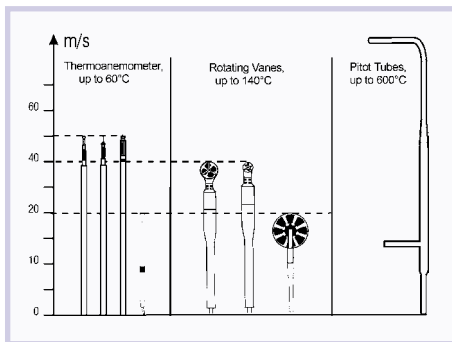


AIR FLOW

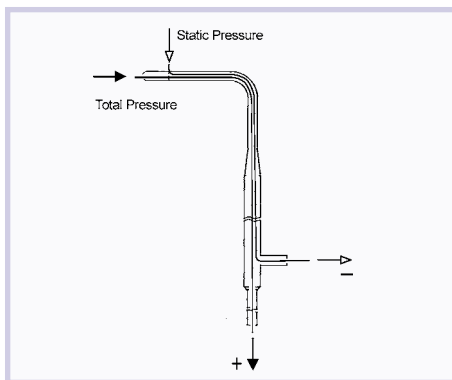
The Right Flow Sensor For Any Measuring Task



For measuring the flow velocity, typically, three methods are used, which are particularly different from each other with regard to their measuring range and the operating temperature:

- ▶ Pitot tubes
- ▶ Rotating vanes
- ▶ Thermoanemometer probes

Pitot Tubes



The air velocity is determined by the dynamic pressure and the static pressure. Pitot tubes are robust and are available in special steel or nickel-plated brass. They connect to ALMEMO® devices by silicone hoses and a differential pressure module.

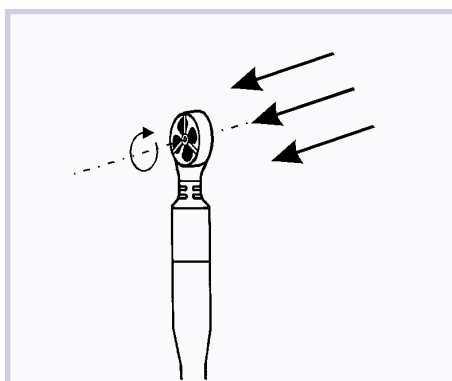
Advantage:

suitable for high flow velocities and harsh operating conditions, high ambient temperatures possible, easy to clean

Disadvantage:

strongly directional, low flow velocities are not measurable, temperature-dependent, limited accuracy, sensitive to turbulent flows

Rotating Vanes



The flow velocity is determined through a frequency measurement. Our rotating vanes are sensitive transducers with diamond bearings that are very precisely adjusted. This ensures high accuracy.

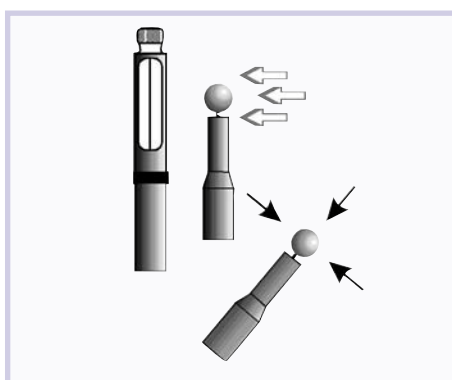
Advantage:

high accuracy at medium flow velocities and medium ambient temperatures, insensitive to turbulent flows

Disadvantage:

sensitive sensor technology, sensitive to mechanical stress, directional

Thermoanemometers



Thermistors and hot wire anemometers are highly sensitive sensors. The measuring element is continuously heated up. A control circuit keeps the temperature of the element, which has cooled down by the air flow, on a constant value. The control current is proportional to the flow velocity.

Advantage:

even very small air speeds can be measured (e.g. draught measurements), direction-independent measurements are also possible

Disadvantage:

sensitive sensor technology, sensitive to mechanical stress and contamination, sensitive to turbulent flows, high current consumption, limited ambient temperature

Correction Factors for Exact Measurements of the Air Speed

Air Temperature	940 mbar	960 mbar	980 mbar	1000 mbar	1020 mbar	1040 mbar
-30°C	0.942	0.932	0.922	0.913	0.904	0.895
-20°C	0.961	0.951	0.941	0.932	0.923	0.914
-10°C	0.980	0.970	0.960	0.950	0.941	0.931
0°C	0.998	0.988	0.978	0.968	0.958	0.949
10°C	1.016	1.005	0.995	0.985	0.975	0.966
20°C	1.035	1.024	1.013	1.003	0.993	0.983
30°C	1.051	1.040	1.029	1.019	1.009	0.999
40°C	1.069	1.057	1.047	1.036	1.026	1.016
50°C	1.085	1.074	1.063	1.052	1.042	1.031
60°C	1.102	1.09	1.079	1.068	1.057	1.047
70°C	1.118	1.106	1.095	1.084	1.073	1.063
80°C	1.135	1.123	1.111	1.100	1.089	1.078
90°C	1.151	1.139	1.127	1.116	1.105	1.094
100°C	1.167	1.154	1.142	1.131	1.120	1.109
150°C	1.242	1.229	1.216	1.204	1.192	1.180
200°C	1.314	1.300	1.287	1.274	1.261	1.249
250°C	1.381	1.367	1.353	1.339	1.326	1.313
300°C	1.446	1.431	1.416	1.402	1.388	1.375
400°C	1.567	1.55	1.534	1.519	1.504	1.489
500°C	1.68	1.663	1.646	1.629	1.613	1.597
600°C	1.784	1.766	1.748	1.73	1.713	1.696
700°C	1.884	1.865	1.846	1.827	1.809	1.791

The true air velocity depends on the air temperature and the barometric air pressure. Therefore, the measured value must be corrected according to the above table to obtain exact measurements of the air speed.

Example:

Measured air velocity 50m/s, air temperature 80°C, atmospheric pressure 960mbar. The measured value must be multiplied with the correction value 1.123. The air velocity is, therefore, 56.1m/s.

Air Speed For Selected Dynamic Pressures (Prandtl Pitot Tube, T = 22°C)

Dynamic Pressure [Pa]	Dyn. Press. [mm h.o.water]	Air Speed [m/s]
1	0.1	1.29
2	0.2	1.83
3	0.3	2.24
4	0.41	2.59
5	0.51	2.89
10	1.02	4.09
20	2.04	5.78
30	3.06	7.08
40	4.08	8.18
50	5.1	9.14
100	10.2	12.93

Flows Measurements à la ALMEMO®

When measuring flows using ALMEMO® sensors, the ALMEMO® instruments provide important data functions for averaging (over time or over single measurements) and for volume flow measurement (width, length, diameter, cross sectional area of the ventilating channel). For Pitot tube measurements the temperature influence can be automatically compensated.

Please ask for our detailed ALMEMO® Manual.

It will provide you with valuable tips and a detailed description regarding flow measurements using ALMEMO® equipment.

AIR FLOW

Rotating Vanes for Air and Gases FV A915 S120 / S140



- ▶ Sensitive sensor with diamond bearing and precise adjustment for high accuracies.
- ▶ The aluminium rotating vanes have stream-lined measuring heads made from plastic material (polysulfone).
- ▶ The shafts are, as standard, guided in protected, oiled beryllium-brass bearing sleeves and supported in tips made from special case-hardened steel.
- ▶ Particularly suitable for use in climatology.
- ▶ Equipped with snap-on measuring heads and, as a result, very easy to service.

Type:

Meas. range: 0.4 to 20m/s

Meas. range: 0.4 to 40m/s

Order no. FVA915S120

Order no. FVA915S140

Technical Data:

Accuracy:	±0.5% of final val. ±1.5% of measured val.
Max. resolution:	0.01m/s
Nominal temperature:	22°C ±2K
Operative range:	-20 to +140°C
Meas. head diameter:	22mm, head is replaceable
Sensor length:	175mm
Inlet opening:	starting from 35mm
Cable length:	1.5m, ALMEMO® connector

Accessories:

Spare snap-on head 20m/s	Order no. ZV9915S120
Spare snap-on head 40m/s	Order no. ZV9915S140
Extension set Ø 15mm, 4 x 255mm	Order no. ZV9915VR3
Telescope extension Ø 15...24mm, 330/1010mm	Order no. ZV9915TV

Rotating Vanes for Air and Gases FV A915 S220 / S240



- ▶ Sensitive sensor with diamond bearing and precise adjustment for high accuracies.
- ▶ The aluminium rotating vanes have stream-lined measuring heads made from plastic material (polysulfone).
- ▶ The shafts are, as standard, guided in protected, oiled beryllium-brass bearing sleeves and supported in tips made from special case-hardened steel.
- ▶ Particularly suitable for use in climatology.
- ▶ Equipped with snap-on measuring heads and, as a result, very easy to service.

Type:

Meas. range: 0.5 to 20m/s

Meas. range: 0.6 to 40m/s

Order no. FVA915S220

Order no. FVA915S240

Technical Data:

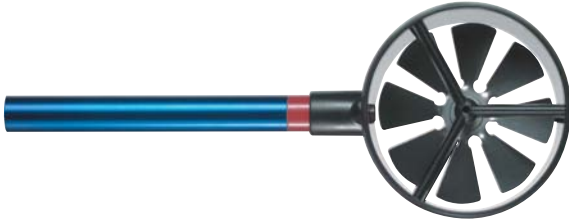
Accuracy:	±1% of final val. ±3% of measured val.
Max. resolution:	0.01m/s
Nominal temperature:	22°C ±2K
Operative range:	-20 to +140°C
Meas. head diameter:	11mm, head replaceable
Inlet opening:	starting from 15mm
Sensor length:	165mm
Cable length:	1.5m, ALMEMO® connector

Accessories:

Spare snap-on head 20 m/s	Order no. ZV9915S220
Spare snap-on head 40 m/s	Order no. ZV9915S240
Extension set Ø 15mm, 4 x 255mm	Order no. ZV9915VR3
Telescope extension Ø 15...24mm, 330/1010mm	Order no. ZV9915TV

AIR FLOW

Rotating Vanes for Air and Gases FV A915 SMA1



- ▶ Sensitive sensor with diamond bearing and precise adjustment for high accuracies.
- ▶ The aluminium rotating vanes have stream-lined measuring heads made from plastic material (polysulfone).
- ▶ The shafts are, as standard, guided in protected, oiled beryllium-brass bearing sleeves and supported in tips made from special case-hardened steel.
- ▶ Particularly suitable for use in climatology.
- ▶ Equipped with snap-on measuring heads and, as a result, very easy to service.

Type:

Meas. range: 0.1 to 20m/s

Order no. FVA915SMA1

Technical Data:

Accuracy:	±0.5% of fin.v., ±1.5% of m.v.
Max. resolution:	0.01m/s
Nominal temperature:	22°C ±2K
Operative range:	-20 to +140°C
Meas. head diameter:	80mm, head replaceable
Inlet opening:	starting from 108mm
Sensor length:	235mm
Cable length:	1.5m, ALMEMO® connector

Option:

Temperature sensor (NTC) installed Order no. OV9915TE

Accessories:

Spare snap-on head	Order no. ZV9915SMA1
Extension set Ø 15mm, 4 x 255mm	Order no. ZV9915VR3
Telescope extension Ø 15...24mm, 330/1010mm	Order no. ZV9915TV
Carry-case	Order no. ZB9605TK

Rotating vane for measuring air volume FV A915 MA1



Ausführung:

Measuring range : 0.2 to 20 m/s

Order no. FVA915MA1

Mountable hopper for measuring air volume, Ø 200 mm (up to approx. 275 m³/h)

Order no. ZV9915LM

Technical data :

see FVA915SMA1

- ▶ Rotating vane with permanently attached brass probe head
- ▶ Mountable hopper for measuring air volume

Option:

Temperature sensor (NTC), integrated Order no. OV9915TE

01/2011 We reserve the right to make technical changes.


AIR FLOW

Differential pressure and Pitot tube measurement Measuring connector FDA 602 S1K / S6K



Measuring connector FDA602S1K / S6K

- ▶ Pressure measuring connector in compact design for flow measurement with Pitot tubes
- ▶ Fitting for connecting hose between Pitot tube and pressure measuring connector
- ▶ Pressure measuring connector can be plugged directly onto the measuring instrument.

 Advisory note when used in conjunction with ALMEMO® 2890, 5690, 5790, 8590, 8690 :
The new ALMEMO® pressure measuring connector is very slightly higher (8.8 mm). As a result adjacent input sockets on the ALMEMO® device may be partly covered. However, the 1st input socket can always be used without restriction. Or, alternatively, the ALMEMO® pressure measuring connector can be plugged in at any input socket using connecting cable ZA9060AK1.

Accessories

New ALMEMO® pressure measuring connector for barometric pressure 700 to 1100 mbar, without pressure terminal sleeve including programming for automatic atmospheric pressure compensation (Designation *P)

Technical data see page 11.12 Order no. FDAD12SAP
(variant with pressure terminal sleeve, see page 11.12)

Connecting cable, 0.2 meters	Order no. ZA9060AK1
Extension cable, 2 meters	Order no. ZA9060VK2
1 set of silicone hoses black / colorless, 2 meters	Order no. ZB2295S
Silicone hose, black, per meter	Order no. ZB2295SSL
Silicone hose, colorless, per meter	Order no. ZB2295SFL

Variants (including manufacturer's test certificate)

(including one set of silicone hoses, 2 meters)

Measuring ranges ± 1250 Pa ,
Differential pressure (1 to 40 m/s),
Measured variables: m/s, Pa
Measuring connector, independent of position

Order no. FDA602S1K

Measuring ranges ± 6800 Pa
Differential pressure (2 to 90 m/s)
Measured variables m/s, Pa
Measuring connector, independent of position

Order no. FDA602S6K

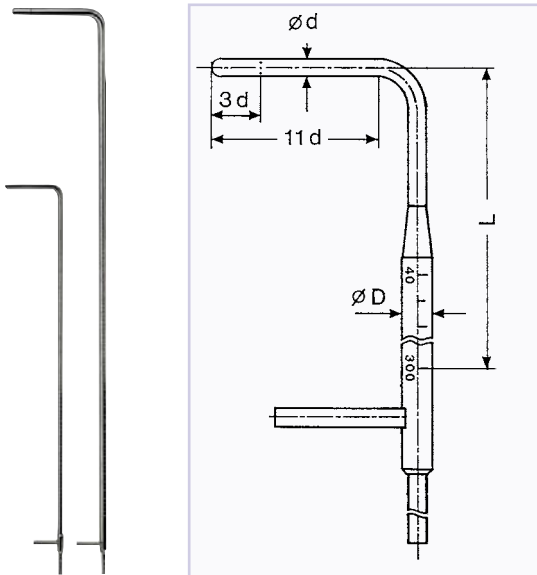


On ALMEMO® devices to obtain precise measured results in m/s the wind tunnel temperature can be entered in the -50 to +700 °C range for compensation purposes.

Technical data

Overload capacity	Max. - three times final value
Max. common mode pressure	700 mbar
Accuracy (zero-pt adjusted)	$\pm 0.5\%$ of final value in range 0 to positive final value
Nominal temperature	25 °C
Temperature drift	$< \pm 1.5 \%$ of final value
Compensated temp. range	0 to +70 °C
Operating range	-10 to +60 °C, 10 to 90% RH, non-condensing
Dimensions	New 74 x 20 x 8.8 mm
Hose terminals	\varnothing 5 mm, 12 mm long
Sensor material	aluminum, nylon, silicone, silica gel, brass

Pitot Tubes for Differential Pressure Sensors FDA602



- ▶ Prandtl Pitot tubes with hemispheric head.
- ▶ For measuring the dynamic pressure, the tip of the Pitot tube has an opening of $0.3d$.
- ▶ For measuring the static pressure, a total of 12 holes with $0.1d$ \varnothing have been arranged at a distance of $3d$.



ALMEMO® devices that have an option for entering factors can also be used to perform wind velocity measurements with cylindrical probes, according to VDEH. The cylindrical Pitot tubes have a probe-related coefficient of 1.7. By entering a factor of 0.767 in the range m/s this coefficient will be considered during the measurement.

01/2011 We reserve the right to make technical changes.

Types and Technical Data:

Head Diameter (d)	Shaft Diameter (D)	Length	Tmax	Permiss. Dust	Material	Order no.
3mm	6mm	300mm	150°C	none	nickel-plated brass	FD991233MS
3mm	6mm	300mm	300°C	none	chrome-nickel steel	FD991233VA
5mm	8mm	400mm	350°C	none	nickel-plated brass	FD991254MS
5mm	8mm	400mm	500°C	none	chrome-nickel steel	FD991254VA
5mm	8mm	600mm	350°C	none	nickel-plated brass	FD991256MS
5mm	8mm	600mm	500°C	none	chrome-nickel steel	FD991256VA
8mm	8mm	400mm	350°C	none	nickel-plated brass	FD991284MS
8mm	8mm	400mm	500°C	none	chrome-nickel steel	FD991284VA
8mm	8mm	800mm	350°C	low	nickel-plated brass	FD991288MS
8mm	8mm	800mm	600°C	low	chrome-nickel steel	FD991288VA
10mm	10mm	800mm	350°C	some	nickel-plated brass	FD991296MS
10mm	10mm	800mm	600°C	some	chrome-nickel steel	FD991296VA*
10mm	10mm	1000mm	350°C	some	nickel-plated brass	FD991297MS
10mm	10mm	1000mm	600°C	some	chrome-nickel steel	FD991297VA*
10mm	20mm	1500mm	350°C	some	nickel-plated brass	FD991298MS
10mm	20mm	1500mm	600°C	some	chrome-nickel steel	FD991298VA*
20mm	20mm	2000mm	350°C	more	nickel-plated brass	FD991299MS
20mm	20mm	2000mm	600°C	more	chrome-nickel steel	FD991299VA*

Option:

Movable screw connection
for brass Pitot tubes with shaft diameter x (6; 8; 10; 20mm) ZB9912KMx
for steel Pitot tubes with shaft diameter x (6; 8; 10; 20mm) ZB9912KVx



*) all VA Pitot tubes
can be operated up to
700°C for a short period

AHLBORN
www.ahlborn.com

AIR FLOW

Thermo-anemometer probe FV A935-TH4 / -TH5



Typ FV A935-TH4Kx / -TH5Kx



- ▶ Thermo-anemometer probes FVA935TH4 and FVA935TH5 are especially suitable for measuring and recording flow velocity and temperature data even when measuring operations are performed in cramped and restricted conditions.
- ▶ Measured values can be acquired with a high level of accuracy even at velocities below 0.5 m/s (100 ft/min).
- ▶ The sensor can be used with either side facing the direction of flow.
- ▶ Temperature is compensated over a wide range. 0 to +50 °C.
- ▶ The sensor tube is only 6 mm in diameter (0.24").

Accessories (only for FVA935THxK1/K2)

Clamped screw connection with thread adapter for telescopic extension / extension sets (max. 80 °C) Order no. ZV9915KV

Telescope extension
Ø 15 to 24 mm, 330 / 1010 mm Order no. ZV9915TV

Extension set Ø 15 mm, 4 x 255 mm Order no. ZV9915VR3



Variant (including works certificate)

- Sensor 2 m/s, length = 210 mm, with handle
- Sensor 2 m/s, length = 80 mm, with electronicbox
- Sensor 2 m/s, length = 300 mm, with electronicbox
- Sensor 20 m/s, length = 210 mm, with handle
- Sensor 20 m/s, length = 80 mm, with electronicbox
- Sensor 20 m/s, length = 300 mm, with electronicbox

Other designs are available on request.

High-temperature thermoanemometer MT8636THx
Operative range -40 to +120°C, up to 40 m/s
probe with cable and electronics housing

Technical data

Flow

Measuring range	FVA935TH4 / TH4Kx	0.08 to 2 m/s
	FVA935TH5 / TH5Kx	0.2 to 20 m/s
Resolution	FVA935TH4 / TH4Kx	0.001 m/s
	FVA935TH5 / TH5Kx	0.01 m/s
Response time		<1.5 s
Accuracy	FVA935TH4 / TH4Kx	± (0.04 m/s + 1% of meas. val.)
	FVA935TH5 / TH5Kx	± (0.2 m/s + 2% of meas. val.)
Temperature compensation		0 to +50 °C
Influence of temperature	FVA935TH4 / TH4Kx	±0.5% of measured value /°C at 0.3 to 2 m/s
	FVA935TH5 / TH5Kx	±0.3% of measured value /°C at 0.3 to 20 m/s
Direction facing the flow		bidirectional
Angle dependence		<3% of measured value with deviation <15°
Pressure range		ambient pressure

Temperature

Measuring range	-20 to +70 °C
Resolution	0.1 °C
Accuracy	±0.7 °C at 0 to 50°C and > 0.5 m/s
Response time T ₉₀	typical 10 seconds

Nominal conditions

Temperature	22 °C ±2 K
Atmospheric humidity	45 ± 10% relative humidity (non-condensing)
Atmospheric pressure	1013 mbar

Power supply

	6 to 13 V / 40 mA
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Dimensions

Probe diameter	6 mm
Flow cross section :	approx. 10 x 3 mm
FVA935TH4/TH5	Probe with handle, probe lengths : 210 mm (plus handle) ALMEMO® cable, 1.5 meters
FVA935TH4Kx/TH5Kx	Probe with remote electronics in the cable housing Probe lengths THxK1, 80 mm / THxK2, 300 mm Probe cable 5 m to electronics, ALMEMO® cable, 1.5 m

- Order no. FVA935TH4
- Order no. FVA935TH4K1
- Order no. FVA935TH4K2
- Order no. FVA935TH5
- Order no. FVA935TH5K1
- Order no. FVA935TH5K2



Thermoelectric Flow Sensor FV A605 TA



- ▶ Probe tube with heated miniature thermistor for flow measurement and precision NTC resistance for automatic compensation.
- ▶ Evaluation electronics are located in a separate sensor transmitter module.
- ▶ High accuracy as a result of integrated temperature compensation and individual calibration in wind tunnel, with laser Doppler anemometer as reference system.
- ▶ Response time only 2s for smoothing the measured value indicated, optionally without smoothing with 100ms response time.
- ▶ Suitable for measuring small flow velocities in gaseous substances, particularly for control systems and monitoring.
- ▶ Typical applications include comfort index measurements, HEVAC applications, environmental technology, clean room technology and process measuring and control technology.



A special connector cable allows to connect the flow sensors to all ALMEMO® multi-purpose devices, data loggers and data acquisition systems. For volume flow rate measurements the cross section of the ventilating shaft can be easily entered into ALMEMO® devices. A problem-free averaging is then possible.

Types (incl. clamping holder and ALMEMO® connecting cable 1.5m long):

Unidirectional (sensitive in one direction) with protected measuring tip

Measuring range up to 1m/s, smoothed

Order no. FVA605TA1D

Measuring range up to 5m/s, smoothed

Order no. FVA605TA5D

Measuring range up to 1m/s, not smoothed

Order no. FVA605TA1U

Measuring range up to 5m/s, not smoothed

Order no. FVA605TA5U

Omnidirectional (direction-independent, symmetrical ball tip) with protecting cage (Ø110mm) including carry-case

Measuring range up to 1m/s, smoothed

Order no. FVA605TA1OD

Measuring range up to 5m/s, smoothed

Order no. FVA605TA5OD

Measuring range up to 1m/s, not smoothed

Order no. FVA605TA1OU

Measuring range up to 5m/s, not smoothed

Order no. FVA605TA5OU

Technical Data:

Electronics Box with Sensor

Measuring range:	
FV A605 TA1(O)	0.01 to 1m/s
FV A605 TA5(O)	0.15 to 5m/s
Resolution:	
FV A605 TA1(O)	0.001m/s
FV A605 TA5(O)	0.01m/s
Accuracy:	
FV A605 TA1(O)	±1.0% of final value and ±1.5% of meas. value
FV A605 TA5(O)	±0.5% of final value ±1.5% of meas. value
Nominal conditions:	22°C, 960hPa
Automatic temperature compensation:	effective in range 0 to 40°C
Temperature influence:	±0.5% of fin. value/°C

Sensor

Head size:	Ø 8mm
Shaft:	Ø 15mm
Operative range:	0 to 40°C
Angle of attack:	
FV A605 TA1/TA5	±30°
FV A605 TA1O/TA5O	±180°
Inlet opening:	
FV A605 TAx:	9mm
FV A605 TAxO:	protecting cage 110mm
Sensor length:	
FV A605 TAx:	300mm
FV A605 TAxO:	310mm
Sensor cable length:	1.5m
Storage temperature:	-30 to +90°C

General Technical Specifications

Measurement medium:	dry air or inert gases
Response time:	
FVA605TAxD	smoothed, 1 τ = 2s
FVA605TAxU	not smoothed, 1 τ = 100ms
Power supply:	through ALMEMO® device (approx. 7... 10V)
Current consumption:	approx. 70mA
Output signal:	0 ... 1V, linearised, load resistance min. 10kohms
Housing:	
Dimensions:	100 x 60 x 35mm (L x W x H)
Protection system:	IP 40 (aluminium housing)
Weight:	approx. 250g
Operating temperature:	0 to 40°C
Storage temperature:	-30 to 90°C
Air humidity:	0 ... 90% r.H., non-condensing
Adjusting reference:	laser Doppler wind tunnel, adjustment at 22°C/approx. 960hPa, (certificate according to SN EN 45001)

01/2011 We reserve the right to make technical changes.