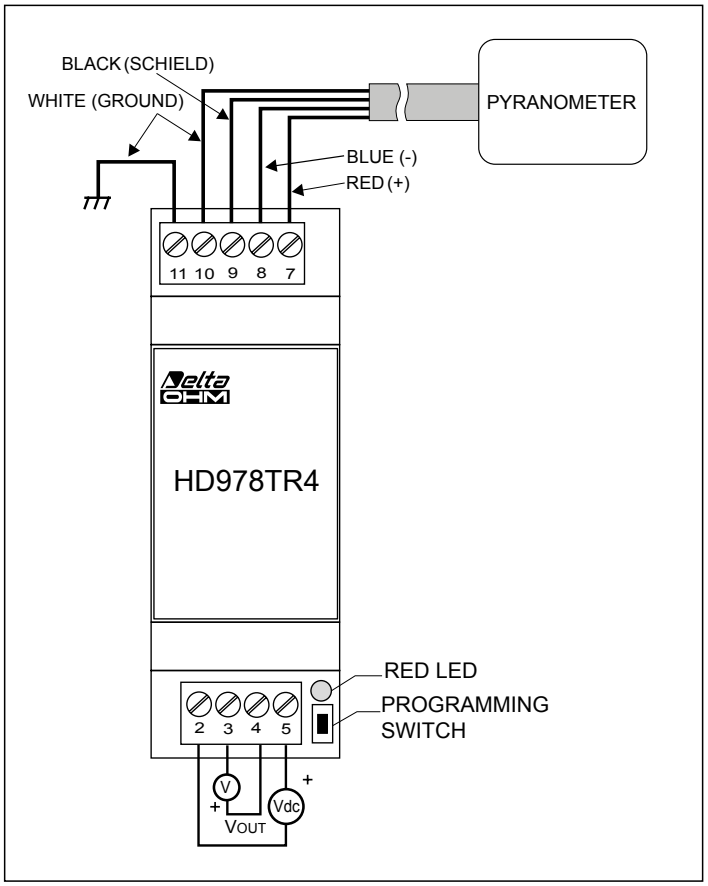
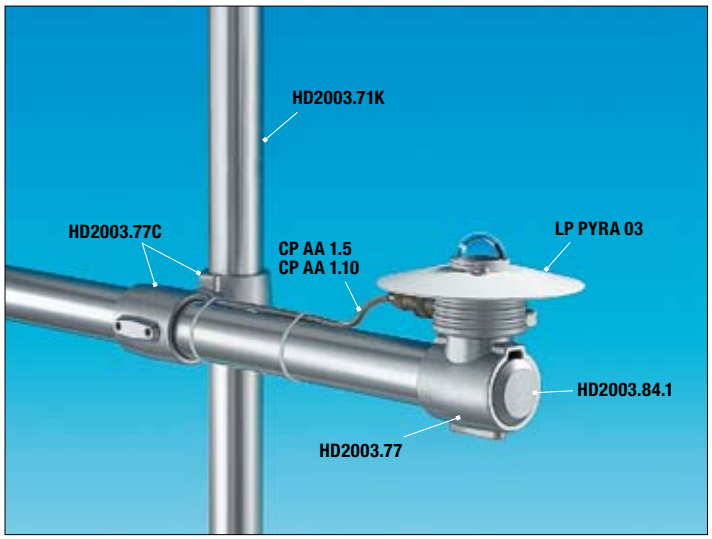
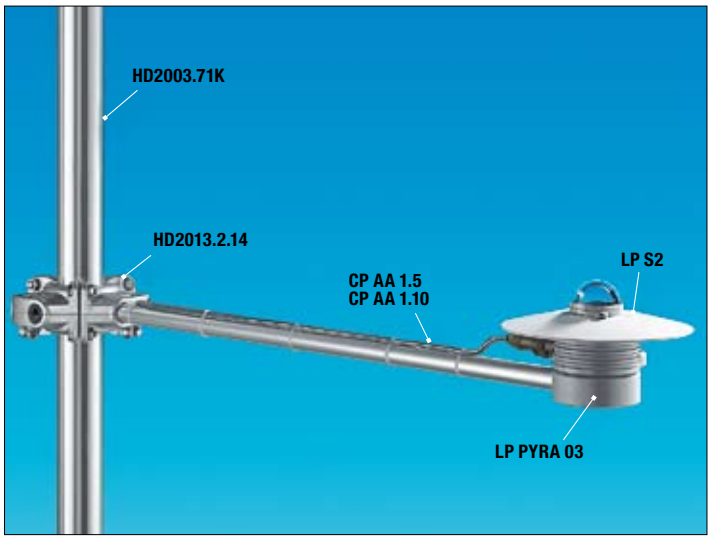


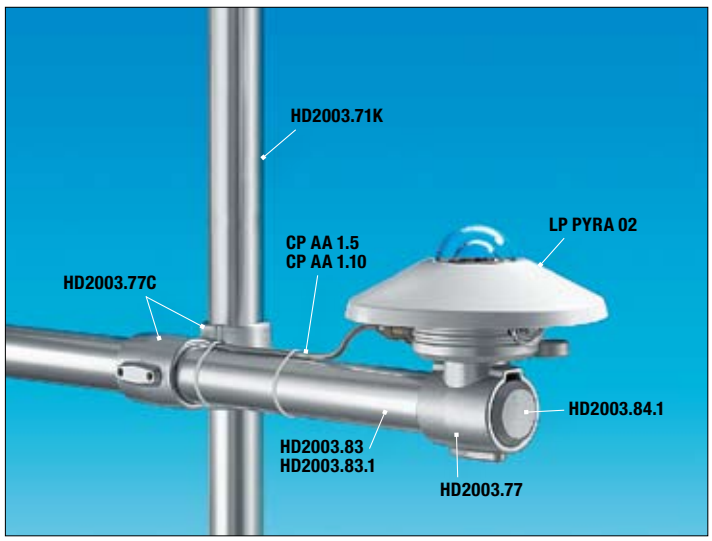
Fig.6 Connection diagram of the HD978TR4 to pyranometer.



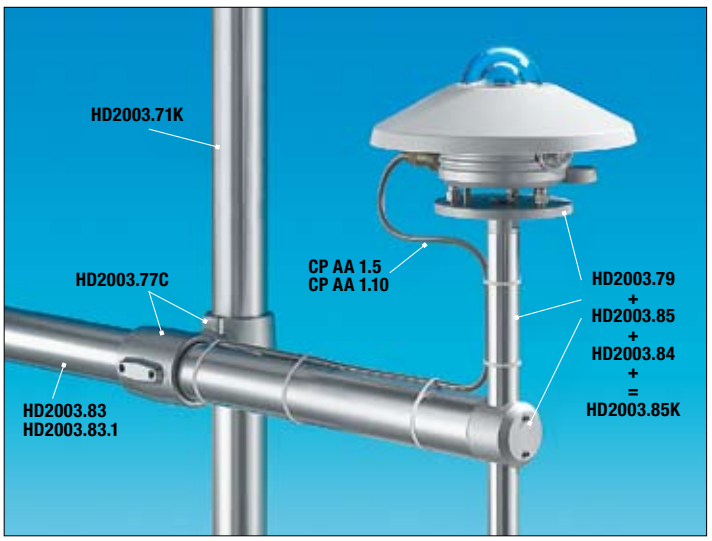
LP PYRA 03 + HD2003.77 + HD2003.77C



HD2013.2.14 + LP PYRA 03 + LP SP2 + LP S2



LP PYRA 02 + HD2003.77C + HD2003.77



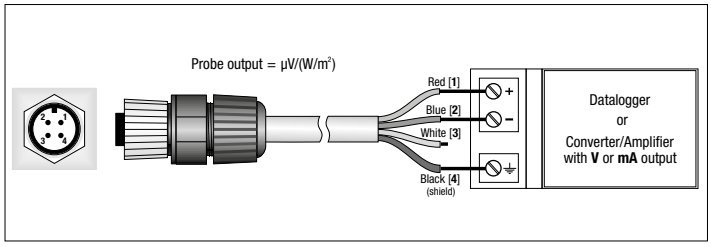
LP PYRA 02 + HD2003.85K + HD2003.77C

LP PYRA 08 - LP PYRA 08AC - LP PYRA 08AV PIRANOMETERS

Delta Ohm manufactures, according to ISO 9060 and the recommendations of the WMO, the range of 2nd class pyranometers **LP PYRA 08**. These tools are robust, reliable, provided to withstand the adverse climatic conditions are suitable for installation in the field.
The pyranometer **LP PYRA 08**, measure the radiation on a flat surface (Watt/m^2). The radiation measured is the sum of direct solar irradiance and diffuse irradiance (global radiation).
The sensors with mV output does not need power and have a typical sensitivity of 15 mV / (kW m^{-2}). The pyranometer are also available with the output signal amplified and converted into a current signal 4 ... 20mA or voltage 0 ... 1 Vdc, 0 ... 5 V or 0 ... 10Vdc. The heating option allows you to operate at low temperatures with good results in those places where frequent snowfall would cover the glass dome for long periods.
Each pyranometer is calibrated individually with reference to the WWR (World Radiometric Reference in Davos CH) and accompanied by calibration report.

LP PYRA 08 thanks to a new sensor used has a response time of less than 8 seconds and is used when it is necessary to record changes in short and very short-term irradiation.

LP PYRA 08 - LP PYRA 08BL CONNECTION DIAGRAMMS



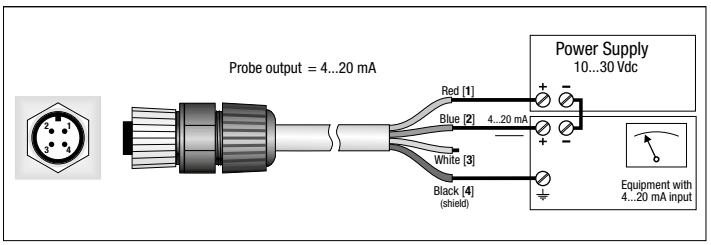
Technical specifications	LP PYRA 08
Typical sensitivity	15 mV (kW/m^2)
Impedance	5Ω
Measuring range	2000 W/m^2
Viewing field	2πsr
Spectral field	305 nm – 2800 nm (50%) (Figure 1)
Working temperature	-40 °C – 80 °C
Specifications according to ISO 9060	
Response time (95%)	**<8 sec**
Zero Off-set	25 W/m^2
a) Response to a thermal radiation (200 W m^{-2})	<|±6| W/m^2
b) Response to a change of temperature 5K/h	<|±2.5| %
Long-term instability (1 year)	<|±2| %
Non linearity	<|±22| W/m^2
Response according to cosine	<|±7| W/m^2
Spectral selectivity	<8%
Tilt response	<|±4| %

Figure 1. Typical spectral response of the pyranometers.

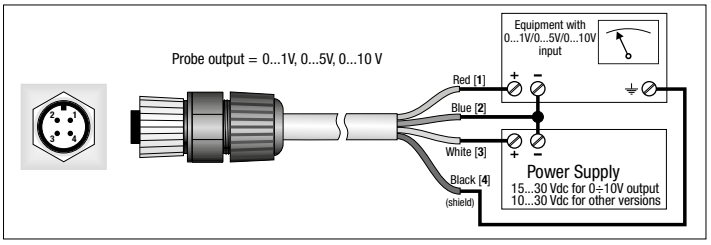
PURCHASING CODES

LP PYRA 08: Second Class pyranometer according to ISO 9060, complete with fast response sensor, calibration report, Silica gel can be replaced when exhausted. Different configurations available. M12 male connector. The cable with the female connectormust be ordered separately. Use the cables CPM12 AA ... 2, 5 or 10 meters.

LP PYRA 08BLAC



LP PYRA 08BLAV



LP PYRA ☐ ☐

- **R** = heating option
- **No letter** = not heated

- **08** = output in mV per kW / m²
- **08BL** = output mV per kW / m², complete with base and level
- **08BLAC** = output 4÷20 mA, complete with base and level
- **08BLAV** = 0÷10 V, complete with base and level

CABLES:

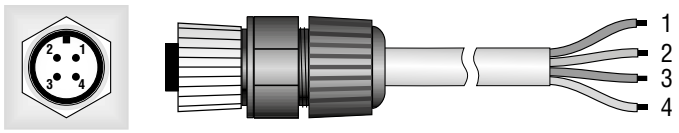
CPM12 AA ☐.☐

- **2** = 2m long
- **5** = 5m long
- **10** = 10m long

- **4** = 4-poles cable for not heated versions
- **8** = 8-poles cable with heating, **option R**

WIRING DIAGRAMS:

4-poles cable CPM12 AA4…



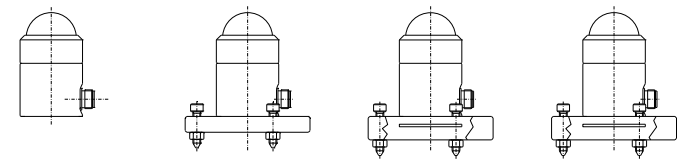
Spina M12 fissa 4 poli **Presa M12 volante 4 poli**

LP PYRA 08, LP PYRA 08BL, LP PYRA 08BLAC

Connector	Function	Colour
1	Negative (-)	Blue
2	Positive (-)	Red
3	Display	Black
4	Not connected	White

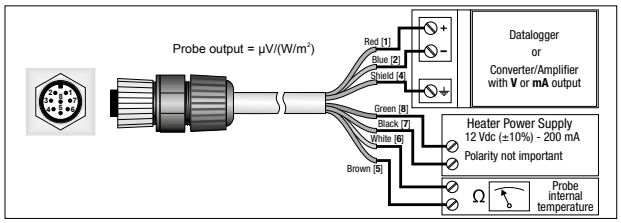
LP PYRA 08BLAV

Connector	Function	Colour
1	(+) Vout and (-) Vcc	Blue
2	(+) Vout	Red
3	Display	Black
4	(+) Vcc	White

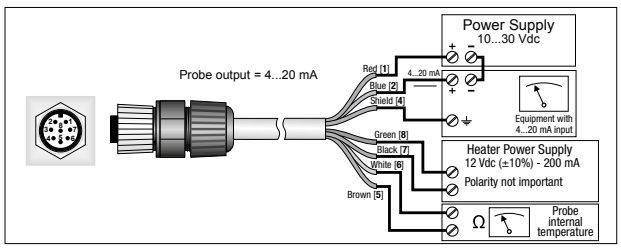


LP PYRA 08 **LP PYRA 08BL** **LP PYRA 08BLAC** **LP PYRA 08BLAV**

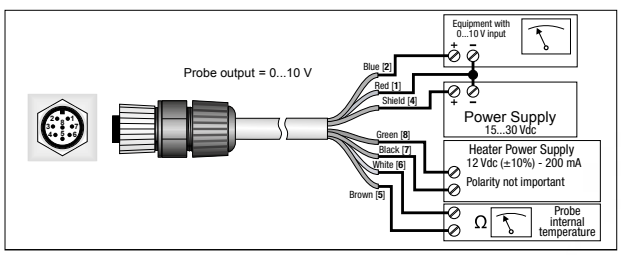
LP PYRA 08R - LP PYRA 08BLR CONNECTION DIAGRAMS



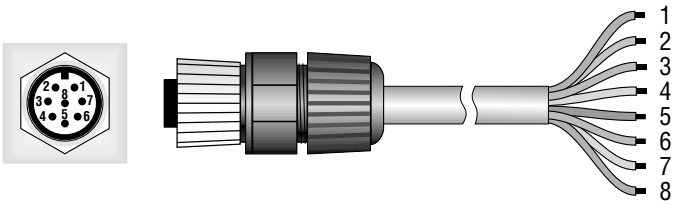
LP PYRA 08 - LP PYRA 08BLACR CONNECTION DIAGRAMS



LP PYRA 08 - LP PYRA 08BLAVR CONNECTION DIAGRAMS



8-poles cable CPM12 AA8…



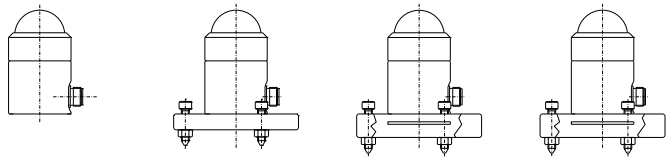
Spina M12 fissa 8 poli **Presa M12 volante 8 poli**

LP PYRA 08R, LP PYRA 08BLR, LP PYRA 08BLACR

Connector	Function	Colour
1	Positive (+)	Red
2	Negative (-)	Blue
3		
4	Display	Sock
5	NTC (10K)	Brown
6		White
7	Heater	Black
8		Green

LP PYRA 08BLAVR

Connector	Function	Colour
1	(-) Vout and (-) Vcc	Red
2	(+) Vout	Blue
3		
4	(+) Vcc	Sock
5	NTC (10K)	Brown
6		White
7	Heater	Black
8		Green



LP PYRA 08R **LP PYRA 08BLR** **LP PYRA 08BLACR** **LP PYRA 08BLAVR**

LP PYRA 08BLAC

LP PYRA 08 BL

LP PYRA 08

LP PYRA 05
LP PYRA 06

LP PYRA 05 - LP PYRA 06
ALBEDOMETERS

Delta Ohm manufactures two different models of albedometers:
LP PYRA 05 is constructed starting from two 1st class* pyranometers and the **LP PYRA 06** starting from two 2nd class* pyranometers (* according to ISO 9060 standards and to specifications published by the World Meteorological Organization). An albedometer basically consists of two pyranometers, mounted back-to-back, one looking upward (sky) and one downward (earth). The upward pyrameter measures the incident global radiation (direct radiation + diffuse radiation) striking the ground, while the downward one, measures the global radiation reflected from the ground. The outputs of the two pyranometers electric signals (the two pyranometers which made up of the LP PYRA 05 are coupled in order to have the same sensitivity) can be directly sent to a data logger or to an automatic data processor. Albedo is the fraction of solar radiation that is reflected from the ground, with respect to incident radiation:

$$\text{ALBEDO} = \frac{\text{Reflected Global Radiation}}{\text{Incident Global Radiation}}$$

By using albedometers, we can calculate the net radiation obtained through the difference between incident global radiation and reflected global radiation.
Delta Ohm albedometers operate within 0.3 µm ÷3 µm spectral range. No power supply is needed, as the two pyranometers generate a voltage which is usually equal to:

$$10 \frac{\text{mV}}{\text{kW} \bullet \text{m}^{-2}}$$

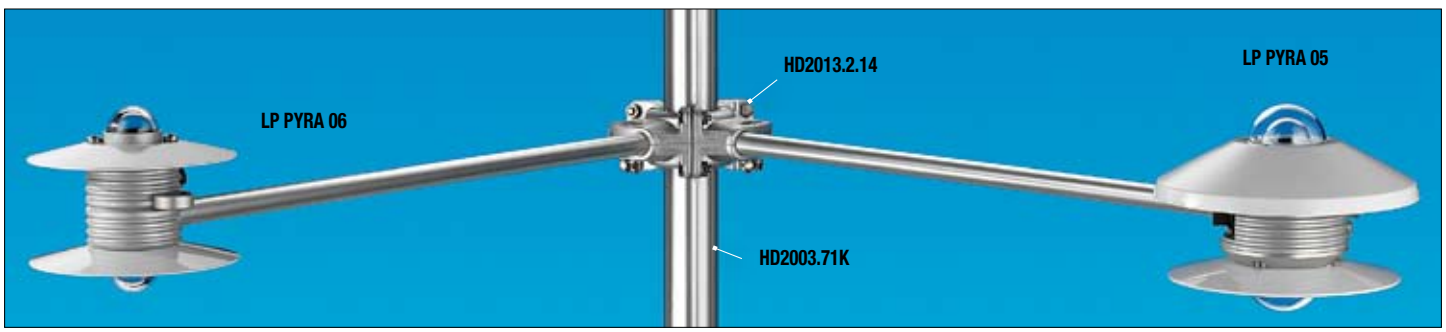
Every pyranometer composing the albedometer is calibrated separately as per the WRR (World Radiometric Reference) standard and is supplied with the relevant Report of Calibration.
These are strong and reliable ground-based instruments, especially designed to be used under all weather conditions. They are suitable for installation of the field.
Recommended use: climatological research, weather stations, road weather stations, agriculture stations, etc…

Technical Specification	LP PYRA 05*	LP PYRA 06*
Typical sensitivity	10 µV/(W/m²)	
Typical Impedance	33 Ω ÷ 45 Ω	
Irradiance range	0 ÷ 2000 W/m²	
Viewing angle	2π sr	
Spectral range	305 nm ÷ 2800 nm W/m² (50%)	
Operating Temperature	-40 °C ÷ 80 °C	
Weight (pyranometer only)	1.35 Kg	1.1 Kg
ISO 9060 Specifications		
Response time (95 %)	< 28 sec	< 30sec
Zero off-set		
3a) thermal radiation (200 Wm⁻²)	15 W/m²	25 W/m²
3b) themperature change 5K/h	<|± 4|W/m²	<|± 6|W/m²
3a) Long term stability 1 year	<|± 1.5|%	<|± 2.5|%
3b) Non linearity	<|± 1|%	<|± 2|%
3c) Cosine response	<|±18|W/m²	<|±22|W/m²
3d) Spectral selectivity	<|±5|%	<|±7|%
3e) Temperature response	< 4 %	< 8 %
3f) Tilt response	<|± 2|%	<|± 4|%

* All technical data, excluding weight, are referred to one of the two pyranometers composing the albedometer.

ORDERING CODES

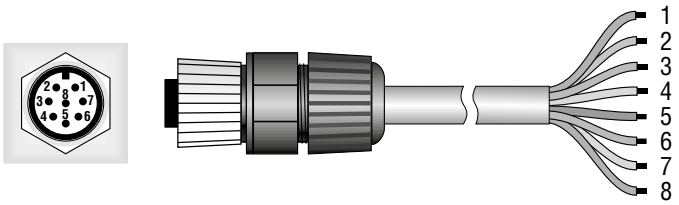
LP PYRA 05: Albedometer made up of two 1st Class pyranometers, according to ISO 9060. Complete with: top shade disk and bottom shade disc, drying cartridge with silicagel crystals, 2 silica gel cartridges, spirit level, rod for attachment to a mast, and Report of Calibration. Typical sensitivity 10µV/(W/m²). **The connection cable has to be ordered separately.**
LP SP1: Top shade disc for albedometer LP PYRA 05 (upward pyranometer).
LP SP3: Bottom shade disk for albedometer LP PYRA 05 (downward pyranometer).



HD 2013.2.14 + LP PYRA 05 + LP PYRA 06

LP SG: Drying cartridge with silicagel crystals, complete with O-ring.
LP G: Pack of 5 cartridges of silicagel.
LP PYRA 06: Albedometer made up of two 2nd Class pyranometers, according to ISO 9060. Complete with: top shade disk and bottom shade disc, spirit level, rod for attachment to a mast, connecting cable 5m and Report of Calibration. Typical sensitivity 10µW/(W/m²). **The connection cable has to be ordered separately.**
CP AA 2.5: Flying 7-pole connector, complete with UV-resistant cable L=5m. For the instruments LP PYRA 05- LP PYRA 06 - LP UVB 02.
CP AA 2.10: Flying 7-pole connector, complete with UV-resistant cable L=10m. For the instruments LP PYRA 05- LP PYRA 06 - LP UVB 02.
HD978TR3 Configurable signal converter amplifier with 4÷20mA (20÷4mA) output. Input measuring range -10..+60mV. Default setting 0÷20mV. Minimum measuring range 2mV.
HD978TR5: Wall configurable, signal converter amplifier with 4÷20mA (20÷4mA) output. Input measuring range –10...+60mV. Default settings 0÷20mV. Minimum measuring range 2mV.
HD978TR4 Configurable signal converter amplifier with 0÷10 (10÷0Vdc) output.
Input measuring range -10..+60mV. Default setting 0÷20mV.
Minimum measuring range 2mV.
HD978TR6: Wall configurable, signal converter amplifier with 0÷10 (10÷0Vdc) output. Input measuring range –10...+60mV. Default settings 0÷20mV. Minimum measuring range 2mV.

WIRING DIAGRAM LP PYRA 05 - LP PYRA 06

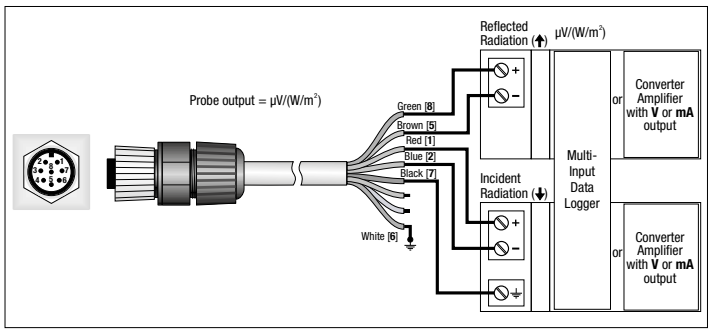


Fixed 8-pole plug M12 **Flying 8-pole M12 socket**

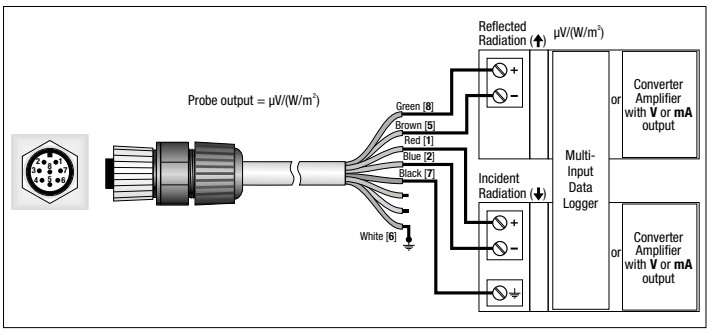
Connector	Function	Colour
8	V out (+) of the signal generated by the lower detector (↑)	Green
6	Housing (⏚) (LP PYRA 05) Not connected (LP PYRA 06)	White
2	V out (-) of the signal generated by the upper detector (↓)	Blue
1	V out (+) of the signal generated by the upper detector (↓)	Red
7	Display (⏚)	Black
5	V out (-)of the signal generated by the lower detector (↑)	Brown

CONNECTION DIAGRAMS

LP PYRA 05



LP PYRA 06



LP PYRA 05

LP PYRA 06

LP NET 07
NET IRRADIANCE METER

LP NET 07 measures the net radiation across a surface, from near ultraviolet to far infrared. The Net radiation is defined as the difference between the radiation that reaches the upper surface and the irradiation on the lower surface of the net radiometer. The surface of the upper receiver measures the direct solar radiation plus the diffuse one and the radiation at longer wavelengths emitted from the sky (clouds), while the lower receiving area measures the solar radiation reflected from the ground (albedo) and the radiation length wavelengths emitted from the earth.
The instrument is designed and constructed to be used outdoors in any weather conditions.

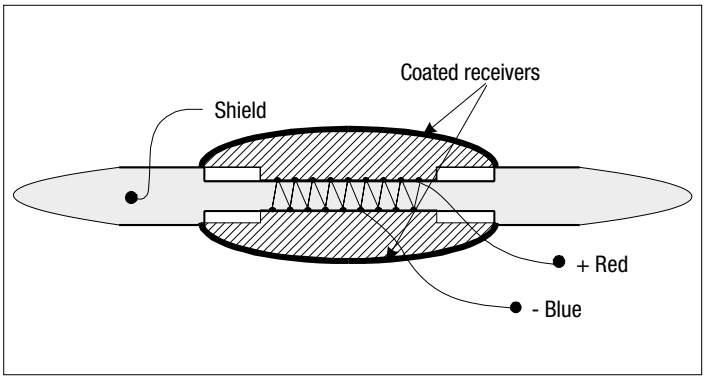


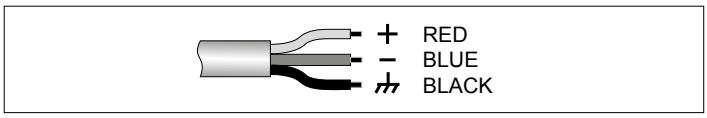
FIG. 1

Working Principle
The net radiometer LP NET 07 is based on a thermopile sensor whose warm joints are in thermal contact with the receiver while the upper cool joints are in thermal contact with the lower receiver. The temperature difference between the two receivers is proportional to the net irradiation. The temperature difference between hot and cold junction is converted into a voltage by Seebeck effect. The two receivers are made from a portion of spherical coated Teflon®. The particular form of the two receivers provides a response in accordance with the cosine. The Teflon® coating, as well as allowing outdoor installation for long periods without risk of damage, can have a constant spectral response from ultraviolet (200nm) up to far infrared (100 μm).

Installing and mounting the net radiometer for total irradiance measurements:

- To allow cleaning the two receiving surfaces regularly, LP NET 07 should be mounted in easily reachable places. The surfaces can be washed with plain water or pure ETHIL alcohol.
- Mount the instrument so that no shadow will be cast on it at any time of day and of the seasons, from obstructions such as buildings, trees, or any other obstacle.
- In the NORTHERN hemisphere, the net radiometer is normally oriented towards SOUTH, while it should be oriented NORTHWARD, in the SOUTHERN hemisphere.

CONNECTION DIAGRAM LP NET 07



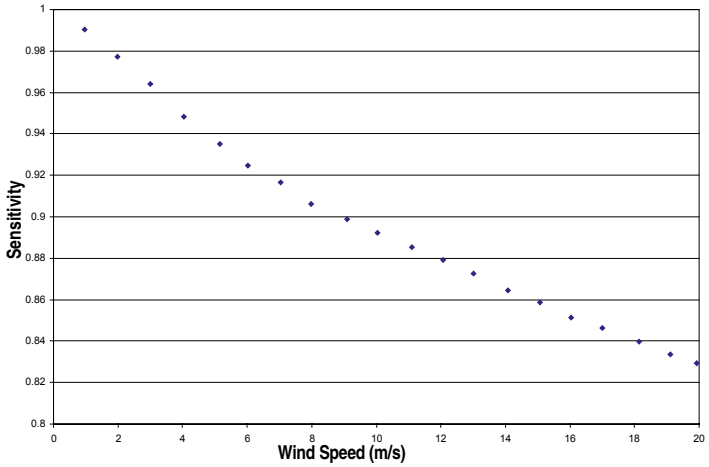


FIG. 2

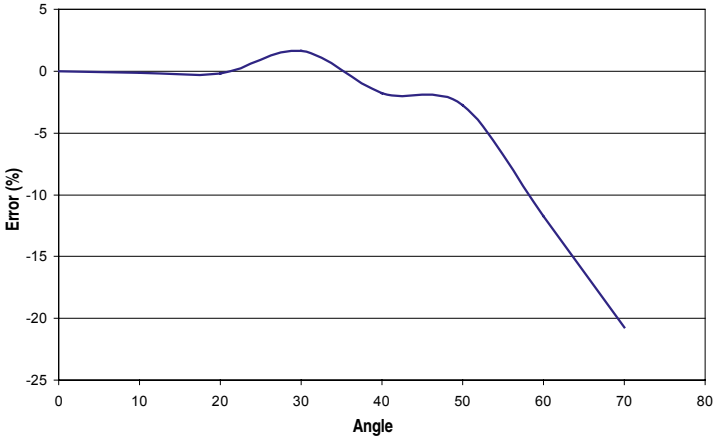


FIG. 3

- The instrument should be mounted at a height of at least 1.5 m above the ground. Please note that the flow on the lower receiver is representative of a circular area with a radius of 10 times the height.
- When installing the net-radiometer avoid, wherever possible, to touch the surfaces of the receiving net-radiometer.

Electrical Connections and requirements for electronic reading:
- LP NET 07 does not require any power supply.
- It is available with a 5 m. output cable
- It is supplied with a PTFE, UV resistant, braided shield and 2-wire cable. The color code is as follows:
  black → connected to the housing
  red → (+) positive pole of the signal generated by the detector
  blue → (-) negative pole of the signal generated by the detector
  Fig.1 shows the wiring diagram.
- It has to be connected to a millivoltmeter or to a data acquisition system with input impedance higher than 4000kΩ. Normally, the output signal from the net radiometer does not exceed ±20 mV. In order to grant the best performances in measurements, the instrument resolution should be of 1μV.

Maintenance:
Cleaning can be done with normal maps for the cleaning of lens paper and water, if not enough, just use pure ethyl alcohol. After cleaning with alcohol it is necessary to clean the domes again with water only.
We strongly recommend to calibrate LP NET 07 annually. The calibration can be carried out by comparison with another net-radiometer sample in the field. The field calibration is less precise than a calibration performed in the laboratory but has the advantage of not having to remove the instrument from its housing.

Calibration and measurements:
Net radiometer sensitivity, indicated as S (or calibration factor), allows determining the net radiant flow passing through a surface. **S factor is measured in μV/(Wm^{-2}).**
- Measured the potential difference (DDP) at the ends of the flow probe is obtained by the following formula E_e

$$E_e = DDP/S$$

where;
E_e: indicates the radiant flux expressed in W/m^2,
DDP: indicates the potential difference expressed in μV and measured by the multimeter,
S: indicates the calibration factor expressed in μV/(W/m^2) and shown on the net radiometer label (calibration factor is also mentioned in the calibration report).
N.B. If the difference of potential (DDP) is positive, the radiation on the upper surface is higher than the radiation on the lower surface (typically during daylight hours); if DDP is negative, the radiation on the lower surface is higher that the one on the upper surface (typically at night).

Each net-radiometer is individually calibrated at the factory and is distinguished by its calibrator factor.

Calibration is performed inside Delta Ohm Metrological Laboratory and performed with a net radiometer-reference with a solar simulator as the source of light.Calibration is performed with a beam of light in parallel.

Sensitivity to wind speed:
At the same radiant flux, by increasing the wind speed decreases the net radiometer output signal will (sensitivity decrease by increasing wind speed).
Measurements taken inside the wind tunnel, have shown that S_v sensitivity, related to the wind speed for LP NET 07, can be corrected by using the following functions:

$S_v = S_0(1-0.011 \times V)$ $\quad V \leq 10$m/s
$S_v = S_0(0.95-0.006 \times V)$ $\quad 10$m/s$<V<20$m/s

Where: S_0 = sensitivity at zero wind speed
V = wind speed in m/s

Fig. 2 shows the calibration factor related with wind speed.

Once we know both the net radiation - calculated through the sensitivity at zero wind speed (F_{net_0}) - and the wind speed in (V) in m/s, the correct data is obtained by using the following formula:

$F_{net} = F_{net_0}/(1-0.011 \times V)$ $\quad V \leq 10$m/s
$F_{net} = F_{net_0}/(0.95-0.006 \times V)$ $\quad 10$m/s$<V<20$m/s

Cosine response/Directional error:
The radiation falling on a surface should be measured with a sensor, whose response related to the light incidence angle, has to be a Lambertian Response. A receiver is known as Lambertian when its sensibility (S_ϑ), related to the incidence angle between the light and the detector surface, has the following behavior:

$$S_\vartheta = S_0 \cos(\vartheta)$$

Where: S_0 is the sensitivity when light strikes perpendicular to the surface, ϑ is the angle between the incident light beam and the line which is normal to the surface.
Fig. 3 shows the typical behavior of the error related to the angle of incidence.

Technical specifications:

Typical sensitivity:	10 μV/(W/m^2)
Impedance:	2Ω ÷ 4 Ω
Measuring range:	±2000 W/m^2
Spectral range:	0.2 μm ÷ 100 μm
Operating temperature:	-40 °C ÷ 80 °C
Weight:	0.35 Kg
Response time (95%):	<75 sec

ORDERING CODE
LP NET 07: Net radiometer. Connecting cable: 5 m standard length. Different cable lengths upon request.
HD978TR3 Configurable signal converter amplifier with 4÷20mA (20÷4mA) output. Input measuring range -10..+60mV. Default setting 0÷20mV. Minimum measuring range 2mV.
HD978TR5: Wall configurable, signal converter amplifier with 4÷20mA (20÷4mA) output. Input measuring range –10...+60mV. Default settings 0÷20mV. Minimum measuring range 2mV.
HD978TR4 Configurable signal converter amplifier with 0÷10 (10÷0Vdc) output.
Input measuring range -10..+60mV. Default setting 0÷20mV.
Minimum measuring range 2mV.
HD978TR6: Wall configurable, signal converter amplifier with 0÷10 (10÷0Vdc) output. Input measuring range –10...+60mV. Default settings 0÷20mV. Minimum measuring range 2mV.

LP PHOT 02

LP PHOT 02 – LP PHOT 02AC – LP PHOT 02AV PHOTOMETRIC PROBES

The LP PHOT 02, LP PHOT 02AC, and LP PHOT 03AV probes measure illuminance (lux), defined as the ratio between the luminous flux (lumen) through a surface and the surface area (m^2). The spectral response curve of a photometric probe is equal to the human eye, known as *standard photopic curve V(λ).* The difference in spectral response between LP PHOT 02 and the standard photopic curve V(λ) is calculated by means of the error f_1'.

LP PHOT 02 is designed and constructed for outdoor installation for long periods.

The photometric measurement for external use is used for the measurement of daylight in climatological and meteorological applications.

Working principle

LP PHOT 02 probe is based on a solid state sensor, whose spectral response corrected by filters to fit the response of the human eye. The typical spectral response curve is shown in fig.1.

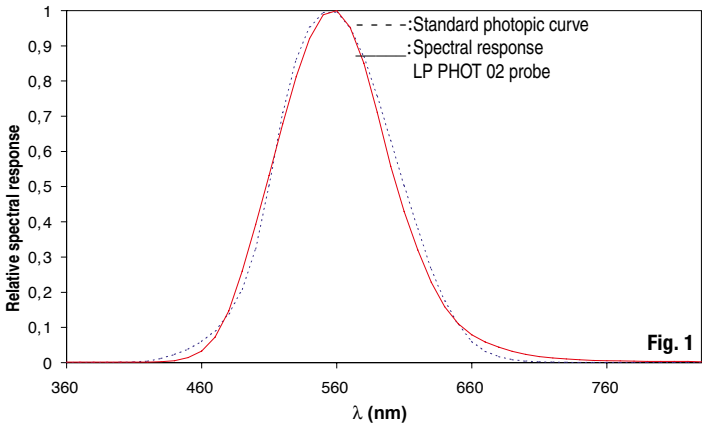


Fig. 1

LP PHOT 02 is provided with a 50 mm diameter transparent glass dome, in order to protect the sensor against atmospheric damage.

The cosine corrected response has been obtained through both the PTFE diffuser and case particular shapes. Deviation between the theoretical response and the real one, is shown in fig.2.

The LP PHOT 02 excellent cosine response allows for use even when the sun elevation is low.

Installing and mounting the LP PHOT 02 probe for global radiation measurements:

Before installation, the silica-gel cartridge must be refilled. Silica-gel crystals absorb humidity in the dome chamber and in case of particular climatic conditions, prevent internal condensation forming on the dome inner wall, with a consequent alteration in measurements.

Do not wet or touch the instrument with your hands while refilling the silica-gel cartridge. Carry out the following instructions in a (possibly) dry environment:

1- Loosen the three screws that fix the white shade disk
2- Unscrew the silica-gel cartridge using a coin
3- Remove the cartridge perforated cap
4- Open the silica-gel sachet (supplied with the luxmeter)
5- Fill the cartridge with silica-gel crystals
6- Close the cartridge with its own cap, and check that the sealing O-Ring is in the right position.
7- Screw the cartridge to the luxmeter using a coin
8- Make sure the cartridge is tightly screwed (otherwise silica-gel crystal will last for a shorter time)
9- Position the shade and tighten it with the screws
10- The luxmeter is ready for use

Fig.3 shows the operations needed to refill the cartridge with silica-gel crystals

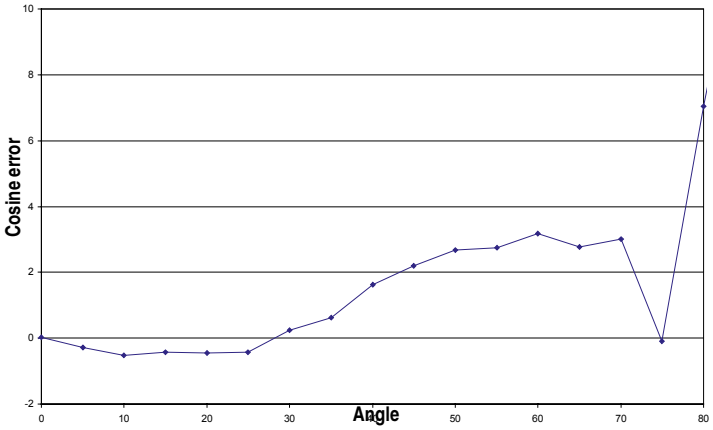


Fig. 2

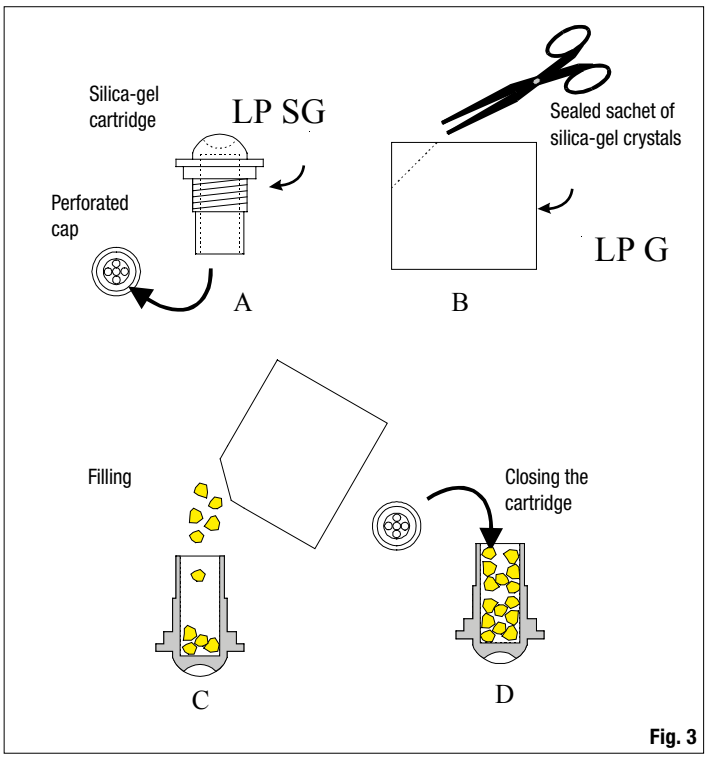


Fig. 3

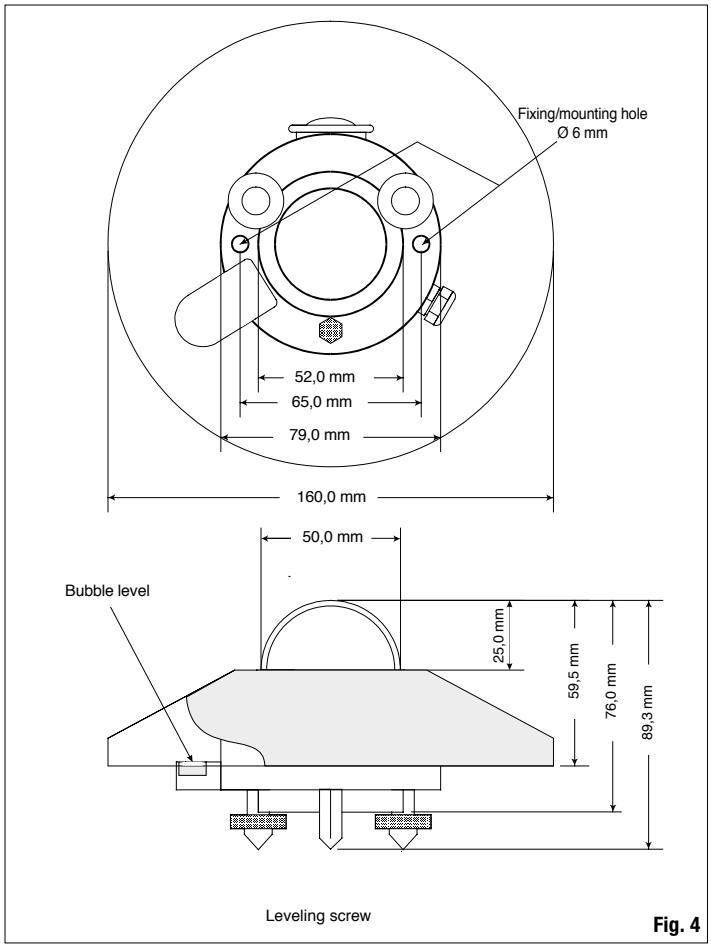
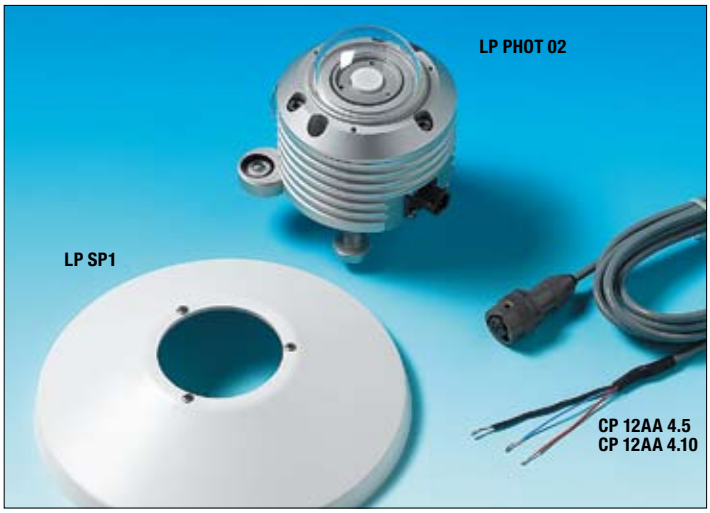


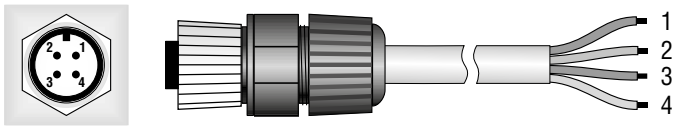
Fig. 4



adjustment of the luxmeter is made by means of two leveling screws. Use the two 6mm-diameter screw holes with an interaxial distance of 65 mm, to mount the instrument on a plane. To access the holes, remove the shade disk and reposition it after mounting (see fig. 4).

- LP S1 mounting kit is supplied upon demand as an accessory, and allows for an easy mounting of the instrument on a mast. The mast maximum diameter shall not exceed 50 mm. The operator will check that the mast height does not exceed the luxmeter plane, in order to avoid measurement errors due to any reflection or shadow of the mast itself. To fix the luxmeter to the mounting bracket, remove the shade disk by loosening the three screws, then fix the luxmeter to the bracket and mount the white shade disk again.
- The luxmeter should be thermally isolated from the mounting bracket, and the electrical contact with the ground must be properly made.

WIRING DIAGRAM LP PHOT 02



Fixed 4-pole plug M12 **Flying 4-pole M12 socket**

P PHOT 02

Connector	Function	Color
1	V out (+)	Red
2	V out (-)	Blue
3	Not connected	White
4	Shield (⏚)	Black

LP PHOT 02 AC

Connector	Function	Color
1	Positivo (+), +Vdc	Red
2	Negativo (-), -Vdc	Blue
3	Not connected	White
4	Shield (⏚)	Black

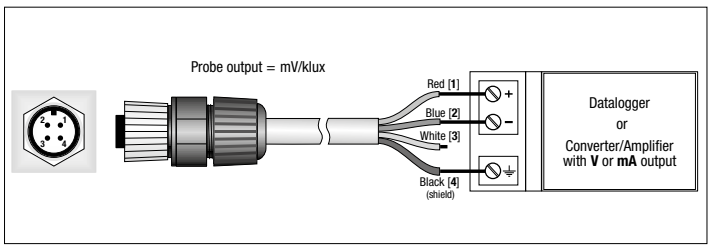
LP PHOT 02 AV

Connector	Function	Color
1	(+) Vout	Red
2	(-) Vout e (-) Vdc	Blue
3	(+) Vdc	White
4	Shield (⏚)	Black

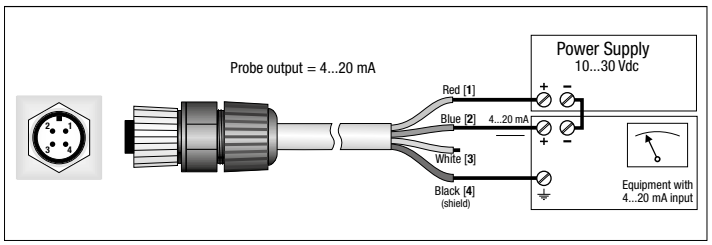
- To allow cleaning the outer dome regularly and carrying out the instrument maintenance, LP PHOT 02 should be mounted in easily reachable places. At the same time, you should check that no building, tree, or any other obstacle exceeds the horizontal plane where the luxmeter is mounted. In case this is not possible, you should find a place where obstacles do not exceed 5 degrees elevation over the path followed by the sun from rising until sunset.
- The luxmeter should be located far from any obstacle which might reflect sunlight (or any shadow) onto the instrument.
- For a correct horizontal placing, LP PHOT 02 is provided with a bubble level; inclination

CONNECTION DIAGRAMS

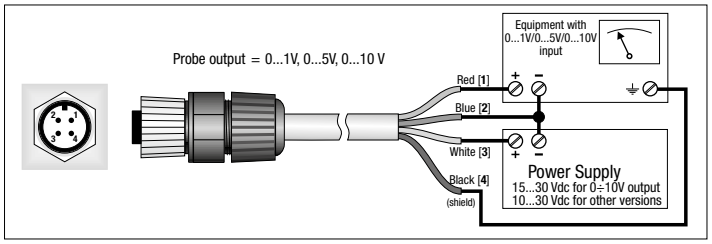
LP PHOT 02



LP PHOT 02 AC



LP PHOT 02 AV



LP PHOT 02 Electrical Connections and requirements for electronic readout devices

- LP PHOT 02 luxmeter is passive and it does not require any power supply.
- LP PHOT 02 is supplied with a flying 4-pole M12 connector
- UV-proof cables are available already assembled, with standard length 5m or 10m.
- Amplified probes are available, with current output signal 4÷20mA or voltage output 0…1Vdc, 0…5Vdc or 0…10Vdc.
- The **optional** cable is UV-proof, cable colors and connector poles are matched as follows:
  Black → shield braid
  Red → (+) signal generated by the detector
  Blue → (-) negative signal generated by the detector (in contact with the housing)
  See wiring scheme.
- LP PHOT 02 is to be connected to a millivoltmeter or data acquisition unit which input load resistance must be > 100kΩ.

Maintenance:

In order to grant the best precision and accuracy in measurements, the outer dome must be always kept clean; the cleaner you keep the dome, the better the accuracy in measurements will be. Washing can be made with water and standard lens paper; in case this wouldn't work, use pure ETHIL alcohol. After using alcohol, the dome must be washed with water only. Sudden rise and fall in temperature throughout day and night, might cause condensation to appear on the luxmeter dome; in this case the performed reading is highly overestimated. To reduce condensation, the luxmeter is provided with a cartridge containing desiccant material, such as Silica-gel. Silica-gel efficiency decreases in time while absorbing humidity. Active silica-gel crystals are **yellow** colored, while they turn into **white** when they gradually loose power. To replace them, see instructions at paragraph n. **3**. Silica-gel generally lasts from 2 to 6 months, depending on which climatic conditions you have and where the luxmeter works.

Calibration and measurements:

The Luxmeter sensitivity, indicated as **S** (or calibration factor), allows determining illuminance by measuring a signal in Volts at the probe ends. **S** factor is measured in **V/klux.**

- Once the difference of potential (DDP) has been measured at sensor ends, E_e illuminance is obtained through the following formula:

$$E_e = DDP/S$$

where;
E_e: indicates Illuminance expressed in klux,
DDP: indicates the difference of potential expressed in mV and measured by the multimeter,
S: indicates the calibration factor expressed in mV/klux and shown on the luxmeter label (calibration factor is also mentioned in the calibration report).

Each probe is individually calibrated at the factory and is distinguiched by its calibrator factor. Calibration is carried out by using a standard **illuminant A**, as indicated in CIE publication N° 69 "Methods of characterizing illuminance meters and luminance meters: Performance, characteristics and specifications, 1987". Calibration is carried out by comparison with a reference luxmeter, assigned to Delta Ohm Metrological Laboratory.
To get the best performances from LP PHOT 02, we strongly recommend to check calibration annually.

Technical specifications:

Typical sensitivity:	0,5 ÷2,0 mV/klux
Response time:	<0.5 sec (95%)
Impedance:	0.5 ÷ 1 KΩ
Measuring range:	0-150 klux
Viewing angle:	2π sr
Spectral range:	Standard photopic curve
Operating temperature:	-40°C ÷ 80°C
Error f'_1	<9 %
Cosine response/directional error:	< 8 % (between 0° and 80°)
Long term instability(1 year):	<|±3| %
Non-linearity:	<1 %
Temperature response	< 0.1%/°C
Weight:	0.90 Kg
Dimensions:	fig. 4

ORDERING CODES

LP PHOT 02: Photometric probe for outdoor **Illuminance** measurements (0÷150klux), CIE photopic filter, diffuser for cosine correction, complete with LP SP1 protection and silica gel cartridge, bubble level, flying 4-pole M12 plug and Calibration Report. Cable has to be ordered separately.

LP PHOT 02AC: Photometric probe for outdoor **Illuminance** measurements (0÷150klux), CIE photopic filter, diffuser for cosine correction. **4÷20mA output**, integrated transmitter amplifier. Power supply 10…30Vdc. complete with LP SP1 protection and silica gel cartridge, bubble level, flying 4-pole M12 plug and Calibration Report. **5m or 10m cables with connectors available on request.**

LP PHOT 02AV: Photometric probe for outdoor **Illuminance** measurements (0÷150klux), CIE photopic filter, diffuser for cosine correction. **0÷1Vdc, 0÷5Vdc, 0÷10Vdc output**, integrated transmitter amplifier. Power supply 10…30Vdc **(15..30Vdc for 0…10Vdc output).** Complete with LP SP1 protection and silica gel cartridge, bubble level, flying 4-pole M12 plug and Calibration Report. **5m or 10m cables with connectors available on request.**

LP S1: Mounting kit for LP PHOT 02: bracket for attachment to a mast, including fasteners and levelling screws.

LP SP1: UV resistant plastic shade disk (BASF LURAN S777K).

LP SG: Desiccant sachet with silica gel crystals, complete with inner O-ring and cap.

LP G: Packet with 5 silica gel spare cartridge.

CPM12 AA4.5: 4-pole UV resistant cable L=5 m. For the instruments LP PHOT 02, LP PHOT 02AC, LP PHOT 02AV.

CPM12 AA4.10: 4-pole UV resistant cable L=10 m. For the instruments LP PHOT 02, LP PHOT 02AC, LP PHOT 02AV.

Configurable amplifiers and converters

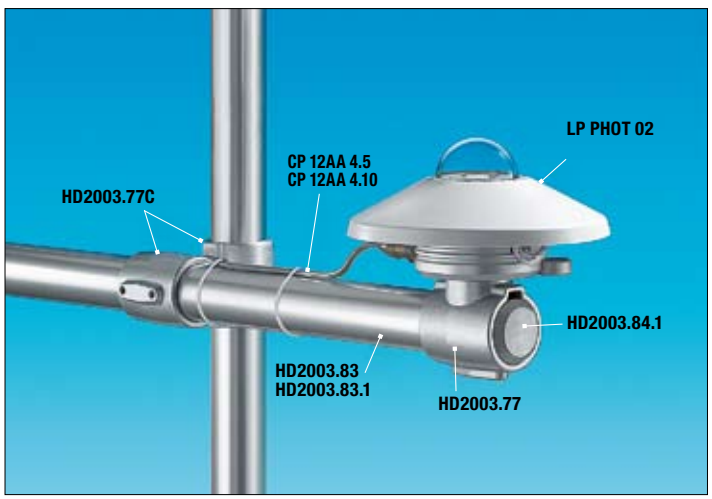
HD978TR3: Configurable signal converter amplifier with 4÷20mA (20÷4mA) output. Input measuring range –10..+60mV. **Default setting 0÷20mV.** Two DIN module (35mm) for rail attachment. Minimum measuring range 2mV. **Configurable with HD 778 TCAL.**

HD978TR4: Configurable signal converter amplifier with 0÷10 (10÷0Vdc) output. Input measuring range –10..+60mV. **Default setting 0÷20mV.** Two DIN module (35mm) for rail attachment. Minimum measuring range 2mV. **Configurable with HD 778 TCAL.**

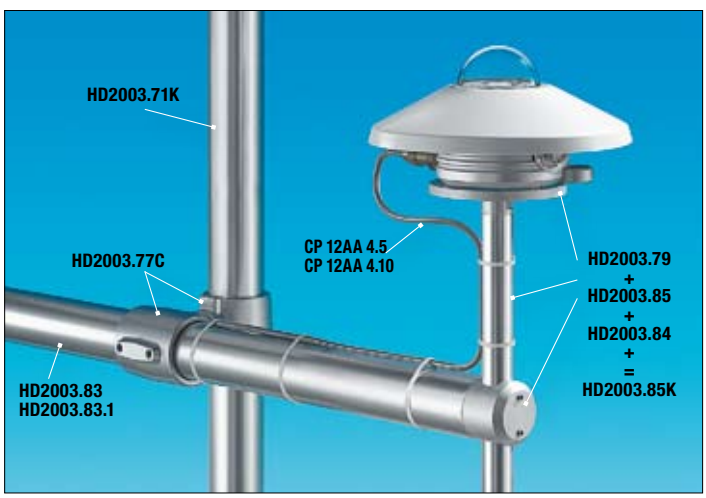
HD978TR5: Configurable signal converter amplifier with 4÷20mA (20÷4mA) output. Input measuring range –10..+60mV. **Default setting 0÷20mV.** Minimum measuring range 2mV. **Configurable with HD 778 TCAL. For wall mounting.**

HD978TR6: Configurable signal converter amplifier with 0÷10 (10÷0Vdc) output. Input measuring range –10..+60mV. **Default setting 0÷20mV.** Minimum measuring range 2mV. **Configurable with HD 778 TCAL. For wall mounting.**

HD 778 TCAL: Power generator in the range –60mv…+60mV, **regulated by PC through RS232C serial port. DeltaLog-7** software to configure type K, J, T and N thermocouple transmitters and HD978TR3, HD978TR4, HD978TR5 and HD974TR6 converters.



LP PHOT 02



LP PHOT 02

LP UVA 02 - LP UVA 02AC - LP UVA 02AV RADIOMETRIC PROBES

The radiometric LP UVA 02, LP UVA 02AC, and LP UVB02AV probes measure the global irradiance in the UVA on a flat surface (Watt/ m^2). The irradiance is the sum of direct solar irradiance and of diffuse irradiance from the sky.
The radiometer can also be used for monitoring UVA irradiance indoor.

Working Principle
LP UVA 02 radiometer is based on a solid state sensor, the spectral match with the desired curve is obtained using special filter. The relative spectral response is reported on figure 4.
In order to protect the diffuser from the dust, LP UVA 02 is equipped with a 50mm glass dome.
The cosine low response is obtained with a particular shaped PTFE diffuser. In figure 5 the cosine error versus angle of incident is reported.
The excellent cosine law response of LP UVA 02 allow to use the radiometer at any sun's zenith angle. (The diffused component of the UVA increases as the sun moves away from the zenith, so the error on direct component due to imperfect response according to the cosine becomes negligible on the measurement of global irradiance).

Installation and Mounting of the Radiometer for the Measurement of Global Radiation:
Before installation, refill the cartridge containing silica-gel crystals. Silica gel absorbs humidity in the dome chamber and prevents (in particular climatic conditions) internal condensation forming on the internal walls of the domes and measurement alteration.
Do not touch the silica gel crystals with your hands while refilling the cartridge. Carry out the following instructions in an environment as dry as possible:

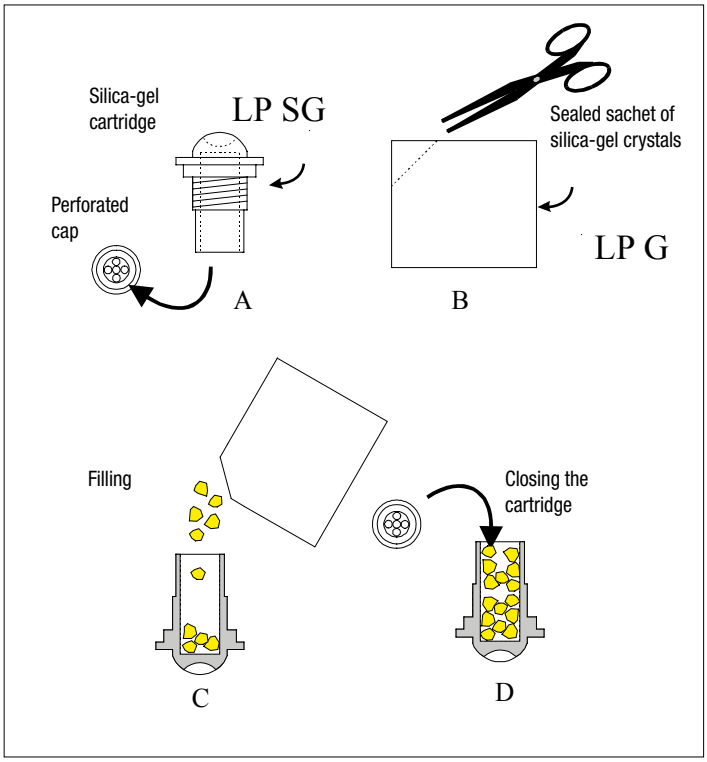
1- Loosen the three screws that fix the white shade disk
2- Unscrew the silica gel cartridge using a coin
3- Remove the cartridge perforated cap
4- Open the sachet containing silica gel (supplied with the radiometer)
5- Replace the silica gel crystals
6- Close the cartridge with its own cap, paying attention that the sealing O-ring be properly positioned.
7- Screw the cartridge to the radiometer body using a coin
8- Check that the cartridge is screwed tightly (if not, silica gel life will be reduced)
9- Position the shade disk and screw it with the screws
10- The radiometer is ready for use.

Figure N.1 shows the operations necessary to fill the cartridge with the silica gel crystals.

- The LP UVA 02 radiometer has to be mounted in a readily accessible location to clean the dome regularly and to carry out maintenance. At the same time, check that no building, construction, tree or obstruction exceeds the horizontal plane where the radiometer lays. If this is not possible, select a site where obstructions do not exceed 5 degrees of elevation, in the path followed by the sun, between earliest sunrise and latest sunset.
- The radiometer has to be located far from any kind of obstruction, which might reflect sunlight (or sun shadow) onto the radiometer itself.
- The LP UVA 02 radiometer is provided with a spirit level for carrying out an accurate horizontal leveling. The adjustment is made by means of two leveling screws that allow to adjust the radiometer inclination. Use the two 6mm-diameter holes and a 65mm interaxial distance to mount the instrument on a plane. Remove the shade disk to access the holes and reposition it after mounting (see fig. 2).
- The LP S1 mounting kit, supplied on demand as an accessory, allows an easy mounting of the radiometer on a mast. The mast maximum diameter shall not exceed 50 mm. The operator shall take care that the mast height does not exceed the radiometer plane to avoid measurement errors caused by any reflection or shadow of the mast itself. To fix the radiometer to the mounting bracket, remove the shade disk loosening the three screws, fix the radiometer, and mount the white shade disk again.
- It is suggested to thermally isolate the radiometer from its mounting brackets, and to check that the electrical contact with the ground be done properly

Electrical Connection and Requirements for Electronic Readout Devices:

- LP UVA 02 radiometer does not require any power supply.
- LP UVA 02 is supplied with a flying 4-pole M12 connector
- UV-proof PTFE cables are **available on request**, cable colors and connector poles of the screened 2-wire cable are matched as follows:
  Black → shield braid
  Red → (+) signal generated by the detector
  Blue → (-) negative signal generated by the detector (connected to the housing)
- LP UVA 02 is to be connected either to a millivoltmeter or data acquisition unit which input load resistance must be > 5MΩ. Typically, the radiometer output signal does not exceed 20mV. In order to better exploit the radiometer features, the readout instrument should have a 1μV resolution.



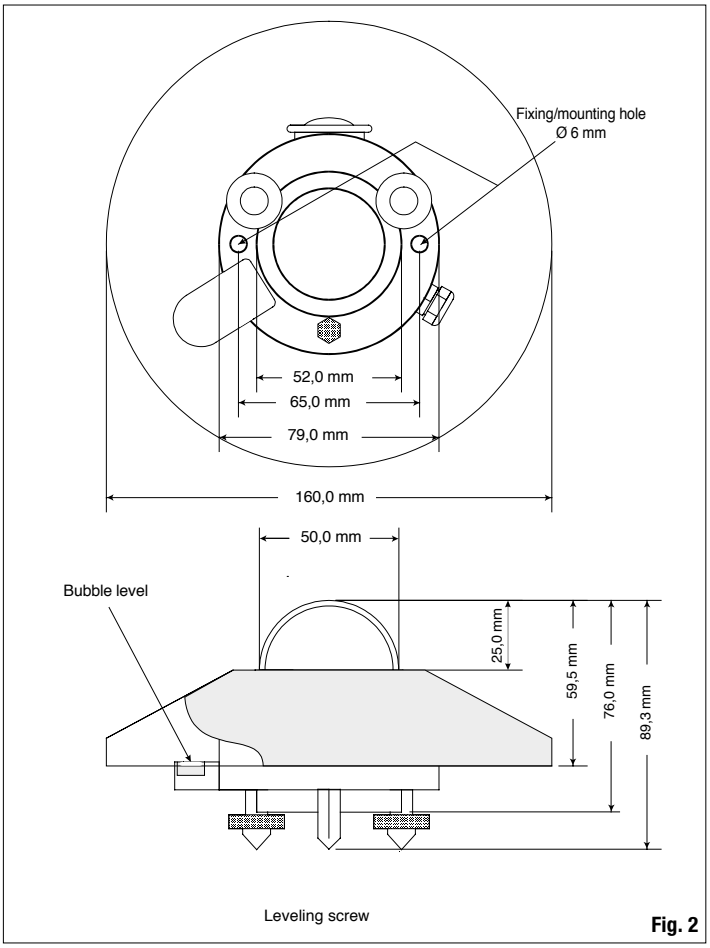
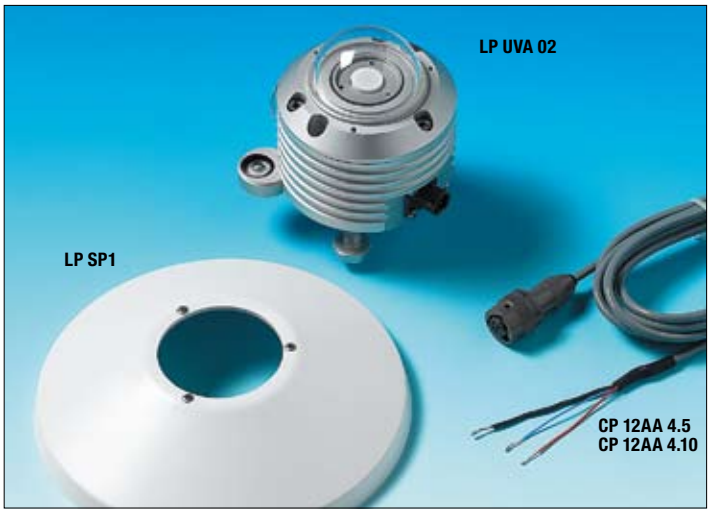


Fig. 2



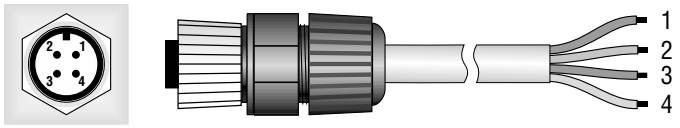
active when their color is **yellow**, while they turn **white** as soon as they loose their power. Read instructions on how to replace them. Silica gel typical lifetime goes from 2 to 6 months depending on the environment where the radiometer works.

Calibration and Measurements:
The radiometer **S** sensitivity (or calibration factor) allows to determine the irradiance by measuring a signal in Volts at the ends of the resistance which short-circuits the terminals of the photodiode ends. The **S** factor is measured in $\mu V/(Wm^{-2})$.

- Once the difference of potential (DDP) has been measured at the ends of the sensor, the E_e irradiance is obtained applying the following formula:

$$E_e = DDP/S$$

WIRING DIAGRAM LP PHOT 02



Fixed 4-pole plug M12 **Flying 4-pole M12 socket**

LP UVA 02

Connector	Function	Color
1	V out (+)	Red
2	V out (-)	Blue
3	Not connected	White
4	Shield (⏚)	Black

LP UVA 02 AC

Connector	Function	Color
1	Positivo (+), +Vdc	Red
2	Negativo (-), -Vdc	Blue
3	Not connected	White
4	Shield (⏚)	Black

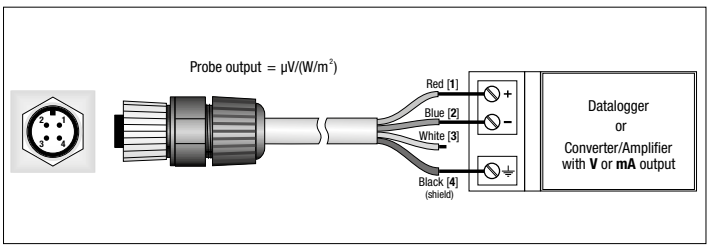
LP UVA 02 AV

Connector	Function	Color
1	(+) Vout	Red
2	(-) Vout e (-) Vdc	Blue
3	(+) Vdc	White
4	Shield (⏚)	Black

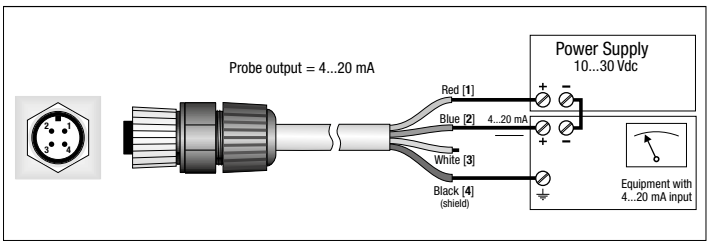
Maintenance:
It is important to keep the outer glass dome clean to grant measurement best accuracy. Consequently, the more the dome will be kept clean, the more measurements will be accurate. Washing can be made using water and standard papers for lens, or, in some cases, using pure ethyl alcohol. After using alcohol, clean again the dome with water only.
Because of the high rise/fall in temperature between day and night, some condensation might appear on the radiometer dome. To minimize the condensation growth, the radiometer is provided with a cartridge containing desiccant material: Silica gel. The efficiency of the Silica gel crystals decreases in the course of time while absorbing humidity. Silica gel crystals are

CONNECTION DIAGRAMS

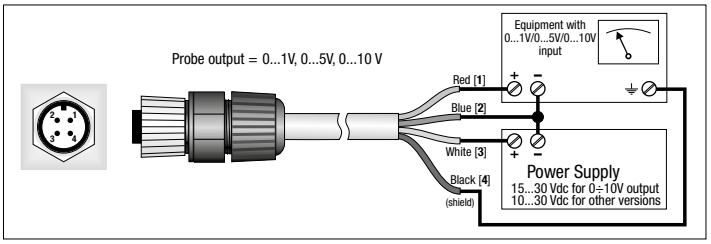
LP UVA 02



LP UVA 02 AC



LP UVA 02 AV



Where:
E_e: is the Irradiance expressed in W/m^2,
DDP: is the difference of potential expressed in µV and measured by the multimeter,
S: is the calibration factor in µV/(W/m^2) shown on the radiometer label (and mentioned in the calibration report) .

Each radiometer is individually calibrated at the factory and is distinguished by its calibrator factor.
The calibration is carried out following procedure N° DHLF-E-59. This procedure is used in the SIT calibration center N° 124 for the calibration of UVA radiometer.
The calibration was performed by reference to Delta Ohm srl primary standard with monochromatic light at 365 nm obtained separating the emission line of a Xe-Hg lamp with an inferential filter. To get best performances from your LP UVA 02 it is strongly recommended that the calibration be checked annually.
N.B. At the moment no international agreement exist for the calibration of this kind of radiometer, so the calibration coefficient is dependent from the calibration procedure like reported in the following article:
"*Source of Error in UV Radiation Measurements*", T. C. Larason, C. L. Cromer on "*Journal of Research of the National Institute of Standards and Technology*" Vol. 106, Num. 4, 2001. (The article is free on the NIST's WEB site at the following address : http://www.nist.gov/jers)

Technical Specifications:

Typical sensitivity:	150 ÷ 350µV/(W/m^2)
Response time:	<0.5 sec (95%)
Impedance:	5 ÷ 7.5 KΩ
Measuring range:	0-200 W/m^2
Viewing angle:	2π sr
Spectral range:	327 nm ÷ 384 nm (1/2) 312 nm ÷ 393 nm (1/10) 305 nm ÷ 400 nm (1/100)
Operating temperature:	-40 °C ÷ 80 °C
Cosine response:	< 8 % (between 0° and 80°)
Long-term non-stability: (1 year)	<|±3| %
Non-linearity:	<1 %
Temperature response:	< 0.1%/°C
Dimensions:	figure 2
Weight:	0.90 Kg

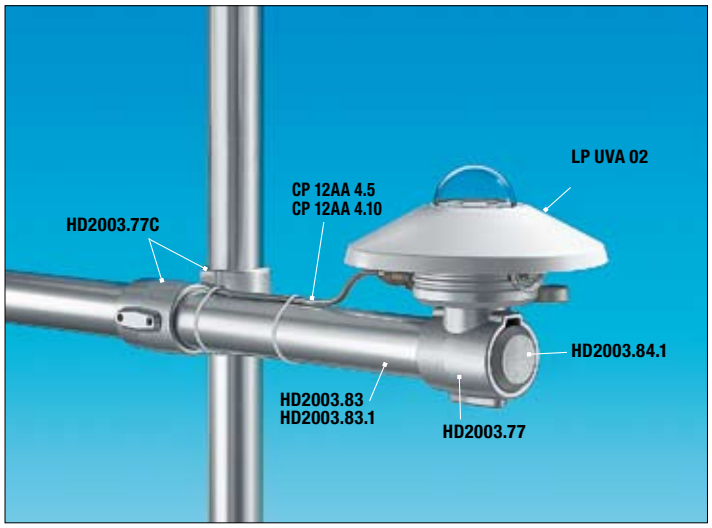
ORDERING CODES

LP UVA 02: Radiometric probe for the outdoor measurement of UVA irradiance (315…400nm), complete with LP SP1 protection, silica gel cartridge, 2 spare sachets with silica gel crystals, bubble level, flying M12 4-pole connector and Calibration Report. **Cable has to be ordered separately.**

LP UVA 02AC: Amplified radiometric probe for the outdoor measurement of UVA irradiance (315…400nm), **4÷20mA output (0…150W/m²)**, integrated transmitter amplifier, **power supply 10…30Vdc**. Complete with flying M12 4-pole connector and Calibration Report. **Cable has to be ordered separately.**

LP UVA 02AV: Amplified radiometric probe for the outdoor measurement of UVA irradiance (315…400nm), **0÷1Vdc, 0÷5Vdc, 0÷10Vdc output (0…150W/m²)**, integrated transmitter amplifier, **power supply 10…30Vdc**. **(15..30Vdc for 0…10Vdc output).** Complete with flying M12 4-pole connector and Calibration Report. **Cable has to be ordered separately.**

LP S1: Mounting kit for LP UVA 02: bracket for attachment to a mast, including fasteners and leveling screws.



LP UVA 02

LP SP1: UV resistant plastic shade disk (BASF LURAN S777K).

LP SG: Desiccant sachet with silica gel crystals, complete with inner O-ring and cap.

LP G: Packet with 5 silica gel spare cartridge.

CPM12 AA4.5: 4-pole UV resistant cable L=5 m. For the instruments LP UVA 02, LP UVA 02AC, LP UVA 02AV.

CPM12 AA4.10: 4-pole UV resistant cable L=10 m. For the instruments LP UVA 02, LP UVA 02AC, LP UVA 02AV.

Configurable amplifiers and converters

HD978TR3: Configurable signal converter amplifier with 4÷20mA (20÷4mA) output. Input measuring range –10..+60mV. **Default setting 0÷20mV.** Two DIN module (35mm) for rail attachment. Minimum measuring range 2mV. **Configurable with HD 778 TCAL.**

HD978TR4: Configurable signal converter amplifier with 0÷10 (10÷0Vdc) output. Input measuring range –10..+60mV. **Default setting 0÷20mV.** Two DIN module (35mm) for rail attachment. Minimum measuring range 2mV. **Configurable with HD 778 TCAL.**

HD978TR5: Configurable signal converter amplifier with 4÷20mA (20÷4mA) output. Input measuring range –10..+60mV. **Default setting 0÷20mV.** Minimum measuring range 2mV. **Configurable with HD 778 TCAL. For wall mounting.**

HD978TR6: Configurable signal converter amplifier with 0÷10 (10÷0Vdc) output. Input measuring range –10..+60mV. **Default setting 0÷20mV.** Minimum measuring range 2mV. **Configurable with HD 778 TCAL. For wall mounting.**

HD 778 TCAL: Power generator in the range –60mv…+60mV, **regulated by PC through RS232C serial port. DeltaLog-7** software to configure type K, J, T and N thermocouple transmitters and HD978TR3, HD978TR4, HD978TR5 and HD974TR6 converters.

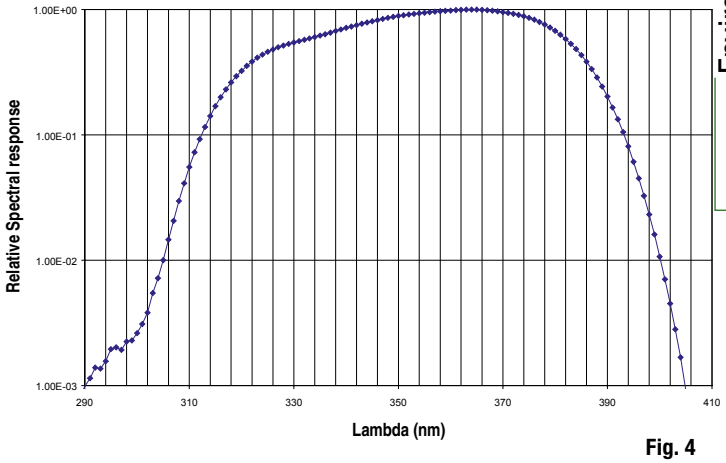


Fig. 4

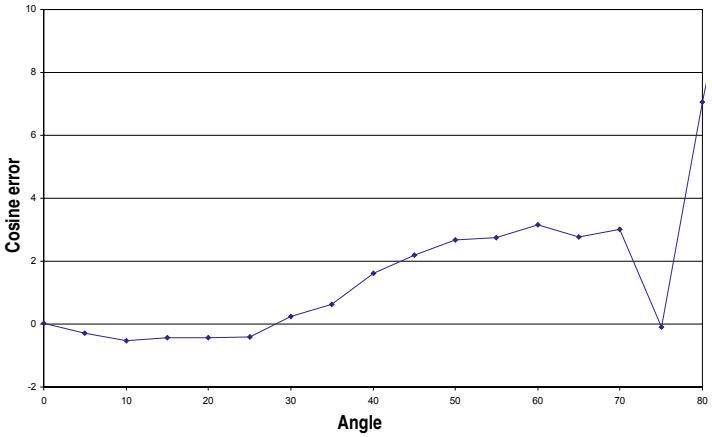


Fig. 5

LP UVB 02

LP UVB 02
RADIOMETRIC PROBE FOR ENVIRONMENTAL USE

The LP UVB 02 radiometer measures the global irradiance in the UVB spectral region on a flat surface (Watt/m^2). In particular, the instrument's spectral sensitivity is centered at 305nm with a 5nm band width (FWHM). The global irradiance is the sum of the direct solar irradiance and the sky diffuse irradiance on a surface parallel to the ground. In contrast to the visible spectrum where the direct component prevails over the diffuse component, in the UVB spectral region light is strongly diffused by atmosphere and thus the two components are equivalent. Therefore it is of primary importance for the instrument to be capable of measure both components accurately.

The LP UVB 02 probe is typically used in the following sectors:

- Monitoring the ozone layer. Indeed, the radiation around 295nm–315nm is strongly absorbed by ozone located in the stratosphere, therefore each small variation of the ozone layer corresponds to an increase or decrease of the radiation reaching the ground.
- Effects of UVB radiation (the most harmful to human health) on living beings.
- UVB radiation measurement in work spaces.

The LP UVB 02 radiometer needs power to function. Power is required to amplify the weak signal generated by the photodiode. Indeed, the radiometer is a current/voltage amplifier (transimpedance amplifier). This choice measures sun-produced UVB irradiance. Indeed, the need to use sophisticated filters (partially attenuating the signal concerned) and the relatively weak sun-produced irradiation in this spectral area, in the best case, make the photodiode-generated current in the order of hundreds of pAmpere. So it is not possible to use cable meters or tens of meters long as the noise might be greater than the signal itself. Therefore the signal must be amplified.

LP UVB 02 is robust and was manufactured to operate for long periods without maintenance (if powered correctly). This characteristic makes it suitable for location in meteorological stations.

A platinum-resistance thermometer (Pt100) is inserted inside the LP UVB 02 in order to control its temperature. Internal temperature must remain within its functioning range, otherwise measurements could be affected by higher systematic errors than those asserted in the manual. Exposure to temperature higher than +60°C can alter the interferential-filters spectral characteristics.

WORKING PRINCIPLE

The LP UVB 02 radiometer is based on an innovative solid state photodiode, the spectral response of which was adapted to that desired by using special interferential filters. In particular, the used photodiode and filters have exceptional stability characteristics, both for temperature and through time. This allowed manufacturing of an instrument that does not need heating, thus reducing energy consumption.

Particular attention has been given to filter design so as to make the instrument completely blind to wavelengths outside the concerned pass-band. The solar energy within the 302nm–308nm spectral band is only 0.01% of the total energy from the sun reaching Earth's surface. The relevant spectral response curve is shown in Fig. 1A (in linear scale) and Fig. 1B (in logarithmic scale).

The LP UVB 02 is provided with a 50mm-external-diameter dome in order to supply a suitable protection of the sensor to the atmospheric agents. Quartz was chosen due to its optimum transmission in the UV range.

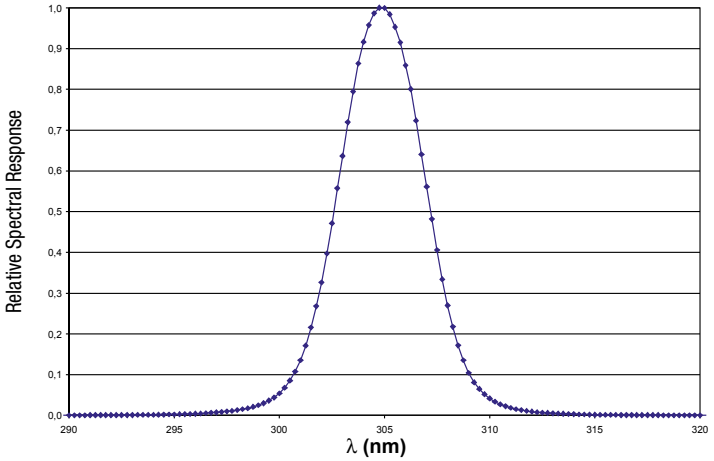


Fig. 1A

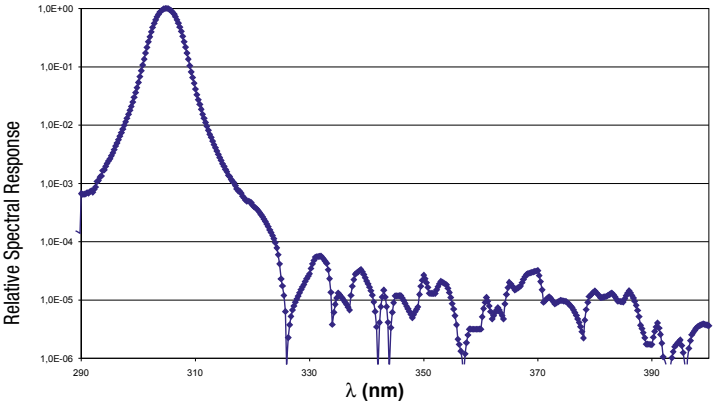


Fig. 1B

The response in accordance with the cosine law has been obtained thanks to the particular shape of the diffuser and of the housing. The departure between a theoretical response and the measured one is shown in the Fig. 2.

The excellent relation between the response of the LP-UVB-02 and the cosine law allows to use the instrument also when the sun has a very low raising (the UVB diffuse radiation increases as the sun is leaving the zenith, therefore the error on the direct radiation, owing to the imperfect response according to the cosine law, becomes negligible referred to the measurement of the global radiation).

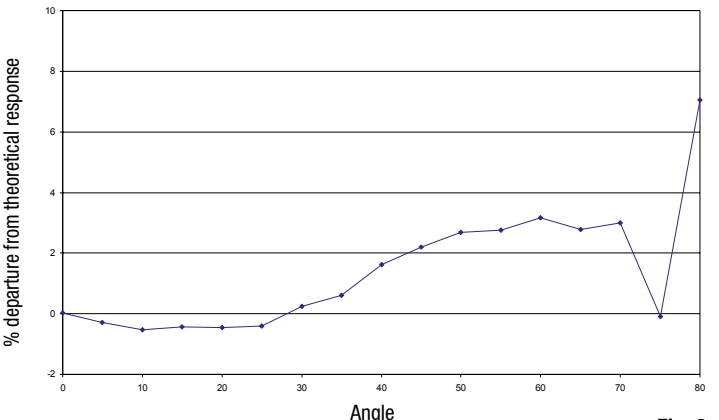


Fig. 2

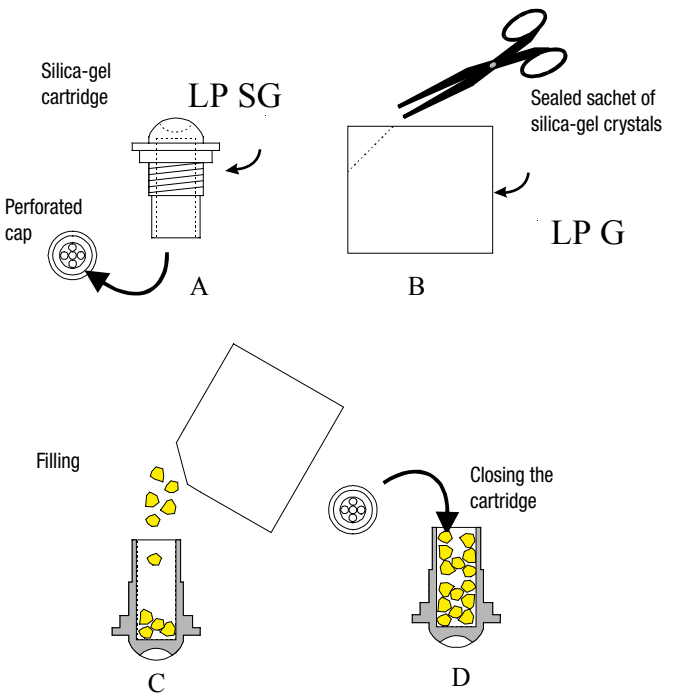


Fig. 3

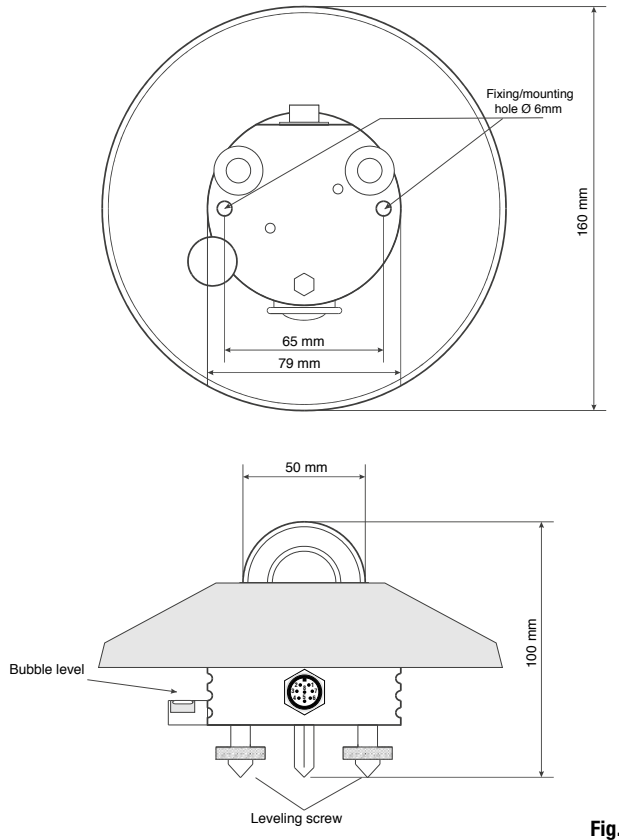


Fig. 4

Installation and Mounting of the Radiometer for the Measurement of the Global Radiation
Before installing the radiometer refill the cartridge containing the silica-gel crystals. Silica gel absorbs humidity in the dome chamber; in case of particular climatic conditions this humidity can cause condensation on the internal side of the dome and then modify the measurement. Do not touch the silica gel crystals with your hands and do not wet them while refilling the cartridge. Carry out the following instructions in an environment as dry as possible:

1- loosen the three screws that fix the white shade disk
2- unscrew the silica gel cartridge using a coin
3- remove the cartridge perforated cap
4- open the sachet containing the silica gel (supplied with the radiometer)
5- fill the cartridge with the silica-gel crystals
6- close the cartridge with its own cap, paying attention that the sealing O-ring be properly positioned and undamaged
7- screw the cartridge to the radiometer body using a coin
8- **check that the cartridge is screwed tightly** (if not, the silica-gel life will be reduced)
9- position the shade disk and tighten it with the screws
10- the radiometer is ready for use

Fig. 3 shows the operations necessary to fill the cartridge with the silica-gel crystals.

- The LP UVB 02 has to be mounted in a readily accessible location to be able to provide for a periodic cleaning of the external dome and for the maintenance. Check also that no building, construction, tree or obstruction exceeds horizontal plane where the radiometer lays. If this is not possible, select a site where obstructions do not exceed 5 degrees of elevation, in the path followed by the sun, between earliest sunrise and latest sunset.
- The radiometer has to be located far from any kind of obstruction, which might throw the solar radiation (or its shade) on the radiometer.
- The LP UVB 02 radiometer is provided with a spirit level for carrying an accurate horizontal leveling. The adjustment is made by means of two leveling screws that allow to adjust the radiometer inclination. Use the two 6mm-diameter and 65mm-interaxial-distance holes to mount the instrument on a plane. Remove the shade disk to access the holes and reposition it after mounting (see Fig. 4).
- The LP S1 mounting kit (Fig. 5), supplied on demand as an accessory, allows an easy mounting of the radiometer on a mast. The mast maximum diameter shall not exceed 50 mm. The operator shall take care that the mast height does not exceed the radiometer plane to avoid measurement errors caused by any reflection or shadow of the mast itself. To fix the radiometer to the mounting bracket, remove the shade disk loosening the three screws, fix the radiometer and mount the white shade disk again.
- It's suggested to thermally isolate the radiometer from its mounting brackets and to check that the electrical contact with the ground be done properly.

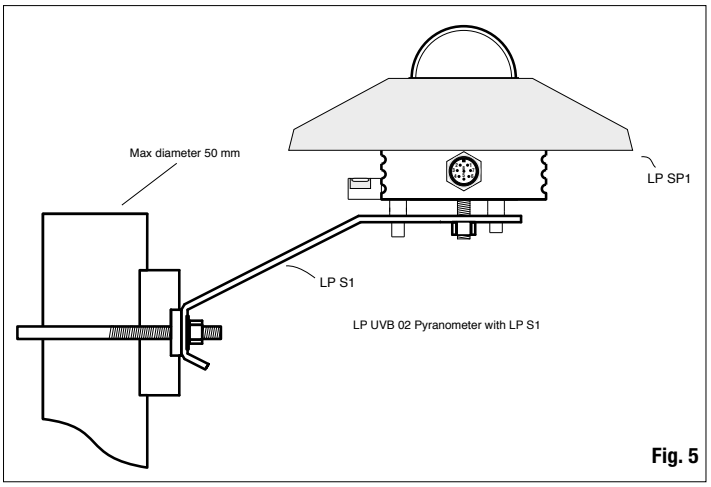


Fig. 5

Electrical Connections and Requirements for Electronic Readout Devices

The connections on the output connector are indicated below:

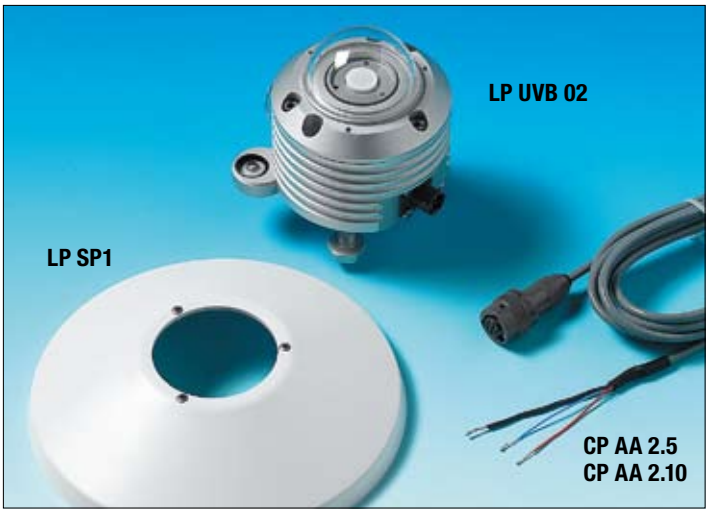
Pin8: V+, positive supply voltage for LP UVB 02 internal electronics. 7Vdc < V+ <30Vdc
Pin6: VoutTemp+, output signal for temperature measurement. 0V (-40°C) < Vout Temp+ < 1V (+60°C)
Pin2: Vout+, output signal for irradiance measurement in the UVB band. 0V < VoutUV+ < 4V.
Pin1: Ground of the two output signals, VoutTemp+, VoutUV+
Pin7: Housing.
Pin5: Power supply grounding.

- The LP UVB 02 has to be connected either to a voltmeter or to a data acquisition system with input impedance greater than 10KΩ. Typically, the radiometer output signal, when exposed to the sun, does not exceed 1 volt. In order to better exploit the radiometer features, the readout instrument should have 0.1mV resolution.

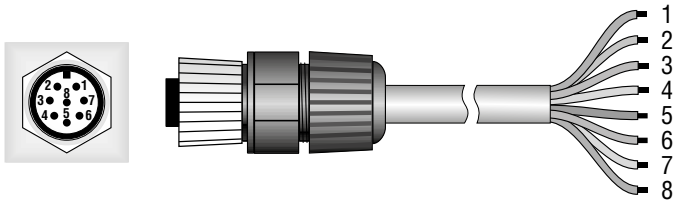
N.B. The input load resistance of the data acquisition system must be greater than 10KΩ. The connection scheme is shown in figure 6.

The cable supplied with the UV-resistant output connector has 5 wires plus the braid (screen); the colour code is shown in fig. 6.

Maintenance
It is important to keep the outer domes clean to grant the best measurement accuracy. Consequently, cleaning the dome more often will give more accurate measurements. Cleaning can be carried out using water and standard papers for lens, or, if not sufficient, using pure ETHYL alcohol. After using alcohol, clean again the dome with water only. Because of the high rise/fall in temperature between day and night, some condensation might appear on the radiometer dome.



WIRING DIAGRAM LP UVB 02

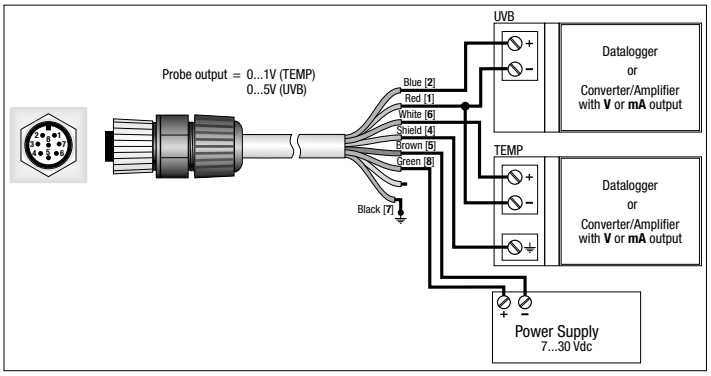


Fixed 8-pole plug M12 **Flying 8-pole M12 socket**

LP UVB 02

Connector	Function	Color
1	Signal GND	Red
2	V out UV (+)	Blue
3	Not connected	
4	Shield	Braid
5	Power GND	Brown
6	Vout Temp. (+)	White
7	Housing	Black
8	Power 7-30Vdc	Green

LP UVA 02 CONNECTION DIAGRAMS



In this case the performed reading is highly overestimated. To minimize the condensation growth, the radiometer is provided with a cartridge containing desiccant material: Silica gel. The efficiency of the Silica gel crystals decreases in time with humidity absorption. Silica-gel crystals are active when their colour is **yellow**, and they turn **white** when they loose their power. Read the instructions of paragraph **3** on how to replace them. Silica gel typical duration goes from 2 to 6 months depending on the environment where the radiometer works.
We recommend to calibrate the instrument annually. Calibration can be performed by DeltaOhm Metrological Laboratories, or by connecting it to an identical instrument calibrated with reference to a Primary Metrological Institute having a known calibration factor.

Calibration and Measurements
The radiometer **S** sensitivity (or calibration factor) allows to determine the irradiance by measuring a signal in Volts generated by the internal amplification circuit. It is possible that an offset be present on the output signal of some fractions of millivolts (0.3-0.4mV), in which case it is also recommended that the data be acquired at night and subtract the night-measurement offset from the performed measurements. Once the difference of potential (VoutUV+) has been measured at the ends of the resistance, the E_e irradiance is obtained applying the following formula:

$$E_e = [VoutUV+] / S$$

where:

E_e: is the irradiance expressed in W/m^2,
VoutUV+: is the difference of potential measured by the multimeter and expressed in V,
S: is the calibration factor in $V/(W/m^2)$, shown on the radiometer label (and mentioned on the calibration report).

In the presence of a possible offset of OF Volts, the previous calculations must be modified as follows:

$$E_e = ([VoutUV+] - OF)/S$$

Similarly, to know the instrument internal temperature once the "VoutTemp+" voltage in volts is known, we get:

$$T=100 \cdot [VoutTemp+] - 40 \ °C$$

Supposing a voltage VoutTemp+=0.532V is read, the previous formula gives the radiometer internal temperature:

$$T=(100 \bullet 0.532) - 40 \ °C = 13.2 \ °C$$

Radiometers are individually calibrated at factory. Calibration is carried out by measuring the radiometer-produced output signal when hit by a parallel and homogeneous light-beam of 304nm monochromatic light.
Note: currently no international calibration standards for this type of radiometer exist; therefore, the calibration coefficient only makes sense if the procedure followed to obtain it has been specified. Therefore the user has to consider that the same radiometer calibrated with different procedures can have different sensitivity factors, as explained in the article "*Source of Error in UV Radiation Measurements*", T. C. Larason, C. L. Cromer issued in the "*Journal of Research of the National Institute of Standards and Technology*" Vol. 106, Num. 4, 2001. (The article is available free of charge on the NIST web site at the following address: http://www.nist.gov/jers)

Technical characteristics
UV MEASUREMENT

Typical sensitivity:	≈5V/(W/m²)
Response time:	<0.5 sec (95%)
Min. load impedance:	10 KΩ
Measurement range:	0-8 W/m²
Viewing range:	2π sr
Spectral range:	305nm Peak 302.5nm ÷ 307.5 nm (1/2) 304nm ÷ 309 nm (1/10) 297.5nm ÷ 311.75nm (1/100) 292.5nm ÷ 316.255nm (1/1000)
Working temperature:	-40 °C ÷ +60 °C
Response according to the cosine law:	< 8 % (between 0° and 80°)
Long-term instability(1 year):	<|±3| %
Non linearity:	<1 %
Response according to temperature:	< 0.01%/°C

TEMPERATURE MEASUREMENT

Measurement range	-40°C +60°C
Accuracy	±0.2°C
Min. load impedance:	10 KΩ

POWER SUPPLY

Vdc+	7÷30 V DC
Typical consumption:	3 mA
Dimensions:	Fig. 4
Weight:	0.90 Kg.

ORDERING CODES:
LP UVB 02: Radiometer for outdoor measurements, complete with LP SP1 protection, 2 spare sachets with silica gel crystals, bubble level, flying M12 8-pole connector and Calibration Report. **Cable has to be ordered separately.**
LP S1: Mounting kit for LP UVB 02: bracket for attachment to a mast, including fasteners and leveling screws
LP SP1: UV resistant plastic shade disk (BASF LURAN S777K).
LP SG: Desiccant sachet with silica gel crystals, complete with inner O-ring and cap.
LP G: Packet with 5 silica gel spare cartridge.
CPM12 AA2.5: 8-pole UV resistant cable L=5 m.
CPM12 AA2.10: 8-pole UV resistant cable L=10 m.

HD 2003
HD 2003.1

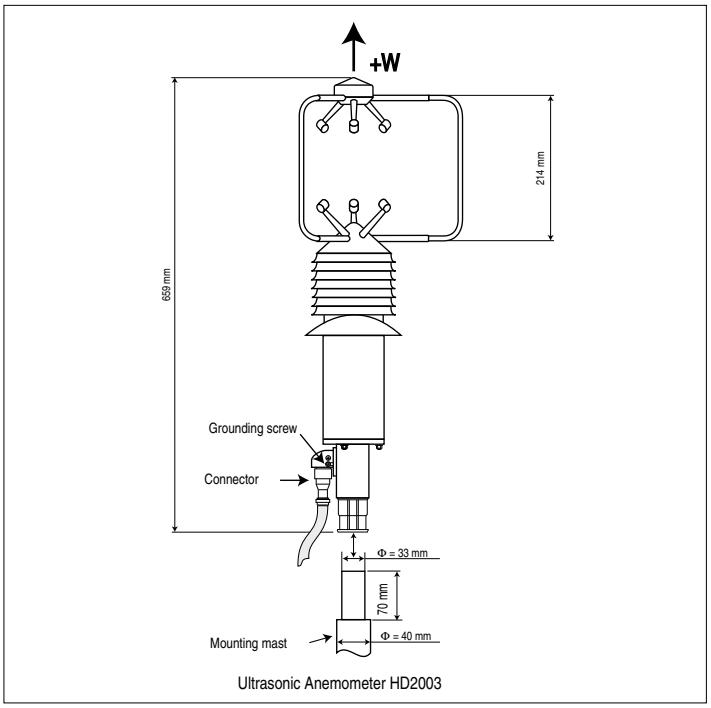
HD 2003, HD 2003.1
THREE AXIS ULTRASONIC ANEMOMETER

HD2003 and HD2003.1 are three axis ultrasonic anemometers, they measure the speed and direction of wind, the U-V-W Cartesian components of speed, sound speed and sonic temperature.
The HD2003 allows also to detect temperature and relative humidity of the air and barometric pressure.

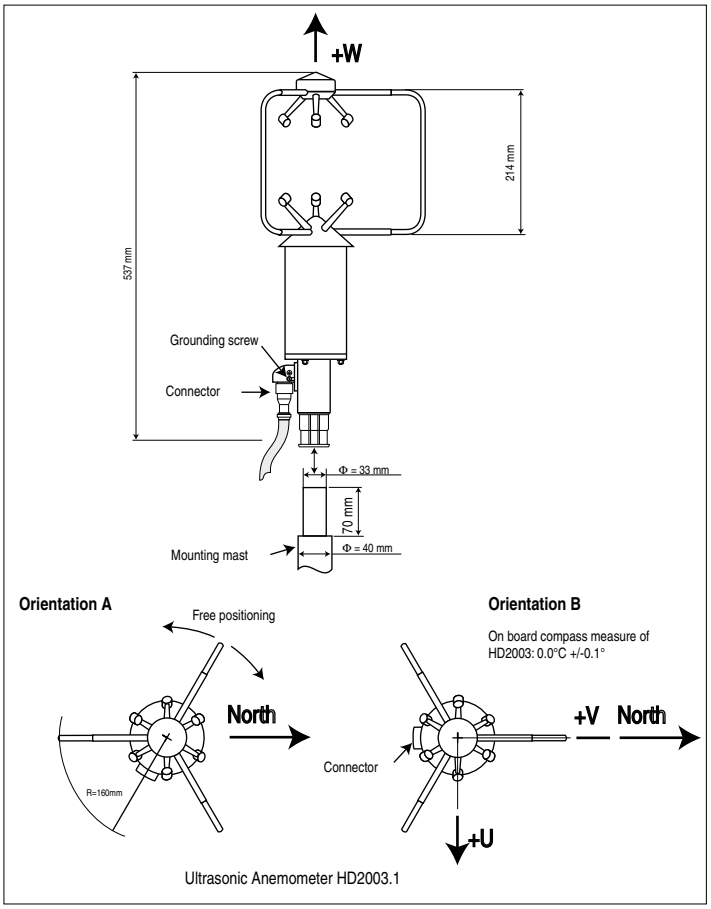
The HD2003 main features are:
- Determination of the anemometric quantities represented in diverse measurement units: wind speed and direction, U-V-W Cartesian components of speed, sound speed, sonic temperature.
- **(HD2003 Model)** additional output quantities: Temperature, Relative Humidity and Pressure.
- 5 analogue voltage or current outputs, with different measuring ranges.
- RS232 and Multidrop RS485 Serial Communication interfaces.
- Configurable output rate of digital output data string.
- Configurable average periods 1÷60sec and 1÷60min. for all output quantities.
- Algorithmic raw date processing and validation, assuring ± 1% precision to anemometric quantities.
- Digital high frequency data acquisition mode with 50Hz data output.
- Self-diagnosis with error checking and report.
- Reliability and precision on whole measuring range, no additional calibration required.
- Flexible, easy-to use **demo software**, configurable according to the user's needs through Computer interface.
- User interface for 'Setup' management and software upgrade through RS232 or RS485.
- Automatic alignment to the magnetic North through built in compass.
- No moving part, with reduced maintenance and service costs.
- Rugged and reliable structure, suitable for continuous operation even in severe environmental conditions.
- Low power consumption.
- **(On request)** Heaters Option: built-in heating device of sonic transducers, to prevent ice and snow formation. Assures correct measurements even in presence of sleet or snow.

Typical applications:
- Meteorology
- Aviation and Navigation
- Tunnels, Highways
- Climatology
- Sport and winter stations
- Safety in yards
- Industrial buildings

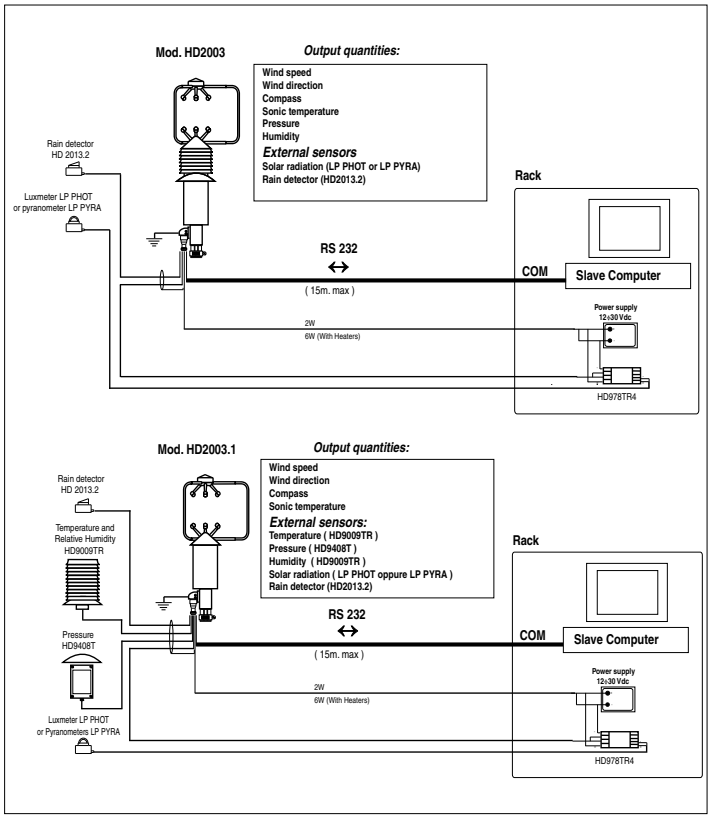
Technical specifications
Output quantities
- Anemometric parameters: Wind speed and direction, Sound Speed, Sonic Temperature, U-V-W Components
- Meteorological parameters: **(Model HD2003)** Pressure, Temperature, Relative Humidity
- Heading: Compass with magnetic Azimuth
- Moving Averages: 1÷60 sec./ 1 ÷ 60 min.
- Output rate: 1÷3600 sec. or 1/50 sec. (RS232 or RS485)

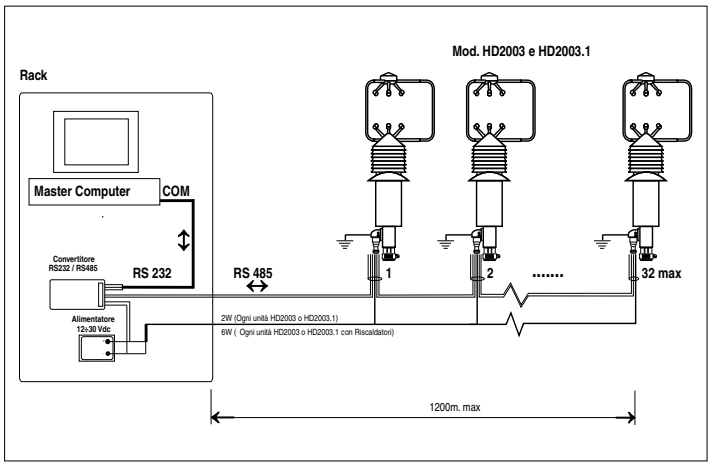


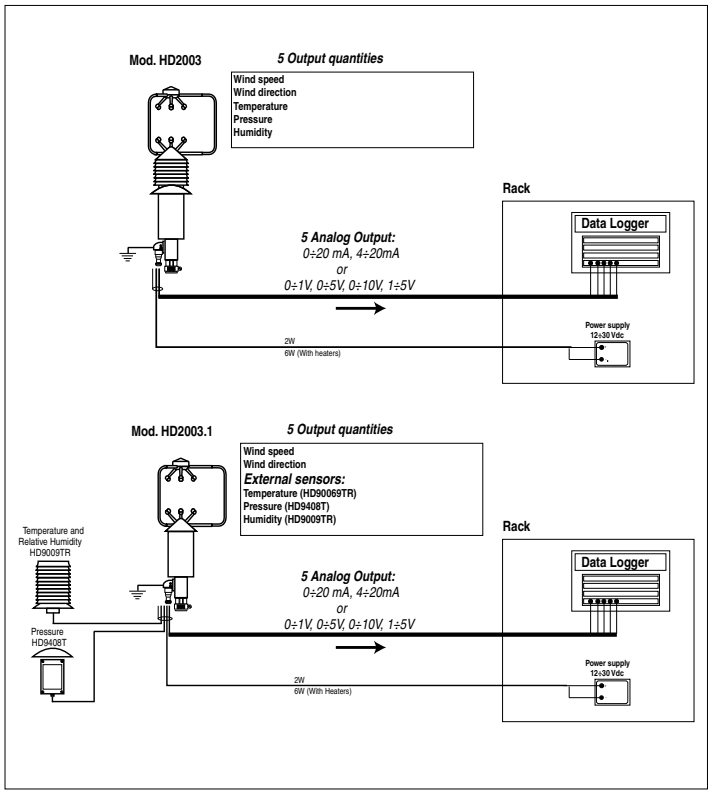
Ultrasonic Anemometer HD2003



Ultrasonic Anemometer HD2003.1







Wind Speed

• Measuring unit	m/s, cm/s, km/h, knots, mph
• Range	0÷65 m/s (234 km/h)
• Resolution	0.01 m/s
• Accuracy	± 1% of reading

Wind Direction

• Range	Azimuth: 0÷360° Elevation: ± 60°
• Resolution	0. 1°
• Accuracy	± 1°

Sound speed

• Range	300 ÷ 380 m/s
• Resolution	0.01 m/s
• Accuracy	± 1% of reading

Sonic Temperature

• Range	-40 + 60°C
• Resolution	0.1 °C
• Accuracy	± 1°C

Compass

• Range	0 ÷ 360°
• Resolution	0.1 °
• Accuracy	± 1°

Digital Outputs

• Communications	RS-232 full duplex, Multidrop RS-485 half duplex
• Baud Rate	9600 ÷ 115200 bit/sec.
• Output Rate	Normal functioning mode: 1 ÷ 3600 sec Digital high frequency: 1/50 sec
• Measured data	Digital string of anemometric quantities and compass **(Model HD2003)** Pressure, temperature, relative humidity

Analog Outputs

• Number	5, selectable between all available output quantities
• Range	0÷20mA, 4÷20mA, 0÷1V, 0÷5V, 1÷5V, 0÷10V
• Resolution	14 bit max

Power supply

• Range	12 ÷ 30 VDC
• Power	<2W (typically 110mA @ 15Vdc) <6W Models with heaters and environment temperature not lower than ñ10°C

Heaters (On request at the time of placing the order)
Heating with automatic temperature control on sonic transducers, to prevent ice and snow formation.

Temperature, Relative Humidity, and Pressure Sensors (Model 2003)

Temperature
Pt100 sensor
Analog output 0÷20mA, 4÷20mA, 0÷1V, 0÷5V, 1÷5V, 0÷10V
Range: -40 + 60°C
Resolution 0.1°C
Accuracy ± 0.2°C, ± 0.15°C of reading

Relative Humidity
Capacitive sensor
Analog output (0 ÷ 100% RH): 0÷20mA, 4÷20mA, 0÷1V, 0÷5V, 1÷5V, 0÷10V
Range: 0 ÷ 100% RH
Resolution 0.1 % RH
Accuracy ± 2% RH @ 23°C un the range 5÷90%RH, 2.5% in the remaining range.

Pressure
Piezoresistive sensor
Analog output: 0÷20mA, 4÷20mA, 0÷1V, 0÷5V, 1÷5V, 0÷10V
Range 800 ÷ 1100 mbar (On request: 600 ÷ 1100 mbar)
Resolution 0.1mbar
Accuracy ± 0.4mbar @ 20°C
Thermic effects ± 0.8mbar from -40°C up to +60°C
Long-term stability < 0.2% f.s. in 6 months @ 20°C

ORDER CODES:

HD2003: Static anemometer for measuring the speed and direction of wind, air temperature, relative humidity and barometric pressure. Wind speed and direction, U-V-W Cartesian Components of speed, sound speed, sonic temperature. Five different analogue voltage or current outputs for different ranges. Communication software for bi-directional links for net connection of different anemometers, interfaces available RS-232 and RS-485. Different measuring units and average periods are available. Ultrasonic transducers heating as optional. 12..30 Vdc power supply, 120mA consumption at 15Vdc. To be mounted on a mast diam.33mm. Flying connector included.

HD2003R: Transducers heating option for HD 2003 against ice or snow.

HD2003.1: Static anemometer for measuring the speed and direction of wind. Wind speed and direction, U-V-W Cartesian Components of speed, sound speed, sonic temperature.

Five different analogue voltage or current outputs for different ranges. Communication software for bi-directional links for net connection of different anemometers, interfaces available RS-232 and RS-485. Different measuring units and average periods are available. Transducers heating as optional. 12..30 Vdc power supply, 120mA consumption at 15Vdc. To be mounted on a mast diam.33mm. Flying connector included.

HD200.1R: Transducers heating option for HD 2003.1 against ice or snow.

CP2003/5: 26-pole shielded cable diam. 8mm, length 5m. complete with watertight connector at one side and free at the other end.

CP2003/10: 26-pole shielded cable diam. 8mm, length 10m. complete with watertight connector at one side and free at the other end.

CP2003/C: Watertight 26-pole connector Tyco 62IN- 16A – 16 – 265 – 4 0445

HD2003.77: Clamping for mast ∅ 40mm

HD2003.77C: 2 crossed sleeves for tube ∅ 40mm

HD2003.1.14: Crossed clamping for mast ∅ 40mm with 6 inputs ∅ 16mm

HD2003.2.17: Support rod for sensors ∅ 16mm, length 500mm

HD2003.71K: Mast kit ∅ 40mm, height 2m, in two pieces, ∅ 33mm tapered tip (HD2003.71, HD2003.72, HD2003.73)

HD2003.74: Clamping with bubble level for ∅ 40mm mast with 3 bracing tie rods

HD2003.75: Flange for ∅ 40mm mast with grounding rod.

HD2003.75K: Accessories kit for bracing the mast, to fix on the ground (HD2003.80, HD2003.82 - stainless steel strings). 2m fixing diameter.

HD2003.78: Flange plate for ∅ 40mm mast to fasten on the floor

HD2003.78K: Accessories kit for bracing the mast, to fasten on the floor (HD2003.81, HD2003.82- stainless steel strings). 2m fixing diameter.

HD2003.79K: Fixing kit to mount pyranometers on clamping ∅ 40mm (HD2003.77 – HD2003.79)

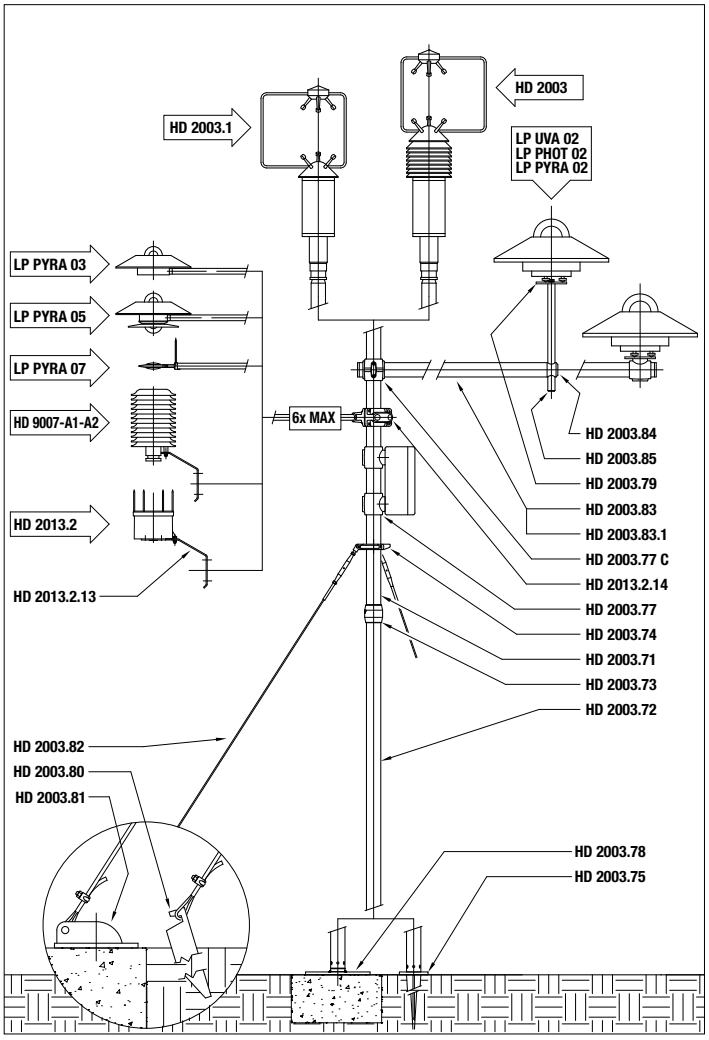
HD2003.83: Transverse mast L=150 cm

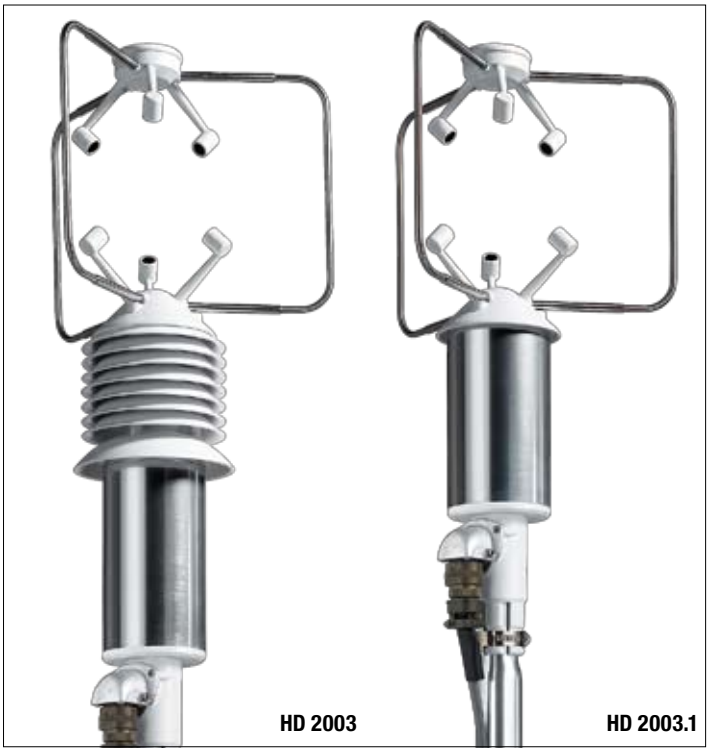
HD2003.83.1: Transverse mast L=75 cm

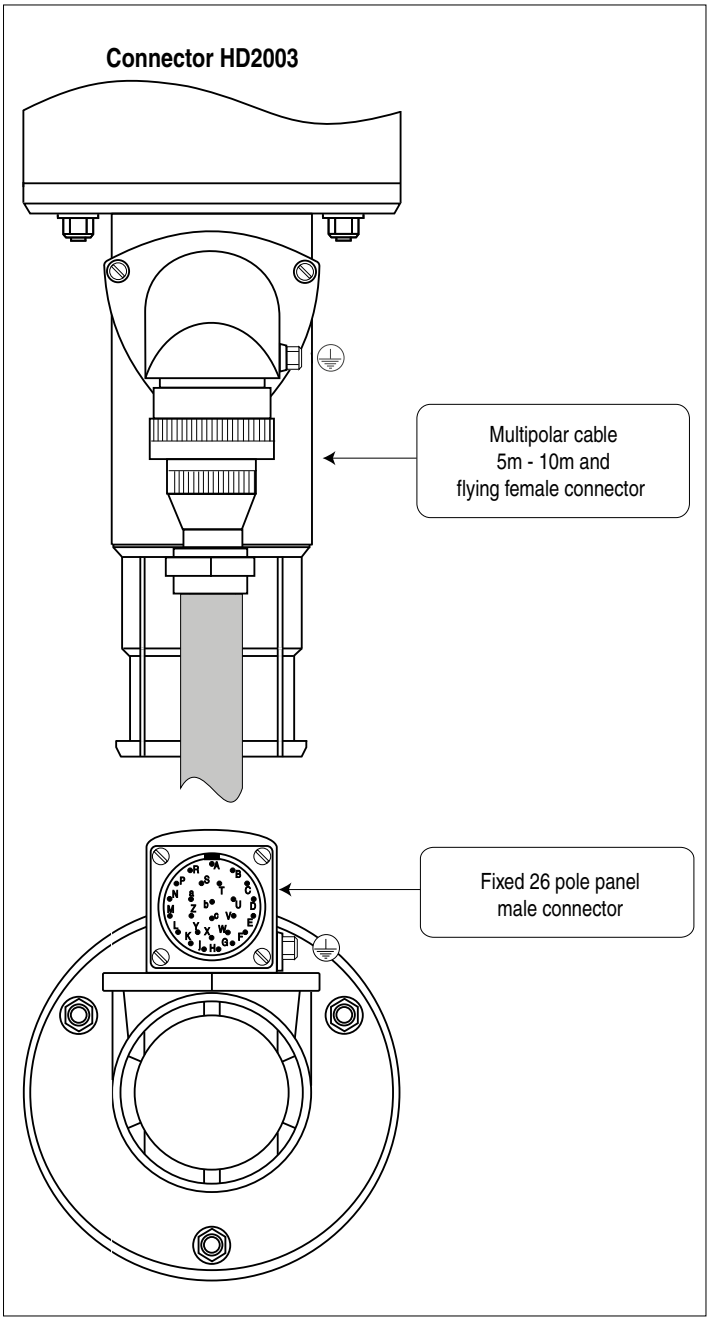
HD2003.85K: Fixing kit with adjustable height to mount pyranometers on ∅ 40mm mast (HD2003.84 – HD2003.85 – HD2003.79)

Please specify also the following:

- **Model HD2003**: optional range of pressure sensor 600 ÷ 1100 mbar (Factory Default = 800 ÷ 1100 mbar)
- **Model HD2003**: if you need to employ additional output quantities, by external sensors with **analog output 0÷1V**. In order to linearize their range on the scale **0÷1V**, it is necessary to specify in this case the number of sensors that you intend to employ (max. two), and their physical range.
- **Model HD2003.1**: if you need to employ additional external sensors with **analog output 0÷1V**. In order to linearize their range on the scale **0÷1V**, it is necessary to specify in this case the number of sensors that you intend to employ (max. five), and their physical range.







HD 2013.2
RAIN DETECTOR

The **HD2013.2** is a rain detector based on the capacity principle. The capacity value of the sensitive element, on an alumina rest, changes according to the surface dampened by raindrops. An integrated heater keeps it dry, evaporates water and prevents false signals caused by fog or dew. The heater also activates at low temperatures, melting the snow and allowing to detect snow precipitations. The instrument external circular dome acts as a windshield for the sensor, preventing false indications. The instrument is equipped with three different outputs: a "Rain ON/OFF" output, which detects whether it is raining/snowing (ON) or not (OFF), also used to control a relay coil or similar devices; a 0…1V voltage analogue output (calibrated) and a 1,5…6KHz frequency output (not calibrated), which provide an accurate indication of current precipitation intensity. The ON/OFF output comes with a delay circuit that indicates the "rain over" condition with a 2 minute delay, so that the "rain over" condition is distinguished from the "light rain" one. The heater can be disabled when power consumption is critical. To do it, set the Heater OFF input on 0V.
If requested when ordering, a bird spike, consisting of a 6-spike ring (spike height: 60mm, diameter: 3 mm), can be mounted.

Typical Applications
The rain detector can be used either as a separate device, or connected to a data logger system (for example: in a weather station). In figure 1, the HD2013.2 ON/OFF output is connected to a relay coil that powers an engine: should it rain, the ON/OFF output will energize the relay coil, which will close the normally open contact (in this case the rain detector is employed as part of a control system, such as, for example, for closing windows). Warning: when the HD2013.2 is connected to a relay coil, use always a protection diode, as shown in figure 1.

Installation and Maintenance
Place the detector far from buildings, trees, etc…, taking care that no object is over the detector, as it might prevent rain detection. Use the supplied accessories to mount the instrument; the bracket can be fixed to a post having a diameter from 30 to 50mm; the post can be either horizontal or vertical thanks to the bracket double drilling. A standard 5-m cable is supplied for the electrical connection with an IP68 connector to be inserted at the bottom of the instrument: the colours of the leads and the relating functions are to be found in the technical specifications. To ensure good immunity from noises, it is recommended to connect the cable braid to the earth and to keep the heater and the electronics earth leads separate. Clean the sensor regularly with a cotton flock soaked in distilled water; in case of ingrained dirt, mild cleansers can be used in moderation.
The sensor is fragile, as it is placed on an alumina rest, thus handle it with care!

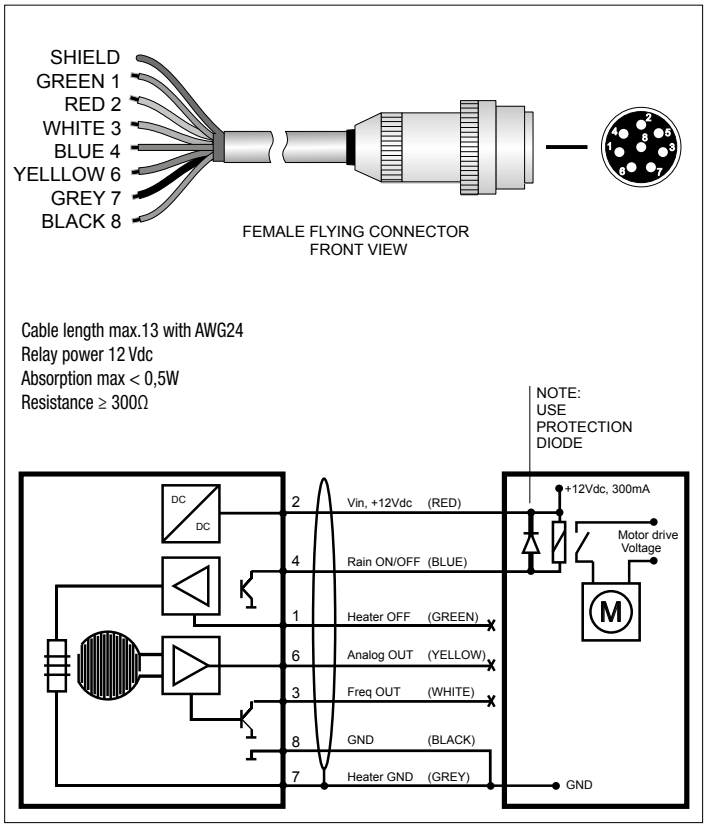


Fig. 1

Technical Data/Specifications

Sensor

Type	Capacitive, with integrated heater
Sensor	6.6cm²
Angle	30°

Sensitivity

Min. sensitive area	0.05cm²
ON delay/Trip delay (OFF>>ON)	< 0.1ms
OFF delay/Shut-off delay (ON>>OFF)	< 5min

Dimensions

Diam. x height	ø107 x 70 mm
Weight	450g
Cable length	5m (other lengths available on request)
Material	BASF LURAN S777K

Electrical Features

Power Supply	
Supply Voltage	12Vdc ± 10%
Current Consumption	130mA (typical) 230mA (max) 10mA (with heater disabled)
Sensor Power Consumption	0.5 … 2.3W
Outputs	
Rain ON/OFF	Open collector, closed in case of rain.
Max. Voltage	15V
Max. Current	50mA
Analogue Output	0…1V (0V = rain, 1V = dry sensor)
Frequency Output	1500 … 6000Hz (rain … dry sensor) Not calibrated
Inputs	
Heater OFF	OFF = connected to GND
Closing Contact Capacity	15Vdc, 2mA

Ambient Conditions

Operating Temperature	-15 … +55°C
Storage Temperature	-40 … +65°C

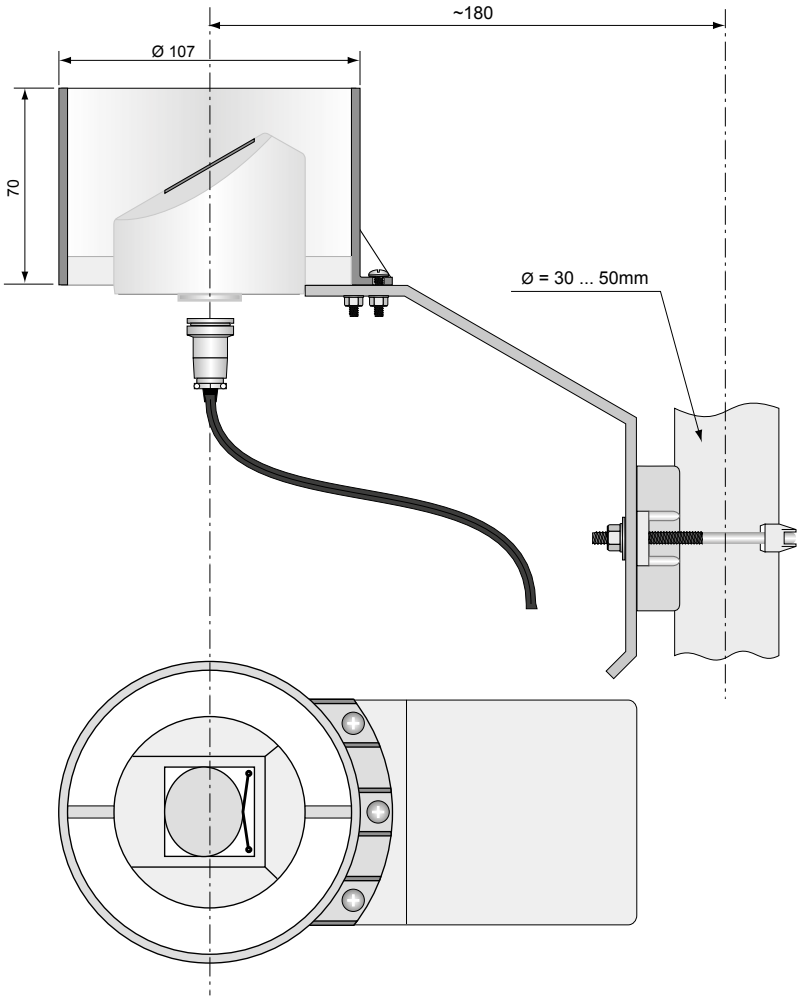
Electrical Connection – Colour Codes		**Pin**	
Power supply (+)	Red	2	+12 Vdc
Rain ON/OFF	Blue	4	Rain ON/OFF
Heater OFF	Green	1	Heather OFF
Analogue Output	Yellow	6	Analogue Output
Frequency Output	White	3	Frequency Output
Electronics Earth	Black	8	GND
Heater Earth	Grey	7	GND Heather

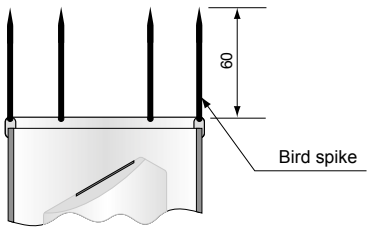
Ordering Codes

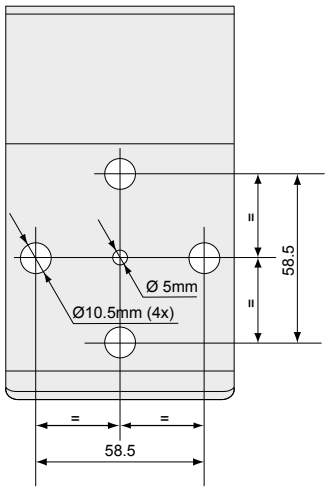
HD2013.2: Rain detector equipped with mounting bracket. 8-pole connector output according to IEC 60130-9 **IP68**. Complete with flying female connector. **Connection cable has to be ordered separately**.

CP2013.2.5: 5-m connection cable: 8-pole IEC 60130-9 IP68 female connector on one end. Other lengths available on request.

HD2013.2D: "Bird spike", consisting of a 6-spike ring (spike height: 60mm, diameter: 3 mm), to be expressly requested when ordering.







HD2013
TIPPING BUCKET RAIN GAUGE

The HD2013 is a reliable and sturdy bucket rain gauge, built entirely from corrosion resistant materials in order to guarantee its durability. So as to ensure accurate measurement even with low temperature climatic conditions or during and after precipitations of snow, a version with a heater which is automatically activated around +4°C has been developed so that snow deposits and ice formations are prevented.
The rain gauge is formed by a metal base on which a tipping bucket is set. The rain collector cone, fixed to the aluminium cylinder, channels the water inside the tipping bucket: once the predefined level is reached, the calibrated bucked rotates under the action of its own weight, discharging the water. During the rotation phase, the usually closed reed contact opens for a fraction of a second, sending an impulse to the counter.
The quantity of rainfall measured is based on the count of the number of times the bucket is emptied: the reed contacts, usually closed, open at the moment of the rotation between one bucket's section and the other. The number of impulses can be detected and recorded by **a datalogger such as the HD2013-D** DeltaOhm or by a pulse counter.

View of tipping bucket

Electrical connection

A removable filter for periodic cleaning and maintenance is inserted in the water collector cone so as to prevent leaves or other elements blocking the end of the hole.
For better water flow, the collector cone is treated with a teflon® paint.

The HD2013R, the version with a heater, operates using either 12Vdc or 24Vdc voltage and uses about 35W. Heating is activated around +4°C.
When submitting your order, upon request a bird dissuader, made of 8 3mm-diameter spikes, 60 mm in height, can be installed on the rain gauge.

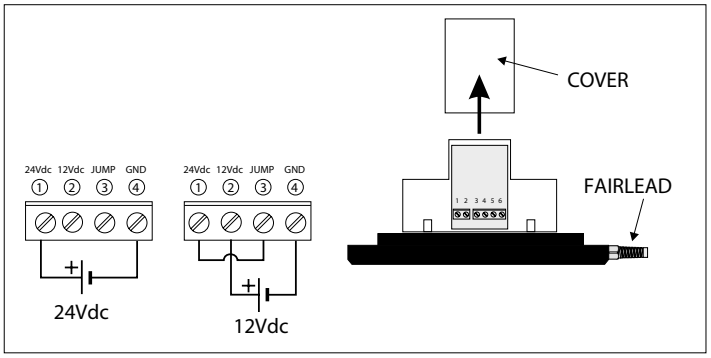


Fig. 1 Electric connection.

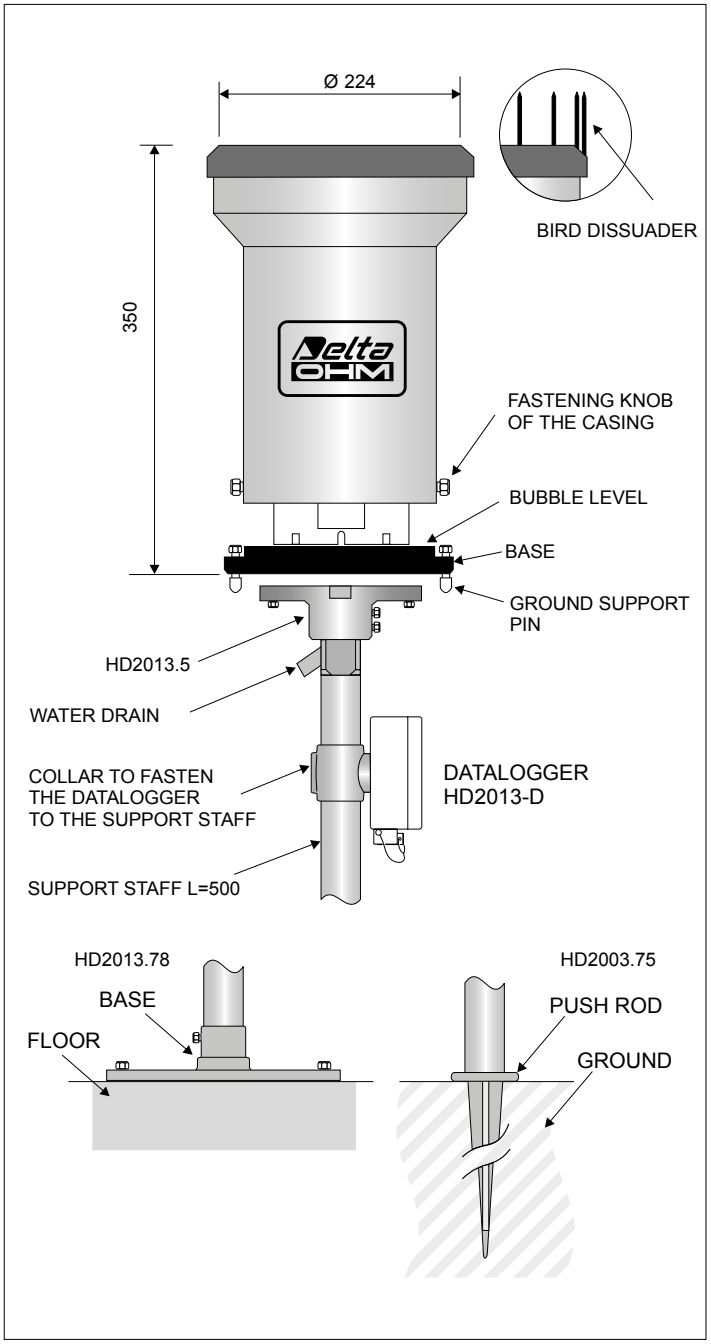


Fig. 2 Mechanical dimensions, and floor or ground fastening system.

INSTALLATION AND MAINTENANCE

Upon request the rain gauge can be supplied ready calibrated at 0.1 - 0.2 or 0.5 mm of rain per commutation of the bucket: the calibration value is shown on the instrument's label.

The instrument must be installed in an open area, away from buildings, trees, etc…, ensuring the space over it is free from all objects which could obstruct rain measurements, and in an easily accessible position for the filter to be cleaned periodically.

Avoid installation in areas exposed to gusts of wind, turbulence (for example the top of a hill) as these may distort the measurements.

The rain gauge can be installed on the ground or raised 500 mm above the ground. Other sizes above the ground are available on request.

Three adjustable support feet have been provided for ground installation so that the instrument can be levelled correctly, and the holes aligned so that it can be fixed to the floor.

For raised installations a collar has been provided which fastens around the base of the instrument on which the support staff must be inserted. The staff may end with either a flange so that it can be fixed to the floor, or a tip to be driven into the ground. The various fastening systems can be seen in fig. 2.

For the tipping device to function correctly and so for the measurement to be correct, it is important that the instrument is placed perfectly level. The base of the rain gauge is fitted with a bubble level.

For installation, unscrew the three screws at the sides of the cylinder that supports the water collector cone.

Note: a heating resistor is fitted around the cone vertex in the **HD2013R** version. To disconnect the power leads, the terminal block's protection cover must be removed and the connector plugged into the heater's leads coming from the cone needs disconnecting.

Electric connection

For the version without heater use a two-wired lead, for the version with heater use a four-wired lead. Slide the cable through the fairlead and fasten it with the cable-holder located near the entry hole at the base of the rain gauge.

The correct configuration of the connections is illustrated in figure 1. **The rain gauge output, available on terminals 5 and 6, must be connected to the rain gauge datalogger HD2013-D input** (please see the details in the instrument's description) **or to a pulse counter or to a datalogger**.

The heated version requires power for the resistors: the mode of connection depends on the level of power used (12Vdc or 24Vdc) and must be made in the manner reported in fig. 1.

The 24Vdc power must be connected between terminals 1 (+) and 4 (-), while for 12Vdc power use terminals 2 (+) and 4 (-) with a jumper between the terminals 1 and 3. If the connection are set correctly, a led placed near the terminals will be lit up.

Maintenance

Verify filter cleanliness periodically; check that there is no debris, leaves or anything else that might obstruct the passage of water.

Check that the tipping bucket contains no dirt, sand, … deposits, or any other obstruction.

If necessary, the surface can be cleaned with mild non aggressive detergent.

Technical characteristics

	HD2013R	HD2013
Power	12Vdc or 24Vdc ±10% / 35W	---
Type of output contact	NC contact (opens during commutation)	
Resolution	0.1 - 0.2 or 0.5 mm/commutation (on request at the time of placing the order)	
Precision	± 2% between 20÷300 mm/h	
Operating temperature range	-20°C ... +60°C	+4°C … +60°C
Heater intervention temperature	+4°C	---
Protection degree	IP67	
Collector area	400 cm^2	

ORDER CODES

HD2013: Rain gauge with tipping bucket, area 400 cm^2, for temperatures from +4°C to +60°C; resolution on request, at the time of placing the order 0.1 - 0.2 or 0.5 mm. Output contact normally closed.

HD2013R: Rain gauge with tipping bucket, area 400 cm^2, for temperatures from -25 to +60°C; resolution on request, at the time of placing the order 0.1 - 0.2 or 0.5 mm. Output contact normally closed. Power voltage 12Vdc or 24Vdc ±10% / absorption 35W.

HD2013.18: Bird dissuader.

HD2013.5K: Accessory kit for installation of the 500 mm raised from ground rain gauge, formed by a support plate for the staff, support staff L=500 mm, fastening screws.

HD2013.75: Base with tip for the ground to support the raised from ground rain gauge (to add to the Accessory kit HD2013.5K).

HD2013.78: Level base for fastening the raised from ground rain gauge (to add to the Accessory kit HD2013.5K).

HD2013.77/40: Flange to fasten the datalogger to the support staff.

Tip for ground for rain gauge raised from ground

Support plate for rain gauge raised from ground

Rain gauge installed on the ground.

Rain gauge with bird dissuader.

Bubble level

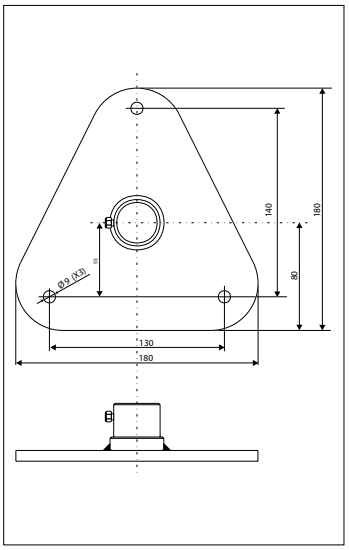


Fig. 3 Base for ground fastening HD2013.78

HD 2013-D
DATALOGGER TO MEASURE RAINFALL

HD2013-D is a datalogger that has been specifically developed to capture and memorize weather and atmospheric precipitation trends. Together with the capacious memory, its long life Lithium battery guarantees remarkable recording capacity without it being necessary for the user to intervene. The large display not only provides the total and partial precipitations in real time, in both millimetres and inches, but also the environment temperature. It is supplied with **DeltaLog6** dedicated software, using which all the instrument's parameters can be set. It is connected to the PC **through an RS232C serial port** using the cable supplied. HD2013-D can be connected to the most popular types of rain gauges using NC or NO output contact.
For software installation and running, please refer to the documentation on the instrument's accompanying CD-ROM.

Important note: in order to make the instrument completely waterproof, buttons have not been used but reed relays were chosen instead. These can be operated with a magnet. The magnet is fixed to the end of a small aluminium handle, and this is connected to the case. After use the magnet, must be put away and stored in its housing.
On the instrument front there are two areas indicated in red corresponding to **"Clear/Up"** and **"Select/Set"**: the magnet should be placed on these areas to perform the instrument programming operations. Placing the magnet for some time on the red zone and then subsequently withdrawing it is the equivalent of activating a button. For the sake of simplicity, in the instrument description which follows, this operation will be called: **"activation of the Clear/Up button", "activation of the Select/Set button".**

Installation and connections
The HD2013-D case has an IP67 degree of protection. The two function keys that allow the instrument to be controlled are formed of reed contacts operated externally by using a magnet supplied with the instrument.
In the lower part of the case there are two connectors for the rain gauge (three-pole male connector in the centre of the case) and the PC's RS232C serial port (five-pole male connector on the right). At the bottom of the case there are two holes so that the instrument can be fastened to a wall. As raised rain gauge it can be fasten to the support staff through the base HD2003.77.

Operation
The datalogger counts and memorizes the emptying of the rain gauge's small bucket through a magnet activating a reed relay on each emptying: each commutation corresponds to a quantity of rain equal to the rain gauge resolution. The following resolutions can be set using the DeltaLog6 software: from 0.050 to 1.599mm of rain. Furthermore, by using the software the type of reed contact closing can be selected. This depends on the type of rain gauge: it can either be normally closed (NC) or normally open (NO) In both cases an alarm display is set in case the small bucket, after its rotation, does not go back to the expected rest position according to the type of contact selected.
The datalogger stores the ambient temperature at a fixed interval of 15'.

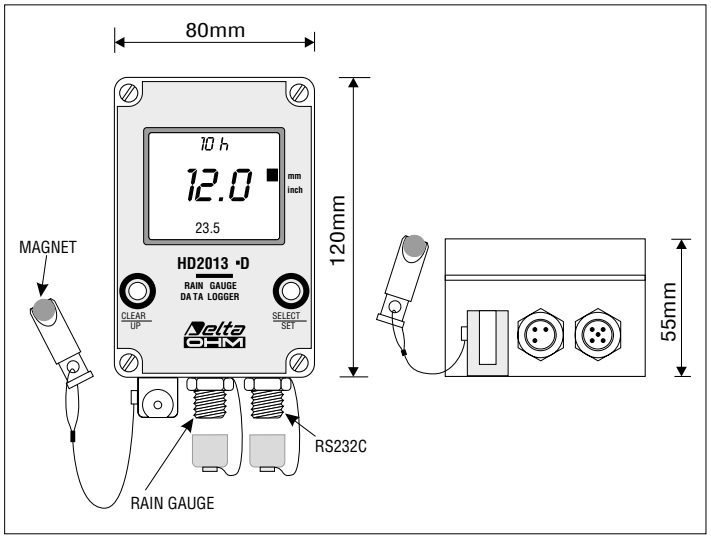


Fig. 4 General view and mechanical dimensions.

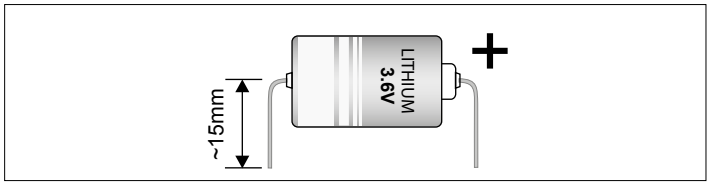


Fig. 5 3.6V Lithium battery

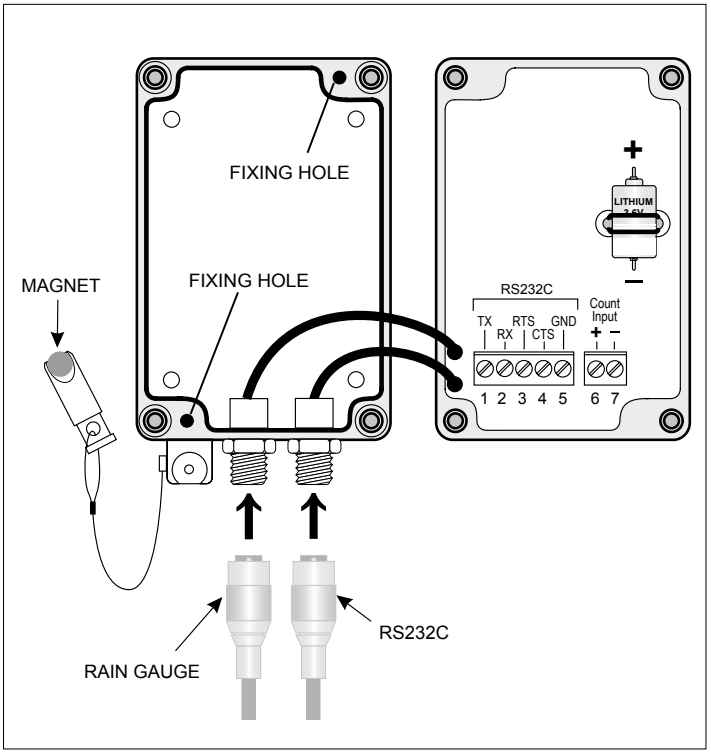


Fig. 6 Inside the instrument

Keyboard description

In normal operating conditions the HD2013-D display shows the hour and minutes on the top line, the precipitation quantity since last reset (partial precipitations), and the temperature detected by the sensor located inside the case.

By operating directly on the instrument buttons it is possible to:

- Display the total precipitation quantity since the last reset or since the last battery change
- Modify date and time
- Reset the partial rain quantity.

The functions performed by the two buttons are described:

Clear/UP BUTTON

The menu can be accessed by starting from the normal functioning mode and activating the button for **more than 3 seconds:** the words "ZERO CNT OR MENU" are then displayed.

At this point further action on the same button resets the partial counter (CLEAR function): the display returns to normal functioning mode displaying the complete day, month, year date and the partial count at zero once.

Should you be inside the parameters modification menu, the same button increases the current value.

Select/SET BUTTON

Select the menu parameter to be modified: the top line on the display shows the selected parameter while the middle line shows the current value. The parameter displayed can be increased by using the CLEAR/UP button; the new setting can be confirmed by using the SELECT/SET button.

On entering the menu (the words "ZERO CNT OR MENU" appear on the display), pressing the SELECT/SET button causes a circular routine to present the following parameters in this same order:

YEAR: modification of the year
MON: modification of the month
DAY: modification of the day
HOUR: modification of the hour
MIN: modification of the minutes
SEC: modification of the seconds
TOT: displays the total quantity of precipitation

On further activating the SELECT/SET button the normal functioning mode returns.

When one of the items is displayed by pressing the CLEAR/UP button its value can be increased.

To confirm the new setting press the SELECT/SET button.

The detailed description of the steps necessary for the modification of the minutes are outlined as an example below.

To enter the menu from the normal measurement condition press the CLEAR/UP button for three seconds. When the display shows "ZERO CNT OR MENU", press the SELECT/SET button five times until the current minutes are displayed (**YEAR >> MON >> DAY >> HOUR >> MIN**). Using the CLEAR/UP button means the displayed minutes can be increased up to the new value. This can be confirmed using the SELECT/SET button.

Device for data logger setting

Battery replacement

HD2013-D is powered by a 3.6V type ½AA Lithium battery with axial rheophores. The battery's charge status is constantly monitored and shown on the HD2013 display. When the symbol begins to blink it means the charge level is no longer sufficient to power the instrument and the battery needs replacing.

Proceed as follows:

1. Download the data and disconnect the instrument from the PC;
2. Unscrew the four screws on the front cover;
3. Release the battery from the ring fastening it to the printed circuit and take it out of its housing;
4. Cut the rheophores of the new battery to a length of about 15 mm.
5. Put the new battery in **making sure the polarity is correct as outlined in fig. 5**
6. Fasten it with the elastic ring and close the cover with the screws.

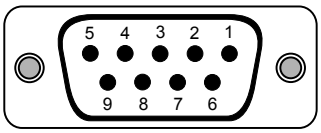
Connection to the PC

HD2013-D can be connected to a PC with a Windows operating system via serial cable or by using a cable connected directly to the instrument's internal terminal block (RS232); the temperature and rain data contained in the datalogger memory can be discharged by using the **DeltaLog6 software** and the data can be displayed in graphic or tabular form.

The connector located at the base of the instrument is used with the supplied serial cable.

The internal terminal block can only be used if a longer serial cable is ordered. Note that in this case the cable length cannot exceed 15 metres. The connection is outlined in the following table:

HD2013-D terminal block	Sub D 9-pole female serial connector
1 - TX	3
2 - TX	2
3 - RTS	7
4 - CTS	8
5 - GND	5



Technical characteristics

Power	Replaceable 3.6V type ½AA Lithium battery
Type of event recorded	NC or NO contact that the program is able to select. Ambient temperature at a fixed interval of 15'. An alarm is generated (it can be disabled) if the contact remains in an unstable condition for more than 3 seconds.
Resolution	From 0.050 to 1.599mm/sample
Storage capacity	93000 samples (equal to 18600mm of rain with a resolution of 0.2mm/sample) 2 years of temperature with a fixed interval of 15'
PC interface	Insulated RS232C serial port – 9600 baud
Display indications	Partial rain in millimetres or inches Total rain in millimetres or inches Environment temperature °C/°F
Operating temperature range	-20°C ... +60°C
Protection degree	IP67
Software supplied	DeltaLog6

ORDER CODES

HD2013-D: Rain gauge datalogger with LCD display; reads and records up to 93000 impulses, given each time the bucket is emtied. Visualizes and up-dates the internal temperature every minute and saves it every 15 minutes. Insulated RS232C serial output, DeltaLog6 software supplied. 3.6V Lithium battery power. IP67 protection degree

CP2013.2P: One meter 3-pole cable to connect the rain gauge to the HD2013-D fixed to the support staff.

CP2013/RS232: 5-pole cable / RS232C to download data from datalogger to PC.

HD2013.77/40: Flange to fasten the datalogger to the support staff.

Water Analysis

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  Portable pH meters
- HD 2156.1 - HD 2156.2 — pag. 342
  Portable pH and conductivity meters
- HD 9609 — pag. 345
  Portable pH Simulator
- DO 9403T-RI - DO9785T - DO 9765T — pag. 346
  pH - Redox transmitters
- HD 2106.1 - HD 2106.2 - HD 2306.0 — pag. 352
  Portable conductivity meters
- HD 2156.1 - HD 2156.2 — pag. 357
  Portable conductivity and pH meters
- DO 9786T - DO 9766T — pag. 360
  Conductivity transmitters
- HD 2109.1 - HD 2109.2 — pag. 364
  Dissolved oxygen meters
- HD 98569 — pag. 366
  Multi-Parameter meter: pH, conductivity, dissolved oxygen
- HD 3405.2- HD 2205.2 — pag. 371
  Bench-top pH meters
- HD 3456.2 - HD 2256.2 — pag. 376
  Bench-top pH and conductivity meters
- HD 3406.2 - HD 2206.2 — pag. 382
  Benck-top conductivity meters
- HD 3456.2 - HD 2256.2 — pag. 387
  Benck-top conductivity and pH meters
- HD 3409.2 — pag. 393
  Dissolved oxygen bench-top meter
- HD 2259.2 — pag. 395
  Dissolved oxygen and pH bench-top meter
- HD 22569.2 — pag. 398
  pH electrodes, conductivity probes, dissolved oxygen probes
- pH electrodes, conductivity probes, O_2 probes — pag. 401
- HD 22.2 - HD 22.3 — pag. 404
  Electrode holder
- HD 40.1 - HD 40.2 — pag. 405
  Thermal printers
- HD 25.2 — pag. 406
  Bench-top turbidity meter

The qualitative level of our instruments is the result of a continuous evolving of the product itself. This way bring to slight differences between what reported on this manual and the instruments you bought. We can not completely exclude the presence of errors for which we apologise. Data, images and descriptions included in this catalogue can not be enforced legally. We reserve the right to perform any modification and correction at any time without notice.

HD 2105.1
HD 2105.2

HD 2105.1, HD 2105.2
TEMPERATURE-pH METERS

The **HD2105.1** and **HD2105.2** are portable instruments with a large LCD display. They measure the pH and the redox potential (ORP) in mV. They measure the temperature using Pt100 or Pt1000 immersion, penetration or contact probes.
The electrode calibration can be carried out on one, two or three points and the calibration sequence can be chosen from a list of 13 buffers.
The temperature probes are equipped with an automatic recognition module and factory calibration data are stored inside.
The HD2105.2 is a **datalogger**. It stored up to 34,000 pH and temperature samples which can be transferred to a PC from the instrument connected via the multi-standard RS232C serial port and USB 2.0. The storing interval, printing, and baud rate can be configured using the menu.
The HD2105.1 and HD2105.2 models are fitted with an RS232C serial port and can transfer the acquired measurements in real time to a PC or to a portable printer.
The *Max, Min* and *Avg* function calculate the maximum, minimum or average values.
Other functions include: the relative measurement REL, the Auto-HOLD function, and the automatic turning off that can also be excluded.
The instruments have IP67 protection degree.

INSTRUMENT TECHNICAL CHARACTERISTICS

Instrument

Dimensions (Length x Width x Height)	185x90x40mm
Weight	470g (complete with batteries)
Materials	ABS, rubber
Display	2x4½ digits plus symbols Visible area: 52x42mm

Operating conditions

Operating temperature	-5…50°C
Storage temperature	-25…65°C
Working relative humidity	0…90%RH without condensation
Protection degree	**IP67**

Power

Batteries	4 1.5V type AA batteries
Autonomy	200 hours with 1800mAh alkaline batteries
Power absorbed with instrument off	20µA
Mains	Output mains adapter 12Vdc / 1000mA

Security of memorized data	Unlimited, independent of battery charge conditions

Time

Date and time	Schedule in real time
Accuracy	1min/month max drift

*Measured values storage - model **HD2105.2***

Type	2000 pages containing 17 samples each
Quantity	Total of 34000 samples
Storage interval	1s, 5s, 10s, 15s, 30s, 1min, 2min, 5min, 10min, 15min, 20min, 30min and 1h.

Serial interface RS232C

Type	RS232C electrically isolated
Baud rate	Can be set from 1200 to 38400 baud
Data bit	8
Parity	None
Stop bit	1
Flow Control	Xon/Xoff
Serial cable length	Max 15m
Selectable print interval	1s, 5s, 10s, 15s, 30s, 1min, 2min, 5min, 10min, 15min, 20min, 30min and 1h.

*USB interface - model **HD2105.2***

Type	1.1 - 2.0 electrically isolated

Connections

Input module for the temperature probes	8-pole male DIN45326 connector
pH/mV input	Female BNC
Serial interface and USB	8-pole MiniDin connector
Mains adapter	2-pole connector (positive at centre)

Measurement of pH by Instrument

Measurement range	-2.000…+19.999pH
Resolution	0.01 or 0.001pH selectable from menu
Accuracy	±0.001pH
Input impedance	$>10^{12}\Omega$
Calibration error @25°C	|Offset|>20mV Slope<50mV/pH or Slope>63mV/pH Sensitivity < 85% or Sensitivity > 106.5%
Temperature compensation automatic/manual	-50…+150°C

HD2110CSNM

HD2101/USB

Measurement of mV by Instrument

Measurement range	-1999.9…+1,999.9mV
Resolution	0.1mV
Accuracy	±0.1mV
Drift after 1 year	0.5mV/year

Measurement of temperature by Instrument

Pt100 measurement range	-200…+650°C
Pt1000 measurement range	-200…+650°C
Resolution	0.1°C
Accuracy	±0.1°C
Drift after 1 year	0.1°C/year

TECHNICAL DATA OF PROBES AND MODULES EQUIPPED WITH INSTRUMENT
Temperature probes Pt100 sensor using SICRAM module

Model	Type	Application range	Accuracy
TP87	**Immersion**	-50°C…+200°C	±0.25°C (-50°C…+200°C)
TP472I.0	**Immersion**	-50°C…+400°C	±0.25°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP473P.0	**Penetration**	-50°C…+400°C	±0.25°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP474C.0	**Contact**	-50°C…+400°C	±0.3°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP475A.0	**Air**	-50°C…+250°C	±0.3°C (-50°C…+250°C)
TP472I.5	**Immersion**	-50°C…+400°C	±0.3°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP472I.10	**Immersion**	-50°C…+400°C	±0.3°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)

Temperature drift @ 20°C 0.003%/°C

4 wire Pt100 and 2 wire Pt1000 Probes

Model	Type	Application range	Accuracy
TP87.100	**Pt100 4 wires**	**-50…+200°C**	**Class A**
TP87.1000	**Pt1000 2 wires**	**-50…+200°C**	**Class A**

Temperature drift @ 20°C 0.005%/°C

ORDER CODES

HD2105.1: The kit is composed of: instrument HD2105.1, 4 1.5V alkaline batteries, operating manual, case and DeltaLog9 software. **Electrodes, temperature probe, calibration solutions, data transfer cable for PC or printer have to be ordered separately.**
HD2110CSNM: 8-pole connection cable MiniDin - Sub D 9-pole female for RS232C.
HD2101/USB: Connection cable USB 2.0 connector type A - 8-pole MiniDin.
C.206: Cable for instruments of the series HD21…1 and .2 to connect directly to USB input of PC.
DeltaLog9: Software for download and management of the data on PC using Windows 98 to Vista operating systems.
SWD10: Stabilized power supply at 230Vac/12Vdc-1A mains voltage.
HD40.1: The kit includes: 24-columm portable thermal printer, serial interface RS232, 57mm paper width, four NiMh 1.2V rechargeable batteries, SWD10 power supply, instruction manual, 5 thermal paper rolls
BAT-40: Spare battery pack for HD40.1 printer with built-in temperature sensor.
RCT: The kit includes 4 thermal paper rolls 57mm wide and 32mm diameter.

HD22.3

HD22.2: Laboratory electrode holder composed of base plate with built-in magnetic stirrer, shaft and replaceable electrode holder. Suitable diameter 12mm. Powered by power supplier SWD10 (optional).
HD22.3: Laboratory electrode holder composed of base plate. Flexible arm for free positioning. Suitable for electrodes with diameter 12mm.

pH Electrodes

KP 20: Gel pH combined electrode for general use , with S7 screw connector, EPOXY body.
KP 30: Gel pH combined electrode for general use, 1m cable with BNC, EPOXY body .
KP 50: Gel pH combined electrode, porous Teflon ring junction, suitable for emulsions, demineralised water, with S7 screw connector, glass body.
KP 61: 3 diaphragm liquid filled pH combined electrode for wine, milk, cream, etc., S7 screw connector, liquid reference filling, glass body.
KP 62: 1 diaphragm gel pH combined electrode for pure water, varnishes, gel filled, S7 screw connector, glass body.
KP 63: 1 liquid filled pH combined electrode for general use, varnishes, 1m cable with BNC, glass body.
KP 64: Liquid filled pH combined electrode ,Teflon ring diaphragm, for wine, varnishes, emulsions, S7 screw connector, glass body.
KP 70: Pointed gel combined pH microelectrode diam. 6 x L=70 mm., with S7 screw connector, EPOXY body, glass tip, open junction.
KP 80: Pointed gel pH combined electrode, with S7 screw connector, glass body, for cream, milk, viscous material, open junction.
KP100: Flat membrane gel combined pH electrode with S7 screw connector, glass body, for skin, leather, paper.
Characteristics and dimensions of the probes at page 401
CP: 1.5m extension cable with BNC/S7 connector for electrode without cable, thread S7.
CP: 1.5m extension cable with BNC/S7 connector for electrode without cable, thread S7.
CP 5: 5m extension cable with BNC/S7 connector for electrode without cable, thread S7.
CP 10: 10m extension cable with BNC/S7 connector for electrode without cable, thread S7.
CP 15: 15m extension cable with BNC/S7 connector for electrode without cable, thread S7.
CE : S7 screw connector for pH electrode.
BNC: female BNC for extension cable

ORP Electrodes

KP 90: REDOX PLATINUM liquid filled electrode with S7 screw connector, glass body.
KP 91: Gel REDOX PLATINUM electrode, 1m cable with BNC, EPOXY body
Characteristics and dimensions of the probes at page 397

pH Buffer solutions

HD8642: Buffer solution 4.01pH - 200cc.
HD8672: Buffer solution 6.86pH - 200cc.
HD8692: Buffer solution 9.18pH - 200cc.

Redox Buffer solutions

HDR220: Redox buffer solution 220mV 0.5 l.
HDR468: Redox buffer solution 468mV 0.5 l.

Electrolyte solutions

KCL3M Ready to use solution for electrode refilling – 100 cc

Cleaning and maintenance

HD62PT: Diaphragm cleaning (tiourea in HCl) - 500ml.
HD62PP: Protein cleaning (pepsin in HCl) - 500ml.
HD62RF: Regeneration (fl uorhydric acid) - 100ml.
HD62SC: Solution for electrode preservation - 200ml.

Temperature probes complete with SICRAM module

TP87: PT100 sensor immersion probe. Stem Ø 3 mm, length 70 mm. Cable length 1 m.
TP472I.0: Pt100 sensor immersion probe. Stem Ø 3 mm, length 230 mm. Cable length 2 m.
TP473P.0: Pt100 sensor penetration probe. Stem Ø 4mm, length 150 mm. Cable length 2 m.
TP474C.0: Pt100 sensor contact probe. Stem Ø 4mm, length 230mm, contact surface Ø 5mm. Cable length 2 m.
TP475A.0: Air probe, sensor Pt100. Stem Ø 4mm, length 230mm. Cable length 2 m.
TP472I.5: Immersion probe, sensor Pt100. Stem Ø 6mm, length 500 mm. Cable length 2 m.
TP472I.10: Immersion probe, sensor Pt100. Stem Ø 6mm, length 1,000mm. Cable length 2 m.

Temperature probes without SICRAM module

TP47.100: Direct 4 wires Pt100 sensor immersion probe. Probe's stem Ø 3mm, length 230mm. Connection cable 4 wires with connector, length 2 m.
TP47.1000: Pt1000 sensor immersion probe. Probe's stem Ø 3mm, length 230mm. Connection cable 2 wires with connector, length 2 m.
TP87.100: Pt100 sensor immersion probe. Probe's stem Ø 3mm, length 70mm. 4 wire connection cable with connector, length 1 m.
TP87.1000: Pt1000 sensor immersion probe. Probe's stem Ø 3mm, length 70mm. 2-wire connection cable with connector, length 1 m.
TP47: Module for the connection of Pt100 4-wire and Pt1000 2-wire probes.

HD 2305.0

HD 2305.0
PORTABLE pHMETER

The **HD2305.0** is a portable instrument with a large LCD display. It measures the pH and the redox potential (ORP) in mV. It measures the temperature using Pt100 or Pt1000 immersion, penetration or contact probes.
The electrode calibration can be carried out on one, two or three points at 4.01pH, 6.86pH and 9.18pH.
The temperature probes are equipped with an automatic recognition module and factory calibration data are stored inside.

The Max, Min and Avg function calculate the maximum, minimum or average values.
Other functions include: the relative measurement REL, the Auto-HOLD function, and the automatic turning off that can also be excluded.
The instruments have IP67 protection degree.

HD8642 **HD8672** **HD8692**

INSTRUMENT TECHNICAL CHARACTERISTICS
Measured quantities: pH, mV, °C, °F

Instrument

Dimensions (Length x Width x Height)	140x88x38mm
Weight	160g (complete with batteries)
Materials	ABS
Display	2x4½ digits plus symbols Visible area: 52x42mm

Working conditions

Operating temperature	-5…50°C
Storage temperature	-25…65°C
Working relative humidity	0…90%RH without condensation
Protection degree	**IP67**

Power

Batteries	3 1.5V type AA batteries
Autonomy	200 hours with 1800mAh alkaline batteries
Power absorbed with instrument off	20µA

Connections

Input module for the temperature probes	8-pole male DIN45326 connector
pH/mV input	Female BNC

Measurement of pH by Instrument

Measurement range	-2.000…+19.999pH
Resolution	0.01
Accuracy	±0.01pH±1 digit
Input impedance	$>10^{12}\Omega$
Calibration error @25°C	|Offset|>20mV Slope<50mV/pH or Slope>63mV/pH Sensitivity < 85% or Sensitivity > 106.5%

Measurement of mV by Instrument

Measurement range	-1999.9…+1,999.9mV
Resolution	0.1mV
Accuracy	±0.1mV
Drift after 1 year	0.5mV/year

Measurement of temperature by Instrument

Pt100 measurement range	-200…+650°C
Pt1000 measurement range	-200…+650°C
Resolution	0.1°C
Accuracy	±0.1°C
Drift after 1 year	0.1°C/year

TECHNICAL DATA OF PROBES AND MODULES EQUIPPED WITH INSTRUMENT
Temperature probes Pt100 sensor using SICRAM module

Model	Type	Application range	Accuracy
TP87	Immersion	-50°C…+200°C	±0.25°C (-50°C…+200°C)
TP472I.0	Immersion	-50°C…+400°C	±0.25°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP473P.0	Penetration	-50°C…+400°C	±0.25°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP474C.0	Contact	-50°C…+400°C	±0.3°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP475A.0	Air	-50°C…+250°C	±0.3°C (-50°C…+250°C)
TP472I.5	Immersion	-50°C…+400°C	±0.3°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP472I.10	Immersion	-50°C…+400°C	±0.3°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)

Temperature drift @ 20°C 0.003%/°C

4 wire Pt100 and 2 wire Pt1000 Probes

Model	Type	Application range	Accuracy
TP87.100	Pt100 4 wires	-50…+200°C	Class A
TP87.1000	Pt1000 2 wires	-50…+200°C	Class A

Temperature drift @ 20°C 0.005%/°C

ORDER CODES

HD2305.0: The kit is composed of: instrument HD2305.0, 3 1.5V alkaline batteries, operating manual, case.

HD22.2: Laboratory electrode holder composed of base plate with built-in magnetic stirrer, shaft and replaceable electrode holder. Suitable diameter 12mm. Powered by power supplier SWD10 (optional).

HD22.3: Laboratory electrode holder composed of base plate. Flexible arm for free positioning. Suitable for electrodes with diameter 12mm.

pH Electrodes

KP 20: Gel pH filled combined electrode for general use , with S7 screw connector, EPOXY body.

KP 30: Gel pH combined electrode for general use, 1m cable with BNC, EPOXY body .

KP 50: Gel pH combined electrode, porous Teflon ring junction, suitable for emulsions, demineralised water, with S7 screw connector, glass body.

KP 61: 3 diaphragm liquid filled pH combined electrode for wine, milk, cream, etc., S7 screw connector, liquid reference filling, glass body.

KP 62: 1 diaphragm gel pH combined electrode for pure water, varnishes, gel filled, S7 screw connector, glass body.

KP 63: 1 liquid filled pH combined electrode for general use, varnishes, 1m cable with BNC, glass body.

KP 64: Liquid filled pH combined electrode ,Teflon ring diaphragm, for wine, varnishes, emulsions, S7 screw connector, glass body.

KP 70: Pointed gel combined pH microelectrode diam. 6 x L=70 mm., with S7 screw connector, EPOXY body, glass tip, open junction.

KP 80: Pointed gel pH combined electrode, with S7 screw connector, glass body, for cream, milk, viscous material, open junction.

KP100: Flat membrane gel combined pH electrode with S7 screw connector, glass body, for skin, leather, paper.

Characteristics and dimensions of the probes at page 401

CP: 1.5m extension cable with BNC/S7 connector for electrode without cable, thread S7.

CP: 1.5m extension cable with BNC/S7 connector for electrode without cable, thread S7.

CP 5: 5m extension cable with BNC/S7 connector for electrode without cable, thread S7.

CP 10: 10m extension cable with BNC/S7 connector for electrode without cable, thread S7.

CP 15: 15m extension cable with BNC/S7 connector for electrode without cable, thread S7.

CE : S7 screw connector for pH electrode.

BNC: female BNC for extension cable

HD22.3

ORP Electrodes

KP 90: REDOX PLATINUM liquid filled electrode with S7 screw connector, glass body.

KP 91: Gel REDOX PLATINUM electrode, 1m cable with BNC, EPOXY body

Characteristics and dimensions of the probes at page 402

pH Buffer solutions

HD8642: Buffer solution 4.01pH - 200cc.

HD8672: Buffer solution 6.86pH - 200cc.

HD8692: Buffer solution 9.18pH - 200cc.

Redox Buffer solutions

HDR220: Redox buffer solution 220mV 0.5 l.

HDR468: Redox buffer solution 468mV 0.5 l.

Electrolyte solutions

KCL3M Ready to use solution for electrode refilling – 100 cc

Cleaning and maintenance

HD62PT: Diaphragm cleaning (tiourea in HCl) - 500ml.

HD62PP: Protein cleaning (pepsin in HCl) - 500ml.

HD62RF: Regeneration (fl uorhydric acid) - 100ml.

HD62SC: Solution for electrode preservation - 200ml.

Temperature probes complete with SICRAM module

TP87: PT100 sensor immersion probe. Stem Ø 3 mm, length 70 mm. Cable length 1 m.

TP472I.0: Pt100 sensor immersion probe. Stem Ø 3 mm, length 230 mm. Cable length 2 m.

TP473P.0: Pt100 sensor penetration probe. Stem Ø 4mm, length 150 mm. Cable length 2 m.

TP474C.0: Pt100 sensor contact probe. Stem Ø 4mm, length 230mm, contact surface Ø 5mm. Cable length 2 m.

TP475A.0: Air probe, sensor Pt100. Stem Ø 4mm, length 230mm. Cable length 2 m.

TP472I.5: Immersion probe, sensor Pt100. Stem Ø 6mm, length 500 mm. Cable length 2 m.

TP472I.10: Immersion probe, sensor Pt100. Stem Ø 6mm, length 1,000mm. Cable length 2 m.

Temperature probes without SICRAM module

TP47.100: Direct 4 wires Pt100 sensor immersion probe. Probe's stem Ø 3mm, length 230mm. Connection cable 4 wires with connector, length 2 m.

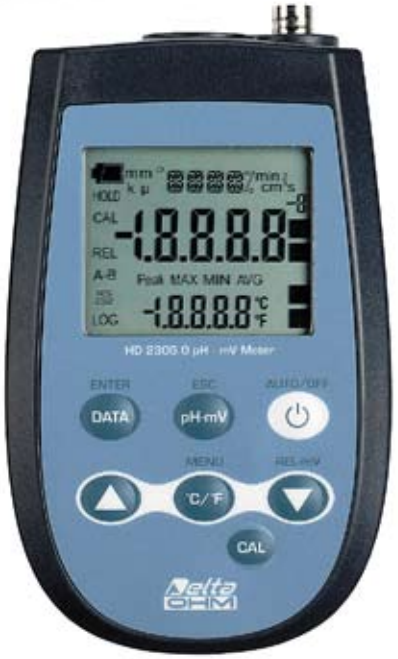
TP47.1000: Pt1000 sensor immersion probe. Probe's stem Ø 3mm, length 230mm. Connection cable 2 wires with connector, length 2 m.

TP87.100: Pt100 sensor immersion probe. Probe's stem Ø 3mm, length 70mm. 4 wire connection cable with connector, length 1 m.

TP87.1000: Pt1000 sensor immersion probe. Probe's stem Ø 3mm, length 70mm. 2-wire connection cable with connector, length 1 m.

TP47: Module for the connection of Pt100 4-wire and Pt1000 2-wire probes.

CP



HD 2156.1
HD 2156.2

HD 2156.1, HD 2156.2
pH METER - CONDUCTIVITY METER - THERMOMETER

The **HD2156.1** and **HD2156.2** are portable instruments with a large LCD display. They measure pH, mV, redox potential (ORP), conductivity, liquid resistivity, total dissolved solids (TDS) and salinity using combined 4-ring and 2-ring conductivity/temperature probes. Temperature only is measured by Pt100 or Pt1000 immersion, penetration or contact probes.
The pH electrode calibration, as well as manual, can be carried out on one, two or three points and the calibration sequence can be chosen from a list of 13 buffers.
The probe calibration can be performed automatically in one or more of the 147µS, 1413µS, 12880µS or 111800µS/cm conductivity calibration solutions.

The HD2156.2 instrument is a **datalogger.** It memorizes up to 20,000 sets of three measurements composed of pH or mV, conductivity or resistivity or TDS or salinity and temperature: these data can be transferred to a PC from the instrument connected via the multi-standard RS232C serial port and USB 2.0. The storing interval, printing, and baud rate can be configured using the menu.

The HD2156.1 and HD2156.2 models are fitted with an RS232C serial port and can transfer the acquired measurements to a PC or to a portable printer in real time.
The *Max, Min* and *Avg* function calculates the maximum, minimum or average values.
Other functions include: the Auto-HOLD function and the automatic turning off which can also be excluded.
The instruments have IP67 protection degree.

INSTRUMENT TECHNICAL CHARACTERISTICS
Measured quantities: pH, mV, χ, Ω, TDS, Nacl, °C, °F

Instrument

Dimensions (Length x Width x Height)	185x90x40mm
Weight	470g (complete with batteries)
Materials	ABS, rubber
Display	2x4½ digits plus symbols Visible area: 52x42mm

Operating conditions

Working temperature	-5…50°C
Storage temperature	-25…65°C
Working relative humidity	0…90%RH without condensation
Protection degree	**IP67**

Power

Batteries	4 1.5V type AA batteries
Autonomy	200 hours with 1800mAh alkaline batteries
Power absorbed with instrument off	20µA
Mains	Output mains adapter 9Vdc / 250mA

Security of memorized data — Unlimited, independent of battery charge conditions

Time

Date and time	Schedule in real time
Accuracy	1min/month max error

*Measured values storage - model **HD2156.2***

Type	2000 pages containing 10 samples each
Quantity	20,000 sets of three measurements composed of pH or mV, χ or Ω or TDS or salinity and temperature.
Storage interval	1s, 5s, 10s, 15s, 30s, 1min, 2min, 5min, 10min, 15min, 20min, 30min and 1h.

Serial interface RS232C

Type	RS232C electrically isolated
Baud rate	Can be set from 1200 to 38400 baud
Data bit	8
Parity	None
Stop bit	1
Flow Control	Xon/Xoff
Serial cable length	Max 15m
Immediate print interval	1s, 5s, 10s, 15s, 30s, 1min, 2min, 5min, 10min, 15min, 20min, 30min and 1h.

*USB interface - model **HD2156.2***

Type	1.1 - 2.0 electrically isolated

Connections

pH/mV input	Female BNC connector
Conductivity input	8-pole male DIN45326 connector
Serial interface and USB	8-pole MiniDin connector
Mains adapter	2-pole connector (positive at centre)

Measurement of pH by Instrument

Measurement range	-2.000…+19.999pH
Resolution	0.01 or 0.001pH selectable from menu
Accuracy	±0.001pH ±1digit
Input impedance	$>10^{12}\Omega$
Calibration error @25°C	|Offset| > 20mV Slope > 63mV/pH or Slope < 50mV/pH Sensitivity > 106.5% or Sensitivity < 85%

Measurement of mV by Instrument

Measurement range	-1999.9…+1999.9mV
Resolution	0.1mV
Accuracy	±0.1mV ±1digit
Drift after 1 year	0.5mV/year

Measurement of conductivity		*Resolution*
Measuring range	0.00…19.99µS/cm	0.01µS/cm
Kcell=0.1		
Measuring range	0.0…199.9µS/cm	0.1µS/cm
Kcell=1	200…1999µS/cm	1µS/cm
	2.00…19.99mS/cm	0.01mS/cm
	20.0…199.9mS/cm	0.1mS/cm
Measuring range	200…1999mS/cm	1mS/cm
Kcell=10		
Accuracy (conductivity)	±0.5%1digit	

Measurement of resistivity		
Measuring range	till 100MΩ·cm/(*)	
Kcell=0.1		
Measuring range	5.0…199.9Ω·cm	0.1Ω·cm
Kcell=1	200…999Ω·cm	1Ω·cm
	1.00k…19.99kΩ·cm	0.01kΩ·cm
	20.0k…99.9kΩ·cm	0.1kΩ·cm
	100k…999kΩ·cm	1kΩ·cm
	1…10MΩ·cm	1MΩ·cm
Measuring range	0.5…5.0Ω·cm	0.1Ω·cm
Kcell=10		
Accuracy (resistivity)	±0.5%±1digit	

Measurement of total dissolved solids (with coefficient χ/TDS=0.5)		
Measuring range	0.00…19.99mg/l	0.05mg/l
Kcell=0.1		
Measuring range	0.0…199.9mg/l	0.5mg/l
Kcell=1	200…1999mg/l	1mg/l
	2.00…19.99g/l	0.01g/l
	20.0…99.9g/l	0.1g/l
Measuring range	100…999g/l	1g/l
Kcell=10		
Accuracy (conductivity)		±0.5%1digit

Measurement of salinity		*Risolution*
Measurement range	0.000…1.999g/l	1mg/l
	2.00…19.99g/l	10mg/l
	20.0…199.9g/l	0.1g/l
Accuracy (salinity)	±0.5%1digit	

Temperature compensation automatic/manual	0…100°C with α_T selectable from 0.00 to 4.00%/°C
Reference temperature	20°C or 25°C
χ / TDS Conversion factor	0.4…0.8
Cell constant K (cm-1)	0.1, 0.7, 1.0 and 10.0

Standard solutions automatically *detected @25°C*	147µS/cm
	1413µS/cm
	12880µS/cm
	111800µS/cm

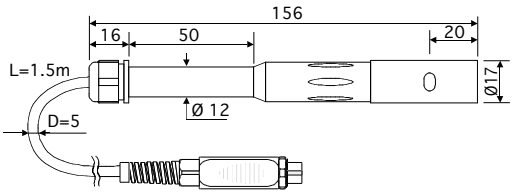
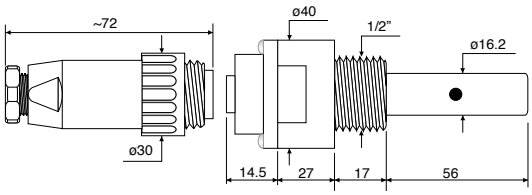
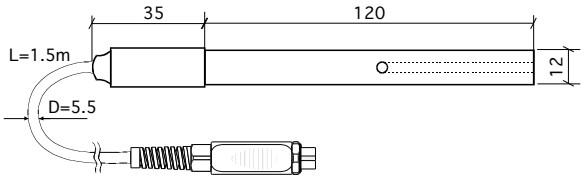
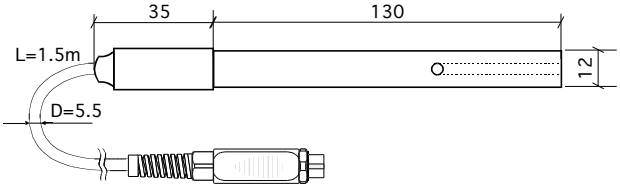
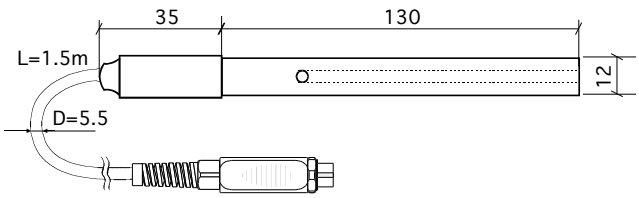
Measurement of temperature	
Pt100 measuring range	-50…+200°C
Pt1000 measuring range	-50…+200°C
Resolution	0.1°C
Accuracy	±0.25°C
Drift after 1 year	0.1°C/anno
Preset cell constant values:	K=0,01 - K=0,1 - K=1, K=10

(*) The resistivity measurement is obtained from the reciprocal of conductivity measurement. Close to the bottom of the scale, the indication of resistivity appears like reported in the table below:

K cell = 0.01 cm^{-1}		**K cell = 0.1 cm^{-1}**	
Conductivity (µS/cm)	Resistivity (MΩ·cm)	Conductivity (µS/cm)	Resistivity(MΩ·cm)
0.001 µS/cm	1000 MΩ·cm	0.01 µS/cm	100 MΩ·cm
0.002 µS/cm	500 MΩ·cm	0.02 µS/cm	50 MΩ·cm
0.003 µS/cm	333 MΩ·cm	0.03 µS/cm	33 MΩ·cm
0.004 µS/cm	250 MΩ·cm	0.04 µS/cm	25 MΩ·cm
…	…	…	…

TECHNICAL DATA OF PROBES AND MODULES EQUIPPED WITH INSTRUMENT

2 and 4 electrode conductivity probes

ORDER CODE	MEASUREMENT RANGE	DIMENSIONS
SP06T	K=0.7 5µS…200mS/cm 0…90°C 4-electrode cell in Pocan/Platinum	
SPT 400.001 **not suitable for** **HD 2306.0**	K=0.01 0,05…19,9µS/cm 2-electrode cell AISI 316 - Teflon	
SPT01G	K=0.1 0.1µS…500µS/cm 0…80°C 2-electrode cell in Glass/Platinum	
SPT1G	K=1 10µS…10mS/cm 0…80°C 2-electrode cell in Glass/Platinum	
SPT10G	K=10 500µS…200mS/cm 0…80°C 2-electrode cell in Glass/Platinum	

Temperature probes with connector 4 wire Pt100 and 2 wire Pt1000 sensor

Model	Type	Working range	Accuracy
TP47.100	Pt100 4 wires	-50…+200°C	Class A
TP47.1000	Pt1000 2 wires	-50…+200°C	Class A
TP87.100	Pt100 4 wires	-50…+200°C	Class A
TP87.1000	Pt1000 2 wires	-50…+200°C	Class A

Temperature drift @20°C 0.005%/°C

ORDER CODES

HD2156.1: The kit is composed of: instrument HD2156.1, 4 1.5V alkaline batteries, operating manual, case and DeltaLog9 software. **Other pH electrodes, conductivity and temperature probes must be ordered separately.**

HD2156.2K: The kit is composed of: instrument HD2156.2 **datalogger**, 4 1.5V alkaline batteries, operating software DeltaLog9. **Other pH electrodes, conductivity and temperature probes must be ordered separately.**

pH/mV probes, conductivity probes, temperature probes, standard calibration solutions for various types of measurements, connection cables for pH electrodes with S7 connector, cables for data transfer to PC or printer have to be ordered separately.

HD2110CSNM: 8-pole connection cable MiniDin - Sub D 9-pole female for RS232C.

C.206: Serial connection cable with USB connector for PC and 8-pole MiniDin male connector for the instrument.

HD2101/USB: Connection cable USB 2.0 connector type A - 8-pole MiniDin (not suitable for HD2156.1K).

DeltaLog9: Software for download and management of the data on PC using Windows 98 to Vista operating systems.

SWD10: Stabilized power supply 100-240 Vac/12Vdc-1A mains voltage

HD40.1: 24-column portable thermal printer, serial interface, 57mm paper width, four NiMH 1.2V rechargeable batteries, SWD10 power supply, instruction manual, 5 thermal paper rolls.

RCT: The kit includes 4 thermal paper rolls 57mm wide and 32mm in diameter.

BAT-40: Spare battery pack for HD40.1 printer with built-in temperature sensor.

HD22.2: Laboratory electrode holder composed of base plate with built-in magnetic stirrer, shaft and replaceable electrode holder. Suitable diameter 12mm. Powered by bench-top meters of the series HD22…with cable HD22.2.1 (optional) or power supplier SWD10 (optional).

HD22.3: Laboratory electrode holder composed of base plate. Flexible arm for free positioning. Suitable for electrodes with diameter 12mm.

pH Electrodes

KP 20: Gel pH filled combined electrode for general use , with S7 screw connector, EPOXY body.

KP 30: Gel pH combined electrode for general use, 1m cable with BNC, EPOXY body .

KP 50: Gel pH combined electrode, porous Teflon ring junction, suitable for emulsions, demineralised water, with S7 screw connector, glass body.

KP 61: 3 diaphragm liquid filled pH combined electrode for wine, milk, cream, etc., S7 screw connector, liquid reference filling, glass body.

KP 62: 1 diaphragm gel pH combined electrode for pure water, varnishes, gel filled, S7 screw connector, glass body.

KP 63: 1 liquid filled pH combined electrode for general use, varnishes, 1m cable with BNC, glass body.

KP 64: Liquid filled pH combined electrode ,Teflon ring diaphragm, for wine, varnishes, emulsions, S7 screw connector, glass body.

KP 70: Pointed gel combined pH microelectrode diam. 6 x L=70 mm., with S7 screw connector, EPOXY body, glass tip, open junction.

KP 80: Pointed gel pH combined electrode, with S7 screw connector, glass body, for cream, milk, viscous material, open junction.

KP100: Flat membrane gel combined pH electrode with S7 screw connector, glass body, for skin, leather, paper.

Characteristics and dimensions of the probes at page 401

CP: 1.5m extension cable with BNC/S7 connector for electrode without cable, thread S7.

CP: 1.5m extension cable with BNC/S7 connector for electrode without cable, thread S7.

CP 5: 5m extension cable with BNC/S7 connector for electrode without cable, thread S7.

CP 10: 10m extension cable with BNC/S7 connector for electrode without cable, thread S7.

CP 15: 15m extension cable with BNC/S7 connector for electrode without cable, thread S7.

CE : S7 screw connector for pH electrode.

BNC: female BNC for extension cable

ORP Electrodes

KP 90: REDOX PLATINUM liquid filled electrode with S7 screw connector, glass body.

KP 91: Gel REDOX PLATINUM electrode, 1m cable with BNC, EPOXY body

Characteristics and dimensions of the probes at page 402

pH Buffer solutions

HD8642: Buffer solution 4.01pH - 200cc.

HD8672: Buffer solution 6.86pH - 200cc.

HD8692: Buffer solution 9.18pH - 200cc.

Redox Buffer solutions

HDR220: Redox buffer solution 220mV 0.5 l.

HDR468: Redox buffer solution 468mV 0.5 l.

Electrolyte solutions

KCL3M Ready to use solution for electrode refilling – 100 cc

Cleaning and maintenance

HD62PT: Diaphragm cleaning (tiourea in HCl) - 500ml.

HD62PP: Protein cleaning (pepsin in HCl) - 500ml.

HD62RF: Regeneration (fl uorhydric acid) - 100ml.

HD62SC: Solution for electrode preservation - 200ml.

Temperature probes complete with SICRAM module

TP87: PT100 sensor immersion probe. Stem Ø 3 mm, length 70 mm. Cable length 1 m.

TP472I.0: Pt100 sensor immersion probe. Stem Ø 3 mm, length 230 mm. Cable length 2 m.

TP473P.0: Pt100 sensor penetration probe. Stem Ø 4mm, length 150 mm. Cable length 2 m.

TP474C.0: Pt100 sensor contact probe. Stem Ø 4mm, length 230mm, contact surface Ø 5mm. Cable length 2 m.

TP475A.0: Air probe, sensor Pt100. Stem Ø 4mm, length 230mm. Cable length 2 m.

TP472I.5: Immersion probe, sensor Pt100. Stem Ø 6mm, length 500 mm. Cable length 2 m.

TP472I.10: Immersion probe, sensor Pt100. Stem Ø 6mm, length 1,000mm. Cable length 2 m.

Temperature probes without SICRAM module

TP47.100: Direct 4 wires Pt100 sensor immersion probe. Probe's stem Ø 3mm, length 230mm. Connection cable 4 wires with connector, length 2 m.

TP47.1000: Pt1000 sensor immersion probe. Probe's stem Ø 3mm, length 230mm. Connection cable 2 wires with connector, length 2 m.

TP87.100: Pt100 sensor immersion probe. Probe's stem Ø 3mm, length 70mm. 4 wire connection cable with connector, length 1 m.

TP87.1000: Pt1000 sensor immersion probe. Probe's stem Ø 3mm, length 70mm. 2-wire connection cable with connector, length 1 m.

TP47: Module for the connection of Pt100 4-wire and Pt1000 2-wire probes.

HD 9609

HD 9609
pH AND mV SIMULATOR

GENERAL CHARACTERISTICS

The simulator **HD 9609** is a portable instrument for checking and calibrating pH and mV measuring instruments. The characteristics of this instrument satisfy any checking and calibrating requirements for both portable and panel-mounted instruments; it may be used in laboratories, in industry or for checks in the field.
Despite its many functions, the instrument is simple to use: a large display, with dual indication, and a series of symbols allow it to be used even by unskilled personnel.

The HD9609 sends to output in channel A the simulation of signals of an electrode for measuring pH, ORP, ISFET, in the range:
- 0 to 14 pH, with resolution 0.10 pH;
- ±1999 mV, with resolution 1 mV.

The user may choose between two output impedance values:
- 100 KΩ, low impedance;
- 1 GΩ, high impedance.

The simulation of the electrode compensation temperature is manually programmed in the range from -20°C to +150°C, while the temperature is measured in degrees Celsius or Fahrenheit.
The pH simulation values may be manually set as desired, in steps of 0.1 or 1 pH.
The mV simulation values may be manually set as desired, in steps of 1 or 10 mV.
The HD9609 is fed with an ordinary 9Vdc alkaline battery.
The electronics are housed in a sturdy ABS case with ergonomic lines.
In designing and making the instrument, each detail has been assessed and selected in order to provide an instrument with high performance and excellent long-term measurement stability.

TECHNICAL CHARACTERISTICS

pH simulation:	0÷14 pH
pH resolution:	0.1 pH
pH accuracy 20÷25°C:	0.002 pH
Thermal drift:	±0.0005 pH/°C from -5°C to 20°C and from 25°C to 50°
mV simulation:	±1999 mV
mV resolution:	1 mV
mV accuracy:	±100 µV
Thermal drift mV scale:	-199.9 ... +199.9: ±0.01 mV/°C from -5 to 20°C and from 25 to 50°C
mV thermal drift:	-1999 ... +1999: ±0.05 mV/°C from -5 to 20°C and from 25 to 50°C
Noise 0÷10 Hz:	1µV peak/peak
Simulation of compensation temperature:	-20 to 150°C (-4 to 302°F)
Output impedance:	100 KΩ 1%, 1GΩ 5% (no leading load capacity)
Display:	LCD 2 lines, 3 ½ digits. Figure height approx. 12.5 mm.
Symbols:	pH, mV, °C, °F, HI imp., LO imp., 0.1 pH, 1 pH, 1 mV, 10 mV
Signals:	LOU, ER1, CAL
Working temperature:	-5 to 50°C (23 to 122°F)
Power supply:	9 Vdc alkaline battery. Low battery indication.
Consumption (instrument only):	5 mA lit, 20 µA off
Autonomy:	about 200 hours
Dimensions:	187 x 72 x 38 mm.
Weight:	300 gr

ORDER CODES

HD 9609: Kit composed of the instrument HD 9609, adapter cables CP 9509BNC, CP 9509 T, carrying case
CP 9509BNC: Adapter cable L = 1 mt, male BNC connector on both ends
CP 9509 T: Adapter cable L = 1 mt, BNC connector on only one end
CP9509S7: Adapter cable L = 1 mt, BNC wall connector one end, S7 male connector on the other end.

DO 9403T-R1

DO 9403T-R1
pH/mV TRANSMITTER

The **DO 9403T-R1** pH transmitter converts the output of a pH electrode, with temperature compensation, into a signal at 4÷20 mA. The pH or Redox electrode input circuit is galvanically insulated against the 4÷20 mA output signal.
An LCD indicator allows viewing of the process signal value and of the various parameters. The accurate design and choice of components make the instrument precise and reliable for a long working life.
The instrument works with a pH or Redox electrode and a temperature probe (Pt100 sensor, 100 Ω at 0°C).

Key functions

PRG Programming of the parameters is activated by pressing the PRG key. The Δ symbol lights up on the display and the message P1 appears, indicating that the parameter P1 is being programmed. When the PRG key is pressed continuously, the messages P2, P3, P4, P5, P6, P7, P8, P9, P10 and the corresponding parameters are displayed in sequence. After P10 the instrument returns to normal function.
After the parameter concerned gas been displayed, it is possible to view its value by pressing the OK key. To change the parameter use the ▲ and ▼ keys. Press the OK key again to confirm the value of the parameter.

SET Key for setting the relay intervention threshold. The Δ symbol and the REL symbol appear on the display, fixed or flashing, indicating the switching on or off threshold of relay A or of relay B.

°C/°F - If this key is pressed it changes the temperature measuring unit to degrees Celsius or degrees Fahrenheit.
- When pressed together with the CAL key it activates the manual temperature setting function.
- If pressed during the pH calibration function it quits the calibration function without storing the calibration.

pH/mV - If this key is pressed it changes the measuring unit to mV or pH.
- When pressed together with the CAL key it activates the pH calibration function.

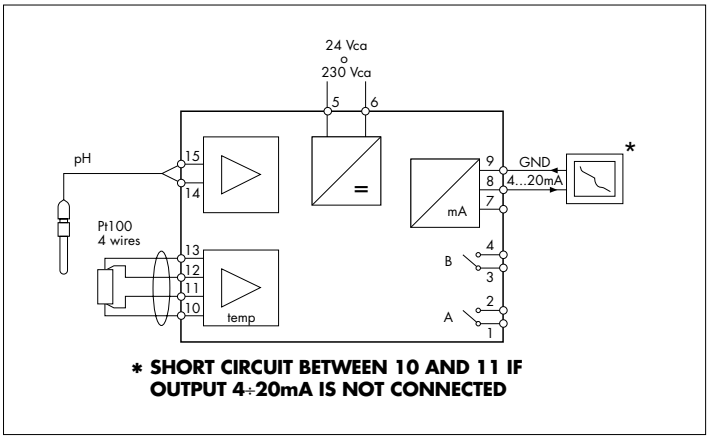


Fig.1 Active transmitter.

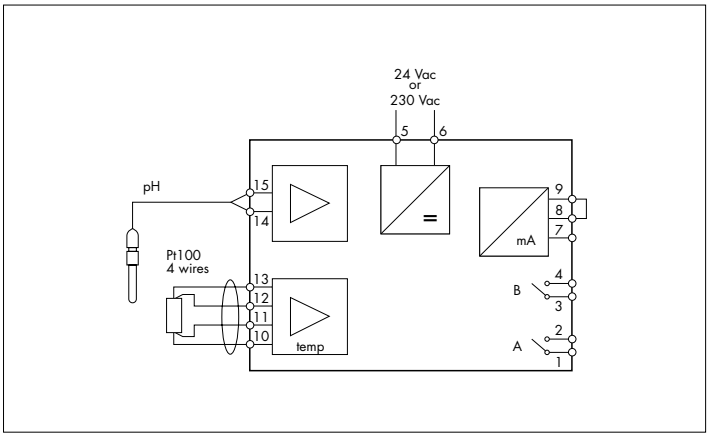


Fig.2 Active indicator.

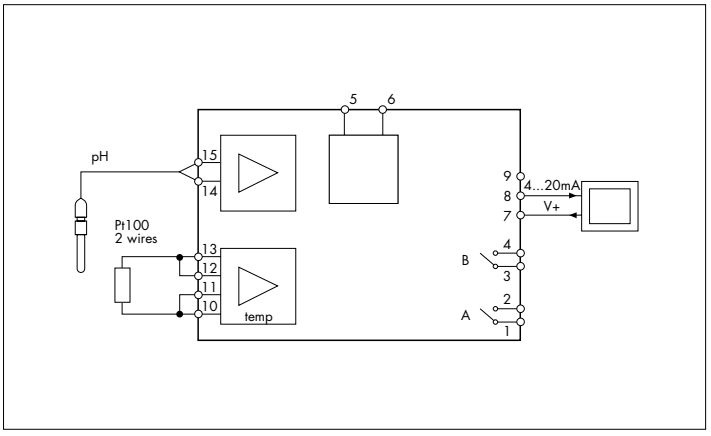


Fig.3 Passive transmitter.

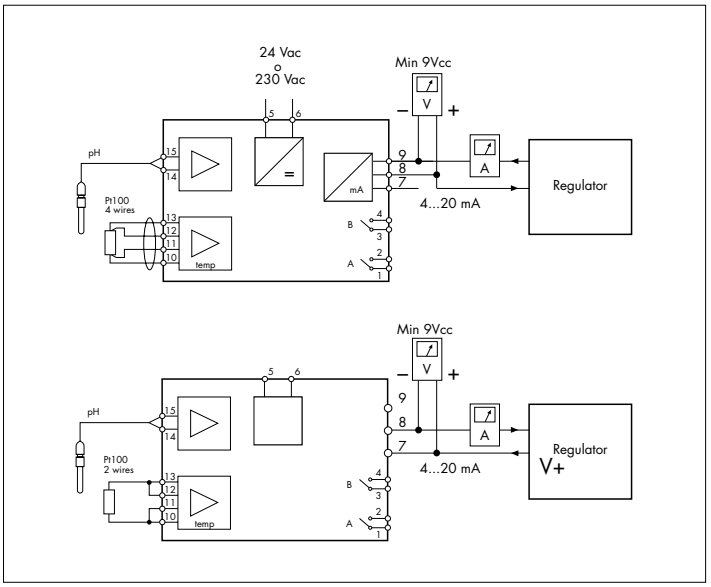


Fig.4

OK Confirms the programming parameters, or the relay SET values, and stores them.

CAL - When pressed together with the °C/°F key it activates the manual temperature setting function.
- When pressed together with the pH/mV key it activates the pH calibration function.
- Key used to confirm pH calibration and manual temperature setting.

▲ - Key for increasing the value displayed in the parameter programming phase.
- During the relay SET point programming phase.
- During the calibration phase.

▼ - Key for decreasing the value displayed in the parameter programming phase.
- During the relay SET point programming phase.
- During the calibration phase.

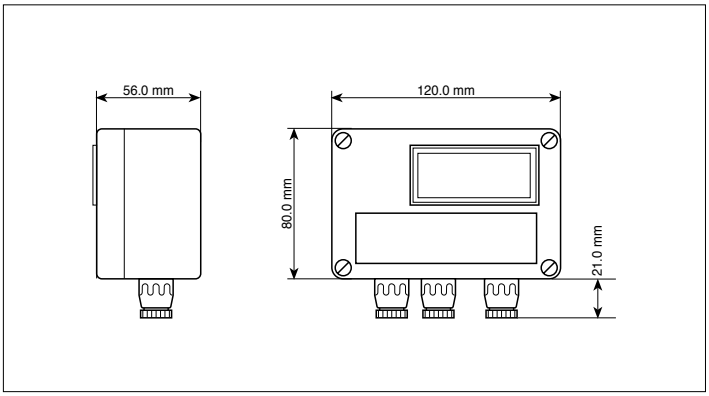
Setting the relay SET point
- Press the SET button; the Δ symbol appears on the display.
- The REL symbol and the letter A also light up on the display to indicate that the value shown corresponds to the switching on threshold of relay A.
- To change this value press the ▲ and ▼ keys.
- Press SET; the REL symbol flashes and the letter A remains lit to indicate that the value shown corresponds to the switching off threshold of relay A.
- To change this value press the ▲ and ▼ keys.
- Press the SET button; the REL symbol and the letter B light up to indicate that the value shown corresponds to the switching off threshold of relay B.
- To change this value press the ▲ and ▼ keys.
- Press SET; the REL symbol flashes and the letter B remains lit to indicate that the value shown corresponds to the switching off threshold of relay B.
- To change this value press the ▲ and ▼ keys.
- Press SET, the instrument stores the set parameters and returns to normal function. The REL and Δ symbols disappear.

NOTE: During the SET point setting phase (REL symbol lit or flashing) the instrument returns to normal function if no key is pressed for 2 minutes.

Manual temperature setting
If the temperature probe is not connected or if the probe is broken the measuring unit °C or °F flashes. In this case it is possible to set the temperature compensation value manually.
- Press the CAL key and the °C/°F key together; the Δ symbol appears and the manual temperature is shown with the measuring unit flashing.
- Using the ▲ and ▼ keys, set the temperature value corresponding to the temperature of the liquid in which you wish to measure the pH.
- Press CAL to confirm this value. The Δ symbol switches off and the instrument returns to the previous display.

Calibration of the pH electrode
Calibration of the offset of the pH electrode:
- Immerse the electrode in the buffer solution used for calibrating the offset (6.86 pH).
- Press the CAL key and the pH/mV key together; the Δ symbol lights up on the display.
- Using the ▲ and ▼ keys, adjust the pH value measured as a function of the liquid temperature.
- Press CAL to confirm this value. The Δ symbol switches off.

Calibration of the slope of the pH electrode:
- Immerse the electrode in the buffer solution used for calibrating the slope (4.01 or 9.18 pH).
- Press the CAL key and the pH/mV key together; the Δ symbol lights up on the display.



Dimensions

- Using the ▲ and ▼ keys, adjust the pH value measured as a function of the liquid temperature.
- Press CAL to confirm this value. The Δ symbol switches off.

NOTE: If you want to quit without storing the new calibration, press the °C/°F key.
N.B.: The instrument can automatically recognize three standard calibration solutions: 4.01 pH, 6.86 pH and 9.18 pH.

Programming the parameters

P1 Relay control unit and analog output, pH or mV.
P2 pH/mV value corresponding to 4 mA at output. May be set between -1.00 pH and 15.00 pH or between -1999 mV and +1999 mV.
P3 pH/mV value corresponding to 20 mA at output. May be set between -1.00 pH and 15.00 pH or between -1999 mV and +1999 mV.
P4 Delay time in the intervention of relay A. May be set between 0 and 250 seconds.
P5 Delay time in the intervention of relay B. May be set between 0 and 250 seconds.
P6 Calibration of Pt100 probe.
P7 4 mA output current calibration.
P8 20 mA output current calibration.
P9 Input voltage calibration.
P10 Display of the offset voltage value and of the slope value of the electrode.

To change one of these parameters press key PRG until the message corresponding to the parameter to be changed appears on the screen.
Press OK to show the value of the parameter.
Using the ▲ and ▼ keys, bring the parameter displayed to the desired value.
Press OK again to confirm.
Parameter P10 cannot be altered, it can only be displayed.
NOTE **P6-P7-P8-P9: calibration procedure to be carried out at a laboratory by skilled workers.**

Pt100 probe calibration (100 Ω at 0°C)
- Connect the Pt100 probe to the instrument. Press the PRG key until the message P6 appears on the display.
- Press the OK key; the currently measured temperature appears on the display.
- Immerse the Pt100 probe and a precision thermometer for reference in the zero calibration bath. Wait long enough for the reading to become stable.

Combined electrode input	pH	-1.00 pH...15.00 pH (-500...+500 mV)
	ORP	-1999...+1999 mV
	Input impedance	>10 Tohm
	Cable length	<50 metres screened (about 5 nF)
	Accuracy	0.1% of reading ±1 digit ±0.01% of pH per °C of temperature drift
Temperature input	Pt100 2/4 wires	-50...199.9°C
	Transducer energizing	0.5 mA DC
	Cable length	<10 metres unscreened <20 metres screened (about 2 nF)
	Accuracy	0.2°C ±0.1% of reading ±2 digits ±0.01°C/°C
pH electrode temp. compensation	Automatic	According to Nerst
Current output	4.00...20.00 mA	Programmable and proportional to the pH or mV value
	Accuracy	0.5% of reading ±0.02 mA
	Insulation	2500 Vac 1 minute
Relay output	A and B	Bistable, contact 3 A/230 Vac free potential
Power supply	Active	24 or 230 Vac -15/+10% 1 VA, 48...62 Hz, see fig. 1
	Passive	4÷20 mA, 2 wire configuration, 10÷35 V, see fig. 2
Temp.	Operation	0...50°C
	Storage	-20...70°C, no condensation
Case	External dimensions	120x80x56 mm
	Protection class	IP64

- Using the ▲ and ▼ keys, adjust the value of the temperature measured by the Pt100 probe so that it corresponds with the value on the reference thermometer.
- Immerse the Pt100 probe and a precision thermometer in the full scale calibration bath. Wait long enough for the reading to become stable.
- Using the ▲ and ▼ keys, adjust the value of the temperature measured by the Pt100 probe so that it corresponds with the value on the reference thermometer.
- Press OK to confirm. To quit programming, press PRG repeatedly.

N.B.: If the temperature shown by the instrument is between ±12°C, the instrument calibrates the probe offset, otherwise it calibrates the gain.

Calibrating the analog output
- Connect a precision milliammeter to the analog output.
- Press the PRG key until the message P7 appears on the display.
- Press OK; the message 4.0 appears on the display, indicating calibration at 4 mA.
- Using the ▲ and ▼ keys, adjust the value of the output current so as to have an indication of 4,00 mA on the precision milliammeter.
- Press the PRG key until the message P8 appears on the display.
- Press OK; the message 20.0 appears on the display, indicating calibration at 20 mA.
- Using the ▲ and ▼ keys, adjust the value of the output current so as to have an indication of 20,00 mA on the precision milliammeter.
- Press OK to confirm. To quit programming, press PRG repeatedly.

Calibrating the voltage input
- Press the PRG key until the message P9 appears on the display.
- Press OK; the mV value of the input appears on the display.
- Simulate a voltage of 0 mV at the input (if the value is between ±25 mV the zero is calibrated, otherwise the full scale value is calibrated).
- Using the ▲ and ▼ keys, adjust the voltage value so as to have the correct voltage value on the display.
- Press the SET key, the REL symbol lights up on the display indicating that the instrument is measuring the voltage present at the input using the second measurement scale.
- Using the ▲ and ▼ keys, adjust the voltage value so as to have the correct voltage value on the display.
- Press the SET key, the REL symbol on the display switches off.
- Simulate a voltage of 450 mV at the input, corresponding to the full scale value of the first scale.
- Using the ▲ and ▼ keys, adjust the voltage value so as to have the correct voltage value on the display.
- Simulate a voltage of 1800 mV at the input, corresponding to the full scale value of the second scale.
- Using the ▲ and ▼ keys, adjust the voltage value so as to have the correct voltage value on the display.
- Press OK to confirm. To quit programming, press PRG repeatedly.

Display

Symbol	description
°C	indicates that the value shown is in °C.
°F	indicates that the value shown is in °F.
pH	indicates that the unit of the value shown is pH.
mV	Indicates that the unit of the value shown is milli Volts.
A	indicates that the relay A is in closed status.
B	indicates that the relay B is in closed status.
REL	- indicates that the value shown corresponds to the closing thresholds of the contacts of relay A or B; - indicates that the offset of the second voltage measurement scale is being calibrated.
REL flashing	indicates that the value shown corresponds to the opening thresholds of the contacts of relay A or B.
Δ	- indicates that the instrument is in the parameter setting phase; - indicates that the closing and opening thresholds of relays A and B are being changed; - indicates that the manual compensation temperature is being changed; - indicates that the pH electrode is being calibrated.

Error signals

OFL - Warning which appears during measurement when the value to be displayed is out of scale.

E1 - Error warning which appears during pH calibration to indicate that the offset value of the electrode is too high in absolute value.

E2 - Error warning which appears during pH calibration to indicate that the difference between the mV readings given by the two buffer solutions used for calibration is too great.

E3 - Error warning which appears during pH calibration to indicate that the mV readings given by the two buffer solutions used for calibration are too close (about 50 mV at 25°C).

E4 - Reading error on the EEPROM.

E5 - Error warning indicating that the slope calculation gives a value 20% lower than the nominal value or gives a negative value.

E6 - Error warning indicating that the slope calculation gives a value 150% lower than the nominal value.

Order code

DO 9403T-R1: pH transmitter 4÷20 mA passive or active, power supply 24 Vac, 120x80x56 mm for use in the field.

HD 882 M100/300: Temperature probe with Pt100 sensor, miniature head, shaft Ø 6x300 mm.

HD 882 M100/600: Temperature probe with Pt100 sensor, DIN B head, shaft Ø 6x600 mm.

HD 8642: Buffer solution 4.01 pH.

HD 8672: Buffer solution 6.86 pH.

HD 8692: Buffer solution 9.18 pH.

HD 220: Buffer solution redox 220 mV

HD 468: Buffer solution redox 468 mV

HD62PT: Diaphragm cleaning (tiourea in HCl) - 500ml.

HD62PP: Protein cleaning (pepsin in HCl) - 500ml.

HD62RF: Regeneration (fluorhydric acid) - 100ml.

HD62SC: Solution for electrode preservation - 200ml

CP5: Extension cable. Connector S/wire - TERMINAL BOARD.

CP5/10: Extension cable L=10m.Connector BNC/S7.

CP5S: Extension cable L=5m. Connector BNC/S7.

CP5S/10: Extension cable L=10m. Connector BNC/S7.

KPI 10: Combined industrial electrode, S7 brass 1“ connector, glass body, Ag/AgCl sat KCl, Ø 12x120, temperature 0÷130°C, porous Teflon fitting.

KPI 11: Combined industrial electrode, S7 brass 1“ connector, Rytron body, Ag/AgCl sat KCl, temperature 0÷100°C, porous Teflon fitting.

KPI 12: Platinum electrode for Redox measurement,S PG13,5 connector, pressure 6 bar.

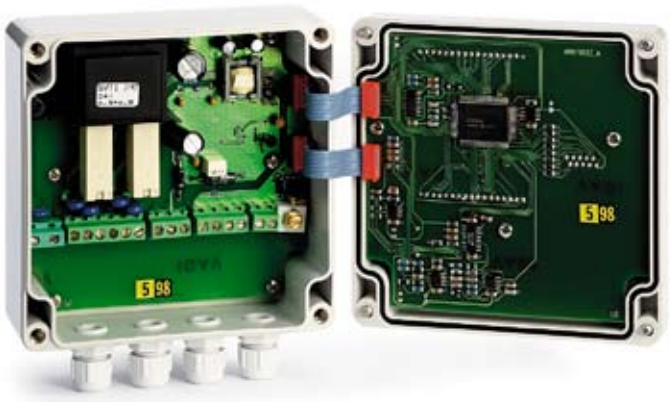
KPI 13: Platinum electrode for Redox measurement, Rytron body, S PG13,5 connector, Ag/AgCl sat KCl.

Electrode dimensions at page 351

DO 9785T
DO 9765T

DO 9785T - DO 9765T
pH TRANSMITTERS

DO 9785T/DO 9765T pH transmitters convert the output of a pH electrode, with temperature compensation, into a signal at 4÷20 mA. The pH electrode input circuit is galvanically insulated against the 4÷20 mA output signal.
An LCD indicator allows viewing of the process signal value and of the various parameters. The accurate design and choice of components make the instrument precise and reliable for a long working life.
The instrument works with a pH electrode or Redox and a temperature probe (Pt 100 sensor, 100 Ω at 0°C).



Technical characteristics

Combined electrode input	pH	-1,00 pH...15,00 pH (-500...+500 mV)
	ORP	-1999...+1999 mV
	Input impedance	>10 Tohm
	Cable length	<50 metres screened (about 5 nF)
	Accuracy	0.1% of reading ±1 digit ±0.01% pH per °C of drift in temperature
Temperature input	Pt100 2/4 wires	-50...199,9°C
	Transducer energizing	0,5 mA DC
	Cable length	<10 metres unscreened <50 metres screened (about 2 nF)
	Accuracy	0.2°C ±0.1% of reading ±2 digits ±0.01°C/°C
pH electrode compensation temperature	Automatic	According to Nernst
	Manual	-50÷200°C
Current output	4.00...20.00 mA	Programmable and proportional to the pH or mV value
	Accuracy	0.5% of reading ±0.02 mA
	Insulation	2500 Vac 1 minute
R Load	Load resistance	$R_{Lmax} = \frac{Vdc-10}{0,022}$ R_{Lmax} = 636 Ω @Vdc = 24 Vdc
Relay output	A and B	Bistable, contact 3A/230 Vac free potential
Power supply	Passive	4÷20 mA, 2 wire configuration, 10÷35 V, see fig. 2
	Active	24 or 230 Vac - 15/+10% 1 VA, 48...62 Hz, see fig. 1
DO 9765T case	External dimensions	120x122x56 mm
	Protection class	IP64
DO 9785T case	External dimensions	96x96x126 mm
	Protection class	IP54

Key functions

PRG Programming of the parameters is activated by pressing the PRG key plus the ▲ and ▼ keys. The message P1 appears on the display, indicating that the parameter P1 is being programmed. When the PRG key is pressed continuously, the messages P2, P3, P4, P5, P6, P7 and the corresponding parameters are displayed in sequence. After P7 the instrument returns to normal function.

SET Key for setting the relay intervention threshold. The ON or OFF symbol appears on the display, indicating the switching on or off threshold of relay A or of relay B.

°C/°F - If this key is pressed it changes the temperature measuring unit to degrees Celsius or degrees Fahrenheit.
- When pressed together with the CAL key it activates the manual temperature setting function.
- If pressed during the conductivity calibration function it quits the calibration function without storing the calibration.

pH/mV - If this key is pressed it changes the measuring unit to mV or pH.
- When pressed together with the CAL key it activates the pH calibration function.

OK Confirms the programming parameters, or the relay SET values, and stores them.

CAL - When pressed together with the °C/°F key it activates the manual temperature setting function.
- When pressed together with the pH/mV key it activates the pH calibration function.
- Key used to confirm pH calibration and manual temperature calibration.

▲ - Key for increasing the value displayed in the parameter programming phase.
- During the relay SET point programming phase.
- During the calibration phase.

▼ - Key for decreasing the value displayed in the parameter programming phase.
- During the relay SET point programming phase.
- During the calibration phase.

Setting the relay SET point
- Press the SET button; the ON symbol appears on the display with the letter A to indicate that the value shown corresponds to the switching on threshold of relay A.
- To change this value press the ▲ and ▼ keys.
- Press SET; the OFF symbol appears with the letter A to indicate that the switching off threshold of relay A is being displayed.
- To change this value press the ▲ and ▼ keys.
- Press the SET button; the ON symbol appears on the display with the letter B to indicate that the value shown corresponds to the switching on threshold of relay B.
- To change this value press the ▲ and ▼ keys.
- Press SET; the OFF symbol appears with the letter B to indicate that the switching off threshold of relay B is being displayed.
- To change this value press the ▲ and ▼ keys.
- Press SET, the instrument stores the values and returns to normal function.

NOTE: During the SET point setting phase (symbols ON or OFF lit) the instrument returns to normal function if no key is pressed for 2 minutes.

Temperature setting for manual compensation
If the temperature probe is not connected or if the probe is broken the measuring unit °C or °F flashes. In this case it is possible to set the temperature compensation value manually.
- Press the CAL key and the °C/°F key together; the message CAL appears at the bottom of the display.
- Using the ▲ and ▼ keys, set the temperature value corresponding to the temperature of the liquid in which you wish to measure the pH value.
- Press CAL to confirm this value. The message CAL disappears.

Calibration of the DO 9785T/DO 9765T with pH electrode
Calibration of the offset of the pH electrode:
- Immerse the electrode in the buffer solution used for calibrating the offset (6.86 pH).
- Press the CAL key and the pH/mV key together; the message CAL appears at the top of the display.
- Using the ▲ and ▼ keys, adjust the pH value measured as a function of the liquid temperature.
- Press CAL to confirm this value. The message CAL disappears.

Calibration of the slope of the pH electrode:
- Immerse the electrode in the buffer solution used for calibrating the slope (4.01 or 9.18 pH).
- Press the CAL key and the pH/mV key together; the message CAL appears at the top of the display.
- Using the ▲ and ▼ keys, adjust the pH value measured as a function of the liquid temperature.
- Press CAL to confirm this value. The message CAL disappears.

NOTE: If you want to quit without storing the new calibration, press the °C/°F key.
N.B.: The instrument can automatically recognize three standard calibration solutions: 4.01 pH, 6.86 pH and 9.18 pH.

Programming the parameters
P1 Relay control unit and analog output, pH or mV.
P2 pH/mV value corresponding to 4 mA at output. May be set between -1.00 pH and 15.00 pH or between -1999 mV and +1999 mV.
P3 pH/mV value corresponding to 20 mA at output.. May be set between -1.00 pH and 15.00 pH or between -1999 mV and +1999 mV.
P4 Delay time in the intervention of relay A. May be set between 0 and 255 seconds.
P5 Delay time in the intervention of relay B. May be set between 0 and 255 seconds.
P6 Calibration of Pt100 probe, calibration of output in current, calibration of output in voltage. **(Calibration procedure to be carried out at a laboratory by skilled personnel).**
P7 Display of the offset voltage value and of the slope value of the electrode.
To change one of these parameters press key PRG until the message corresponding to the parameter to be changed appears on the screen. Using the ▼ and ▲ keys, bring the parameter displayed to the desired value. Press OK to confirm.
Parameter P7 cannot be altered.

Calibrating the voltage input (calibration procedure to be carried out at a laboratory by skilled workers)
- Press the PRG key until the message **P6** appears on the display.
- Press the **CAL key four times**; the message CAL appears at the top of the display and the mV value of the input at the bottom.
- Simulate a voltage of 0 mV at the input (if the value is between ±25 mV the zero is calibrated, otherwise the full scale value is calibrated).
- Using the ▲ and ▼ keys, adjust the voltage value so as to have the correct voltage value on the display.
- Press the **SET** button, the **ON** symbol appears on the display to indicate that the instruments is measuring the voltage of the input using the second scale of measurement.

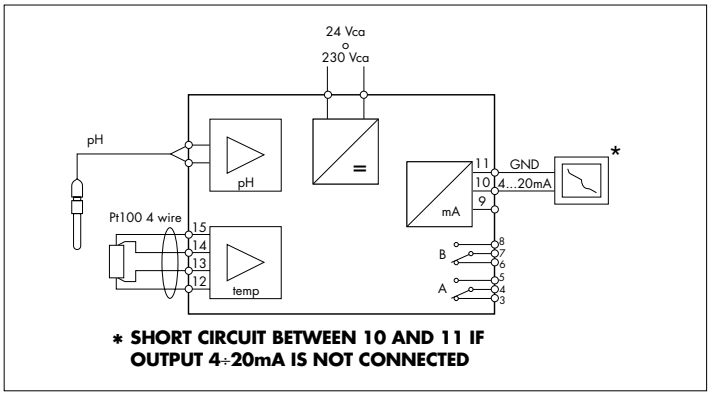


Fig.1 Active transmitter.

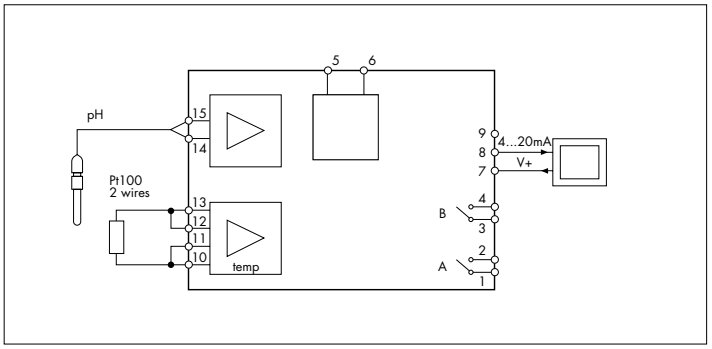


Fig.2 Passive transmitter.

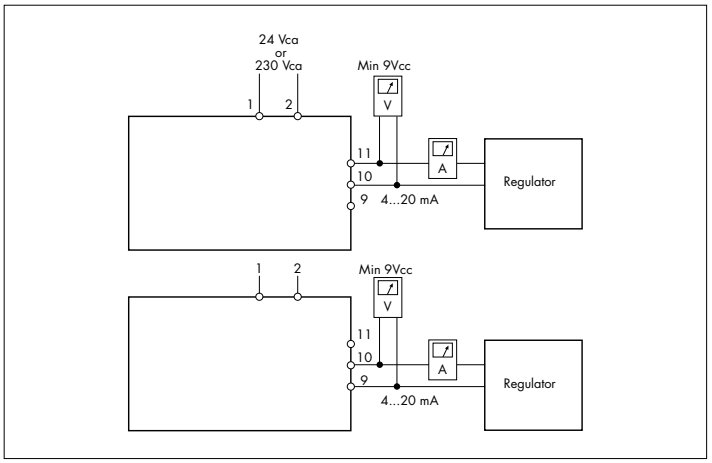
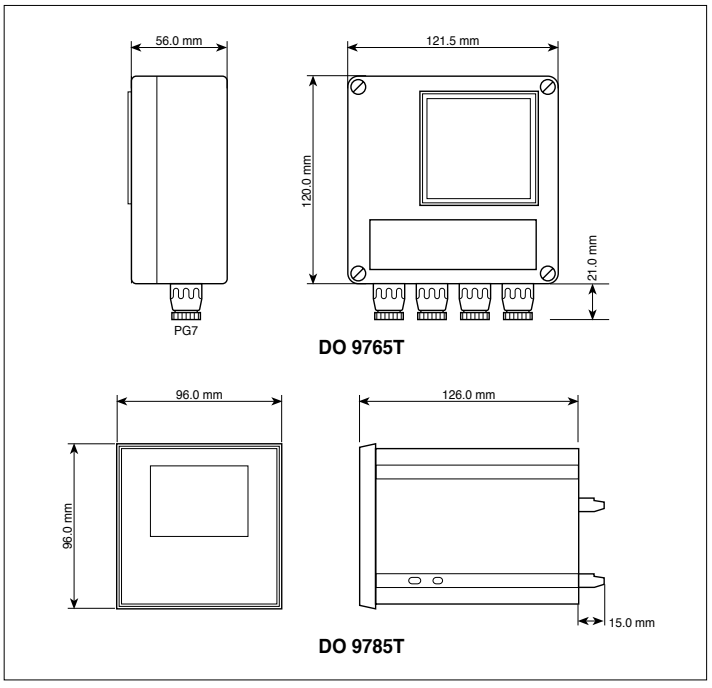


Fig.3



Dimensions

- Using the ▲ and ▼ keys adjust the voltage value so as to have the correct voltage value on the display.
- Press the set button, on the display the symbol **ON** disappears
- Simulate a voltage of 450 mV at the input, corresponding to the full value of the first scale.
- Using the ▲ and ▼ keys, adjust the voltage value so as to have the correct voltage value on the display.
- Simulate a voltage of 1800 mV at the input, corresponding to the full value of the second scale.
- Using the ▲ and ▼ keys, adjust the voltage value so as to have the correct voltage value on the display.
- Press OK to confirm.

Pt100 probe calibration (100 Ω at 0°C) (calibration procedure to be carried out at a laboratory by skilled workers)
- Connect the Pt100 probe to the instrument. Press the PRG key until the message **P6** appears on the display.
- Press the CAL key; the message CAL appears at the bottom of the display and the temperature is shown at the top.
- Immerse the Pt100 probe and a precision thermometer for reference in the zero calibration bath. Wait long enough for the reading to become stable.
- Using the ▲ and ▼ keys, adjust the value of the temperature measured by the Pt100 probe so that it corresponds with the value on the reference thermometer.
- Immerse the Pt100 probe and a precision thermometer in the full scale calibration bath. Wait long enough for the reading to become stable.
- Using the ▲ and ▼ keys, adjust the value of the temperature measured by the Pt100 probe so that it corresponds with the value on the reference thermometer.
- Press OK to confirm.

N.B.: If the temperature shown by the instrument is between ±12°C, the instrument calibrates the probe offset, otherwise it calibrates the gain.

Calibrating the analog output (calibration procedure to be carried out at a laboratory by skilled workers)
- Press the PRG key until the message **P6** appears on the display.
- Connect a precision milliammeter to the analog output.
- Press the **CAL key twice**; the message CAL appears at the top of the display and the message 4.0 at the bottom, indicating calibration at 4 mA.
- Using the ▲ and ▼ keys, adjust the value of the output current so as to have an indication of 4.0 mA on the precision milliammeter.
- Press the CAL key; the message CAL appears at the top of the display and the message 20.0 at the bottom, indicating calibration at 20 mA.
- Using the ▲ and ▼ keys, adjust the value of the output current so as to have an indication of 20.0 mA on the precision milliammeter.
- Press OK to confirm.

Display

Symbol	description
°C	the value shown is in °C.
°F	the value shown is in °F.
pH	the unit of the value shown is pH.
mV	the unit of the value shown is milli Volts.
A	the relay A is in closed status.
B	the relay B is in closed status.
ON	the value shown corresponds to the closing thresholds of the contacts of relay A or B.
OFF	the value shown corresponds to the opening thresholds of the contacts of relay A or B.

Error signal

OFL - Warning which appears during measurement when the value to be displayed is out of scale.

E1 - Error warning which appears during pH calibration to indicate that the offset value of the electrode is too high in absolute value.

E2 - Error warning which appears during pH calibration to indicate that the difference between the mV readings given by the two buffer solutions used for calibration is too great.

E3 - Error warning which appears during pH calibration to indicate that the mV readings given by the two buffer solutions used for calibration are too close (about 50 mV at 25°C).

E4 - Reading error on the EEPROM.

E5 - Error warning indicating that the slope calculation gives a value 20% lower than the nominal value or gives a negative value.

E6 - Error warning indicating that the slope calculation gives a value 150% higher than the nominal value.

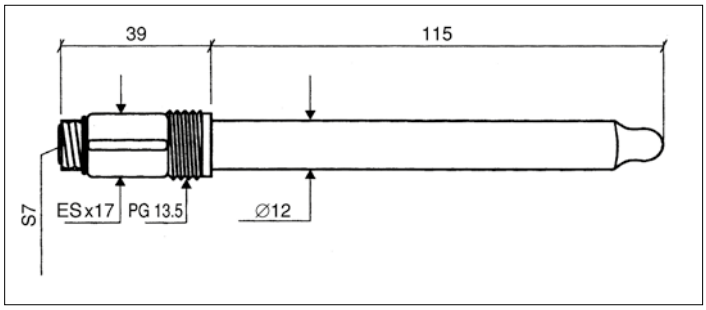
Order code

DO 9785T: pH transmitter 4÷20 mA passive or active, power supply 24 Vac with double display 96x96 mm, for panel mounting.

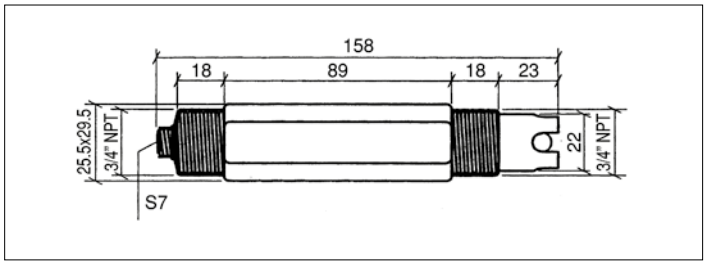
DO 9765T: pH transmitter 4÷20 mA passive or active, power supply 24 Vac with double display 122x120, for use on the field.

HD 882 M100/300: Temperature probe with Pt100 sensor, miniature head, shaft Ø6x300 mm.

HD 8642: Buffer solution 4.01 pH.
HD 8672: Buffer solution 6.86 pH.
HD 8692: Buffer solution 9.18 pH.
HDR 220: Buffer solution Redox 220 mV 0,5l.
HDR 468: Buffer solution Redox 468 mV 0,5l.
HD62PT: Diaphragm cleaning (tiourea in HCl) - 500ml.
HD62PP: Protein cleaning (pepsin in HCl) - 500ml.
HD62RF: Regeneration (fluorhydric acid) - 100ml.
HD62SC: Solution for electrode preservation - 200ml.
CP5/10: Extension cable for connecting the electrode to the DO9403T or to the DO9765T (S7-wire-TERMINAL BOARD) L=10m.
CP5: Extension for connecting the electrode to the DO 9403T-R1 or to the DO 9765T (S7-wire-TERMINAL BOARD) L=5m.
CP5S: Extension for connecting the electrode to the DO 9785T (BNC-S7) L=5m.
CP5S/10: Extension cable L=10m. Connector BNC/S7.
KPI 10: Combined industrial electrode, S7 PG13.5 connector, refillable, glass body, Ag/AgCl sat KCl Ø12x120 mm, temperature 0÷130°C, porous Teflon fitting.
KPI 11: Combined industrial electrode, S7 brass 1" connector, refillable, Rytron body, Ag/AgCl sat KCl, temperature 0÷100°C, porous Teflon fitting.
KPI 12: Platinum electrode for Redox measurement,S PG13,5 connector, pressure 6 bar.
KPI 13: Platinum electrode for Redox measurement, Rytron body, S PG13,5 connector, Ag/AgCl sat KCl.



KPI 10 0…14 pH/ **KPI 12 Redox** ±1999 mV, 0…130°C



KPI 11 0…14 pH / **KPI 13 Redox** ±1999 mV, 0…100°C

HD 2106.1
HD 2106.2

HD 2106.1, HD 2106.2
CONDUCTIVITY METERS - THERMOMETERS

The **HD2106.1** and **HD2106.2** are portable instruments with a large LCD display. They measure conductivity, liquid resistivity, total dissolved solids (TDS), and salinity using combined 4-ring and 2-ring conductivity/temperature probes. Temperature only is measured by Pt100 or Pt1000 immersion, penetration or contact probes.
The probe calibration can be performed automatically in one or more than one of the 147µS, 1413µS, 12880µS or 111800µS/cm conductivity calibration solutions.
The temperature probes are equipped with an automatic recognition module and factory calibration data are stored inside. The HD2106.2 is a **datalogger**. It memorizes up to 36,000 conductivity and temperature samples which can be transferred from the instrument connected to a PC via the multi-standard RS232C serial port and USB 2.0. The storing interval, printing, and baud rate can be configured using the menu. The HD2106.1 and HD2106.2 models are fitted with an RS232C serial port and can transfer to a PC the acquired measurements or to a portable printer in real time. The *Max, Min* and *Avg* function calculates the maximum, minimum or average values. Other functions include: the relative measurement REL, the Auto-HOLD function, and the automatic turning off which can also be excluded.
The instruments have IP67 protection degree.

HD40.1

SWD10

INSTRUMENT TECHNICAL CHARACTERISTICS
Measured quantities: χ, Ω, TDS, Nacl, °C, °F

Instrument

Dimensions (Length x Width x Height)	185x90x40mm
Weight	470g (complete with batteries)
Materials	ABS, rubber
Display	2x4½ digits plus symbols Visible area: 52x42mm

Operating conditions

Working temperature	-5…50°C
Storage temperature	-25…65°C
Working relative humidity	0…90%RH without condensation
Protection degree	**IP67**

Power

Batteries	4 1.5V type AA batteries
Autonomy	200 hours with 1800mAh alkaline batteries
Power absorbed with instrument off	20µA
Mains	Output mains adapter 12Vdc / 1A

Security of memorized data	Unlimited, independent of battery charge conditions

Time

Date and time	Schedule in real time
Accuracy	1min/month max error

*Measured values storage - model **HD2106.2***

Type	2000 pages containing 18 samples each
Quantity	36000 pairs of measurements [χ-°C], [Ω-°C], [TDS-°C] or [Sal-°C]
Selectable storage interval	1s, 5s, 10s, 15s, 30s, 60s (1min), 120s (2min), 300s (5min), 600s (10min), 900s (15min), 1200s (20min), 1800s (30min) and 3600s (1hour)

Serial interface RS232C

Type	RS232C electrically isolated
Baud rate	Can be set from 1200 to 38400 baud
Data bit	8
Parity	None
Stop bit	1
Flow Control	Xon/Xoff
Serial cable length	Max 15m
Selectable print interval	1s, 5s, 10s, 15s, 30s, 60s (1min), 120s (2min), 300s (5min), 600s (10min), 900s (15min), 1200s (20min), 1800s (30min) and 3600s (1hour)

*USB interface - model **HD2106.2***

Type	1.1 - 2.0 electrically isolated

Connections

Conductivity input	8-pole male DIN45326 connector
Input module for the temperature probes	8-pole male DIN45326 connector
Serial interface and USB	8-pole MiniDin connector
Mains adapter	2-pole connector (positive at centre)

Measurement of conductivity		*Resolution*
Measuring range Kcell=0.1	0.00…19.99µS/cm	0.01µS/cm
Measuring range Kcell=1	0.0…199.9µS/cm	0.1µS/cm
	200…1999µS/cm	1µS/cm
	2.00…19.99mS/cm	0.01mS/cm
	20.0…199.9mS/cm	0.1mS/cm
Measuring range Kcell=10	200…1999mS/cm	1mS/cm
Accuracy (conductivity)	±0.5%1digit	

Measurement of resistivity

		Resolution
Measuring range	till 100MΩ·cm/(*)	
Kcell=0.1		
Measuring range	5.0…199.9Ω·cm	0.1Ω·cm
Kcell=1	200…999Ω·cm	1Ω·cm
	1.00k…19.99kΩ·cm	0.01kΩ·cm
	20.0k…99.9kΩ·cm	0.1kΩ·cm
	100k…999kΩ·cm	1kΩ·cm
	1…10MΩ·cm	1MΩ·cm
Measuring range	0.5…5.0Ω·cm	0.1Ω·cm
Kcell=10		
Accuracy (resistivity)	±0.5%±1digit	

Measurement of total dissolved solids (with coefficient χ/TDS=0.5)

Measuring range	0.00…19.99mg/l	0.05mg/l
Kcell=0.1		
Measuring range	0.0…199.9mg/l	0.5mg/l
Kcell=1	200…1999mg/l	1mg/l
	2.00…19.99g/l	0.01g/l
	20.0…99.9g/l	0.1g/l
Measuring range	100…999g/l	1g/l
Kcell=10		
Accuracy (conductivity)	±0.5%1digit	

Measurement of salinity

		Resolution
Measurement range	0.000…1.999g/	l 1mg/l
	2.00…19.99g/l	10mg/l
	20.0…199.9g/l	0.1g/l
Accuracy (salinity)	±0.5%1digit	

Measurement of temperature

Pt100 measuring range	-50…+200°C
Pt1000 measuring range	-50…+200°C
Resolution	0.1°C
Accuracy	±0.25°C
Drift after 1 year	0.1°C/year

Temperature compensation

automatic/manual	0…100°C with α_T selectable from 0.00 to 4.00%/°C
Reference temperature	20°C or 25°C
χ / TDS Conversion factor	0.4…0.8
Cell constant K (cm-1)	0.1, 0.7, 1.0 and 10.0

Standard solutions automatically detected @25°C

147µS/cm
1413µS/cm
12880µS/cm
111800µS/cm

Preset cell constant values: *K=0,01 - K=0,1 - K=1, K=10*

K cell = 0.01 cm^{-1}		K cell = 0.1 cm^{-1}	
Conductivity (µS/cm)	Resistivity (MΩ·cm)	Conductivity (µS/cm)	Resistivity(MΩ·cm)
0.001 µS/cm	1000 MΩ·cm	0.01 µS/cm	100 MΩ·cm
0.002 µS/cm	500 MΩ·cm	0.02 µS/cm	50 MΩ·cm
0.003 µS/cm	333 MΩ·cm	0.03 µS/cm	33 MΩ·cm
0.004 µS/cm	250 MΩ·cm	0.04 µS/cm	25 MΩ·cm
…	…	…	…

(*) The resistivity measurement is obtained from the reciprocal of conductivity measurement. Close to the bottom of the scale, the indication of resistivity appears like reported in the table below:

4 wire Pt100 and 2 wire Pt1000 Temperature probes

Model	Type	Working range	Accuracy
TP47.100	**Pt100 4 wires**	**-50…+200°C**	**Class A**
TP47.1000	**Pt1000 2 wires**	**-50…+200°C**	**Class A**
TP87.100	**Pt100 4 wires**	**-50…+200°C**	**Class A**
TP87.1000	**Pt1000 2 wires**	**-50…+200°C**	**Class A**

Temperature drift @20°C 0.005%/°C

ORDER CODES

HD2106.1: The kit is composed of: instrument HD2106.1, 4 1.5V alkaline batteries, operating manual, case and DeltaLog9 software.

HD2106.2: The kit is composed of: instrument HD2106.2 **datalogger**, 4 1.5V alkaline batteries, operating manual, case and DeltaLog9 software.

Conductivity probes, temperature probes, standard calibration solutions, cables for data transfer to PC or printer have to be ordered separately.

HD2110CSNM: 8-pole connection cable MiniDin - Sub D 9-pole female for RS232C.

C.206: Serial connection cable with USB connector for PC and 8-pole MiniDin male connector for the instrument

HD2101/USB: Connection cable USB 2.0 connector type A - 8-pole MiniDin (not suitable for HD2106.1K).

DeltaLog9: Software for download and management of the data on PC using Windows 98 to Vista operating systems.

SWD10: Stabilized power supply 100-240 Vac/12Vdc-1A mains voltage

HD40.1: 24-column portable thermal printer, serial interface, 57mm paper width, four NiMH 1.2V rechargeable batteries, SWD10 power supply, instruction manual, 5 thermal paper rolls.

RCT: The kit includes 4 thermal paper rolls 57mm wide and 32mm in diameter.

BAT-40: Spare battery pack for HD40.1 printer with built-in temperature sensor.

HD22.2: Laboratory electrode holder composed of base plate with built-in magnetic stirrer, shaft and replaceable electrode holder. Suitable diameter 12mm. Powered by bench-top meters of the series HD22…with cable HD22.2.1 (optional) or power supplier SWD10 (optional).

HD22.3: Laboratory electrode holder composed of base plate. Flexible arm for free positioning. Suitable for electrodes with diameter 12mm.

Standard conductivity calibration solutions

HD8747: Standard calibration solution 0.001mol/l equal to 147µS/cm @25°C, 200cc.

HD8714: Standard calibration solution 0.01mol/l equal to 1413µS/cm @25°C, 200cc.

HD8712: Standard calibration solution 0.1mol/l equal to 12880µS/cm @25°C, 200cc.

HD87111: Standard calibration solution 1mol/l equal to 111800µS/cm @25°C, 200cc.

Temperature probes complete with SICRAM module

TP87: PT100 sensor immersion probe. Stem Ø 3 mm, length 70 mm. Cable length 1 m.

TP472I.0: Pt100 sensor immersion probe. Stem Ø 3 mm, length 230 mm. Cable length 2 m.

TP473P.0: Pt100 sensor penetration probe. Stem Ø 4mm, length 150 mm. Cable length 2 m.

TP474C.0: Pt100 sensor contact probe. Stem Ø 4mm, length 230mm, contact surface Ø 5mm. Cable length 2 m.

TP475A.0: Air probe, sensor Pt100. Stem Ø 4mm, length 230mm. Cable length 2 m.

TP472I.5: Immersion probe, sensor Pt100. Stem Ø 6mm, length 500 mm. Cable length 2 m.

TP472I.10: Immersion probe, sensor Pt100. Stem Ø 6mm, length 1,000mm. Cable length 2 m.

Temperature probes without SICRAM module

TP87.100: Pt100 sensor immersion probe. Probe's stem Ø 3mm, length 70mm. 4 wire connection cable with connector, length 1 m.

TP87.1000: Pt1000 sensor immersion probe. Probe's stem Ø 3mm, length 70mm. 2-wire connection cable with connector, length 1 m.

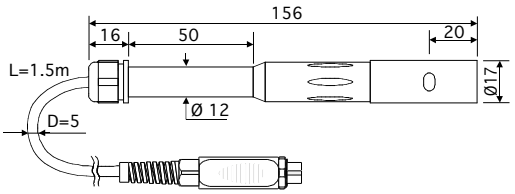
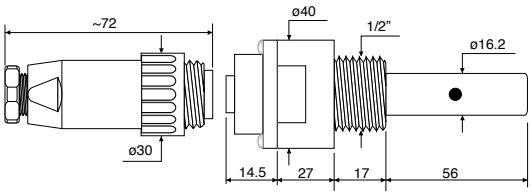
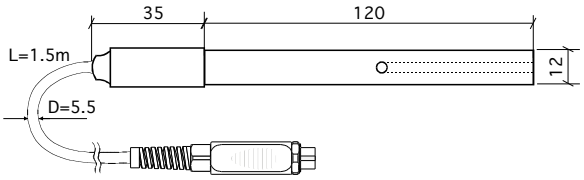
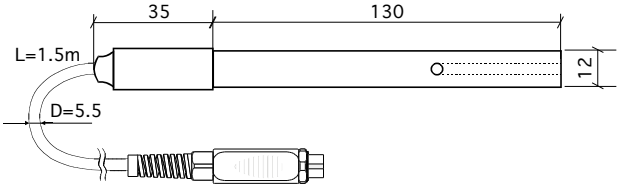
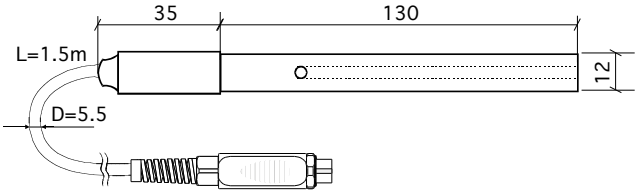
TP47: Module for the connection of Pt100 4-wire and Pt1000 2-wire probes

Conductivity probes

Please see the order codes reported in the probes' technical specifications.

TECHNICAL DATA OF PROBES AND MODULES EQUIPPED WITH INSTRUMENT

2 and 4 electrode conductivity probes

ORDER CODE	MEASUREMENT RANGE	DIMENSIONS
SP06T	K=0.7 5µS…200mS/cm 0…90°C 4-electrode cell in Pocan/Platinum	
SPT 400.001 **not suitable for** **HD 2306.0**	K=0.01 0,05…19,9µS/cm 2-electrode cell AISI 316 - Teflon	
SPT01G	K=0.1 0.1µS…500µS/cm 0…80°C 2-electrode cell in Glass/Platinum	
SPT1G	K=1 10µS…10mS/cm 0…80°C 2-electrode cell in Glass/Platinum	
SPT10G	K=10 500µS…200mS/cm 0…80°C 2-electrode cell in Glass/Platinum	

HD 2306.0

HD 2306.0
CONDUCTIVITY METER - THERMOMETER

The **HD2306.0** is a portable instrument with a large LCD display. It measures conductivity, liquid resistivity, total dissolved solids (TDS), and salinity using combined 4-ring and 2-ring conductivity/temperature probes. Temperature only is measured by Pt100 or Pt1000 immersion, penetration or contact probes. The probe calibration can be performed automatically in one or more than one of the 147µS, 1413µS, 12880µS or 111800µS/cm conductivity calibration solutions. TThe temperature probes are equipped with an automatic recognition module and factory calibration data are stored inside.
The *Max, Min* and *Avg* function calculates the maximum, minimum or average values.
Other functions include: the relative measurement REL, the Auto-HOLD function, and the automatic turning off which can also be disabled.
The instrument has IP67 protection degree.

INSTRUMENT TECHNICAL CHARACTERISTICS
Measured quantities: χ, Ω, TDS, °C, °F

Instrument	
Dimensions	
(Length x Width x Height)	140x88x38mm
Weight	160g (complete with batteries)
Materials	ABS
Display	2x4½ digits plus symbols Visible area: 52x42mm
Operating conditions	
Working temperature	-5…50°C
Storage temperature	-25…65°C
Working relative humidity	0…90%RH without condensation
Protection degree	**IP67**
Power	
Batteries	3 1.5V type AA batteries
Autonomy	200 hours with 1800mAh alkaline batteries
Power absorbed with instrument off	< 20µA

Connections		
Conductivity input/temperature probes	8-pole male DIN45326 connector	
Measurement of conductivity		*Resolution*
Measuring range	0.00…19.99µS/cm	0.01µS/cm
Kcell=0.1		
Measuring range	0.0…199.9µS/cm	0.1µS/cm
Kcell=1	200…1999µS/cm	1µS/cm
	2.00…19.99mS/cm	0.01mS/cm
	20.0…199.9mS/cm	0.1mS/cm
Measuring range	200…1999mS/cm	1mS/cm
Kcell=10		
Accuracy (conductivity)	*±0.5%1digit*	
Measurement of resistivity		
Measuring range	till 100MΩ·cm/(*)	
Kcell=0.1		
Measuring range	5.0…199.9Ω·cm	0.1Ω·cm
Kcell=1	200…999Ω·cm	1Ω·cm
	1.00k…19.99kΩ·cm	0.01kΩ·cm
	20.0k…99.9kΩ·cm	0.1kΩ·cm
	100k…999kΩ·cm	1kΩ·cm
	1…10MΩ·cm	1MΩ·cm
Measuring range	0.5…5.0Ω·cm	0.1Ω·cm
Kcell=10		
Accuracy (resistivity)	*±0.5%±1digit*	
Measurement of salinity		*Resolution*
Measurement range	0.000…1.999g/	l 1mg/l
	2.00…19.99g/l	10mg/l
	20.0…199.9g/l	0.1g/l
Accuracy (salinity)	*±0.5%1digit*	
Measurement of total dissolved solids (with coefficient χ/TDS=0.5)		
Measuring range	0.00…19.99mg/l	0.05mg/l
Kcell=0.1		
Measuring range	0.0…199.9mg/l	0.5mg/l
Kcell=1	200…1999mg/l	1mg/l
	2.00…19.99g/l	0.01g/l
	20.0…99.9g/l	0.1g/l
Measuring range	100…999g/l	1g/l
Kcell=10		
Accuracy (conductivity)	±0.5%±1digit	
Measurement of temperature		
Pt100 measuring range	-50…*+200°C*	
Pt1000 measuring range	-50…*+200°C*	
Resolution	*0.1°C*	
Accuracy	*±0.25°C*	
Drift after 1 year	*0.1°C/year*	
Temperature compensation		
automatic/manual	0…*100°C* with α_T selectable from 0.00 to *4.00%/°C*	
Reference temperature	*20°C or 25°C*	
χ / TDS Conversion factor	0.4…0.8	
Cell constant K (cm⁻¹)	0.1, 0.7, 1.0 and 10.0	
Standard solutions automatically detected @25°C		
	147µS/cm	
	1413µS/cm	
	12880µS/cm	
	111800µS/cm	
Preset cell constant values:	K=0,01 - K=0,1 - K=1, K=10	

(*) The resistivity measurement is obtained from the reciprocal of conductivity measurement. Close to the bottom of the scale, the indication of resistivity appears like reported in the table below:

K cell = 0.1 cm^{-1}	
Conductivity (µS/cm)	**Resistivity (MΩ·cm)**
0.01 µS/cm	100 MΩ·cm
0.02 µS/cm	50 MΩ·cm
0.03 µS/cm	33 MΩ·cm
0.04 µS/cm	25 MΩ·cm

4 wire Pt100 and 2 wire Pt1000 Temperature probes

Model	Type	Working range	Accuracy
TP47.100	**Pt100 4 wires**	**-50…+200°C**	**Class A**
TP47.1000	**Pt1000 2 wires**	**-50…+200°C**	**Class A**
TP87.100	**Pt100 4 wires**	**-50…+200°C**	**Class A**
TP87.1000	**Pt1000 2 wires**	**-50…+200°C**	**Class A**

Temperature drift @20°C 0.005%/°C

ORDER CODES

HD2306.0K: The kit is composed of: instrument HD2306.0, 3 1.5V alkaline batteries, operating manual, case. **Other conductivity probes, temperature probes, calibration solutions must be ordered separately.**

HD22.2: Laboratory electrode holder composed of base plate with built-in magnetic stirrer, shaft and replaceable electrode holder. Suitable diameter 12mm. Powered by bench-top meters of the series HD22…with cable HD22.2.1 (optional) or power supplier SWD10 (optional).

HD22.3: Laboratory electrode holder composed of base plate. Flexible arm for free positioning. Suitable for electrodes with diameter 12mm.

Conductivity probes

Please see the order codes reported in the probes' technical specifications.

Standard conductivity calibration solutions

HD8747: Standard calibration solution 0.001mol/l equal to 147µS/cm @25°C, 200cc.
HD8714: Standard calibration solution 0.01mol/l equal to 1413µS/cm @25°C, 200cc.
HD8712: Standard calibration solution 0.1mol/l equal to 12880µS/cm @25°C, 200cc.
HD87111: Standard calibration solution 1mol/l equal to 111800µS/cm @25°C, 200cc.

Temperature probes complete with SICRAM module

TP87: PT100 sensor immersion probe. Stem Ø 3 mm, length 70 mm. Cable length 1 m.
TP472I.0: Pt100 sensor immersion probe. Stem Ø 3 mm, length 230 mm. Cable length 2 m.
TP473P.0: Pt100 sensor penetration probe. Stem Ø 4mm, length 150 mm. Cable length 2 m.
TP474C.0: Pt100 sensor contact probe. Stem Ø 4mm, length 230mm, contact surface Ø 5mm. Cable length 2 m.
TP475A.0: Air probe, sensor Pt100. Stem Ø 4mm, length 230mm. Cable length 2 m.
TP472I.5: Immersion probe, sensor Pt100. Stem Ø 6mm, length 500 mm. Cable length 2 m.
TP472I.10: Immersion probe, sensor Pt100. Stem Ø 6mm, length 1,000mm. Cable length 2 m.

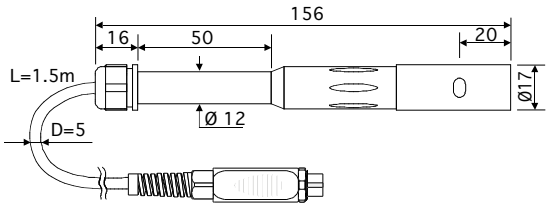
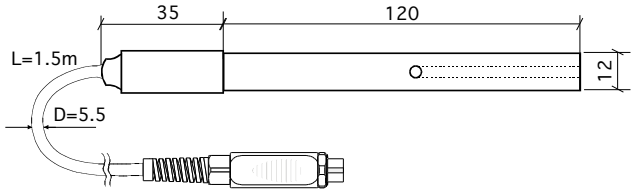
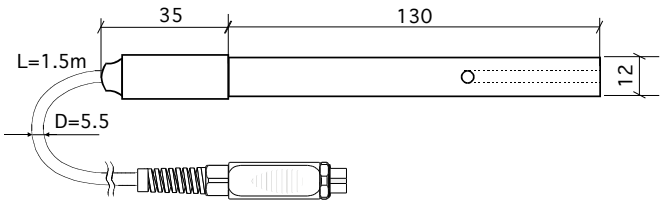
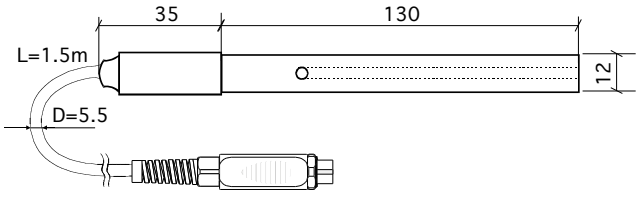
Temperature probes without SICRAM module

TP87.100: Pt100 sensor immersion probe. Probe's stem Ø 3mm, length 70mm. 4 wire connection cable with connector, length 1 m.
TP87.1000: Pt1000 sensor immersion probe. Probe's stem Ø 3mm, length 70mm. 2-wire connection cable with connector, length 1 m.
TP47: Module for the connection of Pt100 4-wire and Pt1000 2-wire probes.

HD8747 **HD8714** **HD8712** **HD8711**

TECHNICAL DATA OF PROBES AND MODULES EQUIPPED WITH INSTRUMENT

2 and 4 electrode conductivity probes

ORDER CODE	MEASUREMENT RANGE	DIMENSIONS
SP06T	K=0.7 5µS…200mS/cm 0…90°C 4-electrode cell in Pocan/Platinum	
SPT01G	K=0.1 0.1µS…500µS/cm 0…80°C 2-electrode cell in Glass/Platinum	
SPT1G	K=1 10µS…10mS/cm 0…80°C 2-electrode cell in Glass/Platinum	
SPT10G	K=10 500µS…200mS/cm 0…80°C 2-electrode cell in Glass/Platinum	

HD 2156.1
HD 2156.2

HD 2156.1 E HD 2156.2
pH METER - CONDUCTIVITY METER - THERMOMETER

The **HD2156.1** and **HD2156.2** are portable instruments with a large LCD display. They measure pH, mV, redox potential (ORP), conductivity, liquid resistivity, total dissolved solids (TDS) and salinity using combined 4-ring and 2-ring conductivity/temperature probes. Temperature only is measured by Pt100 or Pt1000 immersion, penetration or contact probes.

The pH electrode calibration, as well as manual, can be carried out on one, two or three points and the calibration sequence can be chosen from a list of 13 buffers. The probe calibration can be performed automatically in one or more of the 147µS, 1413µS, 12880µS or 111800µS/cm conductivity calibration solutions.

The HD2156.2 instrument is a **datalogger.** It stores up to 20,000 sets of three measurements composed of pH or mV, conductivity or resistivity or TDS or salinity and temperature: these data can be transferred to a PC from the instrument connected via the multi-standard RS232C serial port and USB 2.0. The storing interval, printing, and baud rate can be configured using the menu.

The HD2156.1 and HD2156.2 models are fitted with an RS232C serial port and can transfer the acquired measurements to a PC or to a portable printer in real time.

The *Max, Min* and *Avg* function calculates the maximum, minimum or average values.

Other functions include: the Auto-HOLD function and the automatic turning off which can also be excluded.

The instruments have IP67 protection degree.

INSTRUMENT TECHNICAL CHARACTERISTICS

Measured quantities: pH, mV, χ, Ω, TDS, Nacl, °C, °F

Instrument

Dimensions (Length x Width x Height)	185x90x40mm
Weight	470g (comple te with batteries)
Materials	ABS, rubber
Display	2x4½ digits plus symbols Visible area: 52x42mm

Operating conditions

Working temperature	-5…50°C
Storage temperature	-25…65°C
Working relative humidity	0…90%RH without condensation
Protection degree	**IP67**

Power

Batteries	4 1.5V type AA batteries
Autonomy	200 hours with 1800mAh alkaline batteries
Power absorbed with instrument off	20µA
Mains (SWD10)	Output mains adapter 12Vdc / 1A

Security of memorized data	Unlimited, independent of battery charge conditions

Time

Date and time	Schedule in real time
Accuracy	1min/month max error

*Measured values storage - model **HD2156.2***

Type	2000 pages containing 10 samples each
Quantity	20,000 sets of three measurements composed of pH or mV, χ or Ω or TDS or salinity and temperature.
Selectable storage interval	1s, 5s, 10s, 15s, 30s, 60s (1min), 120s (2min), 300s (5min), 600s (10min), 900s (15min), 1200s (20min), 1800s (30min) and 3600s (1hour)

Serial interface RS232C

Type	RS232C electrically isolated
Baud rate	Can be set from 1200 to 38400 baud
Data bit	8
Parity	None
Stop bit	1
Flow Control	Xon/Xoff
Serial cable length	Max 15m
Selectable print interval	1s, 5s, 10s, 15s, 30s, 60s (1min), 120s (2min), 300s (5min), 600s (10min), 900s (15min), 1200s (20min), 1800s (30min) and 3600s (1hour)

*USB interface - model **HD2156.2***

Type	1.1 - 2.0 electrically isolated

Connections

pH/mV input	Female BNC connector
Conductivity input	8-pole male DIN45326 connector
Serial interface and USB	8-pole MiniDin connector
Mains adapter	2-pole connector (positive at centre)

Measurement of pH by Instrument

Measurement range	-2.000…+19.999pH
Resolution	0.01 or 0.001pH selectable from menu
Accuracy	±0.001pH ±1digit
Input impedance	$>10^{12}\Omega$
Calibration error @25°C	|Offset| > 20mV Slope > 63mV/pH or Slope < 50mV/pH Sensitivity > 106.5% or Sensitivity < 85%

Measurement of mV by Instrument

Measurement range	-1999.9…+1999.9mV
Resolution	0.1mV
Accuracy	±0.1mV ±1digit
Drift after 1 year	0.5mV/year

Measurement of conductivity		*Resolution*
Measuring range	0.00…19.99µS/cm	0.01µS/cm
Kcell=0.1		
Measuring range	0.0…199.9µS/cm	0.1µS/cm
Kcell=1	200…1999µS/cm	1µS/cm
	2.00…19.99mS/cm	0.01mS/cm
	20.0…199.9mS/cm	0.1mS/cm
Measuring range	200…1999mS/cm	1mS/cm
Kcell=10		
Accuracy (conductivity)	*±0.5%1digit*	

Measurement of resitivity		*Resolution*
Measuring range	till 100MΩ·cm/(*)	
Kcell=0.1		
Measuring range	5.0…199.9Ω·cm	0.1Ω·cm
Kcell=1	200…999Ω·cm	1Ω·cm
	1.00k…19.99kΩ·cm	0.01kΩ·cm
	20.0k…99.9kΩ·cm	0.1kΩ·cm
	100k…999kΩ·cm	1kΩ·cm
	1…10MΩ·cm	1MΩ·cm
Measuring range	0.5…5.0Ω·cm	0.1Ω·cm
Kcell=10		
Accuracy (resistivity)	*±0.5%±1digit*	

Measurement of total dissolved solids (with coefficient χ/TDS=0.5)		
Measuring range	0.00…19.99mg/l	0.05mg/l
Kcell=0.1		
Measuring range	0.0…199.9mg/l	0.5mg/l
Kcell=1	200…1999mg/l	1mg/l
	2.00…19.99g/l	0.01g/l
	20.0…99.9g/l	0.1g/l
Measuring range	100…999g/l	1g/l
Kcell=10		
Accuracy (conductivity)	*±0.5%1digit*	

Measurement of salinity		*Risolution*
Measurement range	0.000…1.999g/l	1mg/l
	2.00…19.99g/l	10mg/l
	20.0…199.9g/l	0.1g/l
Accuracy (salinity)	*±0.5%1digit*	

Temperature compensation automatic/manual	0…*100°C* with αT selectable from 0.00 to 4.00%/°C
Reference temperature	20°C or 25°C
χ / TDS Conversion factor	0.4…0.8
Cell constant K (cm-1)	0.1, 0.7, 1.0 and 10.0

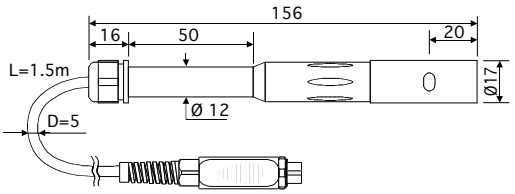
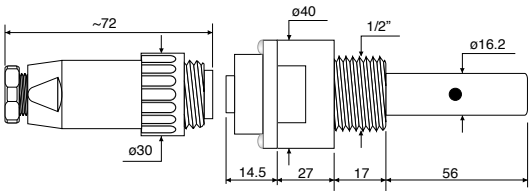
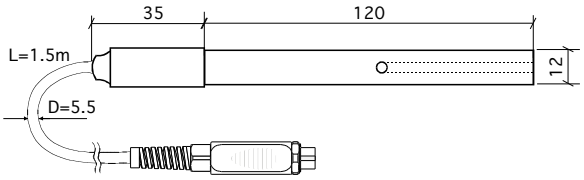
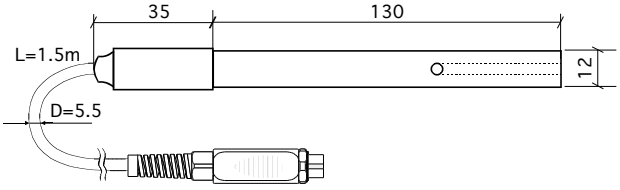
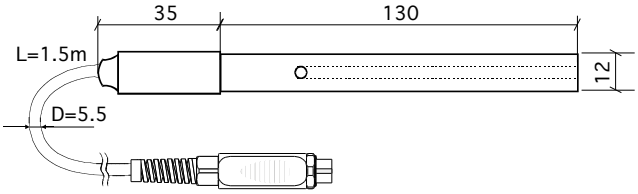
Standard solutions automatically detected @25°C	
	147µS/cm
	1413µS/cm
	12880µS/cm
	111800µS/cm
Measurement of temperature	
Pt100 measuring range	-50…+200°C
Pt1000 measuring range	-50…+200°C
Resolution	0.1°C
Accuracy	±0.25°C
Drift after 1 year	0.1°C/anno
Preset cell constant values:	K=0,01 - K=0,1 - K=1, K=10

The resistivity measurement is obtained from the reciprocal of conductivity measurement. Close to the bottom of the scale, the indication of resistivity appears like reported in the table below:

K cell = 0.01 cm^{-1}		**K cell = 0.1 cm^{-1}**	
Conductivity (µS/cm)	Resistivity (MΩ·cm)	Conductivity (µS/cm)	Resistivity (MΩ·cm)
0.001 µS/cm	1000 MΩ·cm	0.01 µS/cm	100 MΩ·cm
0.002 µS/cm	500 MΩ·cm	0.02 µS/cm	50 MΩ·cm
0.003 µS/cm	333 MΩ·cm	0.03 µS/cm	33 MΩ·cm
0.004 µS/cm	250 MΩ·cm	0.04 µS/cm	25 MΩ·cm

TECHNICAL DATA OF PROBES AND MODULES EQUIPPED WITH INSTRUMENT

2 and 4 electrode conductivity probes

ORDER CODE	MEASUREMENT RANGE	DIMENSIONS
SP06T	K=0.7 5µS…200mS/cm 0…90°C 4-electrode cell in Pocan/Platinum	
SPT 400.001 **not suitable for** **HD 2306.0**	K=0.01 0,05…19,9µS/cm 2-electrode cell AISI 316 - Teflon	
SPT01G	K=0.1 0.1µS…500µS/cm 0…80°C 2-electrode cell in Glass/Platinum	
SPT1G	K=1 10µS…10mS/cm 0…80°C 2-electrode cell in Glass/Platinum	
SPT10G	K=10 500µS…200mS/cm 0…80°C 2-electrode cell in Glass/Platinum	

Temperature probes with 4 wire Pt100 and 2 wire Pt1000 connector sensor

Model	Type	Working range	Accuracy
TP47.100	Pt100 4 wires	-50…+200°C	Class A
TP47.1000	Pt1000 2 wires	-50…+200°C	Class A
TP87.100	Pt100 4 wires	-50…+200°C	Class A
TP87.1000	Pt1000 2 wires	-50…+200°C	Class A

Temperature drift @20°C 0.005%/°C

ORDER CODES

HD2156.1: The kit is composed of: instrument HD2156.1, 4 1.5V alkaline batteries, operating manual, case and DeltaLog9 software.

HD2156.2: The kit is composed of: instrument HD2156.2 **datalogger**, 4 1.5V alkaline batteries, operating manual, case and DeltaLog9 software.
pH/mV probes, conductivity probes, temperature probes, standard calibration solutions for various types of measurements, connection cables for pH electrodes with S7 connector, cables for data transfer to PC or printer have to be ordered separately.

HD2110CSNM: 8-pole connection cable MiniDin - Sub D 9-pole female for RS232C.

C.206: Serial connection cable with USB connector for PC and 8-pole MiniDin male connector for the instrument

HD2101/USB: Connection cable USB 2.0 connector type A - 8-pole MiniDin (not suitable for HD2156.1K).

DeltaLog9: Software for download and management of the data on PC using Windows 98 to Vista operating systems.

SWD10: Stabilized power supply 100-240 Vac/12Vdc-1A mains voltage

HD40.1: 24-column portable thermal printer, serial interface, 57mm paper width, four NiMH 1.2V rechargeable batteries, SWD10 power supply, instruction manual, 5 thermal paper rolls.

RCT: The kit includes 4 thermal paper rolls 57mm wide and 32mm in diameter.

BAT-40: Spare battery pack for HD40.1 printer with built-in temperature sensor.

HD22.2: Laboratory electrode holder composed of base plate with built-in magnetic stirrer, shaft and replaceable electrode holder. Suitable diameter 12mm. Powered by bench-top meters of the series HD22…with cable HD22.2.1 (**optional**) or power supplier SWD10 (**optional**).

HD22.3: Laboratory electrode holder composed of base plate. Flexible arm for free positioning. Suitable for electrodes with diameter 12mm.

pH Electrodes

KP 20: Gel pH filled combined electrode for general use , with S7 screw connector, EPOXY body.

KP 30: Gel pH combined electrode for general use, 1m cable with BNC, EPOXY body .

KP 50: Gel pH combined electrode, porous Teflon ring junction, suitable for emulsions, demineralised water, with S7 screw connector, glass body.

KP 61: 3 diaphragm liquid filled pH combined electrode for wine, milk, cream, etc., S7 screw connector, liquid reference filling, glass body.

KP 62: 1 diaphragm gel pH combined electrode for pure water, varnishes, gel filled, S7 screw connector, glass body.

KP 63: 1 liquid filled pH combined electrode for general use, varnishes, 1m cable with BNC, glass body.

KP 64: Liquid filled pH combined electrode ,Teflon ring diaphragm, for wine, varnishes, emulsions, S7 screw connector, glass body.

KP 70: Pointed gel combined pH microelectrode diam. 6 x L=70 mm., with S7 screw connector, EPOXY body, glass tip, open junction.

KP 80: Pointed gel pH combined electrode, with S7 screw connector, glass body, for cream, milk, viscous material, open junction.

KP100: Flat membrane gel combined pH electrode with S7 screw connector, glass body, for skin, leather, paper.

Characteristics and dimensions of the probes at page 401

CP: 1.5m extension cable with BNC/S7 connector for electrode without cable, thread S7.

CP: 1.5m extension cable with BNC/S7 connector for electrode without cable, thread S7.

CP 5: 5m extension cable with BNC/S7 connector for electrode without cable, thread S7.

CP 10: 10m extension cable with BNC/S7 connector for electrode without cable, thread S7.

CP 15: 15m extension cable with BNC/S7 connector for electrode without cable, thread S7.

CE : S7 screw connector for pH electrode.

BNC: female BNC for extension cable

ORP Electrodes

KP 90: REDOX PLATINUM liquid filled electrode with S7 screw connector, glass body.

KP 91: Gel REDOX PLATINUM electrode, 1m cable with BNC, EPOXY body

Characteristics and dimensions of the probes at page 402

pH Buffer solutions

HD8642: Buffer solution 4.01pH - 200cc.

HD8672: Buffer solution 6.86pH - 200cc.

HD8692: Buffer solution 9.18pH - 200cc.

Redox Buffer solutions

HDR220: Redox buffer solution 220mV 0.5 l.

HDR468: Redox buffer solution 468mV 0.5 l.

Electrolyte solutions

KCL3M Ready to use solution for electrode refilling – 100 cc

Cleaning and maintenance

HD62PT: Diaphragm cleaning (tiourea in HCl) - 500ml.

HD62PP: Protein cleaning (pepsin in HCl) - 500ml.

HD62RF: Regeneration (fl uorhydric acid) - 100ml.

HD62SC: Solution for electrode preservation - 200ml.

Conductivity probes

See oder codes reported in the table at page 358.

Standard conductivity calibration solutions

HD8747: Standard calibration solution 0.001mol/l equal to 147µS/cm @25°C, 200cc.

HD8714: Standard calibration solution 0.01mol/l equal to 1413µS/cm @25°C, 200cc.

HD8712: Standard calibration solution 0.1mol/l equal to 12880µS/cm @25°C, 200cc.

HD87111: Standard calibration solution 1mol/l equal to 111800µS/cm @25°C, 200cc.

Temperature probes complete with SICRAM module

TP87: PT100 sensor immersion probe. Stem Ø 3 mm, length 70 mm. Cable length 1 m.

TP472I.0: Pt100 sensor immersion probe. Stem Ø 3 mm, length 230 mm. Cable length 2 m.

TP473P.0: Pt100 sensor penetration probe. Stem Ø 4mm, length 150 mm. Cable length 2 m.

TP474C.0: Pt100 sensor contact probe. Stem Ø 4mm, length 230mm, contact surface Ø 5mm. Cable length 2 m.

TP475A.0: Air probe, sensor Pt100. Stem Ø 4mm, length 230mm. Cable length 2 m.

TP472I.5: Immersion probe, sensor Pt100. Stem Ø 6mm, length 500 mm. Cable length 2 m.

TP472I.10: Immersion probe, sensor Pt100. Stem Ø 6mm, length 1,000mm. Cable length 2 m.

Temperature probes without SICRAM module

TP87.100: Pt100 sensor immersion probe. Probe's stem Ø 3mm, length 70mm. 4 wire connection cable with connector, length 1 m.

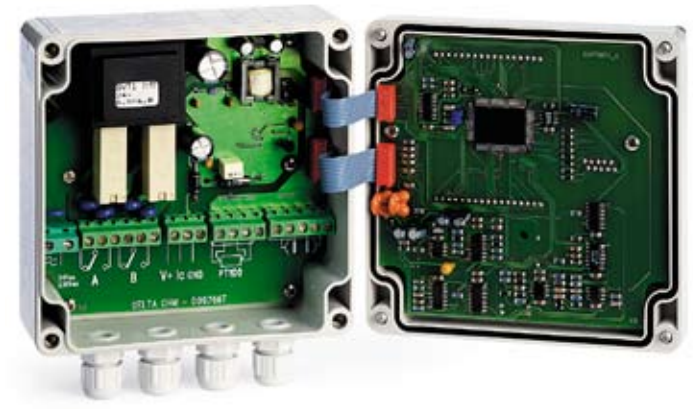
TP87.1000: Pt1000 sensor immersion probe. Probe's stem Ø 3mm, length 70mm. 2-wire connection cable with connector, length 1 m.

TP47: Module for the connection of Pt100 4-wire and Pt1000 2-wire probes.

DO 9786T - R1
DO 9766T - R1

DO 9786T - R1 • DO 9766T - R1
CONDUCTIVITY TRANSMITTERS

DO 9786T/DO 9766T transmitters convert the output of a conductivity electrode with temperature compensation into a 4÷20 mA signal.
The electrode input circuit is galvanically insulated against the 4÷20 mA output signal. An LCD indicator allows viewing of the process signal value and of the various parameters. The accurate design and choice of components make the instrument precise and reliable for a long working life.
The instrument works in conjunction with a conductivity electrode and a temperature probe (Pt100 sensor, 100 Ω at 0°C).



Technical characteristics

Input conductivity	Measuring range	0.0...199.9 mS
	2/4 electrodes	Configurable cell constant 0.01...199.9 cm-1
	Transducer energizing	Square wave 10...1000 mV, depending on conductivity, 200...1600 Hz, depending on conductivity
	Input impedance	>100 Mohm
	Cable length	<10 metres unscreened <50 metres screened (about 2 nF)
	Accuracy	0.5% of reading ±2 digits ±0.01% per °C of drift in temperature
Input temperature	Pt100 2/4 wires	-50...199.9°C
	Transducer energizing	0.5 mA dc
	Cable length	<10 metres unscreened <50 metres screened (about 5 nF)
	Accuracy	0.2°C ±0.1% of reading ±0.01°C/°C of drift in temperature
Compensation temperature	None	
	manual	Linear 0.00...4.00%/°C -50...+200C
	automatic	Linear 0.00...4.00%/°C -50...+200C
	Reference temperature	20 or 25°C Configurable
Current output	4.00...20.00 mA	Programmable and proportional to conductivity
	Accuracy	0.5% of reading ±0.02 mA
	Insulation	2500 Vac 1 minute
Relay output	A and B	Bistable, contact 3A/230 Vac free potential
Power supply	Passive	4÷20 mA, 2 wire configuration, 10÷35 V, see fig. 2
	Active	24/230 Vac - 15/+10% 1 VA, 48...62 Hz, see fig. 1
Case DO 9766T	External dimensions	120x122x56 mm
	Protection class	IP64
Case DO 9786T	External dimensions	96x96x126 mm
	Protection class	IP44

Key functions

PRG Programming of the parameters is activated by pressing the PRG key plus the ▲ and ▼ keys. The message P1 appears on the display, indicating that the parameter P1 is being programmed. When the PRG key is pressed continuously, the messages P2, P3, P4, P5, P6, P7, P8 and the corresponding parameters are displayed in sequence. After P8 the instrument returns to normal function.

SET Key for setting the relay intervention threshold. The ON or OFF symbol appears on the display, indicating the switching on or off threshold of relay A or of relay B.

°C/°F - If this key is pressed it changes the temperature measuring unit to degrees Celsius or degrees Fahrenheit.

\- When pressed together with the CAL key it activates the manual temperature setting function.

\- If pressed during the conductivity calibration function it quits the calibration function without storing the calibration.

χ When pressed together with the CAL key it activates the conductivity calibration function.

OK Confirms the programming parameters, or the relay SET values, and stores them.

CAL - When pressed together with the °C/°F key it activates the manual temperature setting function.
- When pressed together with the χ key it activates the conductivity calibration function.
- Key used to confirm conductivity calibration and manual temperature calibration.

▲ - Key for increasing the value displayed in the parameter programming phase.
- During the relay SET point programming phase.
- During the calibration phase.

▼ - Key for decreasing the value displayed in the parameter programming phase.
- During the relay SET point programming phase.
- During the calibration phase.

Setting the relay SET point

- Press the SET button; the ON symbol appears on the display with the letter A to indicate that the value shown corresponds to the switching on threshold of relay A.
- To change this value press the ▲ and ▼ keys.
- Press SET; the OFF symbol appears with the letter A to indicate that the switching off threshold of relay A is being displayed.
- To change this value press the ▲ and ▼ keys.
- Press the SET button; the ON symbol appears on the display with the letter B to indicate that the value shown corresponds to the switching on threshold of relay B.
- To change this value press the ▲ and ▼ keys.
- Press SET; the OFF symbol appears with the letter B to indicate that the switching off threshold of relay B is being displayed.
- To change this value press the ▲ and ▼ keys.
- Press SET, the instrument stores the values and returns to normal function.

NOTE: During the SET point setting phase (symbols ON or OFF lit) the instrument returns to normal function if no key is pressed for 2 minutes.

Manual temperature setting
If the temperature probe is not connected or if the probe is broken the measuring unit °C or °F flashes. In this case it is possible to set the temperature compensation value manually.
- Press the CAL key and the °C/°F key together; the message CAL appears at the bottom of the display.
- Using the ▲ and ▼ keys, set the temperature value corresponding to the temperature of the liquid in which you wish to measure conductivity.
- Press CAL to confirm this value. The message CAL disappears.

Calibration of the DO 9786T-R1 / DO 9766T-R1 with conductivity probes
Calibration of the DO 9786T-R1 / DO 9766T-R1 transmitters with conductivity probes:
- Immerse the probe in the buffer solution used for calibration.
- Press the CAL key and the ⁒ key together; the message CAL appears at the top of the display.
- The instrument can automatically recognize two standard calibration solutions: a 0.1 molar solution of KCl and a 0.01 molar solution of KCl. The instrument proposes the conductivity value as a function of the measured temperature if the temperature probe is connected, or the manually set temperature.
- Using the ▲ and ▼ keys, adjust the conductivity value measured as a function of the liquid temperature.
- Press CAL to confirm this value. The message CAL disappears.

NOTE: If you want to quit without storing the new calibration, press the °C/°F key.
N.B.: Before calibrating the probe set a cell constant close to the cell constant of the probe that you wish to calibrate with key PRG, function P2. If the message E1 appears during calibration, the instrument is indicating that the probe gain is too high; quit programming (°C/°F button) and increase the value of the cell constant. Likewise, if E2 appears, the instrument is indicating that the probe gain is too low; quit calibration and decrease the cell constant. Repeat the calibration operation.

Programming the parameters
P1 Temperature coefficient. May be set between 0 and 4.0%/°C (0 and 2.2%/°C).
P2 Cell constant. May be set between 0.01 and 199.9.
P3 Conductivity value corresponding to 4 mA at output. May be set between 0 and 199.9 mS.
P4 Conductivity value corresponding to 20 mA at output. May be set between 0 and 199.9 mS.
P5 Delay time in the intervention of relay A. May be set between 0 and 250 seconds.
P6 Delay time in the intervention of relay B. May be set between 0 and 250 seconds.
P7 Reference temperature of the conductivity measurement. May be set between the values 20.0 or 25.0°C.
P8 Calibration of Pt100 probe and calibration of analog output in current (see Pt100 probe calibration and analog output calibration).

To change one of these parameters (except P8) press key PRG until the message corresponding to the parameter to be changed appears on the screen. Using the ▲ and ▼ keys, bring the parameter displayed to the desired value. Press OK to confirm.

Pt100 probe calibration
- Connect the Pt100 probe to the instrument. Press the PRG key until the message P8 appears on the display.
- Press the CAL key; the message CAL appears at the bottom of the display and the temperature is shown at the top.
- Immerse the Pt100 probe and a precision thermometer for reference in the zero calibration bath. Wait long enough for the reading to become stable.
- Using the ▲ and ▼ keys, adjust the value of the temperature measured by the Pt100 probe so that it corresponds with the value on the reference thermometer.
- Immerse the Pt100 probe and a precision thermometer in the full scale calibration bath. Wait long enough for the reading to become stable.
- Using the ▲ and ▼ keys, adjust the value of the temperature measured by the Pt100 probe so that it corresponds with the value on the reference thermometer.
- Press OK to confirm.

N.B.: If the temperature shown by the instrument is between +12°C, the instrument calibrates the probe offset, otherwise it calibrates the gain.

Calibrating the analog output
- Press the PRG key until the message P8 appears on the display.
- Connect a precision milliammeter to the analog output.
- Press the **CAL key twice**; the message CAL appears at the top of the display and the message 4.0 at the bottom, indicating calibration at 4 mA.
- Using the ▲ and ▼ keys, adjust the value of the output current so as to have an indication of 4,000 mA on the precision milliammeter.
- Press the CAL key; the message CAL appears at the top of the display and the message 20.0 at the bottom, indicating calibration at 20 mA.
- Using the ▲ and ▼ keys, adjust the value of the output current so as to have an indication of 20,000 mA on the precision milliammeter.
- Press OK to confirm.

Display

Symbol	Description
°C	indicates that the value shown is in °C.
°F	indicates that the value shown is in °F.
µS	indicates that the unit of the value shown is micro Siemens.
mS	indicates that the unit of the value shown is milli Siemens.
A	indicates that the relay A is in closed status.
B	indicates that the relay B is in closed status.

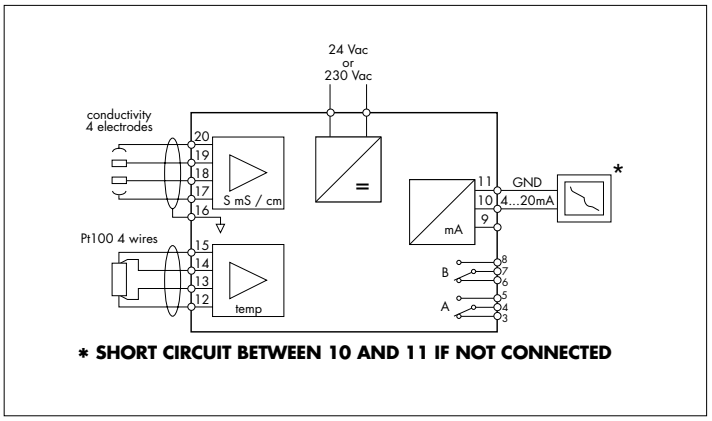


Fig.1 Active transmitter.

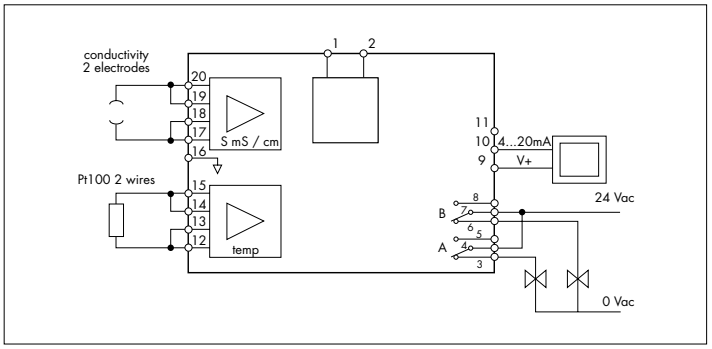


Fig.2 Passive transmitter.

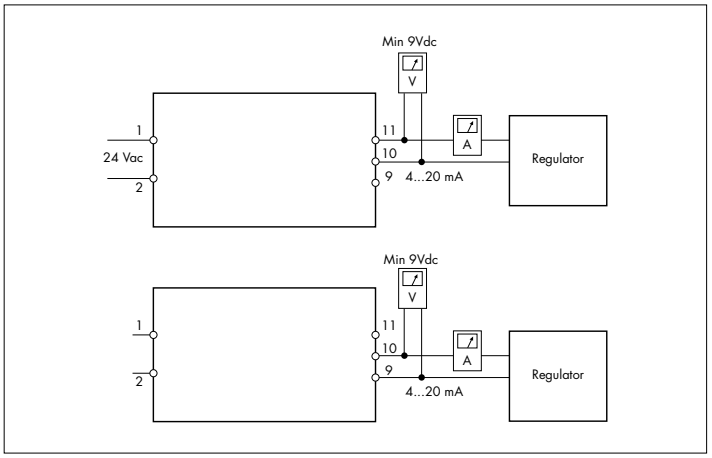
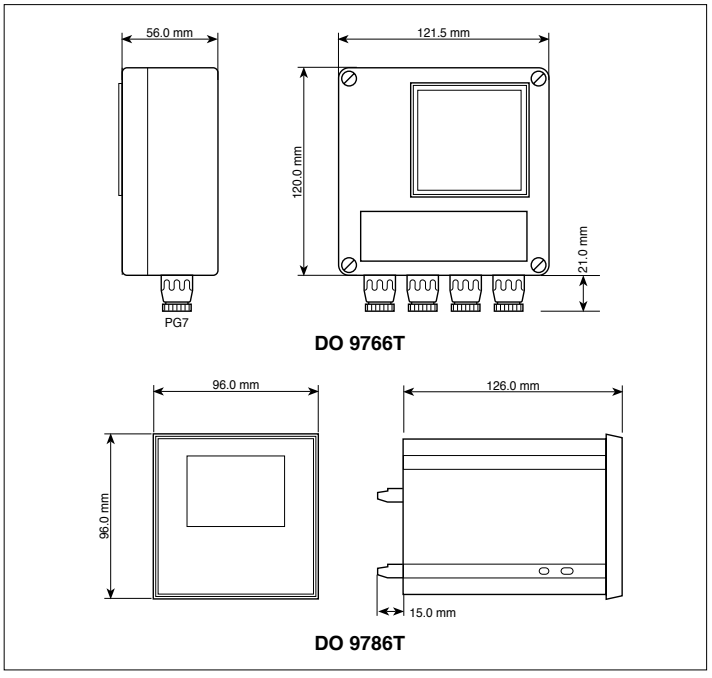


Fig.3 Calibration analog output.



Dimensions

ON indicates that the value shown corresponds to the closing thresholds of the contacts of relay A or B.
OFF indicates that the value shown corresponds to the opening thresholds of the contacts of relay A or B.

Error signals
OFL - Warning which appears during measurement when the value to be displayed is out of scale.
E1 - Error warning which appears during conductivity calibration to indicate that the probe gain is too high. Press P2 to increase the cell constant value.
E2 - Error warning which appears during conductivity calibration to indicate that the probe gain is too low. Press P2 to decrease the cell constant value.
E3 - Error warning which appears to indicate that the instrument is unable to recognize the buffer solution used for automatic calibration. Press the ▲ or ▼ key to make this indication disappear.
E4 - Reading error on the EEPROM.

APPENDIX

Table of compatibility between range and sensor

Conductivity Range	Nominal cell constant			
	0.01÷0.2	0.2÷2	2÷20	20÷199.9
0÷19.99 µS	√			
0÷199.9 µS	√	√		
0÷ 1999 µS	√	√	√	
0÷199.9 µS	√	√	√	√
0÷19.99 mS		√	√	√
0÷199.9 mS			√	√
0÷ 1999 mS				√

Temperature sensor

Temperature	Pt100	Temperature	Pt100
-50°C	80.25 Ω	100°C	138.50 Ω
-25°C	90.15 Ω	125°C	147.94 Ω
0°C	100.00 Ω	150°C	157.32 Ω
25°C	109.73 Ω	175°C	166.62 Ω
50°C	119.40 Ω	199°C	175.47 Ω
75°C	128.98 Ω		

Calculating the temperature coefficient of a solution
If the temperature coefficient of the solution is not known, it may be determined using the DO 9786T/DO 9766T.
- Set the temperature coefficient at 0.0%/°C (parameter P1).

The following measurements should be taken as close as possible to the work point, between 5°C and 70°C, for greater accuracy.
- Immerse the probe in the testing liquid. Wait for the measurement to become stable.
- Take note of the temperature and of the conductivity.
- Increase the solution temperature by at least 10°C.
- Take note of the temperature and of the conductivity.
- Calculate the temperature coefficient using the following formula:

$$\alpha = \frac{(Gx-Gy) \times 100\%}{Gy(Tx-20) - Gx(Ty-20)}$$ (reference temperature 20°C)

Where:
Gx conductivity at temperature Tx
Gy conductivity at temperature Ty

N.B.: if the reference temperature is 25°C, replace 20 with 25.

- Set the temperature coefficient with the value calculated as above (parameter P1).

Calibration of the instrument for measuring conductivity
The conductivity measurement depends strongly on the temperature of the liquid that is to be measured; this relationship must be considered during calibration.

Calibration of the instrument alone by means of a precision resistance
This is a sure and accurate method for calibrating the instrument alone, but it does not allow for the variations of the cell constant that may occur, nor of the state of efficiency and cleanness of the cell.
The precision resistance used for calibration will be chosen according to the scale that you want to calibrate. Typical values are the following:

Conductivity	Resistance
100,0 µS	10.000 Ω
500,0 µS	2.000 Ω
1000 µS	1.000 Ω
5000 µS	200 Ω
10,00 mS	100 Ω
50,00 mS	20 Ω
100,0 mS	10 Ω
500,0 mS	2 Ω
1000 mS	1 Ω

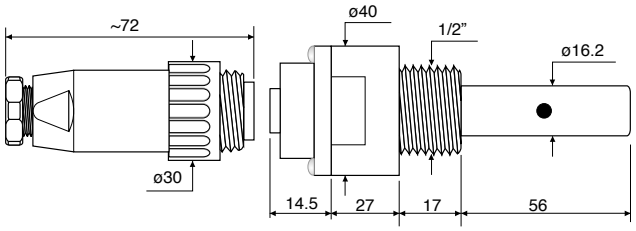
The precision resistance will be connected to the end of the cable that connects the probe to the instrument. This ensures greater accuracy of calibration. Disable the temperature compensation α_T during the calibration of the instrument with the precision resistences.
Calibration with standard solutions
In this case too, for the calibration of the instrument, cable and measuring probes in a standard solution, the greatest attention must be paid to the temperature of the solutions and the cleanness of the measuring cell. It is advised not to carry out calibration below 500 µS/cm. Solutions with low conductivity must be kept closed in their containers. Contact with the air increases their value due to the absorption of CO_2.
The regulations for the preparation of standard solutions with a base of KCl dissolved in water with a high degree of purity supply the method and percentages of KCl and water to be mixed.
DELTA OHM supplies four solutions for calibration:
HD8747: Standard calibration solution 0.001mol/l equal to 147µS/cm @25°C, 200cc.
HD8714: Standard calibration solution 0.01mol/l equal to 1413µS/cm @25°C, 200cc.
HD8712: Standard calibration solution 0.1mol/l equal to 12880µS/cm @25°C, 200cc.
HD87111: Standard calibration solution 1mol/l equal to 111800µS/cm @25°C, 200cc.

Care and maintenance of the conductivity cell
In conductivity measurement systems in industrial plants, if the installation is correctly made, readings are generally reliable for a long time. The important thing is to carry out correct, programmed maintenance of the measuring cell.
Abrasion of the cable due to continued swinging movements must be avoided, as must the formation of deposits and scale on the cell which can change its geometrical structure.
The cell must always be immersed in the liquid that is to be measured. In the industrial field, measurements may range from highly pure water to sewage or water contaminated by corrosive substances.
It is good practice to check the compatibility of the materials of which the cell and the connecting cable are made with the liquid in which the measurement is to be taken. Check that there are no floating bodies, suspended granules that may be more or less conductive, or which could get stuck inside the cell, thus leading to incorrect measurements.
To clean the cell use detergents or substances suitable for the material of which the cell is made.

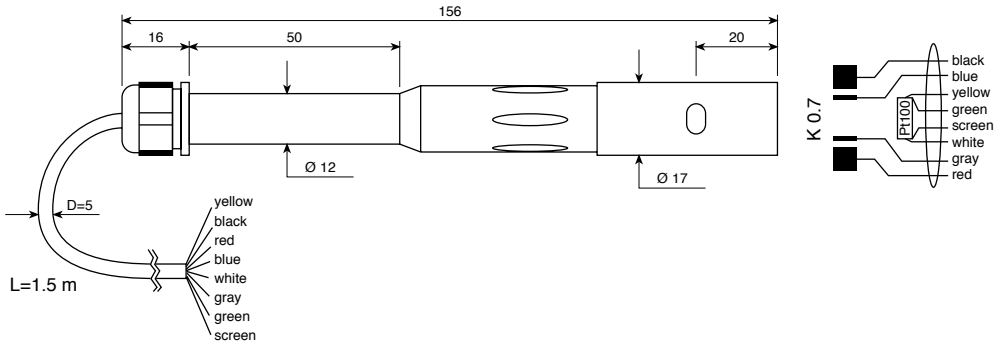
Selecting the cell constant and installation
The measurement range of the liquid to be examined determines the choice of the cell constant to be used.
Installation of the cell will vary according to the application. On the whole, the following points must be considered:
- Choose the correct cell and cell constant, suitable for the application.
- Use suitable materials, cable, cell, supports, so as to resist corrosion and the influence of atmospheric agents.
- The sensor/cell must be firmly fixed, in a place where they are easily accessible for maintenance.
- The liquid in which the sensor is immersed must be a representative part of the whole that is to be measured.
- There must be a moderate flow of liquid so that an updated sample of liquid arrives at the electrodes. Excessive movement or flow causes turbulence and air bubbles between the electrodes. As an air bubble is not conductive, it modifies the volume of the cell and changes the constant.
- Install the sensor in such a way that sludge or particles of material cannot be deposited inside it.
- If installed in containers where high currents are circulating, the conductivity cell may present measuring problems.
- The maintenance and cleaning interval depends on the quality of the liquid in which the cell is installed.

Order code
DO 9786T: Conductivity transmitter 4÷20 mA passive or active, power supply 24 Vac with double display 96x96 mm, for panel mounting.
DO 9766T: Conductivity transmitter 4÷20 mA passive or active, power supply 24 Vac with double display 122x120 mm, for use on the field.
SPT 86: Combined industrial conductivity and temperature probe in POCAN with 4 platinum electrodes, cell constant K = 0.7, 1.5 meters cable, Pt100 with 2 wires. Temperature 0÷90°C.
SPTKI 10: Combined industrial conductivity probe in Glass with 2 black oxidized platinum electrodes, cell constant K = 1, **S7/PG13** screw-joint, 2 wires output: eurostandard S7. Temperature 0÷100°C.
SPTKI 11: Combined industrial conductivity and temperature probe in Rytron with 2 graphite electrodes, cell constant K = 1, 5 meters cable, Pt100 with four wires. Temperature 0÷50°C.
SPTKI 12: Combined industrial conductivity and temperature probe in Rytron with 2 platinum electrodes, cell constant K = 01, 5 meters cable, Pt100 with four wires. Temperature 0÷50°C.
SPTKI 13: Combined industrial conductivity and temperature probe in Rytron with 2 platinum electrodes, cell constant K = 10, 5 meters cable, Pt100 with four wires. Temperature 0÷50°C.
HD 882 M100/300: Temperature probe with Pt100 sensor, miniature head, shaft Ø6x300 mm.
HD 882 M100/600: Temperature probe with Pt100 sensor, miniature head, shaft Ø6x600 mm.
HD 8747: Calibration solution 0.001 mol/l corresponding to 147 µS/cm at 25°C, 200cc.
HD 8712: Calibration solution 0.1 mol/l corresponding to 12,880 µS/cm at 25°C, 200cc.
HD 8714: Calibration solution 0.01 mol/l corresponding to 1413 µS/cm at 25°C, 200cc.
HD 87111: Calibration solution 1 mol/l corresponding to 111800 µS/cm at 25°c, 200cc.

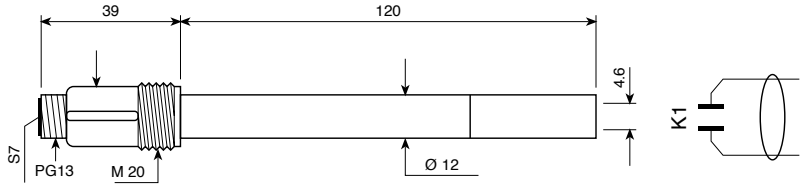
SPT 400.001
cell constant K=0.01



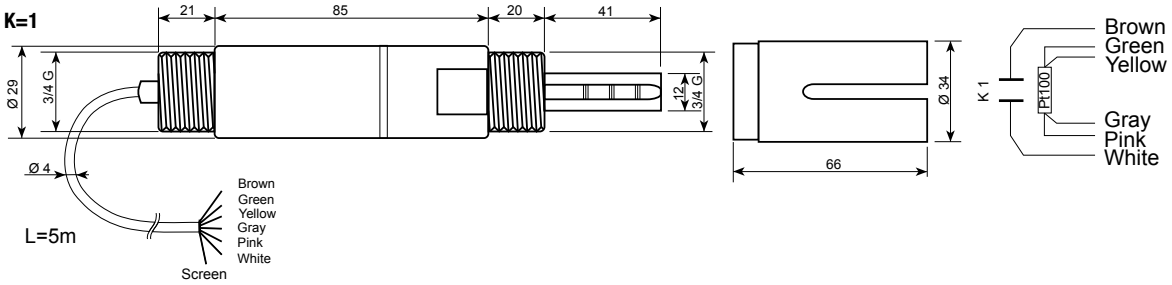
SPT 86
cell constant K=0.7



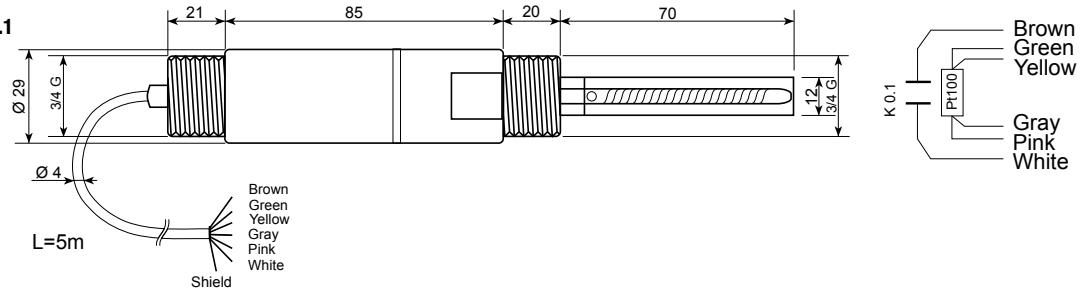
SPTKI 10
cell constant K=1



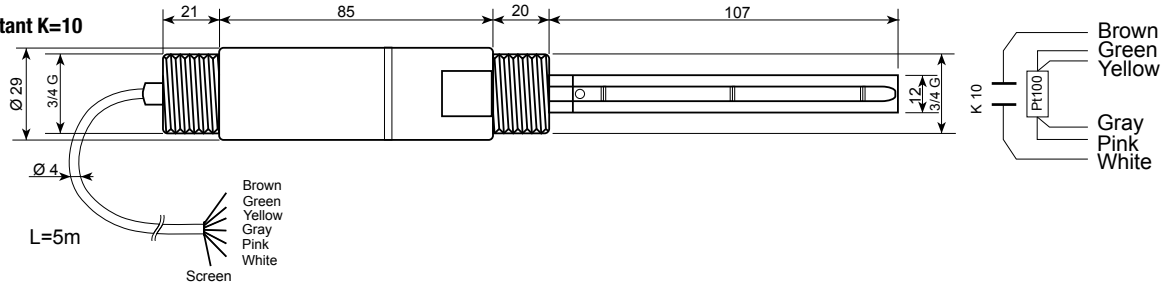
SPTKI 11
cell constant K=1



SPTKI 12
cell constant K=0.1



SPTKI 13
cell constant K=10



	Cell constant	Measuring range	Temperature range	Material	Electrodes	Temperature sensor	Max. pressure	Connection
SPT 400.001	K=0.01	0.05÷19.9µS	0÷120°C	AISI 316 - PTFE	2 AISI 316	-	12bar	4-pole connector
SPT 86	K=0.7	5µS÷20mS	0÷90°C	Pocan	4 platinum	Pt100 2 wire	6bar	1.5 m cable
SPTKI 10	K=1	100µS÷200mS	0÷100°C	Glass	2 platinum	–	6bar	S7
SPTKI 11	K=1	100µS÷10mS	0÷50°C	Rytron	2 platinum	Pt100 4 wire	6bar	5 m cable
SPTKI 12	K=01	1µS÷1mS	0÷50°C	Rytron	2 platinum	Pt100 4 wire	6bar	5 m cable
SPTKI 13	K=10	10µS÷200mS	0÷50°C	Rytron	2 platinum	Pt100 4 wire	6bar	5 m cable

HD 2109.1
HD 2109.2

HD 2109.1, HD 2109.2
DISSOLVED OXYGEN - TEMPERATURE METERS

The **HD2109.1** and **HD2109.2** are portable instruments with a large LCD display. They measure the concentration (in mg/l) of dissolved Oxygen in liquids, the saturation index (in %) and the temperature using SICRAM combined probes of polarographic type with two or three electrodes and integrated temperature sensor. Temperature only is measured by Pt100–SICRAM or direct 4 wire–immersion, penetration or contact probes. Thanks to an internal pressure sensor, the instruments automatically compensate for barometric pressure. The instrument anticipates automatic compensation of the Oxygen probe membrane permeability and of the salinity of the liquid being examined. The dissolved Oxygen probe's quick calibration function guarantees timely correctness of the performed measurements. The dissolved Oxygen and the temperature probes are equipped with an automatic recognition module and factory calibration data are stored inside. The HD2109.2 is a **datalogger**. It stores up to 18,000 dissolved Oxygen concentration, saturation index measurements, barometric pressure and temperature samples which can be transferred from the instrument connected to a PC via the multi-standard RS232C serial port and USB 2.0. The storing interval, printing, and baud rate can be configured using the menu. The HD2109.1 and HD2109.2 models are fitted with an RS232C serial port and can transfer to a PC the acquired measurements or to a portable printer in real time. The *Max, Min* and *Avg* function calculates the maximum, minimum or average values. Other functions include: the relative measurement REL, the Auto-HOLD function, and the automatic turning off which can also be excluded.

The instruments have IP67 protection degree.

INSTRUMENT TECHNICAL CHARACTERISTICS

Measured quantities: mg/l O_2, sat.% O_2, mbar, °C, °F

Instrument	
Dimensions (Length x Width x Height)	185x90x40mm
Weight	470g (complete with batteries)
Materials	ABS, rubber
Display	2x4½ digits plus symbols Visible area: 52x42mm
Operating conditions	
Working temperature	-5…50°C
Storage temperature	-25…65°C
Working relative humidity	0…90%RH without condensation
Protection degree	**IP67**
Power	
Batteries	4 1.5V type AA batteries
Autonomy	200 hours with 1800mAh alkaline batteries
Power absorbed with instrument off	20µA
With dissolved oxygen probe	40µA
Mains (SWD10)	Output mains adapter 12Vdc / 1A
Security of memorized data	Unlimited, independent of battery charge conditions
Time	
Date and time	Schedule in real time
Accuracy	1min/month max error
*Measured values storage - model **HD2109.2***	
Type	2000 pages containing 9 samples each
Quantity	18,000 samples composed of 4 parameters: mg/l O_2 - %O_2 - mbar - (°C or °F)
Selectable storage interval	1s, 5s, 10s, 15s, 30s, 60s (1min), 120s (2min), 300s (5min), 600s (10min), 900s (15min), 1200s (20min), 1800s (30min) and 3600s (1hour)
Serial interface RS232C	
Type	RS232C electrically isolated
Baud rate	Can be set from 1200 to 38400 baud
Data bit	8
Parity	None
Stop bit	1
Flow Control	Xon/Xoff
Serial cable length	Max 15m
selectable print interval immediate	1s, 5s, 10s, 15s, 30s, 60s (1min), 120s (2min), 300s (5min), 600s (10min), 900s (15min), 1200s (20min), 1800s (30min) and 3600s (1hour)
*USB interface - model **HD2109.2***	
Type	1.1 - 2.0 electrically isolated
Connections	
Input for Oxygen and temperature probes	8-pole male DIN45326 connector
Serial and USB interface	8-pole MiniDin connector
Mains adapter	2-pole connector (positive at centre)
Measurement of the concentration of dissolved Oxygen	
Measurement range	0.00…90.00mg/l
Resolution	0.01mg/l
Accuracy (60…110%, 1013mbar, 20…25°C)	±0.03mg/l±1digit

HD40.1

SWD10

Measurement of the saturation index of dissolved Oxygen

Measurement range	0.0…600.0%
Resolution	0.1%
Accuracy	±0.3% ±1digit (in the range 0,0…199,9%) ±1% ±1digit (in the range 200,0…600,0%)

Measurement of barometric pressure

Measurement range	0.0…1100.0mbar
Resolution	0.1mbar
Accuracy	±2mbar±1digit between 18 and 25°C ±(2mbar+0.1mbar/°C) in the remaining range

Setting the salinity

Setting range	0.0…70.0mg/l
Resolution	0.1mg/l

Temperature measurement with the sensor inside the dissolved Oxygen probe

Measurement range	0…+45°C
Resolution	0.1°C
Accuracy	±0.1°C
Drift after 1 year	0.1°C/year

Temperature measurement by Instrument with Pt100 probe

Pt100 measurement range	-200…+650°C
Resolution	0.1°C
Accuracy	±0.21°C
Drift after 1 year	0.1°C/year
Automatic temperatur compensation	0…50°C

TECHNICAL DATA OF PROBES AND MODULES EQUIPPED WITH INSTRUMENT
Temperature probes Pt100 sensor using SICRAM module

Model	Type	Working range	Accuracy
TP87	**Immersion**	-50°C…+200°C	±0.25°C (-50°C…+200°C)
TP472I	**Immersion**	-196°C…+500°C	±0.25°C (-196°C…+350°C) ±0.4°C (+350°C…+500°C)
TP472I.0	**Immersion**	-50°C…+400°C	±0.25°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP473P.0	**Penetration**	-50°C…+400°C	±0.25°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP474C.0	**Contact**	-50°C…+400°C	±0.3°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP472I.5	**Immersion**	-50°C…+400°C	±0.3°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP472I.10	**Immersion**	-50°C…+400°C	±0.3°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)

Temperature drift @20°C 0.003%/°C

Direct 4 wire Pt100 probes

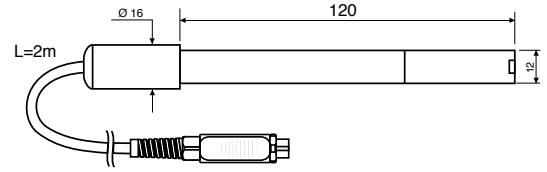
Model	Type	Working range	Accuracy
TP47.100	**4 wire Pt100**	**-50…+400°C**	**Class A**

Temperature drift @20°C 0.003%/°C

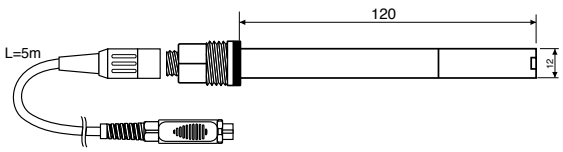
Oxygen probe – dimensions and characteristics

Model	DO9709SS	DO9709SS.5
Type	Polarographic probe, Silver anode, Platinum cathode	
Application range		
Oxygen concentration	0.00…60.00mg/l	
Functioning temperature	0…45°C	
Accuracy instrument with probe	1% FS	
Membrane	Replaceable	
Cabel length	2m	5m

DO9709SS



DO9709SS.5



ORDER CODES

HD2109.1: The kit is composed of: instrument HD2109.1, calibrator DO9709/20, 4 1.5V alkaline batteries, operating manual, case and DeltaLog9 software.
The probes and data transfer cable must be ordered separately.

HD2109.2: The kit is composed of: instrument HD2109.2 **datalogger**, calibrator DO9709/20, connection cable for serial output **HD2101/USB**, 4 1.5V alkaline batteries, operating manual, case and DeltaLog9 software.
The probes and data transfer cable must be ordered separately.

HD2110CSNM: 8-pole connection cable MiniDin - Sub D 9-pole female for RS232C.

C.206: Serial connection cable with USB connector for PC and 8-pole MiniDin male connector for the instrument

HD2101/USB: Connection cable USB 2.0 connector type A - 8-pole MiniDin (not suitable for HD2109.1K).

DeltaLog9: Software for download and management of the data on PC using Windows 98 to Vista operating systems.

SWD10: Stabilized power supply 100-240 Vac/12Vdc-1A mains voltage

HD40.1: 24-column portable thermal printer, serial interface, 57mm paper width, four NiMH 1.2V rechargeable batteries, SWD10 power supply, instruction manual, 5 thermal paper rolls.

RCT: The kit includes 4 thermal paper rolls 57mm wide and 32mm in diameter.

BAT-40: Spare battery pack for HD40.1 printer with built-in temperature sensor.

HD22.2: Laboratory electrode holder composed of base plate with built-in magnetic stirrer, shaft and replaceable electrode holder. Suitable diameter 12mm. Powered by bench-top meters of the series HD22…with cable HD22.2.1 (**optional**) or power supplier SWD10 (**optional**).

HD22.3: Laboratory electrode holder composed of base plate. Flexible arm for free positioning. Suitable for electrodes with diameter 12mm.

Solutions

DO9700: zero solution.

DO9701: electrolyte solution.

Combined dissolved Oxygen/temperature probes

DO9709 SS: The kit includes: combined probe for measurement of O_2 and temperature with replaceable membrane, three membranes, 50ml of zero solution, 50ml of electrolyte solution. Cable length 2m. ∅12mm x 120mm.

DO9709 SS.5: The kit includes: combined probe for measurement of O_2 and temperature, replaceable membrane, Ø 12mm x Ø 12mm. Cable length 5m, three membranes, 50ml of zero solution, 50ml of electrolyte solution.

Temperature probes complete with SICRAM module

TP87: PT100 sensor immersion probe. Stem Ø 3 mm, length 70 mm. Cable length 1 m.

TP472I.0: Pt100 sensor immersion probe. Stem Ø 3 mm, length 230 mm. Cable length 2 m.

TP473P.0: Pt100 sensor penetration probe. Stem Ø 4mm, length 150 mm. Cable length 2 m.

TP474C.0: Pt100 sensor contact probe. Stem Ø 4mm, length 230mm, contact surface Ø 5mm. Cable length 2 m.

TP475A.0: Air probe, sensor Pt100. Stem Ø 4mm, length 230mm. Cable length 2 m.

TP472I.5: Immersion probe, sensor Pt100. Stem Ø 6mm, length 500 mm. Cable length 2 m.

TP472I.10: Immersion probe, sensor Pt100. Stem Ø 6mm, length 1,000mm. Cable length 2 m.

Temperature probes without SICRAM module

TP47.100: Direct 4 wires Pt100 sensor immersion probe. Probe's stem Ø 3mm, length 230mm. Connection cable 4 wires with connector, length 2 m.

TP47.1000: Pt1000 sensor immersion probe. Probe's stem Ø 3mm, length 230mm. Connection cable 2 wires with connector, length 2 m.

TP87.100: Pt100 sensor immersion probe. Probe's stem Ø 3mm, length 70mm. 4 wire connection cable with connector, length 1 m.

TP87.1000: Pt1000 sensor immersion probe. Probe's stem Ø 3mm, length 70mm. 2-wire connection cable with connector, length 1 m.

TP47: Module for the connection of Pt100 4-wire and Pt1000 2-wire probes

DO9700 **DO9701**

HD 98569
MULTIPARAMETER INSTRUMENT: pH - CONDUCTIVITY DISSOLVED OXYGEN - TEMPERATURE

The **HD 98569** is a portable multi-parameter data logger for electrochemical measures: **pH**, **conductivity**, **dissolved oxygen** and **temperature**. It is fitted with a large back-lighted LCD display.
The instrument measures:

- **pH**, **mV**, **redox potential** (ORP) with pH, redox or combined pH/temperature electrodes **complete with SICRAM module**;
- **conductivity**, **resistivity** in liquids, **total dissolved solids** (TDS), and **salinity** with combined 4-ring and 2-ring conductivity and temperature probes **with SICRAM module**.
- **Concentration of dissolved oxygen** in liquids (in mg/l), **saturation index** (in %) **using SICRAM combined probes** of polarographic type with two or three electrodes and integrated temperature sensor.

The instrument ifs fitted with input for the measurement of **temperature** with Pt100 immersion, penetration or contact probes with SICRAM module.

- The pH electrode calibration can be carried out on one or five points and the calibration sequence can be chosen from a list of 8 buffers. Temperature compensation can be automatic or manual.
- The conductivity probe calibration can be performed with automatically detected conductivity calibration solutions: 147µS/cm, 1413µS/cm, 12880µS/cm, 111800µS/cm or manually with calibration solutions having different values.
- The dissolved oxygen probe's quick calibration function guarantees long-term correctness of the performed measurements.
- pH, conductivity dissolved oxygen and temperature probes fitted with SICRAM module can store factory and calibration data inside.

The HD 98569 is a **data logger**, it stores up to 200 single screens (labels) and up to 9000 samples in continuous storage mode: pH or mV, conductivity or resistivity or TDS or salinity, concentration of dissolved oxygen and saturation index and temperature.
The data can be transferred from the instrument connected to a PC via the multi-standard RS232C serial port and USB 2.0-1.1.
The instruments equipped with **HD22BT** Bluetooth option can transfer the data without any connection to a PC fitted with USB/Bluetooth converter HD USBKL1, or to the printer *HD40.2* with Bluetooth interface or to a PC with Bluetooth input.

The serial connection RS232C can be used for direct printing of labels with a 24 column printer (*HD40.1 or HD40.2*).
The software **DeltaLog11** (vers. 2.0 and subsequent ones) allows instrument management and configuration, and data processing on PC.

Technical characteristics of HD 98569

Measured values	
	pH - mV ϰ - Ω - TDS - NaCl mg/l O_2 - %O_2 °C - °F
Instrument	
Dimensions (Length x Width x Height)	250x100x50mm
Weight	640g (complete with batteries)
Materials	ABS, rubber
Display	Graphic, back lighted LCD, 56x38mm. 128x64 points
Operating conditions	
Working temperature	-5 … 50°C
Storage temperature	-25 … 65°C
Working relative humidity	0 … 90% RH without condensate
Protection degree	**IP66**
Power	
Batteries	4 batteries 1.5V type AA
Autonomy (with probes connected)	25 hours with 1800mAh alkaline batteries
Mains (cod. SWD10)	12Vdc/1A (positive at centre)
Security of memorized data	
	Unlimited
Time	
Date and hour	Schedule in real time
Accuracy	1min/month max. departure
Continuous storage (LOG key)	
Quantity	9000 samples of the three inputs
Type	organised in 1800 pages containing 5 samples each
Storage interval	1s … 999s
Storage on command (MEM key)	
Quantity	200 samples of the three inputs
Type	organised in 200 pages containing 1 sample each

① ② ③

④ ⑤

① Only conductivity probes with SICRAM module.
② Input for O_2 and temperature probes or for only temperature probes with SICRAM module.
③ Input for pH, mV, pH and temperature probes or for only temperature probes with SICRAM module.
④ External Power supply.
⑤ RS232 or USB interface.

Calibration storage

pH and Dissolved Oxygen	Last 8 pH and dissolved oxygen calibrations. The last 2 are saved in the SICRAM memory of the probe as well.
Conductivity	Last calibration is saved in the SICRAM memory of the probe.

RS232C serial interface

Type	RS232C electrically isolated
Baud rate	Can be set from 1200 to 38400 baud
Data bit	8
Parity	None
Stop bit	1
Flow control	Xon/Xoff
Length of serial cable	Max 15m

USB interface

Typ	1.1 - 2.0 electrically isolated

Bluetooth interface

Optional for PCs fitted with Bluetooth input or HD USB. KL1 Bluetooth / RS232 adapter. The interface can be installed in Delta Ohm only.

Connections

Enabled inputs for temperature probes with SICRAM module	pH/mV and O_2 inputs.
Input for pH/temperature with SICRAM module	8-pole male DIN45326 connector
Input for conductivity/temperature with SICRAM module	8-pole male DIN45326 connector
Input for dissolved oxygen/temperature with SICRAM module	8-pole male DIN45326 connector
RS232C / USB interface	8-pole MiniDin female connector
Bluetooth	Optional
Mains adapter	2-pole(Ø5.5mm- Ø2.1mm). Positive at centre (e.g. SWD10).

■ *Measurement of pH by instrument*

Measuring range	-9.999…+19.999pH
Resolution	0.01 o 0.001pH selectable from menu
Accuracy	±0.001pH ±1digit
Input impedance	$>10^{12}\Omega$
Calibration error @25°C	|Offset| > 20mV Slope > 63mV/pH or Slope < 50mV/pH Sensitivity > 106.5% or Sensitivity < 85%
Calibration points	Up to 5 points from a list of 8 automatically detected buffers
Temperature compensation	-50...150°C
Automatically detected standard solutions @25°C	1.679pH - 4.000pH - 4.010pH 6.860pH - 7.000pH - 7.648pH 9.180pH - 10.010pH

Measurement of mV by instrument

Measuring range	-1999.9…+1999.9mV
Resolution	0.1mV
Accuracy	±0.1mV ±1digit
Drift after 1 year	0.5mV/year

■ *Measurement of conductivity by instrument*

		Resolution
Measurement range (K cell=0.01)	0.000…1.999µS/cm	0.001µS/cm
Measurement range (K cell=0.1)	0.00…19.99µS/cm	0.01µS/cm
Measurement range (K cell=1)	0.0…199.9µS/cm	0.1µS/cm
	200…1999µS/cm	1µS/cm
	2.00…19.99mS/cm	0.01mS/cm
	20.0…199.9mS/cm	0.1mS/cm
Measurement range (K cell=10)	200…1999mS/cm	1mS/cm
Accuracy (conductivity) instrument	±0.5% ±1digit	

Measurement of resistivity by instrument

		Resolution
Measurement range (K cell=0.01)	Up to 1GΩ·cm	
Measurement range (K cell=0.1)	Up to 100MΩ·cm	(*)
Measurement range (K cell=1)	5.0…199.9Ω·cm	0.1Ω·cm
	200…999Ω·cm	1Ω·cm
	1.00k…19.99kΩ·cm	0.01kΩ·cm
	20.0k…99.9kΩ·cm	0.1kΩ·cm
	100k…999kΩ·cm	1kΩ·cm
	1…10MΩ·cm	1MΩ·cm
Measurement range (K cell=10)	0.5…5.0Ω·cm	0.1Ω·cm
Accuracy (resistivity) instrument	±0.5% ±1digit	

(*) The resistivity measurement is obtained from the reciprocal of conductivity measurement. Close to the bottom of the scale, the indication of resistivity appears like reported in the table below:

K cell = 0.01 cm^{-1}	
Conductivity (µS/cm)	Resistivity (MΩ·cm)
0.001 µS/cm	1000 MΩ·cm
0.002 µS/cm	500 MΩ·cm
0.003 µS/cm	333 MΩ·cm
0.004 µS/cm	250 MΩ·cm
…	…

K cell = 0.1 cm^{-1}	
Conductivity (µS/cm)	Resistivity (MΩ·cm)
0.01 µS/cm	100 MΩ·cm
0.02 µS/cm	50 MΩ·cm
0.03 µS/cm	33 MΩ·cm
0.04 µS/cm	25 MΩ·cm
…	…

Measurement of total dissolved solids (with coefficient χ/TDS=0.5)

	Resolution	
Measurement range (K cell=0.01)	0.00…1.999mg/l	0.005mg/l
Measurement range (K cell=0.1)	0.00…19.99mg/l	0.05mg/l
Measurement range (K cell=1)	0.0…199.9 mg/l	0.5 mg/l
	200…1999 mg/l	1 mg/l
	2.00…19.99 g/l	0.01 g/l
	20.0…199.9 g/l	0.1 g/l
Measurement range (K cell=10)	100…999 g/l	1 g/l
Accuracy (total dissolved solids) instrument	±0.5% ±1digit	

Measurement of salinity

		Resolution
Measurement range	0.000…1.999g/l	1mg/l
	2.00…19.99g/l	10mg/l
	20.0…199.9 g/l	0.1 g/l
Accuracy (salinity) instrument	±0.5% ±1digit	

Automatic/manual temperature compensation

0...100°C with α_T = 0.00…4.00%/°C

Reference temperature

0…50°C (**Default values 20°C or 25°C**)

Conversion factor χ /TDS

0.4…0.8

Admitted cell constants K (cm^{-1})

0.01…20.00

Automatically detected standard solutions (@25°C)

147µS/cm
1413µS/cm
12880µS/cm
111800µS/cm

■ *Measurement of concentration of dissolved oxygen*

Measurement range	0.00…90.00mg/l
Resolution	0.01mg/l
Accuracy instrument	±0.03mg/l ±1digit (60...110%, 1013mbar, 20...25°C)

Measurement of saturation index of dissolved oxygen

Measurement range	0.0…600.0%
Resolution	0.1%
Accuracy instrument	±0.3% ±1digit (in the range 0.0…199.9%) ±1% ±1digit (in the range 200.0…600.0%)

Salinity setting

Setting	directly from menu or automatically by conductivity measurement
Setting range	0.0…70.0g/l
Resolution	0.1g/l

Temperature measurement with the sensor inside the O_2 probe

Measurement range	0.0…50.0°C
Resolution	0.1°C
Accuracy instrument	±0.1°C
Drift after 1 year	0.1°C/year
Automatic temperature compensation	0…50°C

■ *Measurement of temperature by instrument*

Pt100 Measurement range	-50…+150°C
Resolution	0.1°C
Accuracy instrument	±0.1°C ±1digit
Drift after 1 year	0.1°C/year

24 column printing example

```
HD 98569
pH / chi / Oxy / temperature
Ser num=12345678

2007 - 01 - 31  12:00:00

LAB POSITION #1

Operator = Amministratore

SAMPLE ID = 00000001

pH  EL  sernum = 01234567
pH = 7.010
pH out of calibration !

O2 EL sernum = 76543210
mg/l O2 = 5.59

chi EL sernum = 98756410
mS = 2.177

Temp = 25.0°C  ATC
```

Ordering codes

HD 98569: The kit is composed of: instrument **data logger** HD 98569 for measurement of pH - redox - conductivity - resistivity - TDS - salinity - concentration of dissolved oxygen- saturation index - temperature, 4 1.5V batteries type AA, instructions manual, software DeltaLog11 (vers. 2.0 and subsequent ones), carrying case and SICRAM module pH471.1 (cable 1 meter).

The pH/mV electrodes, conductivity probes, dissolved oxygen probes, temperature probes, standard reference solutions for different measurement types, connection cables for data download to PC or printer have to be ordered separately.

HD2110CSNM: 8-pole connection cable Mini Din - Sub D 9-pole female for RS232C, for connection to PC with RS232C USB input.

HD2101/USB: Connection cable USB 2.0 connector type A - 8-pole Mini Din for connection to PC with USB input.

DeltaLog11: Further unit of software (vers. 2.0 and subsequent ones) for data download and management on PC using Windows 98 to Vista operating systems.

SWD10: Stabilized power supply at 100-240Vac/12Vdc-1A mains voltage.

HD40.1: 24-column portable thermal printer, serial interface, 57mm paper width, four NiMH 1.2V rechargeable batteries, SWD10 power supply, instruction manual, 5 thermal paper rolls.

HD40.2: 24-column portable thermal printer, **Bluetooth and serial interface**, 57mm paper width, four NiMH 1.2V rechargeable batteries, SWD10 power supply, instruction manual, 5 thermal paper rolls. Requires the module HD22BT (**optional**) or the cable HD 2110 CSNM (**optional**).

RCT: The kit includes 4 thermal paper rolls 57mm wide and 32mm in diameter.

BAT-40: Spare battery pack for HD40.1 printer with built-in temperature sensor.

HD22.2: Laboratory electrode holder composed of basis plate with incorporated magnetic stirrer, staff and replaceable electrode holder. Height max. 380mm. For ∅12mm electrodes. Powered by bench top meters of series HD22… with cable HD22.2.1 (**optional**) or supplier SWD10 (**optional**)

HD22.3: Laboratory electrode holder with metal basis plate. Flexible electrode holder for free positioning. For Ø 12mm probes.

HD22BT: Bluetooth module for wireless data transmission from instrument PC. **The fitting of the module into the instrument is made exclusively by Delta Ohm, at the time of placing the order.**

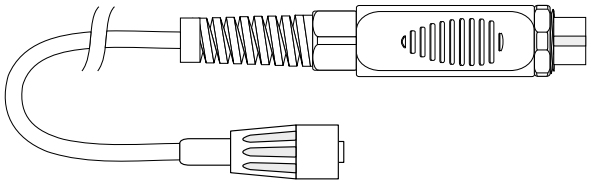
HD USB.KL1: USB/Bluetooth converter to be connected to the PC for wireless data transmission from the instrument with HD22BT module.

SICRAM Modules with S7 input for pH electrodes

KP471.1: SICRAM module for pH electrodes with S7 standard connection, cable L=1m.

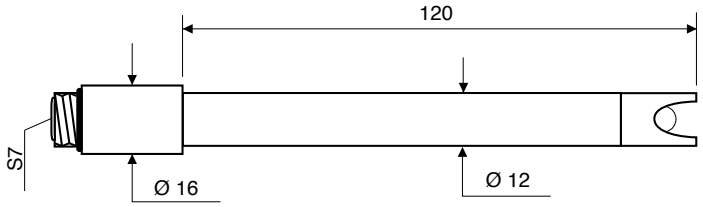
KP471.2: SICRAM module for pH electrodes with S7 standard connection, cable L=2m.

KP471.5: SICRAM module for pH electrodes with S7 standard connection, cable L=5m.

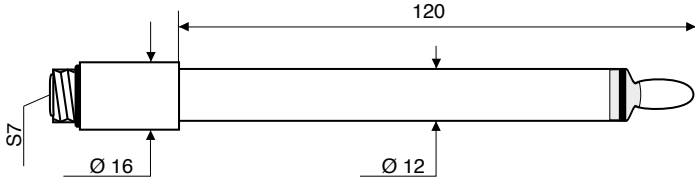


pH Electrodes to be connected to KP471… SICRAM module

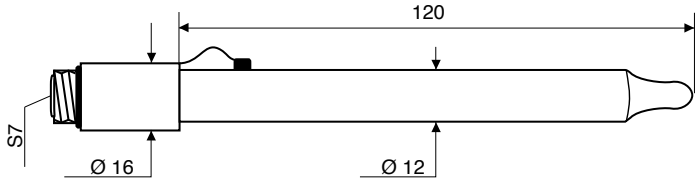
KP20: Combined pH electrode for general use, GEL-filled, with screw connector S7, body in Epoxy,



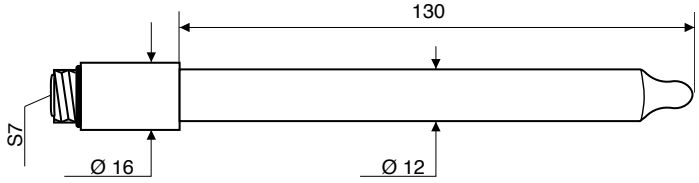
KP 50: Combined pH electrode pH for general use, varnishes, emulsions, GEL-filled, with S7 screw connector, body in glass.



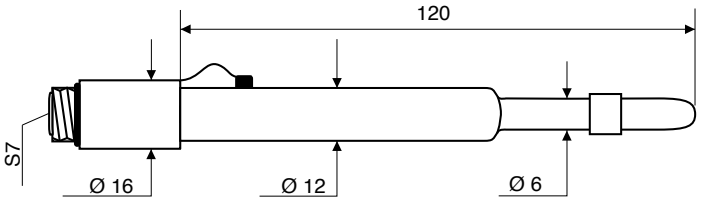
KP 61: Combined pH electrode, 3 diaphragms for milk, cream, etc. gel-filled, with screw connector S7, body in glass.



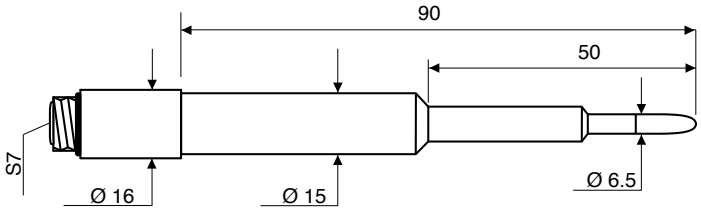
KP 62: Combined pH electrode, 1 diaphragm for pure water, paints, etc. GEL-filled, with screw connector S7, body in glass



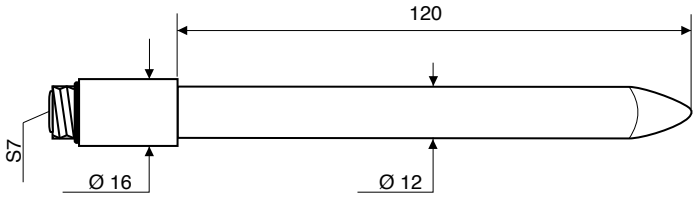
KP 64: Combined pH electrode for water, varnishes, emulsions, etc. reference filling solution KCl 3M, with S7 screw connector, body in glass.



KP 70: Combined pH electrode, micro diam. 6 x L=70mm, GEL-filled, for paste, bread, cheese, etc, with S7 connector, body in glass.

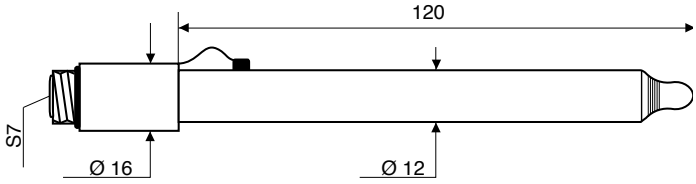


KP 80: Combined pointed pH electrode, gel-filled, with screw connector S7, body in glass.



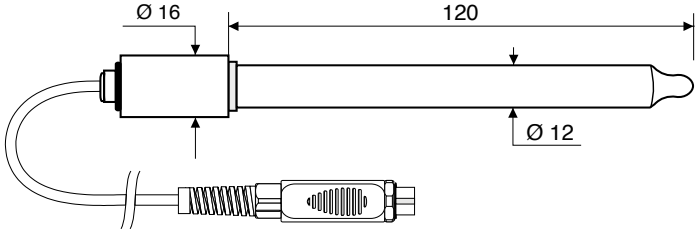
ORP Electrodes to be connected to KP471… SICRAM module

KP90: REDOX PLATINUM electrode, with screw connector S7, reference filling solution KCl 3M, body in glass.

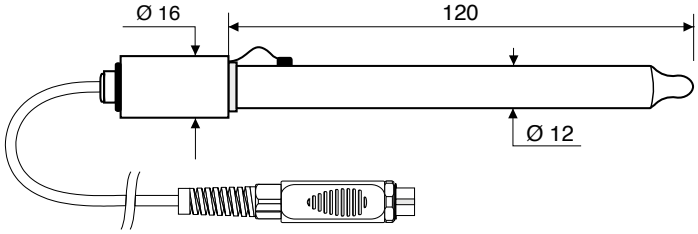


pH Electrodes with SICRAM module

KP 50TS: Combined **pH/temperature** electrode, Pt100 sensor, GEL-filled, with SICRAM module, body in glass, general use, varnishes, emulsions. Cable length 1m.



KP63TS: Combined **pH/temperature** electrode, Pt100 sensor, GEL-filled, with SICRAM module, body in glass, Ag/AgCl sat KCl.



pH buffer solutions

HD8642: Buffer solution 4.01pH - 200cc.
HD8672: Buffer solution 6.86pH - 200cc.
HD8692: Buffer solution 9.18pH - 200cc.

Redox buffer solutions

HDR220: Redox buffer solution 220mV 500cc.
HDR468: Redox buffer solution 468mV 500cc.

Electrolyte solutions

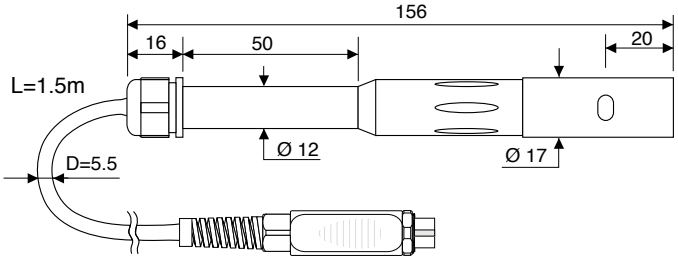
KCL 3M: 50cc ready for use solution for refilling of electrodes.

Cleaning and maintenance

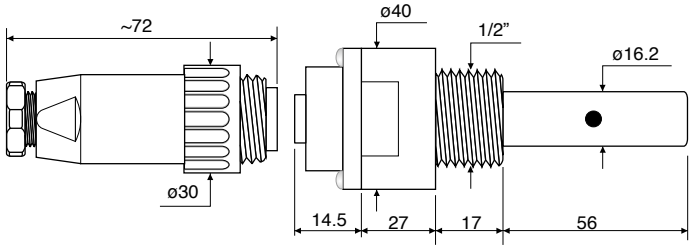
HD62PT: Diaphragm cleaning (tiourea in HCl) - 200cc.
HD62PP: Protein cleaning (pepsin in HCl) - 200cc.
HD62RF: Regeneration (fluorhydric acid) - 100cc.
HD62SC: Solution for electrode preservation - 200cc.

Combined conductivity and temperature probes with SICRAM module

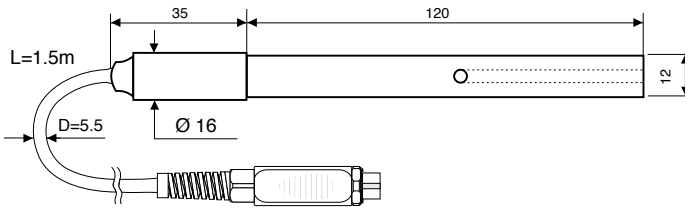
SP06TS: Combined conductivity and temperature 4-electrode cell, body in Pocan. Cell constant K=0.7.
Measurement range 5µS/cm …200mS/cm, 0…90°C.



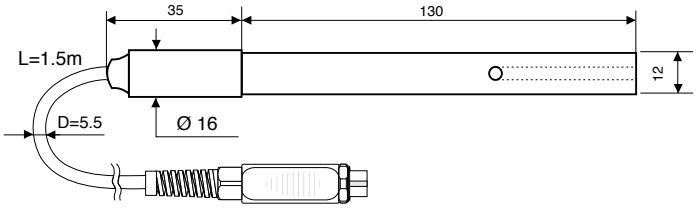
SPT401.001S: Combined conductivity and temperature 2-electrode cell in stainless steel AISI 316. Cell constant K=0.01. Cable 2m.
Measurement range 0.04µS/cm …20µS/cm, 0…120°C. Measurement in closed-ell.



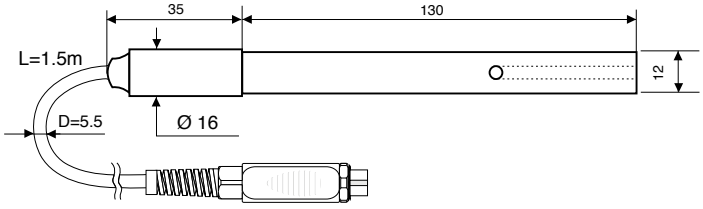
SPT01GS: Combined conductivity and temperature 2-electrode Platinum-wire cell, body in glass. Cell constant K=0.1.
Measurement range 0.1µS/cm …500µS/cm, 0…80°C.



SPT1GS: Combined conductivity and temperature 2-electrode Platinum-wire cell, body in glass. Cell constant K=1.
Measurement range 10µS/cm …10mS/cm, 0…80°C.



SPT10GS: Combined conductivity and temperature 2-electrode Platinum-wire cell, body in glass. Cell constant K=10.
Measurement range 500µS/cm …200mS/cm, 0…80°C.

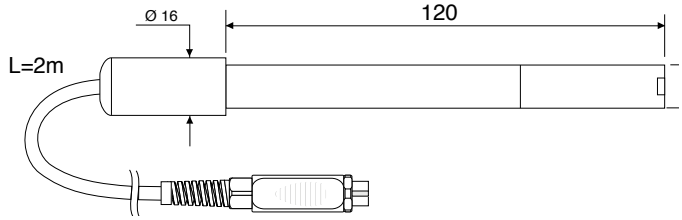


Standard calibration solutions

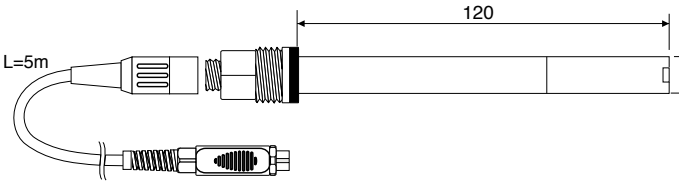
HD8747: Standard calibration solution 0.001mol/l equal to 147µS/cm @25°C - 200cc.
HD8714: Standard calibration solution 0.01mol/l equal to 1413µS/cm @25°C - 200cc.
HD8712: Standard calibration solution 0.1mol/l equal to 12880µS/cm @25°C - 200cc.
HD87111: Standard calibration solution 1mol/l equal to 111800µS/cm @25°C - 200cc.

Combined dissolved oxygen/temperature probes

DO9709 SS: The kit includes: combined probe for the measurement of O_2 and temperature with replaceable membrane, three membranes totally. 50ml of zero solution, 50ml of electrolyte solution. Cable length 2m. Ø12mm x 120mm.



DO9709 SS.5: The kit includes: combined probe for the measurement of O_2 and temperature with replaceable membrane, three membranes totally. 50ml of zero solution, 50ml of electrolyte solution. Cable length 5m. Ø12mm x 120mm.



Accessori es for combined dissolved oxygen/temperature probes

DO9709 SSK: Accessory kit for the DO9709 SS probe consisting of three membranes, 50ml of zero solution, 50ml of electrolyte solution.
DO9709.20: Calibrator for polarographic probes DO9709SS and DO9709SS.5.

Temperature probes with SICRAM module

TP87: Pt100 sensor immersion probe. Probe's stem Ø 3mm, length 70mm. Cable length 1 metre.
TP472I.0: Pt100 sensor immersion probe. Stem Ø 3 mm, length 230 mm. Cable length 2 metres.
TP473P.0: Pt100 sensor penetration probe. Stem Ø 4mm, length 150 mm. Cable length 2 metres.
TP474C.0: Pt100 sensor contact probe. Stem Ø 4mm, length 230mm, contact surface Ø 5mm. Cable length 2 metres.
TP475A.0: Pt100 sensor air probe. Stem Ø 4mm, length 230mm. Cable length 2 metres.
TP472I.5: Pt100 sensor immersion probe. Stem Ø 6mm, length 500 mm. Cable length 2 metres.
TP472I.10: Pt100 sensor immersion probe. Stem Ø 6mm, length 1,000mm. Cable length 2 metres.

HD 3405.2

HD 3405.2
BENCH-TOP pH METER

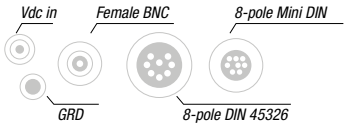
The **HD3405.2** is a 4 bench top instrument for electrochemical measures: **pH, and temperature**.
The displayed data can be stored **(datalogger)** and can be transferred to PC or serial printer thanks to the multi-standard serial port RS232C and USB2.0 and software DeltaLog9 (Vers.2.0 and subsequent ones). The storing and printing parameters can be set from menu.
The **HD3405.2** measures **pH**, **redox potential** (ORP) in mV. It measures **temperature** with Pt100 or Pt1000 immersion, penetration or contact probes. The pH electrode calibration can be carried out on one, two or three points and the calibration sequence can be chosen from a list of 13 buffers. The display shows continually the temperature in °C or °F and one of the parameters according to the connected probe type. Printing and storage always include the temperature in °C or °F and one selectable parameter for each probe type.

Other functions include: Max, Min and Avg function, the Auto-HOLD function, the automatic turning off which can also be excluded.

The instruments have IP66 protection degree.

Technical characteristics HD3405.2
pH - mV - °C/°F measurement

Instrument	
Dimensions (Length x Width x Height)	220x120x55mm
Weight	460g (complete with batteries)
Materials	ABS, rubber
Display	2x4½ characters plus symbols visible area: 52x42mm
Operating conditions	
Working temperature	-5 … 50°C
Storage temperature	-25 … 65°C
Working relative humidity	0 … 90% RH without condensation
Protection degree	**IP66**
Power	
Batteries	3 batteries 1.5V type AA
Autonomy (only batteries)	100 hours with 1800mAh alkaline batteries
Mains (cod. **SWD10**)	Output mains adapter 100-240Vac/ 12Vdc-1A
Security of memorized data	
	Unlimited
Selectable storage interval	
	1s, 5s, 10s, 15s, 30s, 1min, 2min, 5min, 10min, 15min, 20min, 30min and 1hour
Time	
Date and hour	Schedule in real time
Accuracy	1min/month max departure
Serial interface RS232C	
Type	RS232C electrically isolated
Baud rate	Can be set from 1200 to 38400 baud
Data bit	8
Parity	None
Stop bit	1
Flow Control	Xon/Xoff
Serial cable length	Max 15m
Selectable print interval	immediate or 1s, 5s, 10s, 15s, 30s, 1min, 2min, 5min, 10min, 15min, 20min, 30min and 1hour
USB Interface	
Type	1.1 - 2.0 electrically isolated
Connections	
Serial interface and USB	8-pole MiniDin connector
Mains adapter (cod. SWD10)	2-pole connector (positive at centre) 12Vdc/1A
Storage of measured values	
Type	2000 pages of 17 samples each
Quantity	34,000 sets of measures made up of [pH or mV] or and [°C or °F].
Measurement connections	
Temperature probe input with SICRAM module or TP47 module pH/mV input	8-pole male DIN45326 connector female BNC



pH Measurement

Measurement range	-2.000…+19.999pH
Resolution	0.01 or 0.001pH selectable from menu
Accuracy	±0.001pH ±1digit
Input impedance	$>10^{12}\Omega$
Calibration error @25°C	|Offset| > 20mV Slope < 50mV/pH or Slope > 63mV/pH Sensitivity < 85% or Sensitivity > 106.5%
Automatic / manual temperature compensation	-50…+150°C

mV Measurement

Measurement range	-1999.9…+1999.9mV
Resolution	0.1mV
Accuracy	±0.1mV ±1digit
Drift after 1 year	0.5mV/year

Temperature Measurement

Pt100 measurement range	-200…+650°C
Pt1000 measurement range	-200…+650°C
Resolution	0.1°C
Accuracy	±0.1°C ±1digit
Drift after 1 year	0.1°C/year

Automatically detected pH standard solutions (@25°C)

1.679pH - 2.000pH - 4.000pH - 4.008pH
4.010pH - 6.860pH - 6.865pH - 7.000pH
7.413pH - 7.648pH - 9.180pH - 9.210pH
10.010pH

Ordering codes for instrument series HD34…

HD3405.2: The kit is composed of: instrument HD3405.2 **datalogger,** for measurement of pH - redox - temperature, 3 1.5V alkaline batteries, operating manual and **DeltaLog9 version 2.0**.

pH/mV electrodes, conductivity probes, dissolved oxygen probes, temperature probes, standard reference solutions for different measurement types, connection cables for pH electrodes with S7 connector, cables for data download to PC or printer have to be ordered separately.

Common Accessories for instruments series HD34…

HD2110CSNM: 8-pole connection cable Mini Din - Sub D 9-pole female for RS232C, for connection to PC without USB input.

HD2101/USB: Connection cable USB 2.0 connector type A - 8-pole Mini Din for connection to PC with USB input.

SWD10: Stabilized power supply at 100-240Vac/12 Vdc-1A mains voltage.

HD40.1: Portable, serial input, 24 column thermal printer, 57mm paper width.

HD22.2: Laboratory electrode holder composed of basis plate with incorporated magnetic stirrer, staff and replaceable electrode holder. Height max. 380mm. Powerd by bench-top meters of the series HD22… with cable HD22.2.1 (**optional**) or supplier SWD10 (**optional**).

HD22.3: Laboratory electrode holder with metal basis plate. Flexible electrode holder for free positioning. For Ø 12mm probes.

TP47: Module for the connection of Pt100 4-wire and Pt1000 2-wire probes to instrument series HD34…, without amplifying electronics and linearization.

pH Electrodes

KP20: Combined pH electrode for common use, gel filled with screw connector S7 body in Epoxy.

KP30: Combined pH electrode for common use, cable 1 m, gel filled, body in Epoxy.

KP50: Combined pH electrode with Teflon collar diaphragm, for emulsions, deionised water, S7 screw connector, gel filled, body in glass.

KP 61: Combined pH electrode, 3 diaphragms for milk, cream, etc. elektrolyte, with screw connector S7, body in glass.

KP 62: Combined pH electrode, 1 diaphragm for pure water, paints, etc. gel-filled, with screw connector S7, body in glass.

KP 63: Combined pH electrode for common use, varnish, cable 1 m, electrolyte KCl 3M body in glass.

KP 64: Combined pH electrode for water, varnish, emulsions, etc., electrolyte KCl 3M with screw connector S7, body in glass.

KP 70: Combined pH micro electrode diam. 4.5 x L=25 mm. Gel filled with screw connector, body in glass.

KP 80: Combined pointed pH electrode, gel filled with screw connector S7, body in glass.

KP100: Flat membrane gel combined pH electrode with S7 screw connector, glass body, for skin, leather, paper.

CP: Extension cable 1.5m with BNC connectors on one side and S7 on the other side for electrode with S7 connector.

CP5: Extension cable 5m with BNC connectors on one side and S7 on the other side for electrode with S7 connector.

CE: S7 screw connector for pH electrode.

BNC: Female BNC for electrode extension.

ORP Electrodes

KP90: Redox Platinum electrode, with screw connector S7, electrolyte KCl 3M, body in glass.

KP91: Redox Platinum electrode with 1m cable, GEL filled, body in glass.

Electrode dimensions and characteristics at page 402

pH buffer solutions

HD8642: Buffer solution 4.01pH - 200cc.

HD8672: Buffer solution 6.86pH - 200cc.

HD8692: Buffer solution 9.18pH - 200cc.

Redox buffer solutions

HDR220: Redox buffer solution 220mV 0,5 l.

HDR468: Redox buffer solution 468mV 0,5 l.

Elettrolyte solutions

KCL 3M: 50cc ready for use solution for refilling of the electrodes.

Cleaning and maintainance

HD62PT: Diaphragm cleaning (tiourea in HCl) - 500ml.

HD62PP: Protein cleaning (pepsin in HCl) - 500ml.

HD62RF: Regeneration (fluorhydric acid) - 100ml.

HD62SC: Solution for electrode preservation - 500ml.

Temperature probes complete with SICRAM module

TP87: PT100 sensor immersion probe. Stem Ø 3 mm, length 70 mm. Cable length 1 m.

TP472I.0: Pt100 sensor immersion probe. Stem Ø 3 mm, length 230 mm. Cable length 2 m.

TP473P.0: Pt100 sensor penetration probe. Stem Ø 4mm, length 150 mm. Cable length 2 m.

TP474C.0: Pt100 sensor contact probe. Stem Ø 4mm, length 230mm, contact surface Ø 5mm. Cable length 2 m.

TP475A.0: Air probe, sensor Pt100. Stem Ø 4mm, length 230mm. Cable length 2 m.

TP472I.5: Immersion probe, sensor Pt100. Stem Ø 6mm, length 500 mm. Cable length 2 m.

TP472I.10: Immersion probe, sensor Pt100. Stem Ø 6mm, length 1,000mm. Cable length 2 m.

Temperature probes complete with TP47module

TP87.100: Pt100 sensor immersion probe. Probe's stem Ø 3mm, length 70mm. 4 wire connection cable with connector, length 1 m.

TP87.1000: Pt1000 sensor immersion probe. Probe's stem Ø 3mm, length 70mm. 2 wire connection cable with connector, length 1 m.

Accessories

TP47: Module for the connection of Pt100 4-wire and Pt1000 2-wire probes.

pH

mV

HD 2205.2

HD 2205.2
BENCH-TOP pH METER

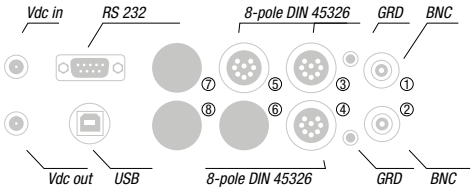
The **HD2205.2** is a bench top instruments for electrochemical measures: **pH** and **temperature**. It is fitted with a large backlighted LCD display.
The **HD2205.2** is equipped with two BNC inputs for the measurement of **pH**, **mV**, **redox potential** (ORP) with pH or redox electrodes, or electrodes with separate reference, and one input for combined pH/temperature probes fitted with SICRAM module.
Al models are fitted with input for the measurement of t**emperature** with Pt100 or Pt1000 immersion, penetration or contact probes. The temperature probes are equipped with an automatic recognition module and factory calibration data are stored inside.
The pH electrode calibration can be carried out on one or five points and the calibration sequence can be chosen from a list of 13 buffers.

- The pH electrode calibration can be carried out on one or five points and the calibration sequence can be chosen from a list of 13 buffers Temperature compensation can be automatic or manual.

The data can be transferred from the instrument connected to a PC via the multi-standard RS232C serial port and USB 2.0. The storing parameters can be configured using the menu.
The RS232C serial port can be used to transfer the acquired measurements to a 24 column portable printer in real time (HD40.1 or HD40.2).
The instruments equipped with **HD22BT** (Bluetooth) option can transfer data without any connection to a PC or printer fitted with Bluetooth input or through Bluetooth/RS232C converter.
The software DeltaLog11 allows instrument management and configuration, and data processing on PC.
The instruments have IP66 protection degree.

Technical characteristics HD2205.2
pH - mV - °C - °F measurement

Instrument	
Dimensions (Length x Width x Height)	265x185x70mm
Weight	490g
Materials	ABS, rubber
Display	Back lighted, matrix point display. 240x64 points, visible area: 128x35mm
Operating conditions	
Working temperature	-5 … 50°C
Storing temperature	-25 … 65°C
Working relative humidity	0 … 90% R.H. without condensate
Protection degree	**IP66**
Power	
	Mains adapter (cod. SWD10) 12Vdc/1A
Auxiliary socket	For supplying of electrode holder with built-in stirrer HD22.2
Security of memorized data	
	Unlimited
Time	
Date and hour	Real time schedule with backup battery E 3.6V - ½AA
Accuracy	1min/month max drift
Measured values storing	
Quantity	2000 screens
Storage interval	1s … 999s



Calibration storage

Quantity	Last 8 calibrations of each physical quantity

RS232C serial interface

Type	RS232C electrically isolated
Baud rate	Can be set from 1200 to 115200 baud
Data bit	8
Parity	None
Stop bit	1
Flow Control	Xon/Xoff
Length of serial cable	Max 15m

USB Interface

Type	1.1 - 2.0 electrically isolated
Bluetooth Interface	HD22BT optional

EMC standard regulations

Security	EN61000-4-2, EN61010-1 level 3
Electrostatic discharge	EN61000-4-2 level 3
Electric fast transients	EN61000-4-4 level 3, EN61000-4-5 level 3
Voltage variations	EN61000-4-11
Electromagnetic interference susceptibility	IEC1000-4-3
Electromagnetic interference emission	EN55020 class B

Connections

Input for temperature probes with SICRAM module⑤	8-pole male DIN45326 connector
Inputs pH/mV ① - ②	female BNC
Inputs for SICRAM module pH/temperature ③ a. ④	8-pole male DIN45326 connector
Serial interface	DB9 connector (9- pole male)
USB interface	USB connector type B
Bluetooth	Optional
Mains adapter	2- pole connector (Ø5.5mm-2.1mm). Positive at centre.
Socket for power supply of electrode holder with built-in magnetic stirrer	2 -pole connector (Ø5.5mm-2.1mm). Positive at centre (output 12Vdc/200mA max).

Measurement of pH by instrument

Measuring range	-9.999…+19.999pH
Resolution	0.01 o 0.001pH selectable from menu
Accuracy	±0.001pH ±1digit
Input impedance	$>10^{12}\Omega$
Calibration error @25°C	|Offset| > 20mV Slope > 63mV/pH o Slope < 50mV/pH Sensitivity > 106.5% or Senstivity < 85%
Calibration points	Up to 5 points from a list of 13 automatically detected buffers.
Automatically detected pH standard solutions (@25°C)	1.679pH - 2.000pH - 4.000pH - 4.008pH - 4.010pH 6.860pH - 6.865pH - 7.000pH - 7.413pH - 7.648pH 9.180pH - 9.210pH - 10.010pH

Measurement of mV by instrument

Measuring range	-1999.9…+1999.9mV
Resolution	0.1mV
Accuracy	±0.1mV ±1digit
Drift after 1 year	0.5mV/year

Measurement of temperature by instrument

Pt100 Measuring range	-50…+150°C
Pt1000 Measuring range	-50…+150°C
Resolution	0.1°C
Accuracy	±0.1°C ±1digit
Drift after 1 year	0.1°C/year

ORDERING CODES

HD2205.2: The kit is composed of: instrument HD2205.2 for measurement of pH - redox - temperature, **datalogger**, stabilized power supply at mains voltage 100-240Vac/12Vdc-1A., instructions manual and software DeltaLog11.

pH/mV electrodes, conductivity probes, dissolved oxygen probes, temperature probes, standard reference solutions for different measurement types, connection cables for pH electrodes with S7 connector, cables for data download to PC or printer have to be ordered separately.

ACCESSORIES

9CPRS232: Connection cable SubD female 9- pole for serial output RS232C.

CP22: USB 2.0 connection cable - connector type A - connector type B.

DeltaLog11: Software for download and management of the data on PC using Windows 98 to Vista operating systems.

SWD10: Stabilized power supply at 100-240Vac/12Vdc-1A mains voltage.

HD40.1: 24-column portable thermal printer, serial interface, 57mm paper width, four NiMH 1.2V rechargeable batteries, SWD10 power supply, instruction manual, 5 thermal paper rolls.

HD40.2: 24-column portable thermal printer, **Bluetooth and serial interface**, 57mm paper width, four NiMH 1.2V rechargeable batteries, SWD10 power supply, instruction manual, 5 thermal paper rolls. Requires the module HD22BT (**optional**) or the cable HD 2110 CSNM (**optional**).

HD2110CSP: Connection cable for instruments series HD34…to printer **S'print-BT**

HD22.2: Laboratory electrode holder composed of basis plate with incorporated magnetic stirrer, staff and replaceable electrode holder. Height max. 380mm. Powerd by bench-top meters of the series HD22… with cable HD22.2.1 (**optional**) or supplier SWD10 (**optional**).

HD22.3: Laboratory electrode holder with metal basis plate. Flexible electrode holder for free positioning. For Ø 12mm probes.

HD22BT: Bluetooth module for wireless data transmission from instrument to PC. **The fitting of the module into the instrument is made exclusively by Delta Ohm, at the time of placing the order.**

TP47: Module for the connection of Pt100 4-wire and Pt1000 2-wire probes.

HD40.1

pH

mV

pH electrodes without SICRAM module *(Inputs ① and ②)*

KP20: Combined pH electrode for general use, gel filled with screw connector S7 body in Epoxy.

KP30: Combined pH electrode for general use, cable 1 m, gel filled, body in Epoxy.

KP50: Combined pH electrode with Teflon collar diaphragm, for emulsions, deionised water, S7 screw connector, gel filled, body in glass.

KP 61: Combined pH electrode, 3 diaphragms for milk, cream, etc. Liquid reference filling, with screw connector S7, body in glass.

KP 62: Combined pH electrode, 1 diaphragm for pure water, paints, etc. gel-filled, with screw connector S7, body in glass.

KP 63: Combined pH electrode for general use, varnish, cable 1 m, electrolyte KCl 3M body in glass.

KP 64: Combined pH electrode for water, varnish, emulsions, etc., electrolyte KCl 3M with screw connector S7, body in glass.

KP 70: Combined pH micro electrode diam. 4.5 x L=25 mm. Gel filled, with screw connector, body in glass.

KP 80: Combined pointed pH electrode, gel filled, with screw connector S7, body in glass.

KP100: Flat membrane gel combined pH electrode with S7 screw connector, glass body, for skin, leather, paper.

CP: Extension cable 1.5m with BNC connectors on one side and S7 on the other side for electrode with S7 connector.

CP5: Extension cable 5m with BNC connectors on one side and S7 on the other side for electrode with S7 connector.

CE: S7 screw connector for pH electrode.

BNC: Female BNC for electrode extension.

pH electrodes with SICRAM module *(Input③)*

KP63TS: Combined pH/temperature electrode with SICRAM module, body in Epoxy, Ag/AgCl sat KCl.

SICRAM Module with BNC input for pH electrodes *(Input ③)*

KP47: SICRAM module for pH electrode with BNC standard connector.

ORP Electrodes *(Inputs ① and ②)*

KP90: Redox Platinum electrode, with screw connector S7, electrolyte KCl 3M, body in glass.

KP91: Redox Platinum electrode with 1m cable, GEL filled, body in glass.

Characteristics and dimensions of the probes at page 402

pH buffer solutions

HD8642: Buffer solution 4.01pH - 200cc.

HD8672: Buffer solution 6.86pH - 200cc.

HD8692: Buffer solution 9.18pH - 200cc.

Redox buffer solutions

HDR220: Redox buffer solution 220mV 0,5 l.

HDR468: Redox buffer solution 468mV 0,5 l.

Electrolyte solutions

KCL 3M: 50cc ready for use solution for electrode refilling.

Cleaning and maintenance

HD62PT: Diaphragm cleaning (tiourea in HCl) - 500ml.

HD62PP: Protein cleaning (pepsin in HCl) - 500ml.

HD62RF: Regeneration (fluorhydric acid) - 100ml.

HD62SC: Solution for electrode preservation - 500ml.

Temperature probes complete with SICRAM module *(Input ⑤)*

TP87: PT100 sensor immersion probe. Stem Ø 3 mm, length 70 mm. Cable length 1 m.

TP472I.0: Pt100 sensor immersion probe. Stem Ø 3 mm, length 230 mm. Cable length 2 m.

TP473P.0: Pt100 sensor penetration probe. Stem Ø 4mm, length 150 mm. Cable length 2 m.

TP474C.0: Pt100 sensor contact probe. Stem Ø 4mm, length 230mm, contact surface Ø 5mm. Cable length 2 m.

TP475A.0: Air probe, sensor Pt100. Stem Ø 4mm, length 230mm. Cable length 2 m.

TP472I.5: Immersion probe, sensor Pt100. Stem Ø 6mm, length 500 mm. Cable length 2 m.

TP472I.10: Immersion probe, sensor Pt100. Stem Ø 6mm, length 1,000mm. Cable length 2 m.

Temperature probes complete with TP47 module *(input⑤)*

TP47.100: Direct 4 wires Pt100 sensor immersion probe. Probe's stem Ø 3mm, length 230mm. Connection cable 4 wires with connector, length 2 m.

TP47.1000: Pt1000 sensor immersion probe. Probe's stem Ø 3mm, length 230mm. Connection cable 2 wires with connector, length 2 m.

TP87.100: Pt100 sensor immersion probe. Probe's stem Ø 3mm, length 70mm. 4 wire connection cable with connector, length 1 m.

TP87.1000: Pt1000 sensor immersion probe. Probe's stem Ø 3mm, length 70mm. 2-wire connection cable with connector, length 1 m.

Accessories

TP47: Module for the connection of Pt100 4-wire and Pt1000 2-wire probes.

HD22.2

HD 3456.2
BENCH-TOP pH AND CONDUCTIVITY METER

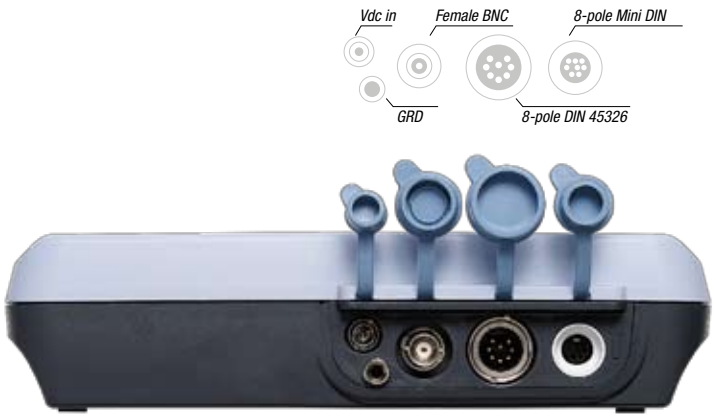
The HD3456.2 is a bench top instrument for electrochemical measures: **pH**, **conductivity and temperature**.
The displayed data can be stored **(datalogger)** and can be transferred to PC or serial printer thanks to the multi-standard serial port RS232C and USB2.0 and software DeltaLog9 (Vers.2.0 and subsequent ones). The storing and printing parameters can be set from menu.

The **HD3456.2** measures **pH**, **mV**, **redox potential** (ORP), **conductivity**, **resistivity in liquids**, **total dissolved solids** (TDS), and **salinity** using combined 4-ring and 2-ring conductivity/temperature probes. **Temperature** is measured by Pt100 or Pt1000 immersion, penetration or contact probes.
The pH electrode calibration, as well as manual, can be carried out automatically on one, two or three points and the calibration sequence can be chosen from a list of 13 buffers.
The conductivity probe calibration can be performed automatically in one or more of the 147µS, 1413µS, 12880µS or 111800µS/cm conductivity calibration solutions.

The display shows continually the temperature in °C or °F and one selectable parameter according to the connected probe type, i.e. in case of conductivity probe it is possible to select between χ or Ω or TDS or g/l.
Other functions of this instrument include: Max, Min and Avg function, the Auto-HOLD function, the automatic turning off which can also be disabled.
The instruments have IP66 protection degree.

Technical characteristics HD3456.2
pH, mV, χ, Ω, TDS, Sal, °C/°F measurement

Instrument	
Dimensions (Length x Width x Height)	220x120x55mm
Weight	460g (complete with batteries)
Materials	ABS, rubber
Display	2x4½ characters plus symbols visible area: 52x42mm
Operating conditions	
Working temperature	-5 … 50°C
Storage temperature	-25 … 65°C
Working relative humidity	0 … 90% RH without condensation
Protection degree	**IP66**
Power	
Batteries	3 batteries 1.5V type AA
Autonomy (only batteries)	100 hours with 1800mAh alkaline batteries
Mains (cod. **SWD10**)	Output mains adapter 100-240Vac/ 12Vdc-1A
Security of memorized data	
	Unlimited
Selectable storage interval	
	1s, 5s, 10s, 15s, 30s, 1min, 2min, 5min, 10min, 15min, 20min, 30min and 1hour
Time	
Date and hour	Schedule in real time
Accuracy	1min/month max drift
Serial interface RS232C	
Type	RS232C electrically isolated
Baud rate	Can be set from 1200 to 38400 baud
Data bit	8
Parity	None
Stop bit	1
Flow Control	Xon/Xoff
Serial cable length	Max 15m
Selectable print interval	immediate or 1s, 5s, 10s, 15s, 30s, 1min, 2min, 5min, 10min, 15min, 20min, 30min and 1ora
USB Interface	
Type	1.1 - 2.0 electrically isolated
Connections	
Serial interface and USB	8-pole MiniDin connector
Mains adapter (cod. SWD10)	2-pole connector (positive at centre) 12Vdc/1A



Storage of measured values

Tipo	2000 pages of 10 samples each
Quantity	20,000 terns of measures made up of [pH or mV], [χ or Ω or TDS or salinity] and temperature.

Connections

pH/mV input	Female BNC connector
Conductivity input	8-pole male DIN45326 connector
Input for temperature probes with TP47 module	8-pole male DIN45326 connector

Measurement of pH by Instrument

Measurement range	-2.000…+19.999pH
Resolution	0.01 o 0.001pH selectable from menu
Accuracy	±0.001pH ±1digit
Input impedance	$>10^{12}\Omega$
Calibration error @25°C	|Offset| > 20mV
	Slope > 63mV/pH or Slope < 50mV/pH
	Sensitivity > 106.5% or Sensitivity < 85%
Automatic / manual temperature compensation	-50…+150°C

Measurement of mV by Instrument

Measurement range	-1999.9…+1999.9mV
Resolution	0.1mV
Accuracy	±0.1mV ±1digit
Drift after 1 year	0.5mV/year

Standard solutions automatically detected (@25°C)

1.679pH - 2.000pH - 4.000pH - 4.008pH
4.010pH - 6.860pH - 6.865pH - 7.000pH
7.413pH - 7.648pH - 9.180pH - 9.210pH
10.010pH

Measurement of conductivity by Instrument		*Resolution*
Measurement range (Kcell=0.01)	0.000…1.999µS/cm	0.001µS/cm
Measurement range (Kcell=0.1)	0.00…19.99µS/cm	0.01µS/cm
Measurement range (Kcell=1)	0.0…199.9µS/cm	0.1µS/cm
	200…1999µS/cm	1µS/cm
	2.00…19.99mS/cm	0.01mS/cm
	20.0…199.9mS/cm	0.1mS/cm
Measurement range (Kcell=10)	200…1999mS/cm	1mS/cm
Accuracy (conductivity)	±0.5% ±1digit	

Measurement of resistivity by Instrument		*Resolution*
Measurement range (Kcell=0.01)	Up to 1GΩ·cm	(*)
Measurement range (Kcell=0.1)	Up to 100MΩ·cm	(*)
Measurement range (Kcell=1)	5.0…199.9Ω·cm	0.1Ω·cm
	200…999Ω·cm	1Ω·cm
	1.00k…19.99kΩ·cm	0.01kΩ·cm
	20.0k…99.9kΩ·cm	0.1kΩ·cm
	100k…999kΩ·cm	1kΩ·cm
	1…10MΩ·cm	1MΩ·cm
Measurement range (Kcell=10) / Res.	0.5…5.0Ω·cm	0.1Ω·cm
Accuracy (resistivity)	±0.5% ±1digit	

Measurement of total dissolved solids (with coefficient χ/TDS=0.5)

Measurement range (Kcell=0.01) / Res.	0.00…1.999mg/l	0.005mg/l
Measurement range (Kcell=0.1) / Res.	0.00…19.99mg/l	0.05mg/l
Measurement range (Kcell=1) / Res.	0.0…199.9 mg/l	0.5 mg/l
	200…1999 mg/l	1 mg/l
	2.00…19.99 g/l	0.01 g/l
	20.0…99.9 g/l	0.1 g/l
Measurement range (Kcell=10) / Res.	100…999 g/l	1 g/l
Accuracy (total dissolved solids)	±0.5% ±1digit	

Measurement of salinity

Measurement range / Resolution	0.000…1.999g/l	1mg/l
	2.00…19.99g/l	10mg/l
	20.0…199.9g/l	0.1g/l
Accuracy (salinity)	±0.5% ±1digit	

Automatic/manual temperature compensation

	0…100°C with α_T that can be selected from 0.00 to 4.00%/°C
Reference temperature	20°C o 25°C selectable from menu
χ/TDS conversion factor	0.4…0.8
Cell constant K (cm^{-1})	0.01 - 0.1 - 0.7 - 1.0 - 10.0

Standard solutions automatically detected (@25°C)

147µS/cm
1413µS/cm
12880µS/cm
111800µS/cm

Measurement of temperature by Instrument

Pt100 measurement range	-50…+200°C
Pt1000 measurement range	-50…+200°C
Resolution	0.1°C
Accuracy	±0.25°C
Drift after 1 year	0.1°C/year

(*) The resistivity measurement is obtained from the reciprocal of conductivity measurement. Close to the bottom of the scale, the indication of resistivity appears like reported in the table below:

K cell = 0.01 cm^{-1}		**K cell = 0.1 cm^{-1}**	
Conductivity (µS/cm)	Resistivity (MΩ·cm)	Conductivity (µS/cm)	Resistivity(MΩ·cm)
0.001 µS/cm	1000 MΩ·cm	0.01 µS/cm	100 MΩ·cm
0.002 µS/cm	500 MΩ·cm	0.02 µS/cm	50 MΩ·cm
0.003 µS/cm	333 MΩ·cm	0.03 µS/cm	33 MΩ·cm
0.004 µS/cm	250 MΩ·cm	0.04 µS/cm	25 MΩ·cm
…	…	…	…

pH

χ

Ω

TDS

ORDERING CODES

HD3456.2: The kit is composed of: instrument HD3456.2 **datalogger**, for the measurement of pH - redox - conductivity - resistivity - TDS - salinity - temperature, 3 1.5V alkaline batteries, operating manual and **DeltaLog9 version 2.0**.

pH/mV electrodes, conductivity probes, dissolved oxygen probes, temperature probes, standard reference solutions for different measurement types, connection cables for pH electrodes with S7 connector, cables for data download to PC or printer have to be ordered separately.

ACCESSORIES

HD2110CSNM: 8-pole connection cable Mini Din - Sub D 9-pole female for RS232C, for connection to PC without USB input.

HD2101/USB: Connection cable USB 2.0 connector type A - 8-pole Mini Din for connection to PC with USB input.

SWD10: Stabilized power supply at 230Vac/9Vdc-300mA mains voltage.

HD40.1: Portable, serial input, 24 column thermal printer, 57mm paper width.

HD2110CSP: Connection cable for instruments series HD34…to printer **S'print-BT**

HD22.2: Laboratory electrode holder composed of basis plate with incorporated magnetic stirrer, staff and replaceable electrode holder. Height max. 380mm. Powerd by bench-top meters of the series HD22… with cable HD22.2.1 (**optional**) or supplier SWD10 (**optional**).

HD22.3: Laboratory electrode holder with metal basis plate. Flexible electrode holder for free positioning. For Ø 12mm probes.

TP47: Module for the connection of Pt100 4-wire and Pt1000 2-wire probes.

pH Electrodes

KP20: Combined pH electrode for common use, gel filled with screw connector S7 body in Epoxy.

KP30: Combined pH electrode for common use, cable 1 m, gel filled, body in Epoxy.

KP50: Combined pH electrode with Teflon collar diaphragm, for emulsions, deionised water, S7 screw connector, gel filled, body in glass.

KP 61: Combined pH electrode, 3 diaphragms for milk, cream, etc. elektrolyte, with screw connector S7, body in glass.

KP 62: Combined pH electrode, 1 diaphragm for pure water, paints, etc. gel-filled, with screw connector S7, body in glass.

KP 63: Combined pH electrode for common use, varnish, cable 1 m, electrolyte KCl 3M body in glass.

KP 64: Combined pH electrode for water, varnish, emulsions, etc., electrolyte KCl 3M with screw connector S7, body in glass.

KP 70: Combined pH micro electrode diam. 4.5 x L=25 mm. Gel filled with screw connector, body in glass.

KP 80: Combined pointed pH electrode, gel filled with screw connector S7, body in glass.

KP100: Flat membrane gel combined pH electrode with S7 screw connector, glass body, for skin, leather, paper.

CP: Extension cable 1.5m with BNC connectors on one side and S7 on the other side for electrode with S7 connector.

CP5: Extension cable 5m with BNC connectors on one side and S7 on the other side for electrode with S7 connector.

CE: S7 screw connector for pH electrode.

BNC: Female BNC for electrode extension.

ORP Electrodes

KP90: Redox Platinum electrode, with screw connector S7, electrolyte KCl 3M, body in glass.

KP91: Redox Platinum electrode with 1m cable, GEL filled, body in glass.

pH buffer solutions

HD8642: Buffer solution 4.01pH - 200cc.

HD8672: Buffer solution 6.86pH - 200cc.

HD8692: Buffer solution 9.18pH - 200cc.

Redox buffer solutions

HDR220: Redox buffer solution 220mV 0,5 l.

HDR468: Redox buffer solution 468mV 0,5 l.

Elettrolyte solutions

KCL 3M: 50cc ready for use solution for refilling of the electrodes.

Cleaning and maintainance

HD62PT: Diaphragm cleaning (tiourea in HCl) - 500ml.

HD62PP: Protein cleaning (pepsin in HCl) - 500ml.

HD62RF: Regeneration (fluorhydric acid) - 100ml.

HD62SC: Solution for electrode preservation - 500ml.

Combined conductivity and temperature probes

SP06T: Combined conductivity and temperature 4-electrode cell in Platinum, body in Pocan. Cell constant K = 0.7. Measurement range 5µS/cm …200mS/cm, 0…90°C.

SPT401.001: Combined conductivity and temperature 2- electrode cell in stainless steel AISI 316. Cell constant K = 0.01. Measurement range 0.04µS/cm …20µS/cm, 0…120°C. Measurement in closed-cell..

SPT01G: Combined conductivity and temperature 2-electrode Platinum-wire cell, body in glass. Cell constant K = 0.1. Measurement range 0.1µS/cm …500µS/cm, 0…80°C.

SPT1G: Combined conductivity and temperature 2-electrode Platinum-wire cell, body in glass. Cell constant K = 1. Measurement range 10µS/cm …10mS/cm, 0…80°C.

SPT10G: Combined conductivity and temperature 2-electrode Platinum-wire cell, body in glass. Cell constant K = 10. Measurement range 500µS/cm …200mS/cm, 0…80°C.

Electrode dimensions and characteristics at page 402

Standard conductivity calibration solutions

HD8747: Standard calibration solution 0.001mol/l equal to 147µS/cm @25°C - 200cc.

HD8714: Standard calibration solution 0.01mol/l equal to 1413µS/cm @25°C - 200cc.

HD8712: Standard calibration solution 0.1mol/l equal to 12880µS/cm @25°C - 200cc.

HD87111: Standard calibration solution 1mol/l equal to 111800µS/cm @25°C - 200cc.

Temperature probes complete with TP47 module

TP47.100: Direct 4 wires Pt100 sensor immersion probe. Probe's stem Ø 3mm, length 230mm. Connection cable 4 wires with connector, length 2 m.

TP47.1000: Pt1000 sensor immersion probe. Probe's stem Ø 3mm, length 230mm. Connection cable 2 wires with connector, length 2 m.

TP87.100: Pt100 sensor immersion probe. Probe's stem Ø 3mm, length 70mm. 4 wire connection cable with connector, length 1 m.

TP87.1000: Pt1000 sensor immersion probe. Probe's stem Ø 3mm, length 70mm. 2 wire connection cable with connector, length 1 m.

Accessories

TP47: Module for the connection of Pt100 4-wire and Pt1000 2-wire probes.

HD 2256.2
BENCH-TOP pH AND CONDUCTIVITY METER

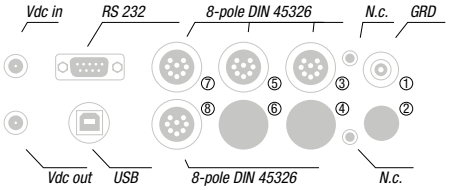
The **HD2256.2** is a bench top instrument for electrochemical measures: **pH**, **conductivity** and **temperature**. It is fitted with a large backlighted LCD display.
The **HD2256.2** measures **pH**, **mV**, **redox potential** (ORP) with pH, redox electrodes or electrodes with separate reference. **Conductivity and resistivity** in liquids, **total dissolevd solids** (TDS) and **salinity** with combined 4-ring and 2-ring conductivity/temperature probes. The conductivity probes can have a direct input or with SICRAM module. The inputs are separate.
Al models are fitted with input for the measurement of t**emperature** with Pt100 or Pt1000 immersion, penetration or contact probes. The temperature probes are equipped with an automatic recognition module and factory calibration data are stored inside.

- The pH electrode calibration can be carried out on one or five points and the calibration sequence can be chosen from a list of 13 buffers Temperature compensation can be automatic or manual.
- The conductivity probe calibration can be performed automatically with automatically detected conductivity calibration solutions: 147µS/cm, 1413µS/cm, 12880µS/cm or 111800µS/cm or manually with calibration solutions having different values.
- Conductivity, dissolved oxygen and temperature probes fitted with SICRAM module can store factory and calibration data inside.

The data can be transferred from the instrument connected to a PC via the multi-standard RS232C serial port and USB 2.0. The storing parameters can be configured using the menu.
The RS232C serial port can be used to transfer the acquired measurements to a 24 column portable printer in real time (HD40.1 or HD40.2).
The instruments equipped with **HD22BT** (Bluetooth) option can transfer data without any connection to a PC or printer fitted with Bluetooth input or through Bluetooth/RS232C converter.
The software DeltaLog11 allows instrument management and configuration, and data processing on PC.
The instruments have IP66 protection degree.

Technical characteristics HD2256.2
pH - mV - χ - Ω - TDS - NaCl - °C - °F

Instrument	
Dimensions (Length x Width x Height)	265x185x70mm
Weight	490g
Materials	ABS, rubber
Display	Back lighted, matrix point display. 240x64 points, visible area: 128x35mm
Operating conditions	
Working temperature	-5 … 50°C
Storage temperature	-25 … 65°C
Working relative humidity	0 … 90% R.H. without condensate
Protection degree	**IP66**
Power	
	Mains adapter (cod. SWD10) 12Vdc/1A
Auxiliary socket	For supplying of electrode holder with built-in stirrer HD22.2
Security of memorized data	
	Unlimited
Time	
Date and hour	Real time schedule with backup battery 3.6V - ½AA
Accuracy	1min/month max drift
Measured values storing	
Quantity	2000 screens
Storage interval	1s … 999s



Calibration storage

Quantity	Last 8 calibrations of each physical quantity

RS232C serial interface

Type	RS232C electrically isolated
Baud rate	Can be set from 1200 to 115200 baud
Data bit	8
Parity	None
Stop bit	1
Flow Control	Xon/Xoff
Length of serial cable	Max 15m

USB Interface

Type	1.1 - 2.0 electrically isolated
Bluetooth Interface	optional

Connections

Input for temperature probes with SICRAM modules⑤	8-pole male DIN45326 connector
pH/mV input ①	BNC female
Input for SICRAM module pH/ temperature ③	8-pole male DIN45326 connector
2/ 4- electrode direct conductivity input ⑧	8-pole male DIN45326 connector
Input conductivity electrodes with SICRAM module⑦	8-pole male DIN45326 connector
Serial interface	DB9 connector (9- pole male)
USB interface	USB connector type B
Bluetooth	Optional
Mains adapter	2-pole connector (Ø5.5mm-2.1mm). Positive at centre
Outlet for power supply of electrode holder with built-in magnetic stirrer	2-pole connector (Ø5.5mm-2.1mm). Positive at centre (output 12Vdc/200mA max).

pH measurement by instrument

Measuring range	-9.999…+19.999pH
Resolution	0.01 o 0.001pH selectable from menu
Accuracy	±0.001pH ±1digit
Input impedance	$>10^{12}\Omega$
Calibration error @25°C	|Offset| > 20mV Slope > 63mV/pH o Slope < 50mV/pH Sensitivity > 106.5% or Sensitivity < 85%
Calibration points	Up to 5 points with 13 automatically detected buffer solutions
Standard solutions automatically detected (@25°C)	1.679pH - 2.000pH - 4.000pH - 4.008pH 4.010pH - 6.860pH - 6.865pH - 7.000pH 7.413pH - 7.648pH - 9.180pH - 9.210pH 10.010pH

mV measurement by instrument

Measuring range	-1999.9…+1999.9mV
Resolution	0.1mV
Accuracy	±0.1mV ±1digit
Drift after 1 year	0.5mV/year

Conductivity measurement by instrument		*Resolution*
Measuring range (Kcell=0.01) / Res.	0.000…1.999µS/cm	0.001µS/cm
Measuring range (Kcell=0.1) / Res.	0.00…19.99µS/cm	0.01µS/cm
Measuring range (K cell=1) / Res.	0.0…199.9µS/cm	0.1µS/cm
	200…1999µS/cm	1µS/cm
	2.00…19.99mS/cm	0.01mS/cm
	20.0…199.9mS/cm	0.1mS/cm
Measuring range (Kcell=10) / Ris.	200…1999mS/cm	1mS/cm
Accuracy (conductivity)	±0.5% ±1digit	

Measurement of resistivity by instrument		*Resolution*
Measuring range (Kcell=0.01)	Up to 1GΩ·cm	(*)
Measuring range (Kcell=0.1)	Up to 100MΩ·cm	(*)
Measuring range (K cell=1)	5.0…199.9Ω·cm	0.1Ω·cm
	200…999Ω·cm	1Ω·cm
	1.00k…19.99kΩ·cm	0.01kΩ·cm
	20.0k…99.9kΩ·cm	0.1kΩ·cm
	100k…999kΩ·cm	1kΩ·cm
	1…10MΩ·cm	1MΩ·cm
Measuring range (Kcell=10)	0.5…5.0Ω·cm	0.1Ω·cm
Accuracy (resistivity)	±0.5% ±1digit	

Measurement of total dissolved solids (with coefficient χ/TDS=0.5)		
Measuring range (Kcell=0.01)	0.00…1.999mg/l	0.005mg/l
Measuring range (Kcell=0.1)	0.00…19.99mg/l	0.05mg/l
Measuring range (K cell=1)	0.0…199.9 mg/l	0.5 mg/l
	200…1999 mg/l	1 mg/l
	2.00…19.99 g/l	0.01 g/l
	20.0…199.9 g/	0.1 g/l
Measuring range (Kcell=10)	100…999 g/l	1 g/l
Accuracy (total dissolved solids)	±0.5% ±1digit	

Measurement of salinity by instrument		
Measuring range	0.000…1.999g/l	1mg/l
	2.00…19.99g/l	10mg/l
	20.0…199.9 g/l	0.1 g/l
Accuracy (salinity)	±0.5% ±1digit	

Automatic/manual temperature compensation	
	0...100°C with α_T = 0.00…4.00%/°C
Reference temperature	0…50°C
Conversion factor χ/TDS	0.4…0.8
Cell constant K (cm^{-1}) already set on instrument	0.01 - 0.1 - 0.5 - 0.7 - 1.0 - 10.0
Cell constants K(cm^{-1}) that can be set by user	0.01…20.00

Standard solutions automatically detected (@25°C)

147µS/cm
1413µS/cm
12880µS/cm
111800µS/cm

Measurement of temperature by instrument	
Pt100 measuring range	-50…+150°C
Pt1000 measuring range	-50…+150°C
Resolution	0.1°C
Accuracy ±0.1°C ±1digit	
Drift after 1 year	0.1°C/year

(*) The resistivity measurement is obtained from the reciprocal of conductivity measurement. Close to the bottom of the scale, the indication of resistivity appears like reported in the table below:

K cell = 0.01 cm^{-1}		**K cell = 0.1 cm^{-1}**	
Conductivity (µS/cm)	Resistivity (MΩ·cm)	Conductivity (µS/cm)	Resistivity(MΩ·cm)
0.001 µS/cm	1000 MΩ·cm	0.01 µS/cm	100 MΩ·cm
0.002 µS/cm	500 MΩ·cm	0.02 µS/cm	50 MΩ·cm
0.003 µS/cm	333 MΩ·cm	0.03 µS/cm	33 MΩ·cm
0.004 µS/cm	250 MΩ·cm	0.04 µS/cm	25 MΩ·cm
…	…	…	…

ORDERING CODES

HD2256.2: The kit is composed of: instrument HD2256.2 for the measurement of pH - redox - conductivity - resistivity - TDS - salinity - temperature, **datalogger**, stabilized power supply at mains voltage 100-240Vac/12Vdc-1A., instructions manual and software DeltaLog11.

pH/mV electrodes, conductivity probes, dissolved oxygen probes, temperature probes, standard reference solutions for different measurement types, connection cables for pH electrodes with S7 connector, cables for data download to PC or printer have to be ordered separately.

ACCESSORIES

9CPRS232: Connection cable SubD female 9- pole for serial output RS232C.
CP22: USB 2.0 connection cable - connector typo A - connector type B.
DeltaLog11: Software for download and management of the data on PC using Windows 98 to Vista operating systems.
SWD10: Stabilized power supply at 230Vac/9Vdc-300mA mains voltage.
HD40.1: Portable, serial input, 24 column thermal printer, 57mm paper width.
HD40.2: 24-column portable thermal printer, **Bluetooth and serial interface**, 57mm paper width, four NiMH 1.2V rechargeable batteries, SWD10 power supply, instruction manual, 5 thermal paper rolls. Requires the module HD22BT (**optional**) or the cable HD 2110 CSNM (**optional**).
HD22.2: Laboratory electrode holder composed of basis plate with incorporated magnetic stirrer, staff and replaceable electrode holder. Height max. 380mm. Powerd by bench-top meters of the series HD22… with cable HD22.2.1 (**optional**) or supplier SWD10 (**optional**).
HD22.3: Laboratory electrode holder with metal basis plate. Flexible electrode holder for free positioning. For Ø 12mm probes.
HD22BT: Bluetooth module for wireless data transmission from instrument to PC. **The fitting of the module into the instrument is made exclusively by Delta Ohm, at the time of placing the order.**
TP47: Module for the connection of Pt100 4-wire and Pt1000 2-wire probes.

pH electrodes without SICRAM module *(Inputs ① and ②)*

KP20: Combined pH electrode for general use, gel filled with screw connector S7 body in Epoxy.
KP30: Combined pH electrode for general use, cable 1 m, gel filled, body in Epoxy.
KP50: Combined pH electrode with Teflon collar diaphragm, for emulsions, deionised water, S7 screw connector, gel filled, body in glass.
KP 61: Combined pH electrode, 3 diaphragms for milk, cream, etc. Liquid reference filling, with screw connector S7, body in glass.
KP 62: Combined pH electrode, 1 diaphragm for pure water, paints, etc. gel-filled, with screw connector S7, body in glass.
KP 63: Combined pH electrode for general use, varnish, cable 1 m, electrolyte KCl 3M body in glass.
KP 64: Combined pH electrode for water, varnish, emulsions, etc., electrolyte KCl 3M with screw connector S7, body in glass.
KP 70: Combined pH micro electrode diam. 4.5 x L=25 mm. Gel filled, with screw connector, body in glass.
KP 80: Combined pointed pH electrode, gel filled, with screw connector S7, body in glass.
KP100: Flat membrane gel combined pH electrode with S7 screw connector, glass body, for skin, leather, paper.
CP: Extension cable 1.5m with BNC connectors on one side and S7 on the other side for electrode with S7 connector.
CP5: Extension cable 5m with BNC connectors on one side and S7 on the other side for electrode with S7 connector.
CE: S7 screw connector for pH electrode.
BNC: Female BNC for electrode extension.

pH electrodes with SICRAM module *(Input③)*

KP63TS: Combined pH/temperature electrode with SICRAM module, body in Epoxy, Ag/AgCl sat KCl.

SICRAM Module with BNC input for pH electrodes *(Input ③)*

KP47: SICRAM module for pH electrode with BNC standard connector.
Electrode characteristics at page 401

ORP Electrodes *(Inputs ① and ②)*

KP90: Redox Platinum electrode, with screw connector S7, electrolyte KCl 3M, body in glass.
KP91: Redox Platinum electrode with 1m cable, GEL filled, body in glass.

χ

mV

pH buffer solutions

HD8642: Buffer solution 4.01pH - 200cc.
HD8672: Buffer solution 6.86pH - 200cc.
HD8692: Buffer solution 9.18pH - 200cc.

Redox buffer solutions

HDR220: Redox buffer solution 220mV 0,5 l.
HDR468: Redox buffer solution 468mV 0,5 l.

Electrolyte solutions

KCL 3M: 50cc ready for use solution for electrode refilling.

Cleaning and maintenance

HD62PT: Diaphragm cleaning (tiourea in HCl) - 500ml.
HD62PP: Protein cleaning (pepsin in HCl) - 500ml.
HD62RF: Regeneration (fluorhydric acid) - 100ml.
HD62SC: Solution for electrode preservation - 500ml.

Conductivity probes and combined conductivity and temperature probes without SICRAM module *(Input ⑦)*

SP06T: Combined conductivity and temperature 4-electrode cell in Platinum, body in Pocan. Cell constant K = 0.7. Measurement range 5µS/cm …200mS/cm, 0…90°C.
SPT401.001: Combined conductivity and temperature 2- electrode cell in stainless steel AISI 316. Cell constant K = 0.01. Measurement range 0.04µS/cm …20µS/cm, 0…120°C. Measurement in closed-cell.
SPT01G: Combined conductivity and temperature 2-electrode Platinum-wire cell, body in glass. Cell constant K = 0.1. Measurement range 0.1µS/cm …500µS/cm, 0…80°C.
SPT1G: Combined conductivity and temperature 2-electrode Platinum-wire cell, body in glass. Cell constant K = 1. Measurement range 10µS/cm …10mS/cm, 0…80°C.
SPT10G: Combined conductivity and temperature 2-electrode Platinum-wire cell, body in glass. Cell constant K = 10. Measurement range 500µS/cm …200mS/cm, 0…80°C.

Combined conductivity / temperature probes with SICRAM module *(Input ⑧)*

SPT1GS: Combined conductivity /temperature 2-electrode Platinum- wire cell, body in glass with SICRAM module. Cell constant K = 1. Measuring range 10µS/cm …10mS/cm, 0…80°C.
Electrode characteristics at page 402

Standard conductivity calibration solutions

HD8747: Standard calibration solution 0.001mol/l equal to 147µS/cm @25°C - 200cc.
HD8714: Standard calibration solution 0.01mol/l equal to 1413µS/cm @25°C - 200cc.
HD8712: Standard calibration solution 0.1mol/l equal to 12880µS/cm @25°C - 200cc.
HD87111: Standard calibration solution 1mol/l equal to 111800µS/cm @25°C - 200cc.

Temperature probes comlpete with SICRAM module *(Input ⑤)*

TP87: PT100 sensor immersion probe. Stem Ø 3 mm, length 70 mm. Cable length 1 m.
TP472I.0: Pt100 sensor immersion probe. Stem Ø 3 mm, length 230 mm. Cable length 2 m.
TP473P.0: Pt100 sensor penetration probe. Stem Ø 4mm, length 150 mm. Cable length 2 m.
TP474C.0: Pt100 sensor contact probe. Stem Ø 4mm, length 230mm, contact surface Ø 5mm. Cable length 2 m.
TP475A.0: Air probe, sensor Pt100. Stem Ø 4mm, length 230mm. Cable length 2 m.
TP472I.5: Immersion probe, sensor Pt100. Stem Ø 6mm, length 500 mm. Cable length 2 m.
TP472I.10: Immersion probe, sensor Pt100. Stem Ø 6mm, length 1,000mm. Cable length 2 m.

Temperature probes complete with TP47 module *(input⑤)*

TP47.100: Direct 4 wires Pt100 sensor immersion probe. Probe's stem Ø 3mm, length 230mm. Connection cable 4 wires with connector, length 2 m.
TP47.1000: Pt1000 sensor immersion probe. Probe's stem Ø 3mm, length 230mm. Connection cable 2 wires with connector, length 2 m.
TP87.100: Pt100 sensor immersion probe. Probe's stem Ø 3mm, length 70mm. 4 wire connection cable with connector, length 1 m.
TP87.1000: Pt1000 sensor immersion probe. Probe's stem Ø 3mm, length 70mm. 2-wire connection cable with connector, length 1 m.

Accessories

TP47: Module for the connection of Pt100 4-wire and Pt1000 2-wire probes.

HD 3406.2

HD 3406.2
BENCH-TOP CONDUCTIVITY METER

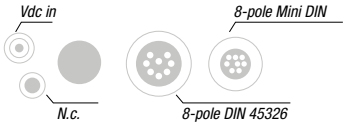
The **HD3406.2** is a bench top instrument for electrochemical measures: **conductivity and temperature**.
The displayed data can be stored **(datalogger)** and can be transferred to PC or serial printer thanks to the multi-standard serial port RS232C and USB2.0 and software DeltaLog9 (Vers.2.0 and subsequent ones). The storing and printing parameters can be set from menu.
The **HD3406.2** measures **conductivity, liquid resistivity in liquids, total dissolved solids (TDS)** and **salinity** using combined 4-ring and 2-ring conductivity/temperature probes. Temperature is measured by Pt100 or Pt1000 immersion, penetration or contact probes.
The probe calibration can be performed automatically in one or more of the 147µS, 1413µS, 12880µS or 111800µS/cm conductivity calibration solutions.
The display shows continually the temperature in °C or °F and one selectable parameter according to the connected probe type, i.e. in case of conductivity probe it is possible to select between χ or Ω or TDS or NaCl.

Other functions of this instrument include: Max, Min and Avg function, the Auto-HOLD function, the automatic turning off which can also be excluded.
The instruments have IP66 protection degree.

Technical characteristics HD3406.2
χ, Ω, TDS, NaCl, °C/°F measurement

Instrument	
Dimensions (Length x Width x Height)	220x120x55mm
Weight	460g (complete with batteries)
Materials	ABS, rubber
Display	2x4½ characters plus symbols visible area: 52x42mm
Operating conditions	
Working temperature	-5 … 50°C
Storage temperature	-25 … 65°C
Working relative humidity	0 … 90% RH without condensation
Protection degree	**IP66**
Power	
Batteries	3 batteries 1.5V type AA
Autonomy (only batteries)	100 hours with 1800mAh alkaline batteries
Mains (cod. **SWD10**)	Output mains adapter 100-240Vac/ 12Vdc-1A
Security of memorized data	Unlimited
Selectable storage interval	1s, 5s, 10s, 15s, 30s, 1min, 2min, 5min, 10min, 15min, 20min, 30min and 1hour
Time	
Date and hour	Schedule in real time
Accuracy	1min/month max drift
Serial interface RS232C	
Type	RS232C electrically isolated
Baud rate	Can be set from 1200 to 38400 baud
Data bit	8
Parity	None
Stop bit	1
Flow Control	Xon/Xoff
Serial cable length	Max 15m
Selectable print interval	immediate or 1s, 5s, 10s, 15s, 30s, 1min, 2min, 5min, 10min, 15min, 20min, 30min and 1hour
USB Interface	
Type	1.1 - 2.0 electrically isolated
Common connections to all models	
Serial interface and USB	8-pole MiniDin connector
Mains adapter (cod. SWD10)	2-pole connector (positive at centre) 12Vdc/1A
Storage of measured values	
Type	2000 pages of 18 samples each
Quantity	36,000 sets of measures made up of [χ - Ω or TDS or NaCl] and [°C- °F]
Measurement connections	
Input conductivity	8-pole male DIN45326 connector
Input for temperature probes complete with TP47 modules	8-pole male DIN45326 connector

Measurement of conductivity by instrument		*Resolution*
Measurement range (Kcell=0.01)	0.000…1.999µS/cm	0.001µS/cm
Measurement range (Kcell=0.1)	0.00…19.99µS/cm	0.01µS/cm
Measurement range (Kcell=1)	0.0…199.9µS/cm	0.1µS/cm
	200…1999µS/cm	1µS/cm
	2.00…19.99mS/cm	0.01mS/cm
	20.0…199.9mS/cm	0.1mS/cm



Range di misura (Kcell=10).	200…1999mS/cm	1mS/cm
Accuracy (conductivity)	±0.5% ±1digit	

Measurement of resistivity by instrument

Measurement range (Kcell=0.01)	Up to 1GΩ·cm	(*)
Measurement range (Kcell=0.1)	Up to 100MΩ·cm	(*)
Measurement range (Kcell=1)	5.0…199.9Ω·cm	0.1Ω·cm
	200…999Ω·cm	1Ω·cm
	1.00k…19.99kΩ·cm	0.01kΩ·cm
	20.0k…99.9kΩ·cm	0.1kΩ·cm
	100k…999kΩ·cm	1kΩ·cm
	1…10MΩ·cm	1MΩ·cm
Measurement range (Kcell=10)	0.5…5.0Ω·cm	0.1Ω·cm
Accuracy (resistivity)	±0.5% ±1digit	

Measurement of total dissolved solids (with coefficient χ/TDS=0.5)

Measurement range (Kcell=0.01)	0.00…1.999mg/l	0.005mg/l
Measurement range (Kcell=0.1)	0.00…19.99mg/l	0.05mg/l
Measurement range (Kcell=1)	0.0…199.9 mg/l	0.5 mg/l
	200…1999 mg/l	1 mg/l
	2.00…19.99 g/	0.01 g/l
	20.0…99.9 g/l	0.1 g/l
Measurement range (Kcell=10)	100…999 g/l	1 g/l
Accuracy (total dissolved solids)	±0.5% ±1digit	

Measurement of salinity

Measurement range / Resolution	0.000…1.999g/l	1mg/l
	2.00…19.99g/l	10mg/l
	20.0…199.9g/l	0.1g/l
Accuracy (salinity)	±0.5% ±1digit	

Temperature measurement by instrument

Measurement range Pt100	-50…+200°C
Measurement range Pt1000	-50…+200°C
Resolution	0.1°C
Accuracy	±0.25°C
Drift after 1 year	0.1°C/year

Automatic/manual temperature compensation

	0…100°C with α_T = 0.00…4.00%/°C
Reference temperature	20°C or 25°C selectable from menu
Conversion factor χ/TDS	0.4…0.8
Cell constant K (cm^{-1})	0.01 - 0.1 - 0.7 - 1.0 - 10.0

Standard solutions automatically detected (@25°C)

147µS/cm
1413µS/cm
12880µS/cm
111800µS/cm

(*) The resistivity measurement is obtained from the reciprocal of conductivity measurement. Close to the bottom of the scale, the indication of resistivity appears like reported in the table below:

K cell = 0.01 cm^{-1}		**K cell = 0.1 cm^{-1}**	
Conductivity (µS/cm)	Resistivity (MΩ·cm)	Conductivity (µS/cm)	Resistivity(MΩ·cm)
0.001 µS/cm	1000 MΩ·cm	0.01 µS/cm	100 MΩ·cm
0.002 µS/cm	500 MΩ·cm	0.02 µS/cm	50 MΩ·cm
0.003 µS/cm	333 MΩ·cm	0.03 µS/cm	33 MΩ·cm
0.004 µS/cm	250 MΩ·cm	0.04 µS/cm	25 MΩ·cm
…	…	…	…

ORDERING CODES

HD3406.2: The kit is composed of: instrument HD3406.2 **datalogger**, for measurement of conductivity - resistivity - TDS - salinity - temperature, 3 1.5V alkaline batteries, operating manual and **DeltaLog9 version 2.0**.

pH/mV electrodes, conductivity probes, dissolved oxygen probes, temperature probes, standard reference solutions for different measurement types, connection cables for pH electrodes with S7 connector, cables for data download to PC or printer have to be ordered separately.

ACCESSORIES

HD2110CSNM: 8-pole connection cable Mini Din - Sub D 9-pole female for RS232C, for connection to PC without USB input.
HD2101/USB: Connection cable USB 2.0 connector type A - 8-pole Mini Din for connection to PC with USB input.
SWD10: Stabilized power supply at 100-240Vac/12Vdc-1A mains voltage.
HD40.1: Portable, serial input, 24 column thermal printer, 57mm paper width.
HD22.2: Laboratory electrode holder composed of basis plate with incorporated magnetic stirrer, staff and replaceable electrode holder. Height max. 380mm.
HD22.3: Laboratory electrode holder with metal basis plate. Flexible electrode holder for free positioning. For Ø 12mm probes.
TP47: Module for the connection of Pt100 4-wire and Pt1000 2-wire probes.

Combined conductivity and temperature probes

SP06T: Combined conductivity and temperature 4-electrode cell in Platinum, body in Pocan. Cell constant K = 0.7. Measurement range 5µS/cm …200mS/cm, 0…90°C.
SPT401.001: Combined conductivity and temperature 2- electrode cell in stainless steel AISI 316. Cell constant K = 0.01. Measurement range 0.04µS/cm …20µS/cm, 0…120°C. Measurement in closed-cell..
SPT01G: Combined conductivity and temperature 2-electrode Platinum-wire cell, body in glass. Cell constant K = 0.1. Measurement range 0.1µS/cm …500µS/cm, 0…80°C.
SPT1G: Combined conductivity and temperature 2-electrode Platinum-wire cell, body in glass. Cell constant K = 1. Measurement range 10µS/cm …10mS/cm, 0…80°C.
SPT10G: Combined conductivity and temperature 2-electrode Platinum-wire cell, body in glass. Cell constant K = 10. Measurement range 500µS/cm …200mS/cm, 0…80°C.
Electrode characteristics at page 402

Standard conductivity calibration solutions

HD8747: Standard calibration solution 0.001mol/l equal to 147µS/cm @25°C - 200cc.
HD8714: Standard calibration solution 0.01mol/l equal to 1413µS/cm @25°C - 200cc.
HD8712: Standard calibration solution 0.1mol/l equal to 12880µS/cm @25°C - 200cc.
HD87111: Standard calibration solution 1mol/l equal to 111800µS/cm @25°C - 200cc.

Temperature probes complete with TP47 module

TP47.100: Direct 4 wires Pt100 sensor immersion probe. Probe's stem Ø 3mm, length 230mm. Connection cable 4 wires with connector, length 2 m.
TP47.1000: Pt1000 sensor immersion probe. Probe's stem Ø 3mm, length 230mm. Connection cable 2 wires with connector, length 2 m.
TP87.100: Pt100 sensor immersion probe. Probe's stem Ø 3mm, length 70mm. 4 wire connection cable with connector, length 1 m.
TP87.1000: Pt1000 sensor immersion probe. Probe's stem Ø 3mm, length 70mm. 2 wire connection cable with connector, length 1 m.

Accessories

TP47: Module for the connection of Pt100 4-wire and Pt1000 2-wire probes.

χ

Ω

mg/l

NaCl

HD 2206.2

HD 2206.2
BENCH-TOP CONDUCTIVITY METER

The **HD2206.2** is a bench top instrument for electrochemical measures: **conductivity**, and **temperature**. It is fitted with a large backlighted LCD display.
The **HD2206.2** measures **conductivity**, **resistivity** in liquids, **total disssolved solids** (TDS), and **salinity** with combined 4-ring and 2-ring conductivity/temperature probes. The conductivity probes can have a direct input or with SICRAM module. The inputs are separate.

AI models are fitted with input for the measurement of t**emperature** with Pt100 or Pt1000 immersion, penetration or contact probes. The temperature probes are equipped with an automatic recognition module and factory calibration data are stored inside.

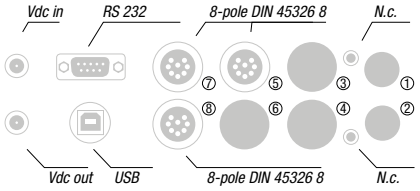
- The conductivity probe calibration can be performed automatically with automatically detected conductivity calibration solutions: 147µS/cm, 1413µS/cm, 12880µS/cm or 111800µS/cm or manually with calibration solutions having different values.

- Conductivity, dissolved oxygen and temperature probes fitted with SICRAM module can store factory and calibration data inside.

The instruments HD2206.2 is a **datalogger**, it can memorize up to 2,000 samples of data.
The data can be transferred from the instrument connected to a PC via the multi-standard RS232C serial port and USB 2.0. The storing parameters can be configured using the menu.
The RS232C serial port can be used to transfer the acquired measurements to a 24 column portable printer in real time (HD40.1 or HD40.2).
The instruments equipped with **HD22BT** (Bluetooth) option can transfer data without any connection to a PC or printer fitted with Bluetooth input or through Bluetooth/RS232C converter.
The software DeltaLog11 allows instrument management and configuration, and data processing on PC.
The instruments have IP66 protection degree.

Technical characteristics HD2206.2
Χ - Ω - TDS - NaCl - °C -°F measurement

Instrument	
Dimensions (Length x Width x Height)	265x185x70mm
Weight	490g
Materials	ABS, rubber
Display	Back lighted, matrix point display. 240x64 points, visible area: 128x35mm
Operating conditions	
Working temperature	-5 … 50°C
Storage temperature	-25 … 65°C
Working relative humidity	0 … 90% R.H. without condensate
Protection degree	**IP66**
Power	
	Mains adapter (cod. SWD10) 12Vdc/1A
Auxiliary socket	For supplying of electrode holder with built-in stirrer HD22.2
Security of memorized data	
	Unlimited
Time	
Date and hour	Real time schedule with backup battery 3.6V - ½AA
Accuracy	1min/month max drift
Measured values storing	
Quantity	2000 screens
Storage interval	1s … 999s



Calibration storage

Quantity	Last 8 calibrations of each physical quantity

RS232C serial interface

Type	RS232C electrically isolated
Baud rate	Can be set from 1200 to 115200 baud
Data bit	8
Parity	None
Stop bit	1
Flow Control	Xon/Xoff
Length of serial cable	Max 15m

USB Interface

Type	1.1 - 2.0 electrically isolated
Bluetooth Interface	optional

Connections

Input for temperature probes with SICRAM module ⑤	8-pole male DIN45326 connector
2/4 ring direct ⑧conductivity input	8-pole male DIN45326 connector
Conductivity probe with SICRAM module input ⑦	8-pole male DIN45326 connector
Serial interface	DB9 connector (9- pole male)
USB interface	USB connector type B
Bluetooth	Optional
Mains adapter	2 -pole (Ø5.5mm-2.1mm). Positive at centre
Socket for power supply of electrode holder with built-in magnetic stirrer	2- pole connector (Ø5.5mm-2.1mm). Positive at centre (output 12Vdc/200mA max).

Measurement of conductivity by instrument		*Resolution*
Measuring range (Kcell=0.01)	0.000…1.999µS/cm	0.001µS/cm
Measuring range (Kcell=0.1)	0.00…19.99µS/cm	0.01µS/cm
Measuring range (K cell=1)	0.0…199.9µS/cm	0.1µS/cm
	200…1999µS/cm	1µS/cm
	2.00…19.99mS/cm	0.01mS/cm
	20.0…199.9mS/cm	0.1mS/cm
Measuring range (Kcell=10)	200…1999mS/cm	1mS/cm
Accuracy (conductivity)	±0.5% ±1digit	

Measurement of resistivity by instrument		
Measuring range (Kcell=0.01)	Up to 1GΩ·cm	(*)
Measuring range (Kcell=0.1)	Up to 100MΩ·cm	(*)
Measuring range (K cell=1)	5.0…199.9Ω·cm	0.1Ω·cm
	200…999Ω·cm	1Ω·cm
	1.00k…19.99kΩ·cm	0.01kΩ·cm
	20.0k…99.9kΩ·cm	0.1kΩ·cm
	100k…999kΩ·cm	1kΩ·cm
	1…10MΩ·cm	1MΩ·cm
Measuring range (Kcell=10)	0.5…5.0Ω·cm	0.1Ω·cm
Accuracy (resistivity)	±0.5% ±1digit	

Measurement of total dissolved solids (with coefficient χ/TDS=0.5)		
Measuring range (Kcell=0.01)	0.00…1.999mg/l	0.005mg/l
Measuring range (Kcell=0.1)	0.00…19.99mg/l	0.05mg/l
Measuring range (K cell=1)	0.0…199.9 mg/l	0.5 mg/l
	200…1999 mg/l	1 mg/l
	2.00…19.99 g/l	0.01 g/l
	20.0…199.9 g/l	0.1 g/l
Measurement range (Kcell=10)	100…999 g/l	1 g/l
Accuracy (total dissolved solids)	±0.5% ±1digit	

Measurement of salinity		*Resolution*
Measuring range	0.000…1.999g/l	1mg/l
	2.00…19.99g/l	10mg/l
	20.0…199.9 g/l	0.1 g/l
Accuracy (salinity)	±0.5% ±1digit	

Automatic/manual temperature compensation	0...100°C with α_T = 0.00…4.00%/°C
Reference temperature	0…50°C
χ/TDS conversion factor	0.4…0.8
Cell constants K (cm^{-1}) already set on the instrument	0.01 - 0.1 - 0.5 - 0.7 - 1.0 - 10.0
Cell constants K(cm^{-1}) that can be set by user	0.01…20.00

Standard solutions automatically detected (@25°C)

147µS/cm
1413µS/cm
12880µS/cm
111800µS/cm

Measurement of temperature by instrument

Pt100 measuring range	-50…+150°C
Pt1000 measuring range	-50…+150°C
Resolution	0.1°C
Accuracy	±0.1°C ±1digit
Drift after 1 year	0.1°C/year

(*) The resistivity measurement is obtained from the reciprocal of conductivity measurement. Close to the bottom of the scale, the indication of resistivity appears like reported in the table below:

K cell = 0.01 cm^{-1}		**K cell = 0.1 cm^{-1}**	
Conductivity (µS/cm)	Resistivity (MΩ·cm)	Conductivity (µS/cm)	Resistivity(MΩ·cm)
0.001 µS/cm	1000 MΩ·cm	0.01 µS/cm	100 MΩ·cm
0.002 µS/cm	500 MΩ·cm	0.02 µS/cm	50 MΩ·cm
0.003 µS/cm	333 MΩ·cm	0.03 µS/cm	33 MΩ·cm
0.004 µS/cm	250 MΩ·cm	0.04 µS/cm	25 MΩ·cm
…	…	…	…

χ

TDS

ORDERING CODES

HD2206.2: The kit is composed of: instrument HD2206.2 for the measurement of conductivity - resistivity - TDS - salinity - temperature, **datalogger**, stabilized power supply at mains voltage 100-240Vac/12Vdc-1A., instructions manual and software DeltaLog11.

pH/mV electrodes, conductivity probes, dissolved oxygen probes, temperature probes, standard reference solutions for different measurement types, connection cables for pH electrodes with S7 connector, cables for data download to PC or printer have to be ordered separately.

ACCESSORIES

9CPRS232: Connection cable SubD female 9- pole for serial output RS232C.

CP22: USB 2.0 connection cable - connector typo A - connector type B.

DeltaLog11: Software for download and management of the data on PC using Windows 98 to Vista operating systems.

SWD10: Stabilized power supply at 230Vac/12Vdc-1A mains voltage.

HD40.1: Portable, serial input, 24 column thermal printer, 57mm paper width.

HD40.2: 24-column portable thermal printer, **Bluetooth and serial interface**, 57mm paper width, four NiMH 1.2V rechargeable batteries, SWD10 power supply, instruction manual, 5 thermal paper rolls. Requires the module HD22BT (**optional**) or the cable HD 2110 CSNM (**optional**).

HD22.2: Laboratory electrode holder composed of basis plate with incorporated magnetic stirrer, staff and replaceable electrode holder. Height max. 380mm. Powerd by bench-top meters of the series HD22… with cable HD22.2.1 (**optional**) or supplier SWD10 (**optional**).

HD22.3: Laboratory electrode holder with metal basis plate. Flexible electrode holder for free positioning. For Ø 12mm probes.

HD22BT: Bluetooth module for wireless data transmission from instrument to PC. **The fitting of the module into the instrument is made exclusively by Delta Ohm, at the time of placing the order.**

TP47: Module for the connection of Pt100 4-wire and Pt1000 2-wire probes.

Conductivity probes and combined conductivity and temperature probes without SICRAM module *(Input ⑦)*

SP06T: Combined conductivity and temperature 4-electrode cell in Platinum, body in Pocan. Cell constant K = 0.7. Measurement range 5µS/cm …200mS/cm, 0…90°C.

SPT401.001: Combined conductivity and temperature 2- electrode cell in stainless steel AISI 316. Cell constant K = 0.01. Measurement range 0.04µS/cm …20µS/cm, 0…120°C. Measurement in closed-cell.

SPT01G: Combined conductivity and temperature 2-electrode Platinum-wire cell, body in glass. Cell constant K = 0.1. Measurement range 0.1µS/cm …500µS/cm, 0…80°C.

SPT1G: Combined conductivity and temperature 2-electrode Platinum-wire cell, body in glass. Cell constant K = 1. Measurement range 10µS/cm …10mS/cm, 0…80°C.

SPT10G: Combined conductivity and temperature 2-electrode Platinum-wire cell, body in glass. Cell constant K = 10. Measurement range 500µS/cm …200mS/cm, 0…80°C.

Electrode dimensions and characteristics at page 402

Combined conductivity / temperature probes with SICRAM module *(Input ⑧)*

SPT1GS: Combined conductivity /temperature 2-electrode Platinum- wire cell, body in glass with SICRAM module. Cell constant K = 1. Measuring range 10µS/cm …10mS/cm, 0…80°C.

Electrode dimensions and characteristics at page 402

Standard conductivity calibration solutions

HD8747: Standard calibration solution 0.001mol/l equal to 147µS/cm @25°C - 200cc.

HD8714: Standard calibration solution 0.01mol/l equal to 1413µS/cm @25°C - 200cc.

HD8712: Standard calibration solution 0.1mol/l equal to 12880µS/cm @25°C - 200cc.

HD87111: Standard calibration solution 1mol/l equal to 111800µS/cm @25°C - 200cc.

HD40.1

Temperature probes complete with SICRAM module *(Input ⑤)*

TP87: PT100 sensor immersion probe. Stem Ø 3 mm, length 70 mm. Cable length 1 m.

TP472I.0: Pt100 sensor immersion probe. Stem Ø 3 mm, length 230 mm. Cable length 2 m.

TP473P.0: Pt100 sensor penetration probe. Stem Ø 4mm, length 150 mm. Cable length 2 m.

TP474C.0: Pt100 sensor contact probe. Stem Ø 4mm, length 230mm, contact surface Ø 5mm. Cable length 2 m.

TP475A.0: Air probe, sensor Pt100. Stem Ø 4mm, length 230mm. Cable length 2 m.

TP472I.5: Immersion probe, sensor Pt100. Stem Ø 6mm, length 500 mm. Cable length 2 m.

TP472I.10: Immersion probe, sensor Pt100. Stem Ø 6mm, length 1,000mm. Cable length 2 m.

Temperature probes complete with TP47 module *(input⑤)*

TP47.100: Direct 4 wires Pt100 sensor immersion probe. Probe's stem Ø 3mm, length 230mm. Connection cable 4 wires with connector, length 2 m.

TP47.1000: Pt1000 sensor immersion probe. Probe's stem Ø 3mm, length 230mm. Connection cable 2 wires with connector, length 2 m.

TP87.100: Pt100 sensor immersion probe. Probe's stem Ø 3mm, length 70mm. 4 wire connection cable with connector, length 1 m.

TP87.1000: Pt1000 sensor immersion probe. Probe's stem Ø 3mm, length 70mm. 2-wire connection cable with connector, length 1 m.

Accessories

TP47: Module for the connection of Pt100 4-wire and Pt1000 2-wire probes.

HD22.3

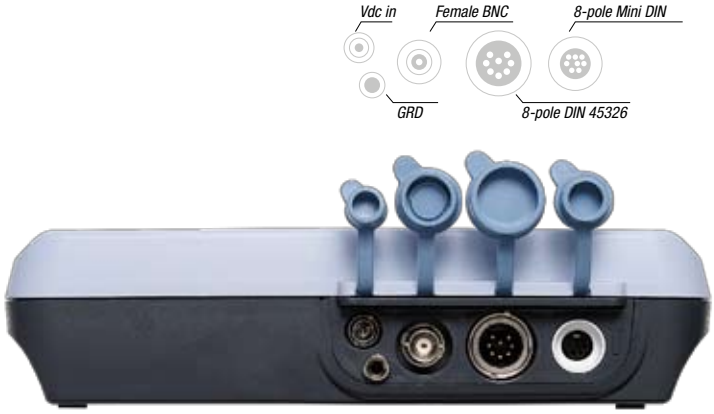
HD 3456.2
BENCH-TOP CONDUCTIVITY AND pH METER

The **HD3456.2** is a bench top instrument for electrochemical measures: **pH**, **conductivity and temperature**.
The displayed data can be stored **(datalogger)** and can be transferred to PC or serial printer thanks to the multi-standard serial ports RS232C and USB2.0 and software DeltaLog9
The **HD3456.2** measures **pH**, **mV**, **redox potential** (ORP), **conductivity**, **resistivity in liquids**, **total dissolved solids** (TDS), and **salinity** using combined 4-ring and 2-ring conductivity/ temperature probes. **Temperature** is measured by Pt100 or Pt1000 immersion, penetration or contact probes.
The pH electrode calibration, as well as manual, can be carried out on one, two or three points and the calibration sequence can be chosen from a list of 13 buffers.
The probe calibration can be performed automatically in one or more of the 147µS, 1413µS, 12880µS or 111800µS/cm conductivity calibration solutions.
The display shows continually the temperature in °C or °F and one selectable parameter according to the connected probe type, i.e. in case of conductivity probe it is possible to select between χ or Ω or TDS or NaCl.

Other functions of this instrument include: Max, Min and Avg function, the Auto-HOLD function, the automatic turning off which can also be excluded.
The instruments have IP66 protection degree.

Technical characteristics HD3456.2
pH, mV, χ, Ω, TDS, Sal, °C/°F measurement

Instrument	
Dimensions (Length x Width x Height)	220x120x55mm
Weight	460g (complete with batteries)
Materials	ABS, rubber
Display	2x4½ characters plus symbols visible area: 52x42mm
Operating conditions	
Working temperature	-5 … 50°C
Storage temperature	-25 … 65°C
Working relative humidity	0 … 90% RH without condensation
Protection degree	**IP66**
Power	
Batteries	3 batteries 1.5V type AA
Autonomy (only batteries)	100 hours with 1800mAh alkaline batteries
Mains (cod. **SWD10**)	Output mains adapter 100-240Vac/ 12Vdc-1A
Security of memorized data	
	Unlimited
Selectable storage interval	
	1s, 5s, 10s, 15s, 30s, 1min, 2min, 5min, 10min, 15min, 20min, 30min and 1hour
Time	
Date and hour	Schedule in real time
Accuracy	1min/month max drift
Serial interface RS232C	
Type	RS232C electrically isolated
Baud rate	Can be set from 1200 to 38400 baud
Data bit	8
Parity	None
Stop bit	1
Flow Control	Xon/Xoff
Serial cable length	Max 15m
Selectable print interval	immediate or 1s, 5s, 10s, 15s, 30s, 1min, 2min, 5min, 10min, 15min, 20min, 30min and 1hour
USB Interface	
Type	1.1 - 2.0 electrically isolated



Connections

Serial interface and USB	8-pole MiniDin connector
Mains adapter (cod. SWD10)	2-pole connector (positive at centre) 12Vdc/1A

Storage of measured values

Tipo	2000 pages of 10 samples each
Quantity	20,000 terns of measures made up of [pH or mV], [χ or Ω or TDS or salinity] and temperature.

Connections

pH/mV input	Female BNC connector
Conductivity input	8-pole male DIN45326 connector
Input for temperature probes with TP47 module	8-pole male DIN45326 connector

Measurement of pH by Instrument

Measurement range	-2.000…+19.999pH
Resolution	0.01 o 0.001pH selectable from menu
Accuracy	±0.001pH ±1digit
Input impedance	$>10^{12}\Omega$
Calibration error @25°C	|Offset| > 20mV Slope > 63mV/pH or Slope < 50mV/pH Sensitivity > 106.5% or Sensitivity < 85%
Automatic / manual temperature compensation	-50…+150°C

Measurement of mV by Instrument

Measurement range	-1999.9…+1999.9mV
Resolution	0.1mV
Accuracy	±0.1mV ±1digit
Drift after 1 year	0.5mV/year

Standard solutions automatically detected (@25°C)

1.679pH - 2.000pH - 4.000pH - 4.008pH - 4.010pH
6.860pH - 6.865pH - 7.000pH - 7.413pH - 7.648pH
9.180pH - 9.210pH - 10.010pH

Measurement of conductivity by Instrument

		Resolution
Measurement range (Kcell=0.01)	0.000…1.999µS/cm	0.001µS/cm
Measurement range (Kcell=0.1)	0.00…19.99µS/cm	0.01µS/cm
Measurement range (Kcell=1)	0.0…199.9µS/cm	0.1µS/cm
	200…1999µS/cm	1µS/cm
	2.00…19.99mS/cm	0.01mS/cm
	20.0…199.9mS/cm	0.1mS/cm
Measurement range (Kcell=10)	200…1999mS/cm	1mS/cm
Accuracy (conductivity)	±0.5% ±1digit	

Measurement of resistivity by Instrument

Measurement range (Kcell=0.01)	Up to 1GΩ·cm	(*)
Measurement range (Kcell=0.1)	Up to 100MΩ·cm	(*)
Measurement range (Kcell=1)	5.0…199.9Ω·cm	0.1Ω·cm
	200…999Ω·cm	1Ω·cm
	1.00k…19.99kΩ·cm	0.01kΩ·cm
	20.0k…99.9kαΩ·cm	0.1kΩ·cm
	100k…999kΩ·cm	1kΩ·cm
	1…10MΩ·cm	1MΩ·cm
Measurement range (Kcell=10)	0.5…5.0Ω·cm	0.1Ω·cm
Accuracy (resistivity)	±0.5% ±1digit	

Measurement of total dissolved solids (with coefficient χ/TDS=0.5)

Measurement range (Kcell=0.01)	0.00…1.999mg/l	0.005mg/l
Measurement range (Kcell=0.1)	0.00…19.99mg/l	0.05mg/l
Measurement range (Kcell=1)	0.0…199.9 mg/l	0.5 mg/l
	200…1999 mg/l	1 mg/l
	2.00…19.99 g/l	0.01 g/l
	20.0…99.9 g/l	0.1 g/l
Measurement range (Kcell=10)	100…999 g/l	1 g/l
Accuracy (total dissolved solids)	±0.5% ±1digit	

Measurement of salinity

Measurement range / Resolution	0.000…1.999g/l	1mg/l
	2.00…19.99g/l	10mg/l
	20.0…199.9g/l	0.1g/l
Accuracy (salinity)	±0.5% ±1digit	

Automatic/manual temperature compensation

0…100°C with α_T that can be selected from 0.00 to 4.00%/°C

Reference temperature	20°C o 25°C selectable from menu
χ/TDS conversion factor	0.4…0.8
Cell constant K (cm^{-1})	0.01 - 0.1 - 0.7 - 1.0 - 10.0

Standard solutions automatically detected (@25°C)

147µS/cm
1413µS/cm
12880µS/cm
111800µS/cm

Measurement of temperature by Instrument

Pt100 measurement range	-50…+200°C
Pt1000 measurement range	-50…+200°C
Resolution	0.1°C
Accuracy	±0.25°C
Drift after 1 year	0.1°C/year

(*) The resistivity measurement is obtained from the reciprocal of conductivity measurement. Close to the bottom of the scale, the indication of resistivity appears like reported in the table below:

K cell = 0.01 cm^{-1}		**K cell = 0.1 cm^{-1}**	
Conductivity (µS/cm)	Resistivity (MΩ·cm)	Conductivity (µS/cm)	Resistivity(MΩ·cm)
0.001 µS/cm	1000 MΩ·cm	0.01 µS/cm	100 MΩ·cm
0.002 µS/cm	500 MΩ·cm	0.02 µS/cm	50 MΩ·cm
0.003 µS/cm	333 MΩ·cm	0.03 µS/cm	33 MΩ·cm
0.004 µS/cm	250 MΩ·cm	0.04 µS/cm	25 MΩ·cm
…	…	…	…

ORDERING CODES

HD3456.2: The kit is composed of: instrument HD3456.2 **datalogger**, for the measurement of pH - redox - conductivity - resistivity - TDS - salinity - temperature, 3 1.5V alkaline batteries, operating manual and **DeltaLog9 version 2.0**.

pH/mV electrodes, conductivity probes, dissolved oxygen probes, temperature probes, standard reference solutions for different measurement types, connection cables for pH electrodes with S7 connector, cables for data download to PC or printer have to be ordered separately.

pH

χ

Ω

TDS

ACCESSORIES

HD2110CSNM: 8-pole connection cable Mini Din - Sub D 9-pole female for RS232C, for connection to PC without USB input.

HD2101/USB: Connection cable USB 2.0 connector type A - 8-pole Mini Din for connection to PC with USB input.

SWD10: Stabilized power supply at 100-240Vac/12Vdc-1A mains voltage.

HD40.1: Portable, serial input, 24 column thermal printer, 57mm paper width.

HD22.2: Laboratory electrode holder composed of basis plate with incorporated magnetic stirrer, staff and replaceable electrode holder. Height max. 380mm. Powerd by bench-top meters of the series HD22… with cable HD22.2.1 (**optional**) or supplier SWD10 (**optional**).

HD22.3: Laboratory electrode holder with metal basis plate. Flexible electrode holder for free positioning. For Ø 12mm probes.

TP47: Module for the connection of Pt100 4-wire and Pt1000 2-wire probes.

pH Electrodes

KP20: Combined pH electrode for common use, gel filled with screw connector S7 body in Epoxy.

KP30: Combined pH electrode for common use, cable 1 m, gel filled, body in Epoxy.

KP50: Combined pH electrode with Teflon collar diaphragm, for emulsions, deionised water, S7 screw connector, gel filled, body in glass.

KP 61: Combined pH electrode, 3 diaphragms for milk, cream, etc. elektrolyte, with screw connector S7, body in glass.

KP 62: Combined pH electrode, 1 diaphragm for pure water, paints, etc. gel-filled, with screw connector S7, body in glass.

KP 63: Combined pH electrode for common use, varnish, cable 1 m, electrolyte KCl 3M body in glass.

KP 64: Combined pH electrode for water, varnish, emulsions, etc., electrolyte KCl 3M with screw connector S7, body in glass.

KP 70: Combined pH micro electrode diam. 4.5 x L=25 mm. Gel filled with screw connector, body in glass.

KP 80: Combined pointed pH electrode, gel filled with screw connector S7, body in glass.

KP 100: Flat membrane gel combined pH electrode with S7 screw connector, glass body, for skin, leather, paper.

ORP Electrodes

KP90: Redox Platinum electrode, with screw connector S7, electrolyte KCl 3M, body in glass.

KP91: Redox Platinum electrode with 1m cable, GEL filled, body in glass.

Electrode characteristics at page 402

CP: Extension cable 1.5m with BNC connectors on one side and S7 on the other side for electrode with S7 connector.

CP5: Extension cable 5m with BNC connectors on one side and S7 on the other side for electrode with S7 connector.

CE: S7 screw connector for pH electrode.

BNC: Female BNC for electrode extension.

pH buffer solutions

HD8642: Buffer solution 4.01pH - 200cc.

HD8672: Buffer solution 6.86pH - 200cc.

HD8692: Buffer solution 9.18pH - 200cc.

Redox buffer solutions

HDR220: Redox buffer solution 220mV 0,5 l.

HDR468: Redox buffer solution 468mV 0,5 l.

Elettrolyte solutions

KCL 3M: 50cc ready for use solution for refilling of the electrodes.

Cleaning and maintainance

HD62PT: Diaphragm cleaning (tiourea in HCl) - 500ml.

HD62PP: Protein cleaning (pepsin in HCl) - 500ml.

HD62RF: Regeneration (fluorhydric acid) - 100ml.

HD62SC: Solution for electrode preservation - 500ml.

Combined conductivity and temperature probes

SP06T: Combined conductivity and temperature 4-electrode cell in Platinum, body in Pocan. Cell constant K = 0.7. Measurement range 5µS/cm …200mS/cm, 0…90°C.

SPT401.001: Combined conductivity and temperature 2- electrode cell in stainless steel AISI 316. Cell constant K = 0.01. Measurement range 0.04µS/cm …20µS/cm, 0…120°C. Measurement in closed-cell..

SPT01G: Combined conductivity and temperature 2-electrode Platinum-wire cell, body in glass. Cell constant K = 0.1. Measurement range 0.1µS/cm …500µS/cm, 0…80°C.

SPT1G: Combined conductivity and temperature 2-electrode Platinum-wire cell, body in glass. Cell constant K = 1. Measurement range 10µS/cm …10mS/cm, 0…80°C.

SPT10G: Combined conductivity and temperature 2-electrode Platinum-wire cell, body in glass. Cell constant K = 10. Measurement range 500µS/cm …200mS/cm, 0…80°C.

Electrode dimensions and characteristics at page 402

Standard conductivity calibration solutions

HD8747: Standard calibration solution 0.001mol/l equal to 147µS/cm @25°C - 200cc.

HD8714: Standard calibration solution 0.01mol/l equal to 1413µS/cm @25°C - 200cc.

HD8712: Standard calibration solution 0.1mol/l equal to 12880µS/cm @25°C - 200cc.

HD87111: Standard calibration solution 1mol/l equal to 111800µS/cm @25°C - 200cc.

Temperature probes complete with TP47 module

TP47.100: Direct 4 wires Pt100 sensor immersion probe. Probe's stem Ø 3mm, length 230mm. Connection cable 4 wires with connector, length 2 m.

TP47.1000: Pt1000 sensor immersion probe. Probe's stem Ø 3mm, length 230mm. Connection cable 2 wires with connector, length 2 m.

TP87.100: Pt100 sensor immersion probe. Probe's stem Ø 3mm, length 70mm. 4 wire connection cable with connector, length 1 m.

TP87.1000: Pt1000 sensor immersion probe. Probe's stem Ø 3mm, length 70mm. 2 wire connection cable with connector, length 1 m.

Accessories

TP47: Module for the connection of Pt100 4-wire and Pt1000 2-wire probes.

HD 2256.2

HD 2256.2
BENCH-TOP CONDUCTIVITY AND pH METER

The **HD2256.2** is a bench top instrument for electrochemical measures: **pH**, **conductivity** and **temperature**. It is fitted with a large backlighted LCD display.
The **HD2256.2** measures **pH**, **mV**, **redox potential** (ORP) with pH, redox electrodes or electrodes with separate reference. **Conductivity and resistivity** in liquids, **total dissolevd solids** (TDS) and **salinity** with combined 4-ring and 2-ring conductivity/temperature probes. The conductivity probes can have a direct input or with SICRAM module. The inputs are separate.

The instruments is fitted with an input for the measurement of t**emperature** with Pt100 or Pt1000 immersion, penetration or contact probes. The temperature probes are equipped with an automatic recognition module and factory calibration data are stored inside.

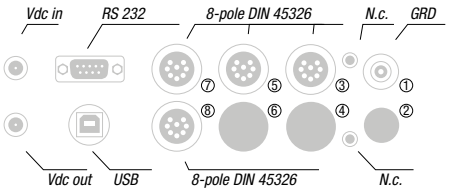
The pH electrode calibration can be carried out on one or five points and the calibration sequence can be chosen from a list of 13 buffers.

- The pH electrode calibration can be carried out on one or five points and the calibration sequence can be chosen from a list of 13 buffers Temperature compensation can be automatic or manual.
- The conductivity probe calibration can be performed automatically with automatically detected conductivity calibration solutions: 147µS/cm, 1413µS/cm, 12880µS/cm or 111800µS/cm or manually with calibration solutions having different values.
- Conductivity, dissolved oxygen and temperature probes fitted with SICRAM module can store factory and calibration data inside.

The instruments HD2256.2 is a **datalogger**, it can memorize up to 2,000 samples of data.
The data can be transferred from the instrument connected to a PC via the multi-standard RS232C serial port and USB 2.0. The storing parameters can be configured using the menu.
The RS232C serial port can be used to transfer the acquired measurements to a 24 column portable printer in real time (HD40.1 or HD40.2).
The instruments equipped with **HD22BT** (Bluetooth) option can transfer data without any connection to a PC or printer fitted with Bluetooth input or through Bluetooth/RS232C converter.
The software DeltaLog11 allows instrument management and configuration, and data processing on PC.
The instruments have IP66 protection degree.

Technical characteristics HD2256.2
pH - mV - ℃ - Ω - TDS - NaCl - °C - °F

Instrument	
Dimensions (Length x Width x Height)	265x185x70mm
Weight	490g
Materials	ABS, rubber
Display	Back lighted, matrix point display. 240x64 points, visible area: 128x35mm
Operating conditions	
Working temperature	-5 … 50°C
Storage temperature	-25 … 65°C
Working relative humidity	0 … 90% R.H. without condensate
Protection degree	**IP66**
Power	
	Mains adapter (cod. SWD10) 12Vdc/1A
Auxiliary socket	For supplying of electrode holder with built-in stirrer HD22.2
Security of memorized data	
	Unlimited
Time	
Date and hour	Real time schedule with backup battery 3.6V - ½AA
Accuracy	1min/month max drift



Measured values storing

Quantity	2000 screens
Storage interval	1s … 999s

Calibration storage

Quantity	Last 8 calibrations of each physical quantity

RS232C serial interface

Type	RS232C electrically isolated
Baud rate	Can be set from 1200 to 115200 baud
Data bit	8
Parity	None
Stop bit	1
Flow Control	Xon/Xoff
Length of serial cable	Max 15m

USB Interface

Type	1.1 - 2.0 electrically isolated
USB Interface	optional

Connections

Input for temperature probes with SICRAM modules⑤	8-pole male DIN45326 connector
pH/mV input ①	BNC female
Input for SICRAM module pH/ temperature ③	8-pole male DIN45326 connector
2/ 4- electrode direct conductivity input ⑧	8-pole male DIN45326 connector
Input conductivity electrodes with SICRAM module⑦	8-pole male DIN45326 connector
Serial interface	DB9 connector (9- pole male)
USB interface	USB connector type B
Bluetooth	Optional
Mains adapter	2-pole connector (Ø5.5mm-2.1mm). Positive at centre
Outlet for power supply of electrode holder with built-in magnetic stirrer	2-pole connector (Ø5.5mm-2.1mm). Positive at centre (output 12Vdc/200mA max).

pH measurement by instrument

Measuring range	-9.999…+19.999pH
Resolution	0.01 o 0.001pH selectable from menu
Accuracy	±0.001pH ±1digit
Input impedance	$>10^{12}\Omega$
Calibration error @25°C	|Offset| > 20mV Slope > 63mV/pH o Slope < 50mV/pH Sensitivity > 106.5% or Sensitivity < 85%
Calibration points	Up to 5 points with 13 automatically detected buffer solutions
Standard solutions automatically detected (@25°C)	1.679pH - 2.000pH - 4.000pH - 4.008pH 4.010pH - 6.860pH - 6.865pH - 7.000pH 7.413pH - 7.648pH - 9.180pH - 9.210pH 10.010pH

mV measurement by instrument

Measuring range	-1999.9…+1999.9mV
Resolution	0.1mV
Accuracy	±0.1mV ±1digit
Drift after 1 year	0.5mV/year

Conductivity measurement by instrument		*Resolution*
Measuring range (Kcell=0.01)	0.000…1.999µS/cm	0.001µS/cm
Measuring range (Kcell=0.1)	0.00…19.99µS/cm	0.01µS/cm
Measuring range (K cell=1)	0.0…199.9µS/cm	0.1µS/cm
	200…1999µS/cm	1µS/cm
	2.00…19.99mS/cm	0.01mS/cm
	20.0…199.9mS/cm	0.1mS/cm
Measuring range (Kcell=10)	200…1999mS/cm	1mS/cm
Accuracy (conductivity)	±0.5% ±1digit	

Measurement of resistivity by instrument		
Measuring range (Kcell=0.01)	Up to 1GΩ·cm	(*)
Measuring range (Kcell=0.1)	Up to 100MΩ·cm	(*)
Measuring range (K cell=1)	5.0…199.9Ω·cm	0.1Ω·cm
	200…999Ω·cm	1Ω·cm
	1.00k…19.99kΩ·cm	0.01kΩ·cm
	20.0k…99.9kΩ·cm	0.1kΩ·cm
	100k…999kΩ·cm	1kΩ·cm
	1…10MΩ·cm	1MΩ·cm
Measuring range (Kcell=10)	0.5…5.0Ω·cm	0.1Ω·cm
Accuracy (resistivity)	±0.5% ±1digit	

Measurement of total dissolved solids (with coefficient χ/TDS=0.5)		
Measuring range (Kcell=0.01)	0.00…1.999mg/l	0.005mg/l
Measuring range (Kcell=0.1)	0.00…19.99mg/l	0.05mg/l
Measuring range (K cell=1)	0.0…199.9 mg/l	0.5 mg/l
	200…1999 mg/l	1 mg/l
	2.00…19.99 g/l	0.01 g/l
	20.0…199.9 g/l	0.1 g/l
Measuring range (Kcell=10)	100…999 g/l	1 g/l
Accuracy (total dissolved solids)	±0.5% ±1digit	

Measurement of salinity by instrument

Measuring range	0.000…1.999g/l	1mg/l
	2.00…19.99g/l	10mg/l
	20.0…199.9 g/l	0.1 g/l
Accuracy (salinity)	±0.5% ±1digit	

Automatic/manual temperature compensation

	0...100°C with α_T = 0.00…4.00%/°C
Reference temperature	0…50°C
Conversion factor χ/TDS	0.4…0.8
Cell constant K (cm^{-1}) already set on instrument	0.01 - 0.1 - 0.5 - 0.7 - 1.0 - 10.0
Cell constants K(cm^{-1}) that can be set by user	0.01…20.00

Standard solutions automatically detected (@25°C)

147µS/cm
1413µS/cm
12880µS/cm
111800µS/cm

Measurement of temperature by instrument

Pt100 measuring range	-50…+150°C
Pt1000 measuring range	-50…+150°C
Resolution	0.1°C
Accuracy	±0.1°C ±1digit
Drift after 1 year	0.1°C/year

(*) The resistivity measurement is obtained from the reciprocal of conductivity measurement. Close to the bottom of the scale, the indication of resistivity appears like reported in the table below:

K cell = 0.01 cm^{-1}		**K cell = 0.1 cm^{-1}**	
Conductivity (µS/cm)	Resistivity (MΩ·cm)	Conductivity (µS/cm)	Resistivity(MΩ·cm)
0.001 µS/cm	1000 MΩ·cm	0.01 µS/cm	100 MΩ·cm
0.002 µS/cm	500 MΩ·cm	0.02 µS/cm	50 MΩ·cm
0.003 µS/cm	333 MΩ·cm	0.03 µS/cm	33 MΩ·cm
0.004 µS/cm	250 MΩ·cm	0.04 µS/cm	25 MΩ·cm
…	…	…	…

ORDERING CODES

HD2256.2: The kit is composed of: instrument HD2256.2 for the measurement of pH - redox - conductivity - resistivity - TDS - salinity - temperature, **datalogger**, stabilized power supply at mains voltage 100-240Vac/12Vdc-1A., instructions manual and software DeltaLog11.

pH/mV electrodes, conductivity probes, dissolved oxygen probes, temperature probes, standard reference solutions for different measurement types, connection cables for pH electrodes with S7 connector, cables for data download to PC or printer have to be ordered separately.

ACCESSORIES

9CPRS232: Connection cable SubD female 9- pole for serial output RS232C.
CP22: USB 2.0 connection cable - connector typo A - connector type B.
DeltaLog11: Software for download and management of the data on PC using Windows 98 to Vista operating systems.
SWD10: Stabilized power supply at 100-240Vac/12Vdc-1A mains voltage.
HD40.1: Portable, serial input, 24 column thermal printer, 57mm paper width.
HD40.2: 24-column portable thermal printer, **Bluetooth and serial interface**, 57mm paper width, four NiMH 1.2V rechargeable batteries, SWD10 power supply, instruction manual, 5 thermal paper rolls. Requires the module HD22BT (**optional**) or the cable HD 2110 CSNM (**optional**).
HD22.2: Laboratory electrode holder composed of basis plate with incorporated magnetic stirrer, staff and replaceable electrode holder. Height max. 380mm. Powerd by bench-top meters of the series HD22… with cable HD22.2.1 (**optional**) or supplier SWD10 (**optional**).

HD22.3: Laboratory electrode holder with metal basis plate. Flexible electrode holder for free positioning. For Ø 12mm probes.
HD22BT: Bluetooth module for wireless data transmission from instrument to PC. **The fitting of the module into the instrument is made exclusively by Delta Ohm, at the time of placing the order.**
TP47: Module for the connection of Pt100 4-wire and Pt1000 2-wire probes.

pH electrodes without SICRAM module *(Inputs ① and ②)*
KP20: Combined pH electrode for general use, gel filled with screw connector S7 body in Epoxy.
KP30: Combined pH electrode for general use, cable 1 m, gel filled, body in Epoxy.
KP50: Combined pH electrode with Teflon collar diaphragm, for emulsions, deionised water, S7 screw connector, gel filled, body in glass.
KP 61: Combined pH electrode, 3 diaphragms for milk, cream, etc. Liquid reference filling, with screw connector S7, body in glass.
KP 62: Combined pH electrode, 1 diaphragm for pure water, paints, etc. gel-filled, with screw connector S7, body in glass.
KP 63: Combined pH electrode for general use, varnish, cable 1 m, electrolyte KCl 3M body in glass.
KP 64: Combined pH electrode for water, varnish, emulsions, etc., electrolyte KCl 3M with screw connector S7, body in glass.
KP 70: Combined pH micro electrode diam. 4.5 x L=25 mm. Gel filled, with screw connector, body in glass.
KP 80: Combined pointed pH electrode, gel filled, with screw connector S7, body in glass.
KP100: Flat membrane gel combined pH electrode with S7 screw connector, glass body, for skin, leather, paper.

ORP Electrodes (inputs ① and ②)
KP 90: REDOX PLATINUM liquid filled electrode with S7 screw connector, glass body.
KP 91: Gel REDOX PLATINUM electrode, 1m cable with BNC, EPOXY body
Characteristics and dimensions of the probes at page 397
CP: Extension cable 1.5m with BNC connectors on one side and S7 on the other side for electrode with S7 connector.
CP5: Extension cable 5m with BNC connectors on one side and S7 on the other side for electrode with S7 connector.
CE: S7 screw connector for pH electrode.
BNC: Female BNC for electrode extension.

pH electrodes with SICRAM module *(Input ③)*
KP63TS: Combined pH/temperature electrode with SICRAM module, body in Epoxy, Ag/AgCl sat KCl.

SICRAM Module with BNC input for pH electrodes *(Input ③)*
KP47: SICRAM module for pH electrode with BNC standard connector.

pH buffer solutions
HD8642: Buffer solution 4.01pH - 200cc.
HD8672: Buffer solution 6.86pH - 200cc.
HD8692: Buffer solution 9.18pH - 200cc.

Redox buffer solutions
HDR220: Redox buffer solution 220mV 0,5 l.
HDR468: Redox buffer solution 468mV 0,5 l.

Electrolyte solutions
KCL 3M: 50cc ready for use solution for electrode refilling.

Cleaning and maintenance
HD62PT: Diaphragm cleaning (tiourea in HCl) - 500ml.
HD62PP: Protein cleaning (pepsin in HCl) - 500ml.
HD62RF: Regeneration (fluorhydric acid) - 100ml.
HD62SC: Solution for electrode preservation - 500ml.

Conductivity probes and combined conductivity and temperature probes without SICRAM module *(Input ⑦)*
SP06T: Combined conductivity and temperature 4-electrode cell in Platinum, body in Pocan. Cell constant K = 0.7. Measurement range 5µS/cm …200mS/cm, 0…90°C.
SPT401.001: Combined conductivity and temperature 2- electrode cell in stainless steel AISI 316. Cell constant K = 0.01. Measurement range 0.04µS/cm …20µS/cm, 0…120°C. Measurement in closed-cell.
SPT01G: Combined conductivity and temperature 2-electrode Platinum-wire cell, body in glass. Cell constant K = 0.1. Measurement range 0.1µS/cm …500µS/cm, 0…80°C.
SPT1G: Combined conductivity and temperature 2-electrode Platinum-wire cell, body in glass. Cell constant K = 1. Measurement range 10µS/cm …10mS/cm, 0…80°C.
SPT10G: Combined conductivity and temperature 2-electrode Platinum-wire cell, body in glass. Cell constant K = 10. Measurement range 500µS/cm …200mS/cm, 0…80°C.

Combined conductivity / temperature probes with SICRAM module *(Input ⑧)*
SPT1GS: Combined conductivity /temperature 2-electrode Platinum- wire cell, body in glass with SICRAM module. Cell constant K = 1. Measuring range 10µS/cm …10mS/cm, 0…80°C.

Standard conductivity calibration solutions
HD8747: Standard calibration solution 0.001mol/l equal to 147µS/cm @25°C - 200cc.
HD8714: Standard calibration solution 0.01mol/l equal to 1413µS/cm @25°C - 200cc.
HD8712: Standard calibration solution 0.1mol/l equal to 12880µS/cm @25°C - 200cc.
HD87111: Standard calibration solution 1mol/l equal to 111800µS/cm @25°C - 200cc.

Temperature probes complete with SICRAM module *(Input ⑤)*
TP87: PT100 sensor immersion probe. Stem Ø 3 mm, length 70 mm. Cable length 1 metre.
TP472I.0: Pt100 sensor immersion probe. Stem Ø 3 mm, length 230 mm. Cable length 2 m.
TP473P.0: Pt100 sensor penetration probe. Stem Ø 4mm, length 150 mm. Cable length 2 m.
TP474C.0: Pt100 sensor contact probe. Stem Ø 4mm, length 230mm, contact surface Ø 5mm. Cable length 2 m.
TP475A.0: Air probe, sensor Pt100. Stem Ø 4mm, length 230mm. Cable length 2 m.
TP472I.5: Immersion probe, sensor Pt100. Stem Ø 6mm, length 500 mm. Cable length 2 m.
TP472I.10: Immersion probe, sensor Pt100. Stem Ø 6mm, length 1,000mm. Cable length 2 m.

Temperature probes complete with TP47 module *(input⑤)*
TP47.100: Direct 4 wires Pt100 sensor immersion probe. Probe's stem Ø 3mm, length 230mm. Connection cable 4 wires with connector, length 2 m.
TP47.1000: Pt1000 sensor immersion probe. Probe's stem Ø 3mm, length 230mm. Connection cable 2 wires with connector, length 2 m.
TP87.100: Pt100 sensor immersion probe. Probe's stem Ø 3mm, length 70mm. 4 wire connection cable with connector, length 1 m.
TP87.1000: Pt1000 sensor immersion probe. Probe's stem Ø 3mm, length 70mm. 2-wire connection cable with connector, length 1 m.

Accessories
TP47: Module for the connection of Pt100 4-wire and Pt1000 2-wire probes.

χ

mV

HD 3409.2

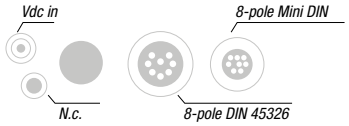
HD 3409.2
BENCH-TOP DISSOLVED OXYGEN METER

The **HD3409.2** is a bench top instrument for electrochemical measures: **dissolved oxygen** and **temperature**.
The displayed data can be stored **(datalogger)** and can be transferred to PC or serial printer thanks to the multi-standard serial ports RS232C and USB2.0 and software DeltaLog9 (Vers.2.0 and subsequent ones). The storing and printing parameters can be set from menu.
The **HD3409.2** measures the **concentration** (in mg/l) **of dissolved Oxygen in liquids**, the **saturation index** (in %) and the **temperature** using SICRAM combined probes of polarographic type with two or three electrodes and integrated temperature sensor. **Temperature** is measured by Pt100-SICRAM or direct 4 wire-immersion, penetration or contact probes.
Thanks to an internal pressure sensor, the instruments automatically compensate for barometric pressure. The instrument anticipates automatic compensation of the Oxygen probe membrane permeability and of the salinity of the liquid being examined. The dissolved Oxygen probe's quick calibration function guarantees timely correctness of the performed measurements.

The display shows continually the temperature in °C or °F and one selectable parameter according to the connected probe type,Printing and storage always include the temperature in °C or °F and one selectable parameter for each probe type.
Other common function of this instrument series include: Max, Min and Avg function, the Auto-HOLD function, the automatic turning off which can also be excluded.
The instruments have IP66 protection degree.

Technical characteristics HD3409.2
mg/l O_2, %O_2, mbar, °C/°F measurement

Instrument	
Dimensions (Length x Width x Height)	220x120x55mm
Weight	460g (complete with batteries)
Materials	ABS, rubber
Display	2x4½ characters plus symbols visible area: 52x42mm
Operating conditions	
Working temperature	-5 … 50°C
Storage temperature	-25 … 65°C
Working relative humidity	0 … 90% RH without condensation
Protection degree	**IP66**
Power	
Batteries	3 batteries 1.5V type AA
Autonomy (only batteries)	100 hours with 1800mAh alkaline batteries
Mains (cod. **SWD10**)	Output mains adapter 100-240Vac/ 12Vdc-1A
Security of memorized data	Unlimited
Selectable storage interval	1s, 5s, 10s, 15s, 30s, 1min, 2min, 5min, 10min, 15min, 20min, 30min and 1hour
Time	
Date and hour	Schedule in real time
Accuracy	1min/month max drift
Serial interface RS232C	
Type	RS232C electrically isolated
Baud rate	Can be set from 1200 to 38400 baud
Data bit	8
Parity	None
Stop bit	1
Flow Control	Xon/Xoff
Serial cable length	Max 15m
Selectable print interval	immediate or 1s, 5s, 10s, 15s, 30s, 1min, 2min, 5min, 10min, 15min, 20min, 30min and 1hour
USB Interface	
Type	1.1 - 2.0 electrically isolated
Common connections to all models	
Serial interface and USB	8-pole MiniDin connector
Mains adapter (cod. SWD10)	2-pole connector (positive at centre) 12Vdc/1A
Power absorbed with instrument off	
Without dissolved oxygen probe	20µA
With dissolved oxygen probe	40µA



Storage of the measured values

Type	2000 pages of 9 samples each
Quantity	18,000 measures made up of the four parameters mg/l 02, %02, mbar, [°C or °F]

Measurement connections

Input for Oxygen probes	8-pole male DIN45326 connector
Input for temperature probes with SICRAM module or TP47 module	8-pole male DIN45326 connector

Measurement of the concentration of dissolved Oxygen

Measurement range	0.00…90.00mg/l
Resolution	0.01mg/l
Accuracy	±0.03mg/l±1digit 60...110%, 1013mbar, 20...25°C)

Measurement of the saturation index of dissolved Oxygen

Measurement range	0.0…600.0%
Resolution	0.1%
Accuracy	±0.3% ±1digit (in the range .0…199.9%) ±1% ±1digit (in the range 00.0…600.0%)

Automatic/manual temperature compensation

	0…50°C

Measurement of barometric pressure

Measurement range	0.0…1100.0mbar
Resolution	0.1mbar
Accuracy	±2mbar±1digit between 18 and 25°C ±(2mbar+0.1mbar/°C)in the remaining range

Salinity setting

Setting range	0.0…70.0g/l
Resolution	0.1g/l

Temperature measurement with the sensor inside the dissolved Oxygen probe

Measurement range	0.0…+45.0°C
Resolution	0.1°C
Accuracy	±0.1°C
Drift after 1 year	0.1°C/year

Temperature measurement by Instrument with Pt100 probe

Pt100 Measurement range	-200…+650°C
Resolution	0.1°C
Accuracy	±0.1°C
Drift after 1 year	0.1°C/year

ORDERING CODES

HD3409.2: The kit is composed of: instrument HD3409.2 **datalogger**, for the measurement of dissolved oxygen concentration - saturation index - temperature, calibrator HD9709/20, 3 1.5V alkaline batteries, operating manual and **DeltaLog9 version 2.0**.

pH/mV electrodes, conductivity probes, dissolved oxygen probes, temperature probes, standard reference solutions for different measurement types, connection cables for pH electrodes with S7 connector, cables for data download to PC or printer have to be ordered separately.

ACCESSORIES

HD2110CSNM: 8-pole connection cable Mini Din - Sub D 9-pole female for RS232C, for connection to PC without USB input.

HD2101/USB: Connection cable USB 2.0 connector type A - 8-pole Mini Din for connection to PC with USB input.

SWD10: Stabilized power supply at 120-240Vac/12Vdc/1A mains voltage.

HD40.1: Portable, serial input, 24 column thermal printer, 57mm paper width.

HD22.2: Laboratory electrode holder composed of basis plate with incorporated magnetic stirrer, staff and replaceable electrode holder. Height max. 380mm. Powerd by bench-top meters of the series HD22… with cable HD22.2.1 (**optional**) or supplier SWD10 (**optional**).

HD22.3: Laboratory electrode holder with metal basis plate. Flexible electrode holder for free positioning. For Ø 12mm probes.

TP47: Module for the connection of Pt100 4-wire and Pt1000 2-wire probes to instrument series HD34…, without amplifying electronics and linearization.

Combined dissolved oxygen and temperature probes

DO9709 SS: The kit includes: combined probe for measurement of O_2 and temperature with replaceable membrane, three membranes, 50ml of zero solution, 50ml of electrolyte solution. Cable length 2m. ∅12mm x 120mm.

DO9709 SS.5: The kit includes: combined probe for measurement of O_2 and temperature with replaceable membrane, three membranes, 50ml of zero solution, 50ml of electrolyte solution. Cable length 5m. ∅12mm x 120mm.

Accessories

DO9709 SSK: Accessory kit for the DO9709 SS probe consisting of three membranes, 50ml of zero solution, 50ml of electrolyte solution.

DO9709.20: Calibrator for polarographic probes DO9709SS and DO9709SS.5.

Probe dimensions and characteristics at page 403

TP87: PT100 sensor immersion probe. Stem Ø 3 mm, length 70 mm. Cable length 1 m.

TP472I.0: Pt100 sensor immersion probe. Stem Ø 3 mm, length 230 mm. Cable length 2 m.

TP473P.0: Pt100 sensor penetration probe. Stem Ø 4mm, length 150 mm. Cable length 2 m.

TP474C.0: Pt100 sensor contact probe. Stem Ø 4mm, length 230mm, contact surface Ø 5mm. Cable length 2 m.

TP475A.0: Air probe, sensor Pt100. Stem Ø 4mm, length 230mm. Cable length 2 m.

TP472I.5: Immersion probe, sensor Pt100. Stem Ø 6mm, length 500 mm. Cable length 2 m.

TP472I.10: Immersion probe, sensor Pt100. Stem Ø 6mm, length 1,000mm. Cable length 2 m.

Temperature probes complete with TP47 module

TP47.100: Direct 4 wires Pt100 sensor immersion probe. Probe's stem Ø 3mm, length 230mm. Connection cable 4 wires with connector, length 2 m

Accessories

TP47: Module for the connection of Pt100 4-wire and Pt1000 2-wire probes.

mg/l

%sat

mbar

°C

HD 2259.2

HD 2259.2
BENCH-TOP DISSOLVED OXYGEN AND pH METER

The **HD2259.2** a bench top instrument for electrochemical measures: **pH**, **dissolved oxygen,** and **temperature**. It is fitted with a large backlighted LCD display.
The **HD2259.2** measures **pH**, **mV**, **redox potential** (ORP) with pH, redox electrodes or electrodes with separate reference; the **concentration of dissolved oxygen in** liquids (in mg/l), and **saturation index** (in %), using SICRAM combined probes of polarographic type with two or three electrodes and integrated temperature sensor.

The instrument fitted with an input for the measurement of t**emperature** with Pt100 or Pt1000 immersion, penetration or contact probes. The temperature probes are equipped with an automatic recognition module and factory calibration data are stored inside.

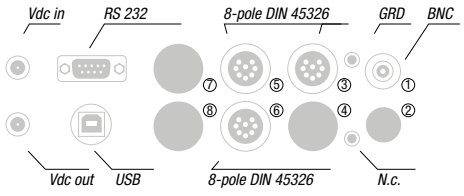
- The pH electrode calibration can be carried out on one or five points and the calibration sequence can be chosen from a list of 13 buffers Temperature compensation can be automatic or manual.
- The dissolved Oxygen probe's quick calibration function guarantees timely correctness of the performed measurements.
- Conductivity, dissolved oxygen and temperature probes fitted with SICRAM module can store factory and calibration data inside.

The instrument HD2259.2 is a **datalogger**, it can memorize up to 2,000 samples of data:
- pH or mV, concentration of dissolved oxygen or saturation index and saturation index and temperature:
- pH or mV, conductivity or resistivity or TDS or salinity, concentration of dissolved oxygen and temperature:

The data can be transferred from the instrument connected to a PC via the multi-standard RS232C serial port and USB 2.0. The storing parameters can be configured using the menu.
The RS232C serial port can be used to transfer the acquired measurements to a 24 column portable printer in real time (S'print-BT).
The instruments equipped with **HD22BT** (Bluetooth) option can transfer data without any connection to a PC or printer fitted with Bluetooth input or through Bluetooth/RS232C converter.
The software DeltaLog11 allows instrument management and configuration, and data processing on PC.
The instruments have IP66 protection degree.

Technical characteristics HD2259.2
pH - mV - mg/l O_2 - %O_2 - mbar - °C - °F measurement

Instrument	
Dimensions (Length x Width x Height)	265x185x70mm
Weight	490g
Materials	ABS, rubber
Display	Back lighted, matrix point display. 240x64 points, visible area: 128x35mm
Operating conditions	
Working temperature	-5 … 50°C
Storage temperature	-25 … 65°C
Working relative humidity	0 … 90% R.H. without condensate
Protection degree	**IP66**
Power	
	Mains adapter (cod. SWD10) 12Vdc/1A
Auxiliary socket	For supplying of electrode holder with built-in stirrer HD22.2
Security of memorized data	
	Unlimited
Time	
Date and hour	Real time schedule with backup battery E 3.6V - ½AA



Accuracy	1min/month max drift

Measured values storing

Quantity	2000 screens
Storage interval	1s … 999s

Calibration storage

Quantity	Last 8 calibrations of each physical quantity

RS232C serial interface

Type	RS232C electrically isolated
Baud rate	Can be set from 1200 to 115200 baud
Data bit	8
Parity	None
Stop bit	1
Flow Control	Xon/Xoff
Length of serial cable	Max 15m

USB Interface

Type	1.1 - 2.0 electrically isolated
Bluetooth Interface	optional

Connections

Input for temperature probes with SICRAM modules⑤	8-pole male DIN45326 connector
pH/mV inputs①	BNC female
Input SICRAM module pH/ temperature probes③	8-pole male DIN45326 connector
Input dissolved oxygen ⑥	8-pole male DIN45326 connector
Serial interface	DB9 connector (9- pole male)
USB interface	USB connector type B
Bluetooth	Optional
Mains adapter	2-pole connector (Ø5.5mm-2.1mm). Positive at centre
Outlet for power supply of electrode holder with built-in magnetic stirrer	2- pole connector (Ø5.5mm-2.1mm). Positive at centre (output 12Vdc/200mA max).

Measurement of pH by instrument

Measuring range	-9.999…+19.999pH
Resolution	0.01 o 0.001pH selectable from menu
Accuracy	.001pH ±1digit
Input impedance	
Calibration error @25°C	|Offset| > 20mV Slope > 63mV/pH o Slope < 50mV/pH Sensitivity < 85% or sensitivity < 85%
Calibration points	Up to 5 points with 13 automatically detected buffer solutions
Automatically detected pH standard solutions (@25°C)	1.679pH - 2.000pH - 4.000pH - 4.008pH 4.010pH - 6.860pH - 6.865pH - 7.000pH 7.413pH - 7.648pH - 9.180pH - 9.210pH 10.010pH

mV measurement by instrument

Measuring range	-1999.9…+1999.9mV
Resolution	0.1mV
Accuracy	±0.1mV ±1digit
Drift after 1 year	0.5mV/year

Measurement of dissolved oxygen by instrument

Resolution	0.01mg/l
Measuring range	0.00…90.00mg/l
Accuracy	±0.03mg/l±1digit (60...110%, 1013mbar, 20...25°C)

Measurement of saturation index of dissolved oxygen

Measuring range	0.0…600.0%
Resolution	0.1%
Accuracy	±0.3% ±1digit (in the range 0.0…199.9%) ±1% ±1digit (in the range 200.0…600.0%)

Automatic temperature compensation

	0…50°C

Measurement of barometric pressure

Measuring range	0.0…1100.0mbar
Resolution	0.1mbar
Accuracy	±2mbar±1digit between 18 and 25°C ±(2mbar+0.1mbar/°C) in the remaining range

Salinity setting

Setting	directly from menu or automatically by conductivity measurement
Setting range	0.0…70.0g/l
Resolution	0.1g/l

Temperature measurement with the sensor inside the dissolved oxygen probe

Measuring range	0.0…50.0°C
Resolution	0.1°C
Accuracy	±0.1°C
Drift after 1 year	0.1°C/year

Measurement of temperature by instrument

Pt100 measuring range	-50…+150°C
Pt1000 measuring range	-50…+150°C
Resolution	0.1°C
Accuracy	±0.1°C ±1digit
Drift after 1 year	0.1°C/year

ORDERING CODES

HD2259.2: The kit is composed of: instrument HD2259.2 for the measurement of pH - redox - concentration of dissolved oxygen, saturation index - temperature, **datalogger,** stabilized power supply at mains voltage 100-240Vac/12Vdc-1A., calibrator HD9709/20, instructions manual and software DeltaLog11.

pH/mV electrodes, conductivity probes, dissolved oxygen probes, temperature probes, standard reference solutions for different measurement types, connection cables for pH electrodes with S7 connector, cables for data download to PC or printer have to be ordered separately.

ACCESSORIES

9CPRS232: Connection cable SubD female 9- pole for serial output RS232C.

CP22: USB 2.0 connection cable - connector typo A - connector type B.

DeltaLog11: Software for download and management of the data on PC using Windows 98 to Vista operating systems.

SWD10: Stabilized power supply at 100-240Vac/12Vdc/1A mains voltage.

HD40.1: Portable, serial input, 24 column thermal printer, 57mm paper width.

HD40.2: 24-column portable thermal printer, **Bluetooth and serial interface**, 57mm paper width, four NiMH 1.2V rechargeable batteries, SWD10 power supply, instruction manual, 5 thermal paper rolls. Requires the module HD22BT (**optional**) or the cable HD 2110 CSNM (**optional**).

HD2110CSP: Connection cable for instruments series HD34…to printer **S'print-BT**

HD22.2: Laboratory electrode holder composed of basis plate with incorporated magnetic stirrer, staff and replaceable electrode holder. Height max. 380mm. Powerd by bench-top meters of the series HD22… with cable HD22.2.1 (**optional**) or supplier SWD10 (**optional**).

HD22.3: Laboratory electrode holder with metal basis plate. Flexible electrode holder for free positioning. For Ø 12mm probes.

HD22BT: Bluetooth module for wireless data transmission from instrument to PC. **The fitting of the module into the instrument is made exclusively by Delta Ohm, at the time of placing the order.**

pH

mg/l

TP47: Module for the connection of Pt100 4-wire and Pt1000 2-wire probes.

Accessories

pH electrodes without SICRAM module *(Inputs ① and ②)*

KP20: Combined pH electrode for general use, gel filled with screw connector S7 body in Epoxy.

KP30: Combined pH electrode for general use, cable 1 m, gel filled, body in Epoxy.

KP50: Combined pH electrode with Teflon collar diaphragm, for emulsions, deionised water, S7 screw connector, gel filled, body in glass.

KP 61: Combined pH electrode, 3 diaphragms for milk, cream, etc. Liquid reference filling, with screw connector S7, body in glass.

KP 62: Combined pH electrode, 1 diaphragm for pure water, paints, etc. gel-filled, with screw connector S7, body in glass.

KP 63: Combined pH electrode for general use, varnish, cable 1 m, electrolyte KCl 3M body in glass.

KP 64: Combined pH electrode for water, varnish, emulsions, etc., electrolyte KCl 3M with screw connector S7, body in glass.

KP 70: Combined pH micro electrode diam. 4.5 x L=25 mm. Gel filled, with screw connector, body in glass.

KP 80: Combined pointed pH electrode, gel filled, with screw connector S7, body in glass.

KP100: Flat membrane gel combined pH electrode with S7 screw connector, glass body, for skin, leather, paper.

CP: Extension cable 1.5m with BNC connectors on one side and S7 on the other side for electrode with S7 connector.

pH electrodes with SICRAM module *(Input③)*

KP63TS: Combined pH/temperature electrode with SICRAM module, body in Epoxy, Ag/AgCl sat KCl.

ORP Electrodes *(Inputs ① and ②)*

KP90: Redox Platinum electrode, with screw connector S7, electrolyte KCl 3M, body in glass.

KP91: Redox Platinum electrode with 1m cable, GEL filled, body in glass.

CP5: Extension cable 5m with BNC connectors on one side and S7 on the other side for electrode with S7 connector.

CE: S7 screw connector for pH electrode.

BNC: Female BNC for electrode extension.

SICRAM module with BNC input for pH electrodes *(input ③)*

KP47: Sicram module for pH electrode with standard BNC connector.

pH buffer solutions

HD8642: Buffer solution 4.01pH - 200cc.

HD8672: Buffer solution 6.86pH - 200cc.

HD8692: Buffer solution 9.18pH - 200cc.

Redox buffer solutions

HDR220: Redox buffer solution 220mV 0,5 l.

HDR468: Redox buffer solution 468mV 0,5 l.

Electrolyte solutions

KCL 3M: 50cc ready for use solution for electrode refilling.

Cleaning and maintenance

HD62PT: Diaphragm cleaning (tiourea in HCl) - 500ml.

HD62PP: Protein cleaning (pepsin in HCl) - 500ml.

HD62RF: Regeneration (fluorhydric acid) - 100ml.

HD62SC: Solution for electrode preservation - 500ml.

Combined dissolved oxygen/temperature probes *(Input ⑥)*

DO9709 SS: The kit includes: combined probe for measurement of O_2 and temperature with replaceable membrane, three membranes, 50ml of zero solution, 50ml of electrolyte solution. Cable length 2m. ∅12mm x 120mm.

DO9709 SS.5: The kit includes: combined probe for measurement of O_2 and temperature with replaceable membrane, three membranes, 50ml of zero solution, 50ml of electrolyte solution. Cable length 5m. ∅12mm x 120mm.

Accessories

DO9709 SSK: Accessory kit for the DO9709 SS probe consisting of three membranes, 50ml of zero solution, 50ml of electrolyte solution

DO9709.20: Calibrator for polarographic probes DO9709SS and DO9709SS.5.

Temperature probes complete with SICRAM module *(Input ⑤)*

TP87: PT100 sensor immersion probe. Stem Ø 3 mm, length 70 mm. Cable length 1 metre.

TP472I.0: Pt100 sensor immersion probe. Stem Ø 3 mm, length 230 mm. Cable length 2 metres.

TP473P.0: Pt100 sensor penetration probe. Stem Ø 4mm, length 150 mm. Cable length 2 metres.

TP474C.0: Pt100 sensor contact probe. Stem Ø 4mm, length 230mm, contact surface Ø 5mm. Cable length 2 metres.

TP475A.0: Air probe, sensor Pt100. Stem Ø 4mm, length 230mm. Cable length 2 metres.

TP472I.5: Immersion probe, sensor Pt100. Stem Ø 6mm, length 500 mm. Cable length 2 metres.

TP472I.10: Immersion probe, sensor Pt100. Stem Ø 6mm, length 1,000mm. Cable length 2 metres.

Temperature probes complete with TP47 module *(input⑤)*

TP47.100: Direct 4 wires Pt100 sensor immersion probe. Probe's stem Ø 3mm, length 230mm. Connection cable 4 wires with connector, length 2 metres.

TP47.1000: Pt1000 sensor immersion probe. Probe's stem Ø 3mm, length 230mm. Connection cable 2 wires with connector, length 2 metres.

TP87.100: Pt100 sensor immersion probe. Probe's stem Ø 3mm, length 70mm. 4 wire connection cable with connector, length 1 metre.

TP87.1000: Pt1000 sensor immersion probe. Probe's stem Ø 3mm, length 70mm. 2-wire connection cable with connector, length 1 metre.

Accessories

TP47: Module for the connection of Pt100 4-wire and Pt1000 2-wire probes.

HD 22569.2

HD 22569.2
BENCH-TOP METER FOR pH - CONDUCTIVITY - DISSOLVED OXYGEN

The instrument **HD22569.2** is a bench top instrument for electrochemical measures: **pH**, **conductivity**, **dissolved oxygen,** and **temperature**. It is are fitted with a large backlighted LCD display.
The **HD22569.2** measures **pH**, **mV**, **redox potential** (ORP) with pH, redox electrodes or electrodes with separate reference; **conductivity**, **resistivity** in liquids, **total dissolved solids** (TDS) and **salinity** with combined 4-ring and 2-ring conductivity/temperature probes with direct input or SICRAM module; **concentration of dissolved oxygen in** liquids (in mg/l) and **saturation index** (in %), using SICRAM combined probes of polarographic type with two or three electrodes and integrated temperature sensor.

The instruments is fitted with an input for the measurement of t**emperature** with Pt100 or Pt1000 immersion, penetration or contact probes. The temperature probes are equipped with an automatic recognition module and factory calibration data are stored inside.

- The pH electrode calibration can be carried out on one or five points and the calibration sequence can be chosen from a list of 13 buffers Temperature compensation can be automatic or manual.
- The conductivity probe calibration can be performed automatically with automatically detected conductivity calibration solutions: 147µS/cm, 1413µS/cm, 12880µS/cm or 111800µS/cm or manually with calibration solutions having different values.
- The dissolved Oxygen probe's quick calibration function guarantees timely correctness of the performed measurements.
- Conductivity, dissolved oxygen and temperature probes fitted with SICRAM module can store factory and calibration data inside.

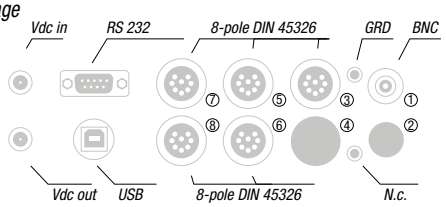
The instruments HD22569.2 is a **datalogger**, it can memorize up to 2,000 samples of data:
- pH or mV, conductivity or resistivity or TDS or salinity, concentration of dissolved oxygen and temperature:

The data can be transferred from the instrument connected to a PC via the multi-standard RS232C serial port and USB 2.0. The storing parameters can be configured using the menu.
The RS232C serial port can be used to transfer the acquired measurements to a 24 column portable printer in real time (HD40.1 or HD40.2).
The instruments equipped with **HD22BT** (Bluetooth) option can transfer data without any connection to a PC or printer fitted with Bluetooth input or through Bluetooth/RS232C converter.
The software DeltaLog11 allows instrument management and configuration, and data processing on PC.
The instruments have IP66 protection degree.

Technical characteristics of HD22569.2
pH - mV - χ - Ω - TDS - NaCl - mg/l O_2 - %O_2 - mbar - °C - °F measurement

Instrument	
Dimensions (Length x Width x Height)	265x185x70mm
Weight	490g
Materials	ABS, rubber
Display	Back lighted, matrix point display. 240x64 points, visible area: 128x35mm
Operating conditions	
Working temperature	-5 … 50°C
Storage temperature	-25 … 65°C
Working relative humidity	0 … 90% R.H. without condensate
Protection degree	**IP66**
Power	
	Mains adapter (cod. SWD10) 12Vdc/1A
Auxiliary socket	For supplying of electrode holder with built-in stirrer HD22.2
Security of memorized data	
	Unlimited
Time	
Date and hour	Real time schedule with backup battery E 3.6V - ½AA
Accuracy	1min/month max drift
Measured values storing	
Quantity	2000 screens
Storage interval	1s … 999s

Calibration storage



Quantity	Last 8 calibrations of each physical quantity

RS232C serial interface

Type	RS232C electrically isolated
Baud rate	Can be set from 1200 to 115200 baud
Data bit	8
Parity	None
Stop bit	1
Flow Control	Xon/Xoff
Length of serial cable	Max 15m

USB Interface

Type	1.1 - 2.0 electrically isolated
USB Interface	optional

Connections

Input for temperature probes with SICRAM modules⑤	8-pole male DIN45326 connector
pH/mV ① input	BNC female
Input for SICRAM module pH/ temperature ③	8-pole male DIN45326 connector
2/ 4- electrode direct conductivity input ⑧	8-pole male DIN45326 connector
Conductivity SICRAM module input ⑦	8-pole male DIN45326 connector
Dissolved Oxygen input ⑥	8-pole male DIN45326 connector
Serial interface	DB9 connector (9- pole male)
USB interface	USB connector type B
Bluetooth	Optional
Mains adapter	2- pole connector (Ø5.5mm-2.1mm). Positive at centre
Outlet for power supply of electrode holder with built-in magnetic stirrer	2-pole connector (Ø5.5mm-2.1mm). Positive at centre (output 12Vdc/200mA max).

pH measurement by instrument

Measuring range	-9.999…+19.999pH
Resolution	0.01 o 0.001pH selectable from menu
Accuracy	±0.001pH ±1digit
Input impedance	$>10^{12}\Omega$
Calibration error @25°C	|Offset| > 20mV Slope > 63mV/pH o Slope < 50mV/pH Sensitivity > 106.5% or Sensitivity < 85%
Calibration points	Up to 5 points with 13 automatically detected buffer solutions
Automatically detected pH standard solutions (@25°C)	1.679pH - 2.000pH - 4.000pH - 4.008pH - 4.010pH 6.860pH - 6.865pH - 7.000pH - 7.413pH - 7.648pH 9.180pH - 9.210pH - 10.010pH

mV measurement by instrument

Measuring range	-1999.9…+1999.9mV
Resolution	0.1mV
Accuracy	±0.1mV ±1digit
Drift after 1 year	0.5mV/year

Measurement of conductivity by instrument

		Resolution
Measuring range (Kcell=0.01)	0.000…1.999µS/cm	0.001µS/cm
Measuring range (Kcell=0.1)	0.00…19.99µS/cm	0.01µS/cm
Measuring range (K cell=1)	0.0…199.9µS/cm	0.1µS/cm
	200…1999µS/cm	1µS/cm
	2.00…19.99mS/cm	0.01mS/cm
	20.0…199.9mS/cm	0.1mS/cm
Measuring range (Kcell=10)	200…1999mS/cm	1mS/cm
Accuracy (conductivity)	±0.5% ±1digit	

Measurement of resistivity by instrument

Measuring range (Kcell=0.01)	Up to 1GΩ·cm	(*)
Measuring range (Kcell=0.1)	Up to 100MΩ·cm	(*)
Measuring range (K cell=1)	5.0…199.9Ω·cm	0.1Ω·cm
	200…999Ω·cm	1Ω·cm
	1.00k…19.99kΩ·cm	0.01kΩ·cm
	20.0k…99.9kΩ·cm	0.1kΩ·cm
	100k…999kΩ·cm	1kΩ·cm
	1…10MΩ·cm	1MΩ·cm
Measuring range (Kcell=10)	0.5…5.0Ω·cm	0.1Ω·cm
Accuracy (resistivity)	±0.5% ±1digit	

Measurement of total dissolved solids (with coefficient Χ/TDS=0.5)

Measurement range (Kcell=0.01)	0.00…1.999mg/l	0.005mg/l
Measurement range (Kcell=0.1)	0.00…19.99mg/l	0.05mg/l

		Resolution
Measurement range (Kcell=1)	0.0…199.9 mg/l	0.5 mg/l
	200…1999 mg/l	1 mg/l
	2.00…19.99 g/l	0.01 g/l
	20.0…99.9 g/l	0.1 g/l
Measurement range (Kcell=10)	100…999 g/l	1 g/l
Accuracy (total dissolved solids)	±0.5% ±1digit	

Measurement of salinity

Measurement range	0.000…1.999g/l	1mg/l
	2.00…19.99g/l	10mg/l
	20.0…199.9g/l	0.1g/l
Accuracy (salinity)	±0.5% ±1digit	

Automatic/manual temperature compensation

	0...100°C with α_T = 0.00…4.00%/°C
Reference temperature	0…50°C
Conversion factor Χ/TDS	0.4…0.8
Cell constants K (cm^{-1})	0.01 - 0.1 - 0.5 - 0.7 - 1.0 - 10.0
already set on instrument	
Cell constants K(cm^{-1}) that can be set by user	0.01…20.00

Standard solutions automatically detected (@25°C)

147µS/cm
1413µS/cm
12880µS/cm
111800µS/cm

Measurement of concentration of dissolved oxygen by instrument

Measuring range	0.00…90.00mg/l
Resolution	0.01mg/l
Accuracy	±0.03mg/l±1digit (60…110%, 1013mbar, 20...25°C)

Measurement of saturation index of dissolved oxygen

Measuring range	0.0…600.0%
Resolution	0.1%
Accuracy	±0.3% ±1digit (in the range 0.0…199.9%) ±1% ±1digit (in the range 200.0…600.0%)

Measurement of barometric pressure

Measuring range	0.0…1100.0mbar
Resolution	0.1mbar
Accuracy	±2mbar±1digit between 18 and 25°C ±(2mbar+0.1mbar/°C) in the remaining range

Salinity setting

Setting	directly from menu or automatically by conductivity measurement
Setting range	0.0…70.0g/l
Resolution	0.1g/l

Temperature measurement with the sensor inside the dissolved Oxygen probe

Measurement range	0.0…+50.00°C
Resolution	0.1°C
Accuracy	±0.1°C
Drift after 1 year	0.1°C/year
Automatic temperature compensation	0…50°C

Measurement of temperature by instrument

Pt100 measuring range	-50…+150°C
Pt1000 measuring range	-50…+150°C
Resolution	0.1°C
Accuracy	±0.1°C ±1digit
Drift after 1 year	0.1°C/year

(*) The resistivity measurement is obtained from the reciprocal of conductivity measurement. Close to the bottom of the scale, the indication of resistivity appears like reported in the table below:

K cell = 0.01 cm^{-1}		**K cell = 0.1 cm^{-1}**	
Conductivity (µS/cm)	Resistivity (MΩ·cm)	Conductivity (µS/cm)	Resistivity(MΩ·cm)
0.001 µS/cm	1000 MΩ·cm	0.01 µS/cm	100 MΩ·cm
0.002 µS/cm	500 MΩ·cm	0.02 µS/cm	50 MΩ·cm
0.003 µS/cm	333 MΩ·cm	0.03 µS/cm	33 MΩ·cm
0.004 µS/cm	250 MΩ·cm	0.04 µS/cm	25 MΩ·cm
…	…	…	…

ORDERING CODES

HD22569.2: The kit is composed of: instrument HD22569.2 for the measurement of pH - redox - conductivity - resistivity - TDS - salinity - concentration of dissolved oxygen, saturation index - temperature, **datalogger**, stabilized power supply at mains voltage 100-240Vac/12Vdc-1A., calibrator HD9709/20, instructions manual and software DeltaLog11.

pH/mV electrodes, conductivity probes, dissolved oxygen probes, temperature probes, standard reference solutions for different measurement types, connection cables for pH electrodes with S7 connector, cables for data download to PC or printer have to be ordered separately.

Accessories

9CPRS232: Connection cable SubD female 9- pole for serial output RS232C.
CP22: USB 2.0 connection cable - connector typo A - connector type B.
DeltaLog11: Software for download and management of the data on PC using Windows 98 to Vista operating systems.
SWD10: Stabilized power supply at 100-240Vac/12Vdc-1A mains voltage.
HD40.1: Portable, serial input, 24 column thermal printer, 57mm paper width.
HD40.2: 24-column portable thermal printer, **Bluetooth and serial interface**, 57mm paper width, four NiMH 1.2V rechargeable batteries, SWD10 power supply, instruction manual, 5 thermal paper rolls. Requires the module HD22BT (**optional**) or the cable HD 2110 CSNM (**optional**).
HD22.2: Laboratory electrode holder composed of basis plate with incorporated magnetic stirrer, staff and replaceable electrode holder. Height max. 380mm. Powerd by bench-top meters of the series HD22… with cable HD22.2.1 (**optional**) or supplier SWD10 (**optional**).
HD22.3: Laboratory electrode holder with metal basis plate. Flexible electrode holder for free positioning. For Ø 12mm probes.
HD22BT: Bluetooth module for wireless data transmission from instrument to PC. **The fitting of the module into the instrument is made exclusively by Delta Ohm, at the time of placing the order.**
TP47: Module for the connection of Pt100 4-wire and Pt1000 2-wire probes.

pH electrodes without SICRAM module *(Inputs ① and ②)*

KP20: Combined pH electrode for general use, gel filled with screw connector S7 body in Epoxy.
KP30: Combined pH electrode for general use, cable 1 m, gel filled, body in Epoxy.
KP50: Combined pH electrode with Teflon collar diaphragm, for emulsions, deionised water, S7 screw connector, gel filled, body in glass.
KP 61: Combined pH electrode, 3 diaphragms for milk, cream, etc. Liquid reference filling, with screw connector S7, body in glass.
KP 62: Combined pH electrode, 1 diaphragm for pure water, paints, etc. gel-filled, with screw connector S7, body in glass.
KP 63: Combined pH electrode for general use, varnish, cable 1 m, electrolyte KCl 3M body in glass.
KP 64: Combined pH electrode for water, varnish, emulsions, etc., electrolyte KCl 3M with screw connector S7, body in glass.
KP 70: Combined pH micro electrode diam. 4.5 x L=25 mm. Gel filled, with screw connector, body in glass.
KP 80: Combined pointed pH electrode, gel filled, with screw connector S7, body in glass.
CP: Extension cable 1.5m with BNC connectors on one side and S7 on the other side for electrode with S7 connector.
CP5: Extension cable 5m with BNC connectors on one side and S7 on the other side for electrode with S7 connector.
CE: S7 screw connector for pH electrode.
BNC: Female BNC for electrode extension.

pH electrodes with SICRAM module *(Input③)*

KP63TS: Combined pH/temperature electrode with SICRAM module, body in Epoxy, Ag/AgCl sat KCl.

SICRAM Module with BNC input for pH electrodes *(Input ③)*

KP47: SICRAM module for pH electrode with BNC standard connector.

ORP Electrodes *(Inputs ① and ②)*

KP90: Redox Platinum electrode, with screw connector S7, electrolyte KCl 3M, body in glass.
KP91: Redox Platinum electrode with 1m cable, GEL filled, body in glass.

pH buffer solutions

HD8642: Buffer solution 4.01pH - 200cc.
HD8672: Buffer solution 6.86pH - 200cc.
HD8692: Buffer solution 9.18pH - 200cc.

Redox buffer solutions

HDR220: Redox buffer solution 220mV 0,5 l.
HDR468: Redox buffer solution 468mV 0,5 l.

Electrolyte solutions

KCL 3M: 50cc ready for use solution for electrode refilling.

Cleaning and maintenance

HD62PT: Diaphragm cleaning (tiourea in HCl) - 500ml.
HD62PP: Protein cleaning (pepsin in HCl) - 500ml.
HD62RF: Regeneration (fluorhydric acid) - 100ml.
HD62SC: Solution for electrode preservation - 500ml.

Conductivity probes and combined conductivity and temperature probes without SICRAM module *(Input ⑦)*

SP06T: Combined conductivity and temperature 4-electrode cell in Platinum, body in Pocan. Cell constant K = 0.7. Measurement range 5µS/cm …200mS/cm, 0…90°C.
SPT401.001: Combined conductivity and temperature 2- electrode cell in stainless steel AISI 316. Cell constant K = 0.01. Measurement range 0.04µS/cm …20µS/cm, 0…120°C. Measurement in closed-cell.
SPT01G: Combined conductivity and temperature 2-electrode Platinum-wire cell, body in glass. Cell constant K = 0.1. Measurement range 0.1µS/cm …500µS/cm, 0…80°C.
SPT1G: Combined conductivity and temperature 2-electrode Platinum-wire cell, body in glass. Cell constant K = 1. Measurement range 10µS/cm …10mS/cm, 0…80°C.
SPT10G: Combined conductivity and temperature 2-electrode Platinum-wire cell, body in glass. Cell constant K = 10. Measurement range 500µS/cm …200mS/cm, 0…80°C.

Combined conductivity / temperature probes with SICRAM module *(Input ⑧)*

SPT1GS: Combined conductivity /temperature 2-electrode Platinum- wire cell, body in glass with SICRAM module. Cell constant K = 1. Measuring range 10µS/cm …10mS/cm, 0…80°C.

Standard conductivity calibration solutions

HD8747: Standard calibration solution 0.001mol/l equal to 147µS/cm @25°C - 200cc.
HD8714: Standard calibration solution 0.01mol/l equal to 1413µS/cm @25°C - 200cc.
HD8712: Standard calibration solution 0.1mol/l equal to 12880µS/cm @25°C - 200cc.
HD87111: Standard calibration solution 1mol/l equal to 111800µS/cm @25°C - 200cc.

Combined dissolved oxygen/temperature probes *(Input ⑥)*

DO9709 SS: The kit includes: combined probe for measurement of O_2 and temperature with replaceable membrane, three membranes, 50ml of zero solution, 50ml of electrolyte solution. Cable length 2m. ∅12mm x 120mm.
DO9709 SS.5: The kit includes: combined probe for measurement of O_2 and temperature with replaceable membrane, three membranes, 50ml of zero solution, 50ml of electrolyte solution. Cable length 5m. ∅12mm x 120mm.
Electrode dimensions and characteristics at page 403

Accessories

DO9709 SSK: Accessory kit for the DO9709 SS probe consisting of three membranes, 50ml of zero solution, 50ml of electrolyte solution
DO9709.20: Calibrator for polarographic probes DO9709SS and DO9709SS.5.

Temperature probes complete with SICRAM module *(Input ⑤)*

TP87: PT100 sensor immersion probe. Stem Ø 3 mm, length 70 mm. Cable length 1 metre.
TP472I.0: Pt100 sensor immersion probe. Stem Ø 3 mm, length 230 mm. Cable length 2 m.
TP473P.0: Pt100 sensor penetration probe. Stem Ø 4mm, length 150 mm. Cable length 2 m.
TP474C.0: Pt100 sensor contact probe. Stem Ø 4mm, length 230mm, contact surface Ø 5mm. Cable length 2 m.
TP475A.0: Air probe, sensor Pt100. Stem Ø 4mm, length 230mm. Cable length 2 m.
TP472I.5: Immersion probe, sensor Pt100. Stem Ø 6mm, length 500 mm. Cable length 2 m.
TP472I.10: Immersion probe, sensor Pt100. Stem Ø 6mm, length 1,000mm. Cable length 2 m.

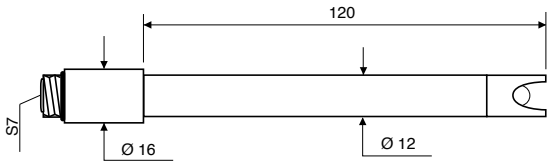
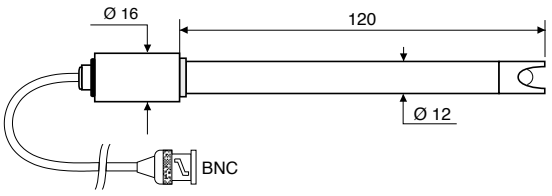
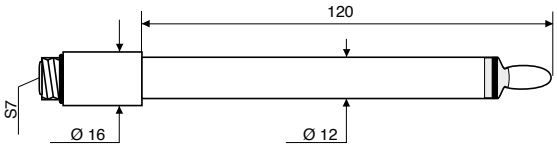
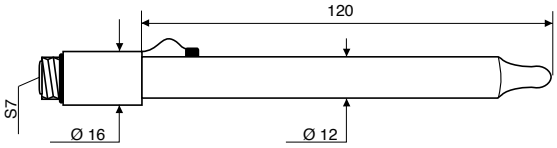
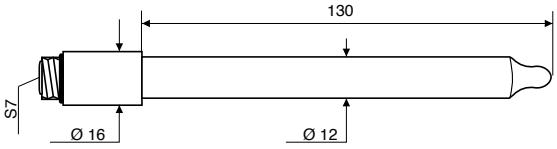
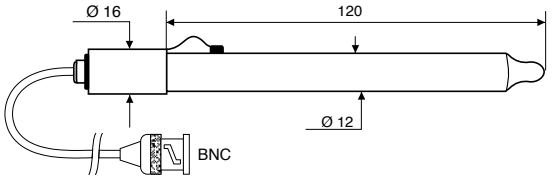
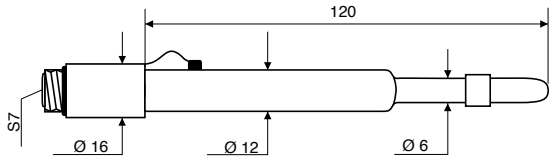
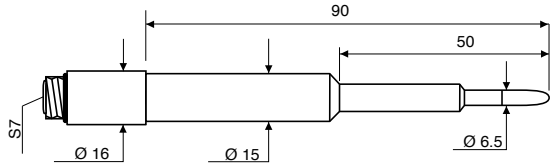
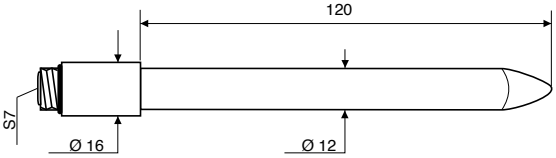
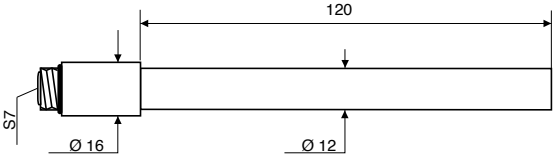
Temperature probes complete with TP47 module *(input⑤)*

TP47.100: Direct 4 wires Pt100 sensor immersion probe. Probe's stem Ø 3mm, length 230mm. Connection cable 4 wires with connector, length 2 m.
TP47.1000: Pt1000 sensor immersion probe. Probe's stem Ø 3mm, length 230mm. Connection cable 2 wires with connector, length 2 m.
TP87.100: Pt100 sensor immersion probe. Probe's stem Ø 3mm, length 70mm. 4 wire connection cable with connector, length 1 m.
TP87.1000: Pt1000 sensor immersion probe. Probe's stem Ø 3mm, length 70mm. 2-wire connection cable with connector, length 1 m.

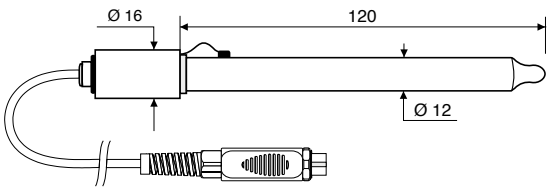
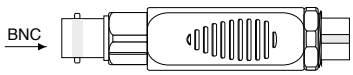
Accessories

TP47: Module for the connection of Pt100 4-wire and Pt1000 2-wire probes.

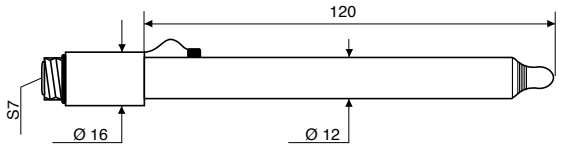
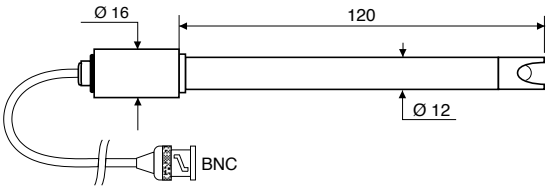
Technical data of pH electrodes without SICRAM module

ORDERING CODE	MEASUREMENT RANGE AND USE	DIMENSIONS
KP20	0…14pH / 0…80°C / 3bar Body in Epoxy - GEL filled 1 ceramic diaphragm Waste water, drinking water, paints, water emulsions, galvanic baths, fruit juices, water suspensions, titration, varnishes.	
KP30	0…14pH / 0…80°C / 3bar Body in Epoxy - GEL filled 1 ceramic diaphfragm Cable L=1m with BNC Waste water, drinking water, water emulsions , galvanic baths, paints, varnishes, water suspensions, fruit juices, titration.	
KP50	0…14pH / 0…80°C / 3bar Body in glass - GEL filled 1 Teflon ring diaphragm Varnishes, cosmetics, water emulsions, galvanic baths, creams, deionised water, TRIS solutions, drinking water, fruit juices, low-ion-content solutions, mayonnaise, preserved food, paints, titration, titration in non-water solutions, water suspensions, detergents, waste water, viscous samples.	
KP61	2…14pH / 0…80°C / 3bar Body in glass Liquid reference filling Triple ceramic diaphragm Waste water, paste, bread, fruit juices, varnishes, cosmetics, creams, deionised water, drinking water, water emulsions, galvanic baths, detergents, yoghurt, milk, titration, preserved food, titration in non-water solutions, water suspensions, mayonnaise, wine, low ion-content solution, butter, proteic substances, paints, viscous samples	
KP62	0…14pH / 0…80°C / 3bar Body in glass - GEL filled 1 ceramic diaphragm Paints, varnishes, drinking water, water emulsions, fruit juices, galvanic baths, water suspensions, titration, waste water.	
KP63	0…14pH / 0…80°C / 1bar Body in glass Reference filling solution KCl 3M 1 ceramic diaphragm Cable L=1m with BNC Paints, varnishes, drinking water, water solutions, fruit juices, galvanic baths, water suspensions, titrations, waste water.	
KP64	0…14pH / 0…80°C / 0.1bar Body in glass Liquid reference KCl 3M Teflon collar diaphragm Paints, varnishes, cosmetics, creams, deionised water, drinking water, water emulsions, fruit juices, detergents, low ion-content solutions, preserved food, water suspensions, titration, titration in non-water solutions, TRIS solutions, waste water, viscous samples, wine.	
KP70	2…14pH / 0…50°C / 0.1bar Body in Epoxy - GEL filled 1 open junction Paste, bread, paints, varnishes, cosmetics, creams, drinking water, water emulsions, fruit juices, galvanic baths, detergents, mayonnaise, preserved foods, cheese, milk, water suspensions, viscous samples, waste water, butter, yoghurt.	
KP80	2…14pH / 0…60°C / 1bar Body in glass - GEL filled 1 open junction Paste, bread, paints, varnishes, cosmetics, creams, drinking water, water emulsions, fruit juices, galvanic baths, detergents, mayonnaise, preserved food, water suspensions, titration, titration in non-water solutions, viscous samples, waste water, yoghurt, milk, butter.	
KP100	2…14pH / 0…80°C / 1bar Body in glass Liquid reference KCl 3M Teflon ring diaphragm Flat membrane gel combined pH electrode, S7 connector, for skin, leather, paper.	

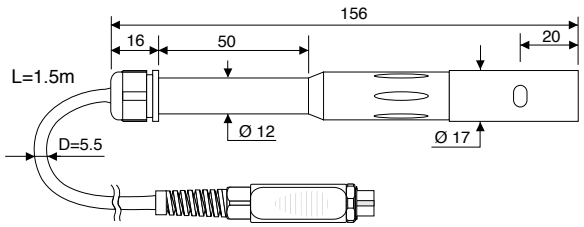
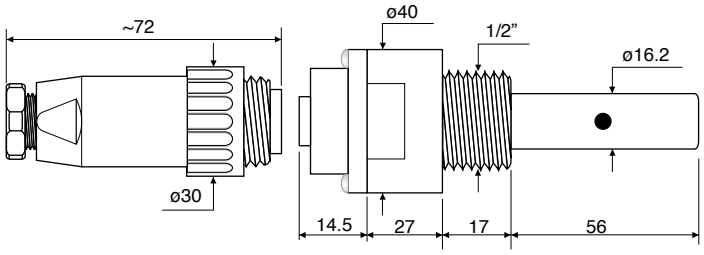
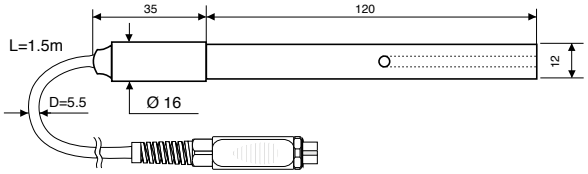
pH electrodes

ORDERING CODE	MEASUREMENT RANGE AND USE	DIMENSIONS
KP63TS	0…14pH / 0…80°C / 1bar Pt100 sensor Body in glass Reference filling solution KCl 3M 1 ceramic diaphragm Cable L=1m **with SICRAM module** Paints, varnishes, drinking water, water solutions, fruit juices, galvanic baths, water suspensions, titrations, waste water.	
KP47	Please refer to employed electrode.	

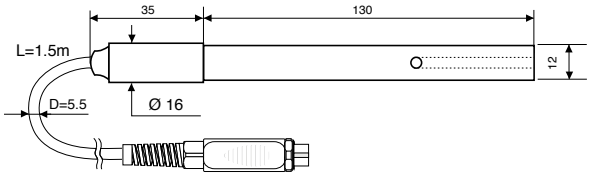
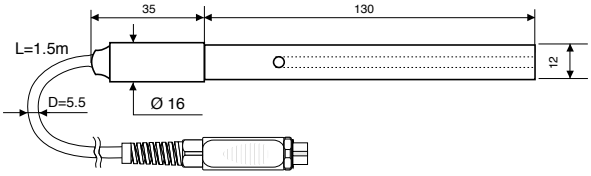
Redox Elettrodes without SICRAM module

ORDERING CODE	MEASUREMENT RANGE AND USE	DIMENSIONS
KP90	±2000mV 0…80°C 5bar Body in glass Reference filling solution KCl 3M General use	
KP91	±1000mV 0…60°C 1bar Body in Epoxy - GEL Cable L=1m with BNC General use No heavy tasks	

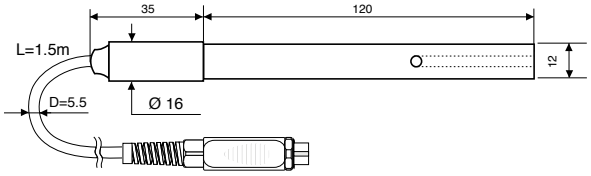
Combined 2-ring or 4-ring conductivity probes without SICRAM module

ORDERING CODE	MEASUREMENT RANGE AND USE	DIMENSIONS
SP06T	K=0.7 5µS/cm …200mS/cm 0…90°C 4-electrode cell in Pocan/Platinum Probe material Pocan General use No heavy tasks	
SPT401.001	K=0.01 0.04µS/cm …20µS/cm 0…120°C 2-electrode cell in AISI 316 Ultrapure water Measurement in closed-cell	
SPT01G	K=0.1 0.1µS/cm …500µS/cm 0…80°C 2-electrode cell in Platinum-wire Probe material glass Pure water	

2-ring or 4-ring conductivity probes without SICRAM module

ORDERING CODE	MEASUREMENT RANGE AND USE	DIMENSIONS
SPT1G	K=1 10µS/cm …10mS/cm 0…80°C 2-electrode cell in Platinum wire Probe material glass General heavy tasks, average conductivity	
SPT10G	K=10 500µS/cm …200mS/cm 0…80°C 2-electrode cell in Platinum wire Probe material glass General heavy tasks, high conductivity	

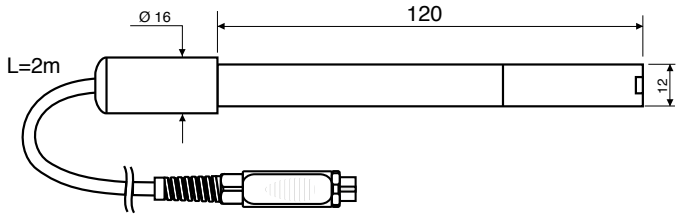
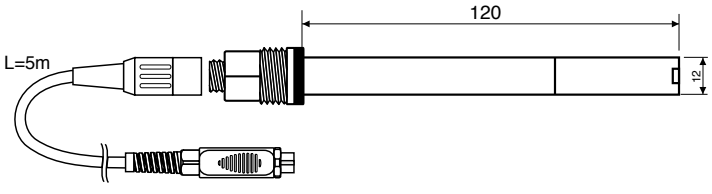
Conductivity probes with SICRAM module

ORDERING CODE	MEASUREMENT RANGE AND USE	DIMENSIONS
SPT1GS	K=1 10µS/cm …10mS/cm 0…80°C 2-electrode cell Glass/Platinum	

Dissolved oxygen probe

Model	D09709 SS	D09709 SS.5
Type	Polarographic probe, Silver anode, Platinum cathode	
Application range		
Application range	0.00…60.00mg/l	
Working temperature	0…45°C	
Accuracy	±1%f.s.	
Membrane	Replaceable	
Cable length	2m	5m (*)

(*)Cable with connector

D09709SS	
D09709SS.5	

Temperature probes

Pt100 temperature probes with SICRAM module

Modell	Type	Application range	Accuracy
TP87	Immersion	-50°C…+200°C	±0.25°C (-50°C…+200°C)
TP472I.0	Immersion	-50°C…+400°C	±0.25°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP473P.0	Penetration	-50°C…+400°C	±0.25°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP474C.0	Contact	-50°C…+400°C	±0.3°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP475A.0	Air	-50°C…+250°C	±0.3°C (-50°C…+250°C)
TP472I.5	Immersion	-50°C…+400°C	±0.3°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)
TP472I.10	Immersion	-50°C…+400°C	±0.3°C (-50°C…+350°C) ±0.4°C (+350°C…+400°C)

Temperature drift @20°C 0.003%/°C

4 wires Pt100 probes or 2 wires Pt1000 probes equipped with TP47 module

Modell	Type	Application range	Accuracy
TP47.100	Pt100 4 wires	-50…+200°C	Class A
TP47.1000	Pt1000 2 wires	-50…+200°C	Class A
TP87.100	Pt100 4 wires	-50…+200°C	Class A
TP87.1000	Pt1000 2 wires	-50…+200°C	Class A

Temperature drift @20°C 0.005%/°C

TP47: Module for the connection of Pt100 4-wire and Pt1000 2-wire probes.

HD 22.2
HD 22.3

HD 22.2 - HD 22.3
ELECTRODE HOLDER

HD 22.2: Laboratory electrode holder composed of base plate with built-in magnetic stirrer, shaft and replaceable electrode holder. Suitable diameter 12mm. Powered by bench top instruments of the series **HD22...** with cable HD22.2.1 (optional), or with power supplier SWD10 (**optional**).

HD 22.3: Laboratory electrode holder with base plate. Flexible arm for free positioning. Suitable for electrodes with diameter 12mm.

HD22.2

HD22.3

HD 40.1
HD 40.2

HD 40.1, HD 40.2
PORTABLE THERMAL PRINTER

The **HD40.1** and **HD40.2** are lightweight, compact, portable thermal printers.
The HD40.1 is connected to instruments or PC through the RS232 serial input.
The HD40.2 features a dual mode data reception system - RS232 serial and Bluetooth.
The Bluetooth wireless connection makes the HD40.2 printer very useful "in the field", since it does not require any connection to the instrument. A careful design allows you to replace the thermal paper roll in a few seconds. A four NiMH **rechargeable** battery pack provides power supply and ensures long autonomy: you can print up to 3000 lines at full charge.
Standard thermal paper roll width: 57mm.
Print resolution: 203 dpi
Print characters (each line): 24
Protection degree: IP40.

SPECIFICATIONS

Printing method	Thermal
Resolution	203 DPI (8 dot/mm)
Printing width	48mm centered in the paper roll
Paper roll width	57mm ... 58mm
Max. paper roll diameter	32mm
Number of columns	24
Printing speed	Up to 90 mm/sec (depending on battery charge and ambient conditions)
Sensors	Paper detection
Character set	IBM II 858 table
Printing formats	Normal or extended
Character font	1 (16 x 24 dot – 2mm x 3mm)
Thermal head durability	
Mechanism life	100 million pulses (temperature: 20...25°C)
Abrasion resistance	50km of paper (temperature: 20...25°C)
Cover group durability	2000 opening/closing cycles or more
Communication interfaces	RS232
Bluetooth (for HD40.2)	
RS232 Baud rate	9600, 19200 and 38400 baud (**the factory parameter is 38400 baud**)
Bluetooth Baud rate	38400 baud (for HD40.2)
Bluetooth operating distance	Up to 10m without hindrance (for HD40.2)
Mains power supply (cod. SWD10)	100-240Vac/12Vdc-1A mains battery charger
Batteries	Four 1.2V AA rechargeable batteries (NiMH)
Printing autonomy	3000 lines 24 characters each. It prints one line every 10 seconds
Switch-off function	0, 5, 10 or 15 minutes
Dimensions	105mm x 165mm x 53mm
Weight	380g (with batteries and paper roll)
Material	ABS

OPERATING CONDITIONS

Operating temperature	0°C ... 50°C
Operating relative humidity	20%RH ... 85%RH not condensing
Storage Temperature / Relative humidity	-25°C ... +70°C / 10%RH ... 90%RH not condensing
Protection degree	IP40

Connections

Serial interface	9-pole D sub male connector
Battery charger power supply (cod. SWD10)	2-pole connector (positive in the middle)

ORDERING CODES

HD40.1: The kit includes: 24-column portable thermal printer, **serial interface RS232**, 57mm paper width, four NiMH 1.2V rechargeable batteries, SWD10 power supply, instruction manual, 5 thermal paper rolls.

HD40.2: The kit includes: 24-column portable thermal printer, **Bluetooth and serial interface RS232**, 57mm paper width, four NiMH 1.2V rechargeable batteries, SWD10 power supply, instruction manual, 5 thermal paper rolls.

The serial cable for PC/instrument connection must be ordered separately.

HD2110CSNM: RS232C 8-pole MiniDin - 9-pole D Sub female null-modem cable for connecting the printer to instruments with MiniDIN connector (HD21xx.1 and HD21xx.2 series, HD34xx.2, HD2010, HD2110, etc.).

9CPRS232: RS232C 9-pole D Sub female null-modem cable for connecting the printer to instrument with 9-pole D Sub connectors (Delta Ohm instruments: HD22xx.2 series, HD98569, HD25.2, etc.).

SWD10: 100-240Vac/12Vdc-1A Mains battery charger.

BAT.40: Spare battery pack for HD40.1 and HD40.2 printers with in-built temperature sensor.

RCT: The kit includes 4 thermal paper rolls 57mm wide and 32mm diameter.

HD 25.2

HD 25.2
BENCH-TOP TURBIDITY METER

The **HD25.2** is a digital turbidity meter for laboratory and mobile use, suitable for measurements in drinking water, waste water and process liquids. The working principle is based on the nephelometric (90° scattered light sensor) method.
It is equipped with three light detectors and two LED light sources (white and infrared) which are permanently kept under control in order to guarantee long-term stability. The instrument performs measurements according to the standards **EPA 180.1, ISO-NEPH (ISO 7027), EBC and ASBC.** It is also able to carry out measures of transmission factor percentage of white and infrared light.

The initial factory calibration is based on Forazin primary standard. For routine calibration a set of stabilized secondary standard solutions is available: STCAL (Turbidity standards for calibration):

- **STCAL 1** less than 0,05 NTU
- **STCAL 2** equal to 8 NTU
- **STCAL 3** equal to 80 NTU
- **STCAL 4** equal to 800 NTU

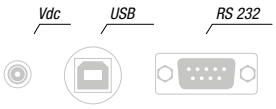
User Calibration is automatic on one, three or four points, depending on the measuring variable.
Stabilized power supply and advanced electronics garantee optimal performances over time.
The HD25.2 is a **datalogger** that stores up to 999 samples.
The data can be transferred from the instrument connected to a PC via the multi-standard RS232C serial port and USB 2.0.
The RS232C serial port can be used to transfer the acquired measurements to a 24 column printer.

The Print function allows to print labels with progressive numeration and automatic incrementation, with all data related to the sample being examined.
The dedicated software **DeltaLog11** allows instrument management and data processing on PC.

The use of the HD25.2 by more customers is facilitated by the "User Mangement" function, which allows, according to the case, to enable or disable some advanced functions of the instrument through password.
The protection degree is IP66.

Technical characteristics

Instrument	
Dimensions (Length x Width x Height)	220x120x55mm
Weight	400g (batteries included)
Materials	ABS
Display LCD	4½ characters plus symbols Visible area: 52x42mm
Operating conditions	
Instrument working temperature	0 … 50°C
Storage temperature instrument	-25 … 65°C
Working relative humidity	0 … 90% R.H. without condensation
Storing of Calibration standards	5…25°C (temperature should not exceed, protect from light)
Protection degree	**IP66**
Power supply	
Batteries	3 1,5 V AA type batteries
Autonomy	100 hours with 1800mAh alkaline
Rete (cod. **SWD10**)	Mains adapter 100-240Vac/12Vdc-1A
Measuring methods	
Standard	EPA180.1, ISO-NEPH (ISO 7027), EBC, ASBC, WHITE %T e IR %T
Light source	LED IR (850nm) and white LED (470nm)
Receiver	Silicium photodiode
Sample cell	∅24mm - height 68mm, 20cc



Measurement of turbidity

Method / Measuring range	EPA180.1	(0…1000 NTU)
	ISO-NEPH	(0…1000 FNU)
	EBC	(0…250 EBC)
	ASBC	(0…9999 ASBC)
	WHITE %T	(0…100 %T)
	IR %T	(0…100 %T)
Resolution	0.01 NTU (0…9.99 NTU)	
	0.1 NTU (10.0…99.9 NTU)	
	1 NTU (100…1000 NTU)	
Accuracy	±2% reading + 0.01 NTU (0…500 NTU)	
	±3% reading (500…1000 NTU)	
Repeatability	±2% reading or 0.01 NTU (the major one)	

Security of memorized data

	Unlimited

Time

Date and hour	real time schedule
Accuracy	1min/month max error

Measured values storing

Quantity	999 samples

Serial interface RS232C

Type	RS232C electrically isolated
Baud rate	Can be set from 1200 to 38400 baud
Data bit	8
Parity	None
Stop bit	1
Flow Control	Xon/Xoff
Serial cable length	Max 15m

USB interface

Type	1.1 - 2.0 electrically isolated

Connections

Seriale interface	DB9 connector (9- pole male)
USB interface	USB connector type B
Mains adapter	2- pole connector (Ø5.5mm-2.1mm). Positive at centre.

Ordering codes

HD25.2K: The kit is composed of: instrument HD25.2, 4 empty cells, 4 calibration standards STCAL, 3 1.5Vdc alkaline batteries, lubricant rag, 25cc Silicon oil, instructions manual, carrying case and software DeltaLog11 for PCs running Windows 98 to Vista.

Accessories

9CPRS232: Connection cable SubD female 9- pole for serial output RS232C
CP22: Connection cable USB 2.0 connector type A - type B
SWD10: Stabilized power supply at 230Vac/9Vdc-300mA mains voltage.
HD40.1: Portable, serial input, 24 column thermal printer, 57mm paper width.
PL: Lubricant rag
OS1: Silicon oil - 25cc.
KCV: 4 empty sample cells ∅24x68mm

Turbidity calibration standards

STCAL 1: Calibration standard with low turbidity formazin reference less than 0,05 NTU.
STCAL 2: Calibration standard with reference formazin 8 NTU - 20cc.
STCAL 3: Calibration standard with reference formazin 80 NTU - 20cc.
STCAL 4: Calibration standard with reference formazin 800 NTU - 20cc.
KS: Kit 4 calibration standard with reference formazinSTCAL 1, STCAL 2, STCAL 3, STCAL 4.

HD40.1

ASBC

FNU

EBC

NTU