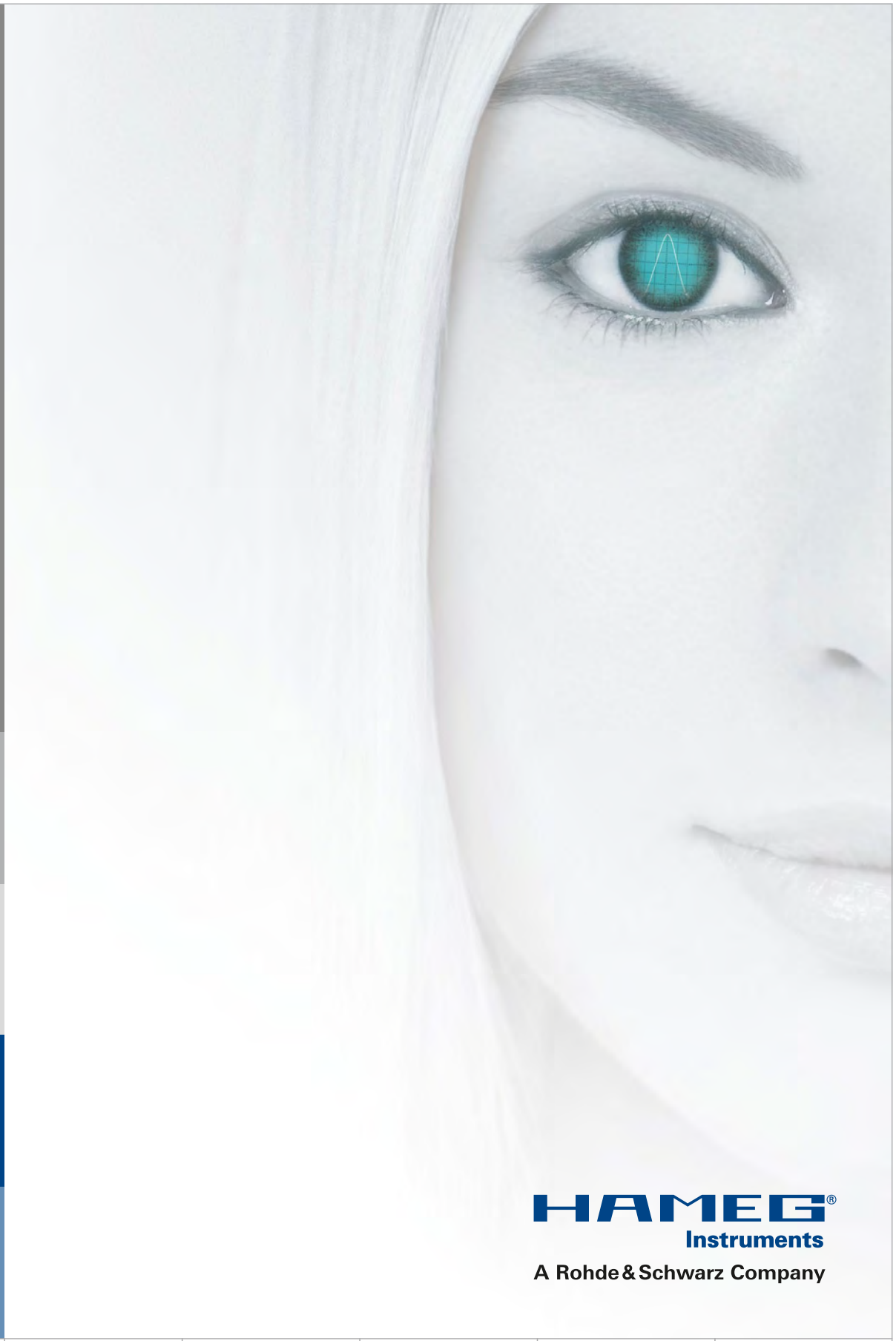
Products 2010/2011

Sensitivity

Accuracy

Quality

Simplicity



HAMEG®
Instruments
A Rohde&Schwarz Company






Great Value in Test & Measurement

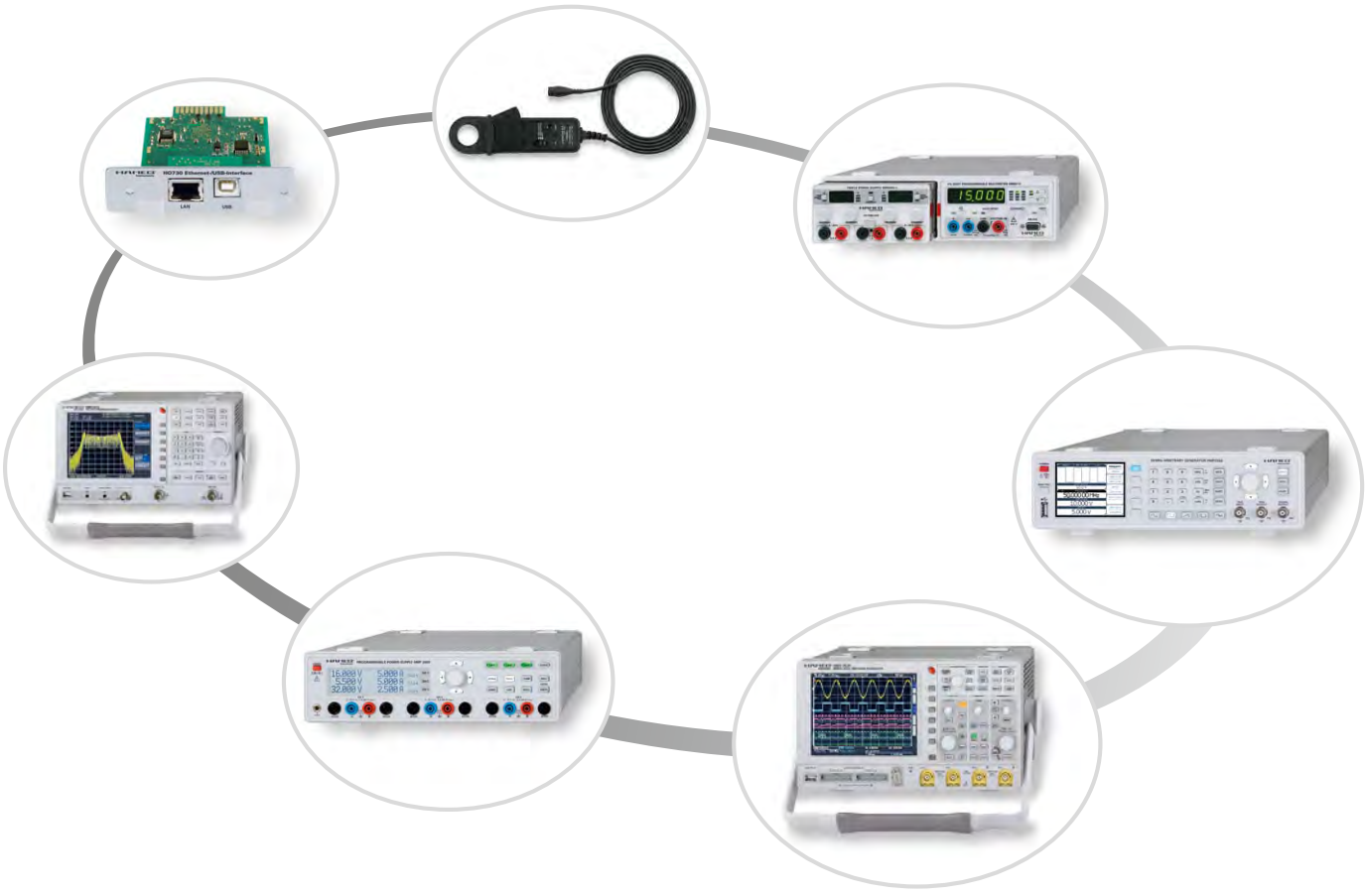
HAMEG Instruments – committed to medium sized companies

HAMEG Instruments GmbH prides itself on over 50 years of a successful company history. Since the company's foundation in 1957, the name HAMEG stands for innovation, user friendliness, longevity, high quality of workmanship, and especially an excellent price/performance ratio. An independent company, a member of the Rohde & Schwarz Group since April 2005, HAMEG is located at Mainhausen near Frankfurt, Germany and develops and distributes its electronic measuring instruments via a global network of competent service and sales partners in more than 60 countries.

HAMEG customers come from industry, small businesses, science, schools and universities, service and last but not least, due to the good price/performance ratio, from the ambitioned hobbyists. Numerous generations of professional engineers, technicians and craftsmen used HAMEG Instruments during their basic training and also in advanced applications of measurement technology.

The enduring success of the HAMEG Instruments is based upon the principles of Sensitivity, Accuracy, Quality and, finally, Simplicity. The company's philosophy is to design electronic measuring instruments which not only guarantee excellent performance and reliability but also offer the greatest possible flexibility, which is of equal importance in every day laboratory, test and production applications. HAMEG measuring instruments concentrate on the essentials. The operation of the instruments is intentionally kept as simple as possible while retaining important functions.

All HAMEG Instruments conform to a standard width, so stacks of several instruments are possible. Due to this feature and the compact sizes they require little space in the working area.



Oscilloscopes

HAMEG Oscilloscopes

Innovation right from the start

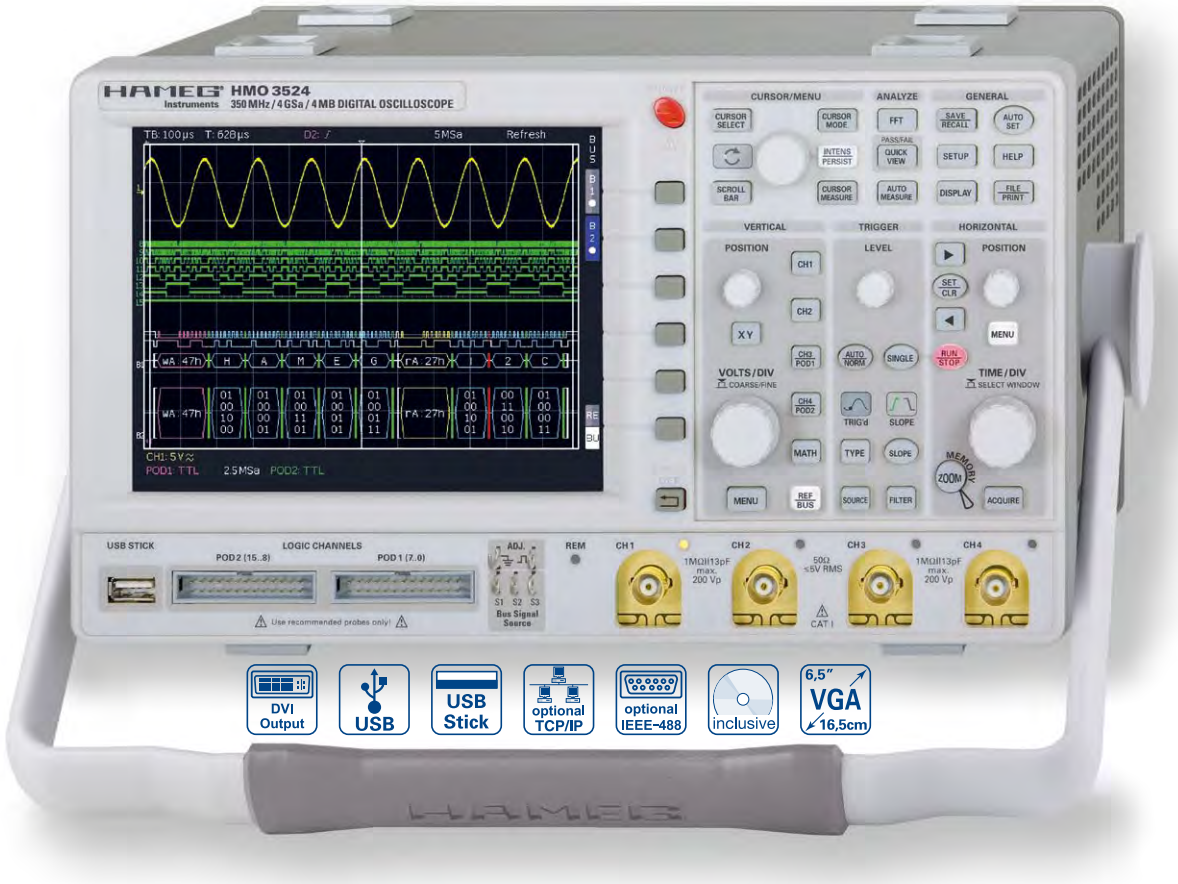
Without doubt, the oscilloscope is the most important measuring instrument for the characterization of signals in the time domain. HAMEG Instruments offers the most comprehensive portfolio for the diverse areas of application in industry, handcraft, science, education, training, and service as well as the private sector. In addition to our innovative DSO's (Digital Storage Oscilloscopes) the classical CRT (cathode ray tube) instruments, purely analog scopes or CombiScopes® (Analog Scope and DSO combined in one instrument) are for the customers' choice.

The demand for purely analog instruments has been diminishing for some time because DSO's offer a host of advantages such as documentation, the ability to extensively analyze data, a compact package etc. MSO's (Mixed-Signal Oscilloscopes) additionally allow the simultaneous display of analog and digital signals on several channels.

Modern electronic gear, as a rule, contains microprocessors, FPGA's, serial interfaces such as I^2C, SPI or UART. The HMO series oscilloscopes, with the available options, feature triggering and decoding of these bus protocols in real time, which is very helpful and time-saving for debugging during the design phase. Modern semiconductor technologies generate signals with rise times of a few ns and thus demand higher bandwidths and sampling rates in order to minimize the measurement errors. The high sampling rate requires a deeper memory in order to acquire a given time window. HAMEG Instruments always offers a well balanced set of these three specifications in order to display a correct measurement result even in critical cases. Last but not least our experience of 50 plus years in oscilloscope technology stands for first-class trigger performance, extraordinary sensitivity, low-noise a/d converters, unexcelled longevity, and an excellent price/performance ratio.

HMO3524

350MHz 2[4] Channel Digital Oscilloscope HMO3522 [HMO3524]



8 Channel
Logic Probe HO3508

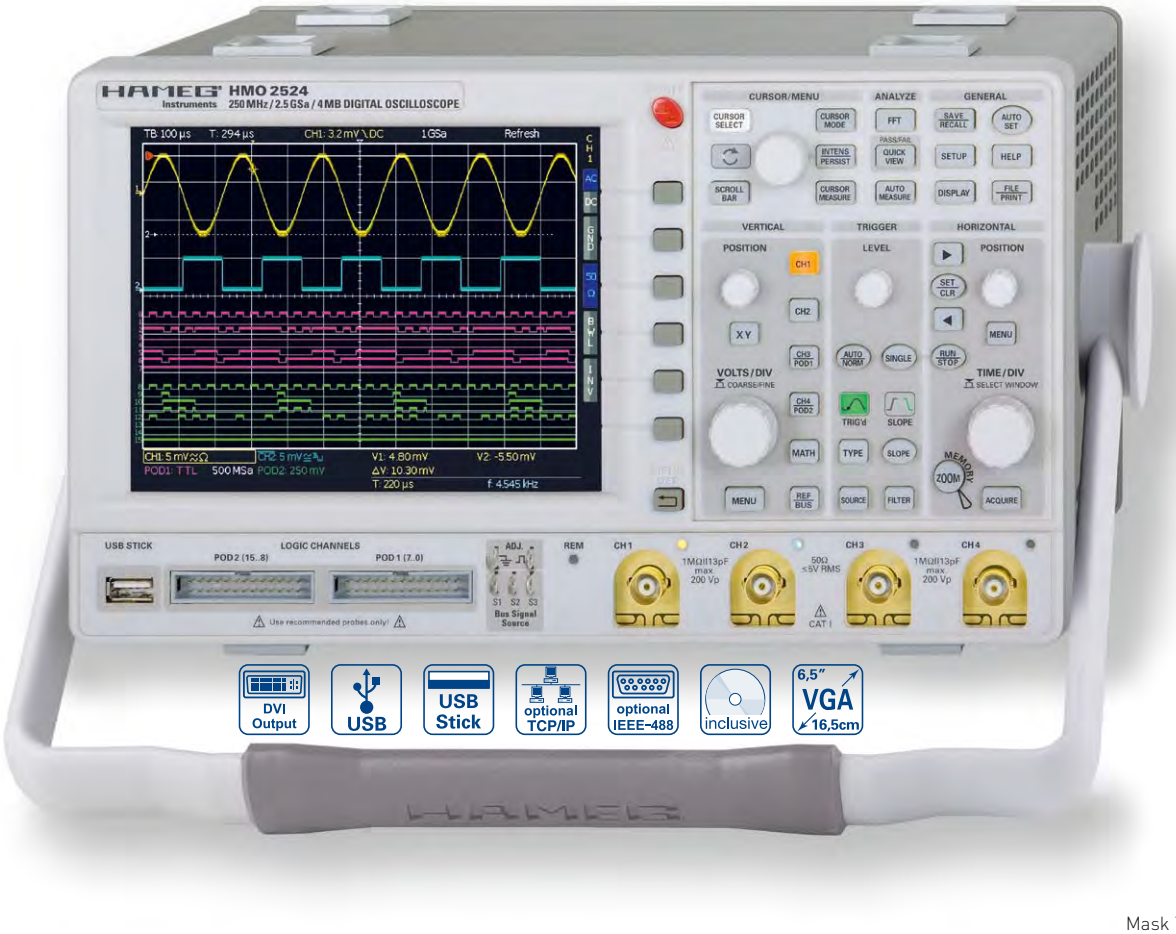
Carrying Case HZ99

Active Probe HZO30

- ☑ **4GSa/s Real Time, 50GSa/s Random Sampling, Low Noise Flash A/D Converter (Reference Class)**
- ☑ **4MPts Memory, Memory Zoom up to 100,000:1**
- ☑ **MSO** (Mixed Signal Opt. HO3508 [HO3516]) with 8 [16] Logic Channels
- ☑ **Serial Bus Trigger** and Hardware accelerated Decode, I^2C, SPI, UART/RS-232 (Opt. HO010)
- ☑ 8 User definable Markers for easy Navigation
- ☑ Pass/Fail Test based on Masks
- ☑ Vertical Sensitivity 1mV/div., Offset Control ±0.2...±20V
- ☑ 12div. x-Axis Display Range, 20div. y-Axis Display Range (**V**irtual**S**creen)
- ☑ Trigger Modes: Slope, Video, Pulsewidth, Logic, Delayed, Event
- ☑ 6 Digit Counter, Automeasurement, Formula Editor, Ratiocursor, FFT for Spectral Analysis
- ☑ Crisp 16.5cm (6.5") TFT VGA Display, DVI Output
- ☑ Lowest Noise Fan
- ☑ 3 x USB for Mass Storage, Printer and Remote Control optional IEEE-488 (GPIB) or Ethernet/USB

See page 72 for technical specifications or www.hameg.com/HMO3522 [www.hameg.com/HMO3524]

250MHz 4 Channel Digital Oscilloscope HMO2524

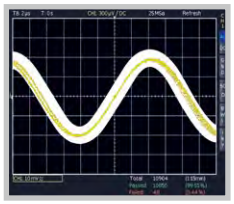


HMO2524

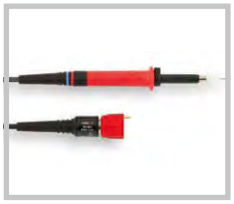
- ☑ **2.5GSa/s Real Time, 25GSa/s Random Sampling, Low Noise Flash A/D Converter (Reference Class)**
- ☑ **4MPts Memory, Memory Zoom up to 100,000:1**
- ☑ **MSO** (Mixed Signal Opt. HO3508 [HO3516]) with 8 [16] Logic Channels
- ☑ **Serial Bus Trigger** and Hardware accelerated Decode, I^2C, SPI, UART/RS-232 (Opt. HO010)
- ☑ 8 User definable Markers for easy Navigation
- ☑ Pass/Fail Test based on Masks
- ☑ Vertical Sensitivity 1mV/div., Offset Control ±0.2...±20V
- ☑ 12div. x-Axis Display Range, 20div. y-Axis Display Range (**V**irtual**S**creen)
- ☑ Trigger Modes: Slope, Video, Pulsewidth, Logic, Delayed, Event
- ☑ 6 Digit Counter, Automeasurement, Formula Editor, Ratiocursor, FFT for Spectral Analysis
- ☑ Crisp 16.5cm (6.5") TFT VGA Display, DVI Output
- ☑ Lowest Noise Fan
- ☑ 3 x USB for Mass Storage, Printer and Remote Control optional IEEE-488 (GPIB) or Ethernet/USB

See page 71 for technical specifications or www.hameg.com/HMO2524

Mask Test



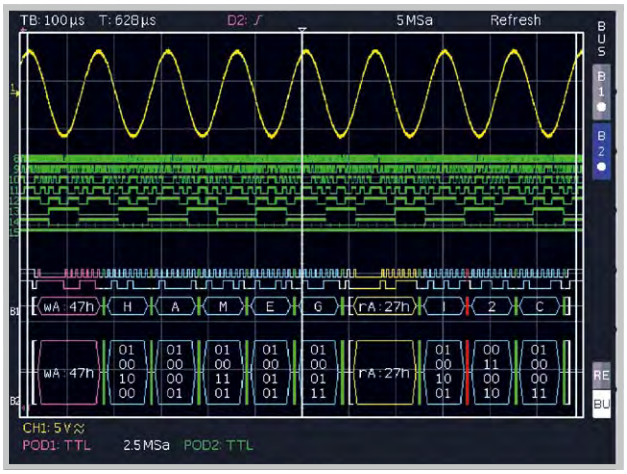
Passive Probe 1000:1
HZO20



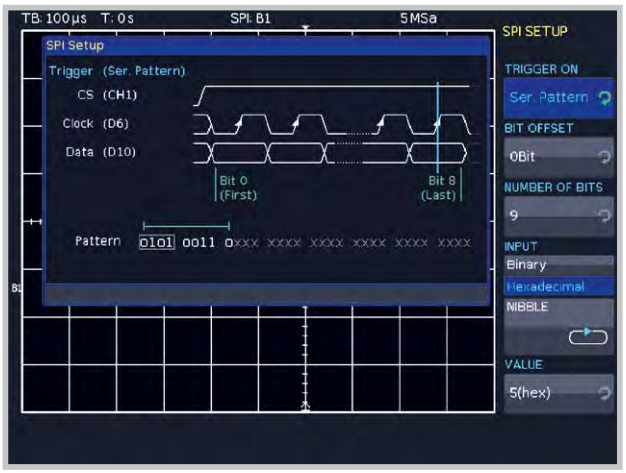
AC/DC Current Probe
100/1000A HZO51

HO010 Serial Bus

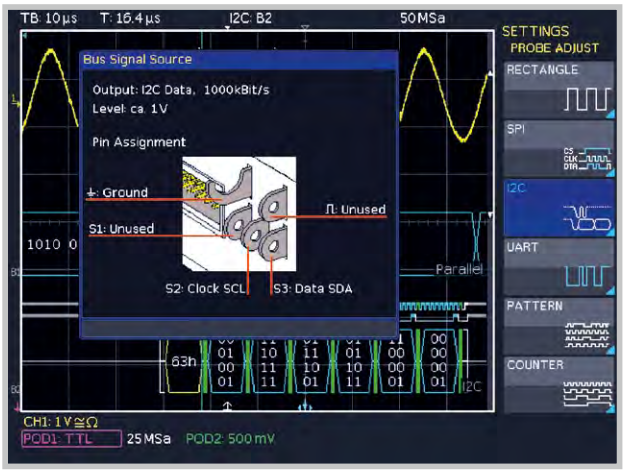
for all Oscilloscopes of the HMO Series



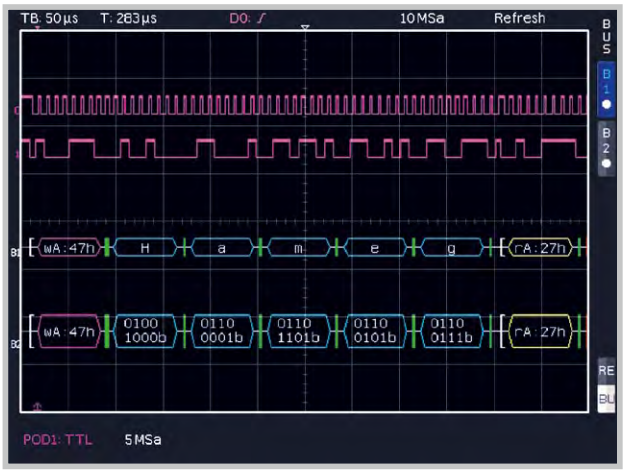
Mixed Signal and Bus Display



SPI Bus Trigger Setup



Setting of the internal Bus Signal Source of the HMO2524



Setting of the internal Bus Signal Source of the HMO2524

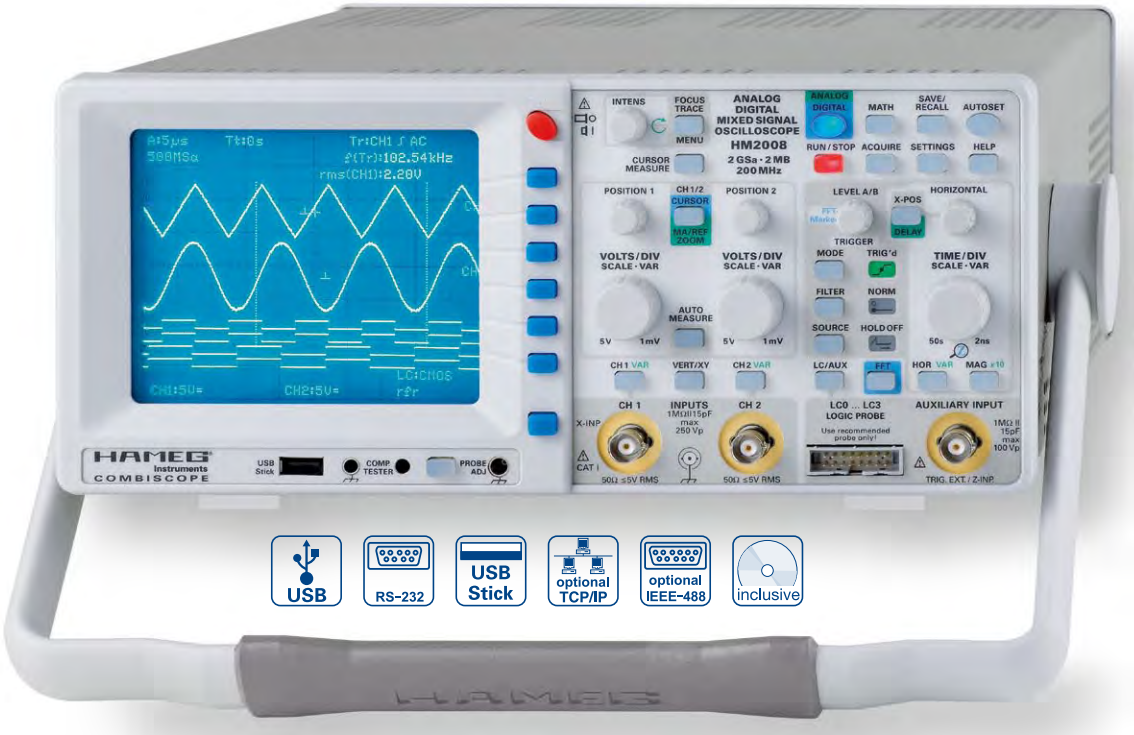
I²C Bus ASCII and Binary

- ☑ I²C, SPI, UART/RS-232 Bus Trigger and Decode
- ☑ Hardware accelerated Decode in Realtime
- ☑ Color Coded Display of the Content for intuitive Analysis and easy Overview
- ☑ More Details of the decoded Values come visible with increasing Zoom Factor
- ☑ Bus Display with synchronous Display of the Data and may be Clock Signal
- ☑ Decode into ASCII, Binary, Hexadecimal or Decimal Format
- ☑ Up to four Lines to show the decoded Values Comfortably
- ☑ Powerful Trigger to isolate specific Messages
- ☑ Option for all Oscilloscopes of the HMO Series, retrofittable

See page 90 for technical specifications or www.hameg.com/HO010

HO010

200MHz Mixed Signal CombiScope®
HM2008

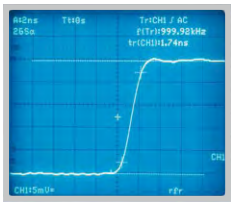


- ☑ **2GSa/s Real Time Sampling, 20GSa/s Random Sampling**
- ☑ **2MPts Memory per Channel, Memory Zoom up to 100,000:1**
- ☑ FFT for Spectral Analysis
- ☑ 2 Channels + 4 Logic Channels with Option HO2010 (MSO)
- ☑ Deflection Coefficients 1mV/div....5V/div., with adjustable DC Offset Voltage; Time Base 2ns/div....50s/div.
- ☑ Acquisition Modes: Single, Refresh, Average, Envelope, Roll, Peak-Detect
- ☑ Front USB-Stick Connector for Screenshots
- ☑ USB/RS-232, optional: IEEE-488 (GPIB) or Ethernet/USB
- ☑ Signal Display: Yt, XY and FFT; Interpolation: Sinx/x, Pulse, Dot Join (linear)
- ☑ Adjustable Input Impedance 1MΩ/50Ω
- ☑ See HM2005-2 for Analog Mode

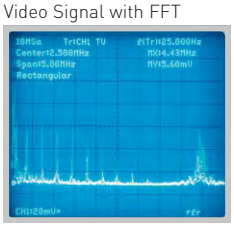
See page 69 for technical specifications or www.hameg.com/HM2008

Logic Probe HO2010

Rise Time Measurement in DSO Mode with 2ns/div., 2GSa/s

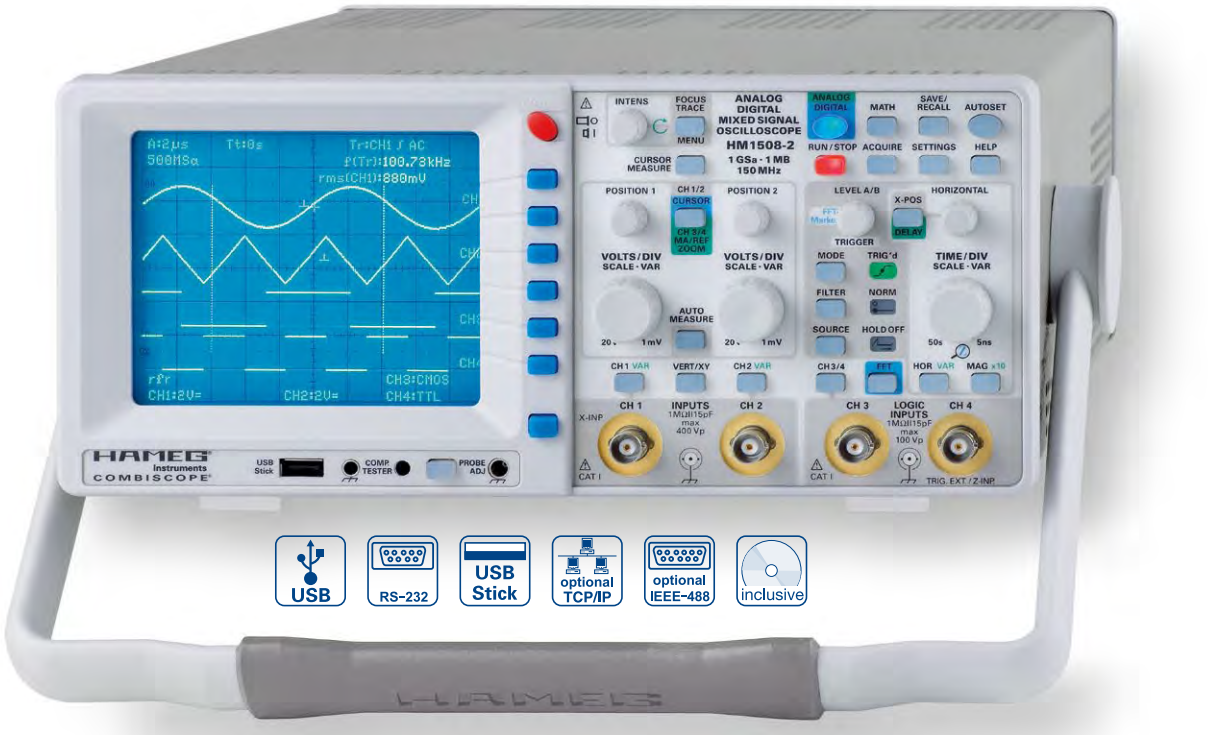


Frequency Analysis of a Video Signal with FFT

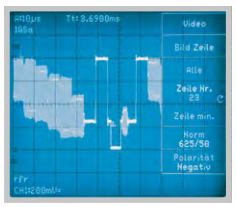


HM1508-2

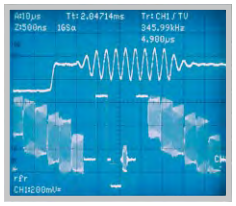
100MHz [150MHz]
CombiScope® [Mixed Signal]
HM1008-2 [HM1508-2]



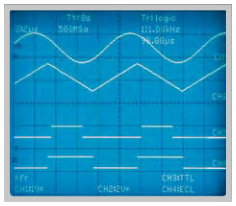
Either PAL or NTSC:
Line Triggering
with Line Counter



DSO Mode: Signal Portion
expanded with Zoom
(Burst in one Line)



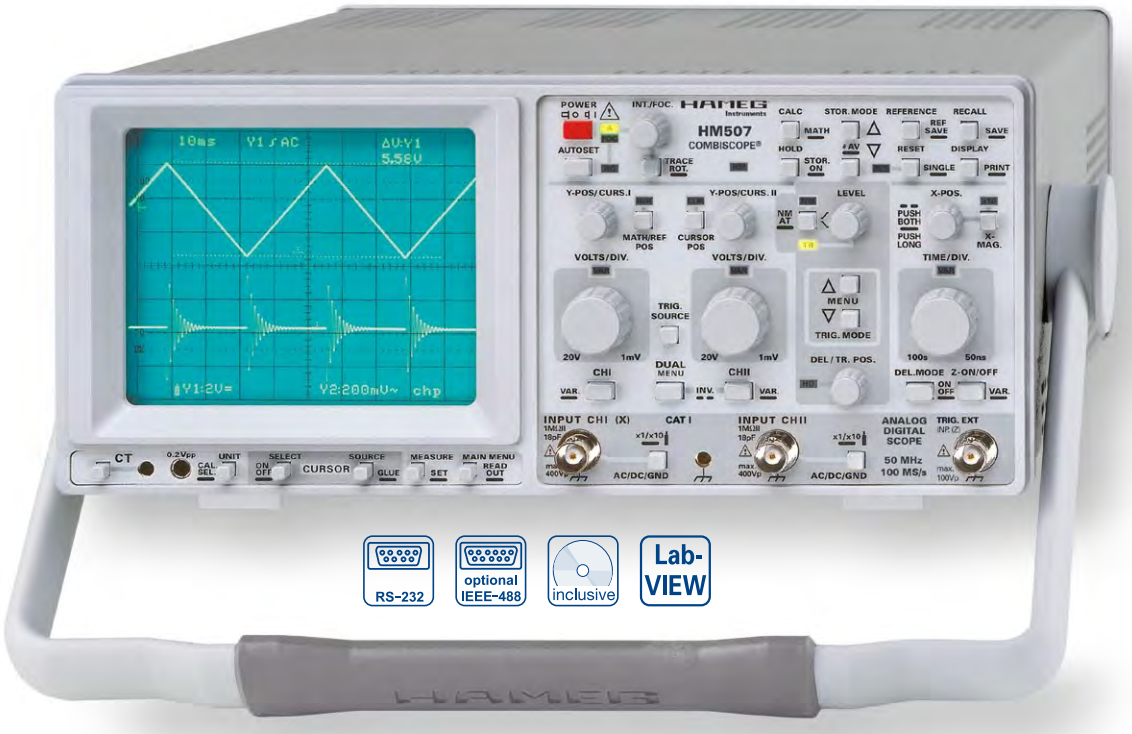
DSO Mode:
4-Channel Display of 2
Analog and 2 Logic Signals



- ☑ **1GSa/s Real Time Sampling, 10GSa/s Random Sampling**
- ☑ **1MPts Memory per Channel,**
  Memory Zoom up to 40,000:1 [50,000:1]
- ☑ FFT for Spectral Analysis
- ☑ 2 Channels [4 Channels (2 Analog, 2 Logic Inputs)]
- ☑ Deflection Coefficients 1mV/div....20V/div.,
  Time Base 5ns/div....50s/div.
- ☑ 8-Bit Low Noise Flash A/D Converters
- ☑ Acquisition Modes: Single, Refresh, Average, Envelope,
  Roll, Peak-Detect
- ☑ Front USB-Stick Connector for Screenshots
- ☑ USB/RS-232, optional: IEEE-488 (GPIB) or Ethernet/USB
- ☑ Signal Display: Yt, XY and FFT;
  Interpolation: Sinx/x, Pulse, Dot Join (linear)
- ☑ See HM1500-2 for Analog Mode (1008-2 though 100MHz)

See page 65 [67] for technical specifications or www.hameg.com/HM1008 [www.hameg.com/HM1508]

50MHz CombiScope®
HM507

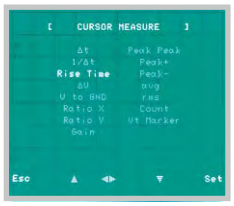


- ☑ **100MSa/s Real Time Sampling, 2GSa/s Random Sampling**
- ☑ **2kPts Memory per Channel**
- ☑ 2 Channels
- ☑ Deflection Coefficients 1mV/div....20V/div.,
  Time Base 20ns/div....100s/div.
- ☑ 8-Bit Low Noise Flash A/D Converters
- ☑ Programmable mathematical Signal Processing
- ☑ Acquisition Modes: Single, Refresh, Envelope, Average, Roll
- ☑ RS-232 Interface for Control and Signal Data Transfer,
  incl. Windows® Software
  optional: Multifunction Interface HO79-6
- ☑ See HM504-2 for Analog Mode

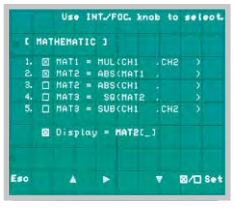
See page 64 for technical specifications or www.hameg.com/HM507

Automatic Measurements

Cursor Measurement

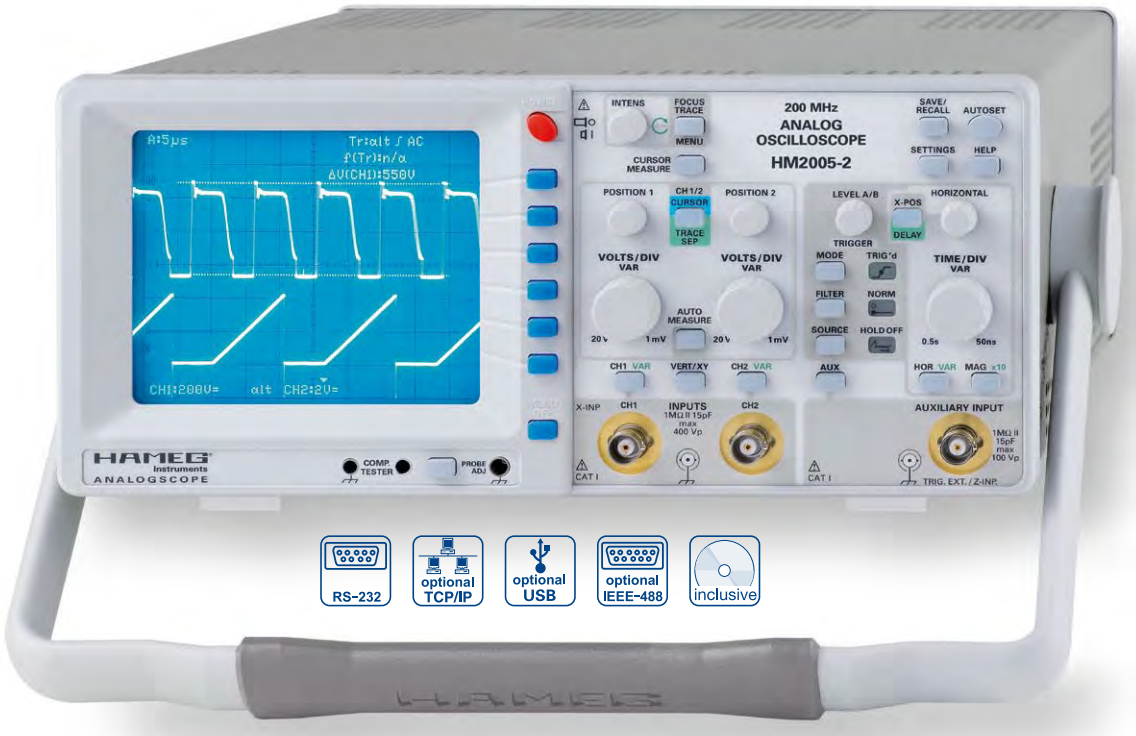


Signal Processing with
userdefined Formulas

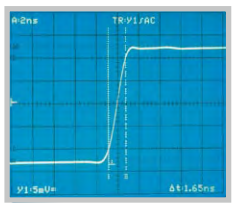


HM2005-2

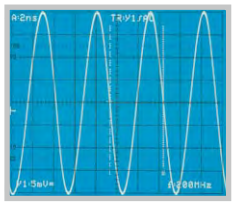
150MHz [200MHz] Analog Oscilloscope
HM1500-2 [HM2005-2]



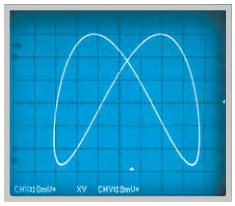
Even fast rising Edges do not cause Overshoot



Excellent dynamic Range Characteristics demonstrated with a 200MHz Signal



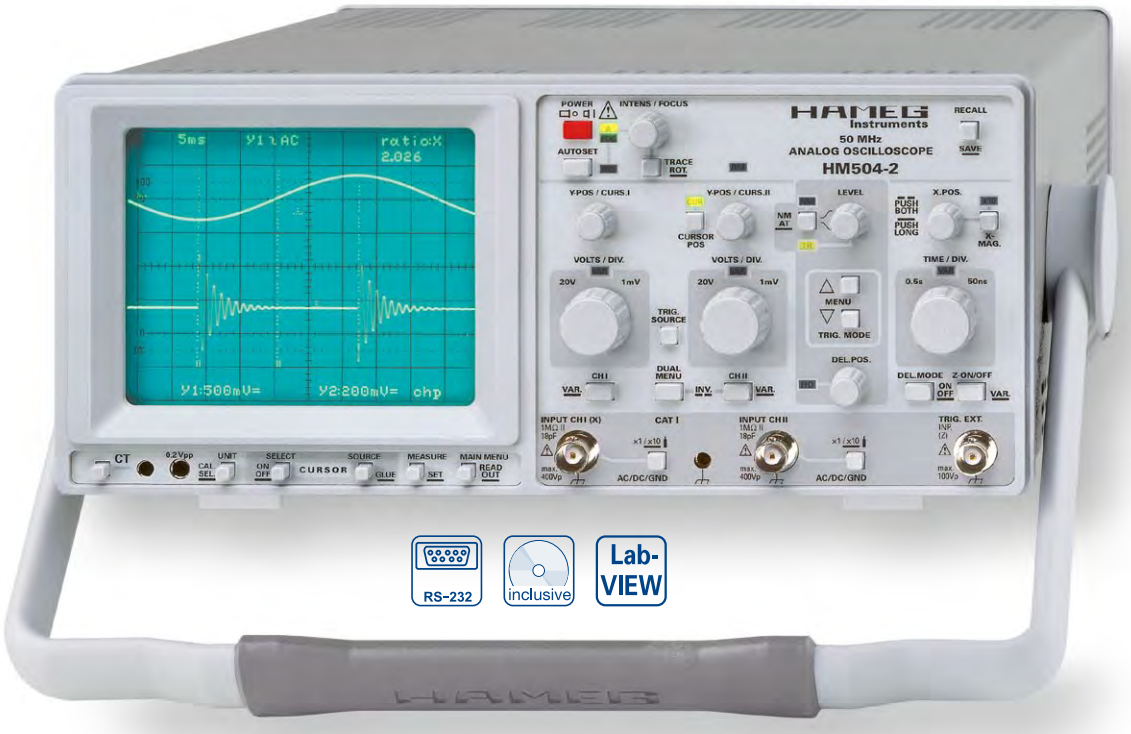
Lissajous Figure (XY Mode)



- ☑ 2 Channels with Deflection Coefficients 1mV/div....20V/div. [5V/div.]
- ☑ 2 Time Bases: 5ns/div....0.5s/div. and 5ns/div....20ms/div. [2ns/div....0.5s/div. and 2ns/div....20ms/div.]
- ☑ Low Noise Measuring Amplifiers with high Pulse Fidelity
- ☑ Videotrigger: odd and even Frames, Line Selection (525/60 and 625/50 Standard)
- ☑ 200MHz [250MHz] 6-Digit Frequency Counter, Cursor and automatic Measurement
- ☑ 14kV high writing Speed CRT, Readout, Autoset, Delay Line, no Fan
- ☑ Save/Recall Memories for Instrument Settings
- ☑ Help Function, Multilingual Menu
- ☑ RS-232 Interface (for Parameter Queries and Control only)

See page 66 [69] for technical specifications or www.hameg.com/HM1500 [www.hameg.com/HM2005]

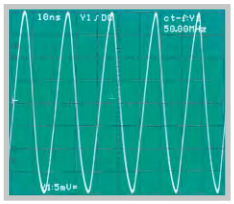
50MHz Analog Oscilloscope
HM504-2



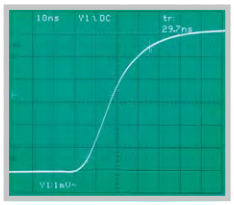
- ☑ 2 Channels with Deflection Coefficients 1mV/div....20V/div.
- ☑ Time Base 50ns/div....0.5s/div., with X Magnification to 10ns/div.
- ☑ Low Noise Measuring Amplifiers with high Pulse Fidelity
- ☑ Triggering 0...100MHz from 5mm Signal Level
- ☑ Time Base Delay provide high X Magnification of any Portion of the Signal
- ☑ 100MHz 4-Digit Frequency Counter, Cursor and Automatic Measurement
- ☑ Save/Recall Memories for Instrument Settings
- ☑ Readout, Autoset, no Fan
- ☑ Yt, XY and Component-Test Modes
- ☑ RS-232 Interface (for Parameter Queries and Control only)

See page 63 for technical specifications or www.hameg.com/HM504

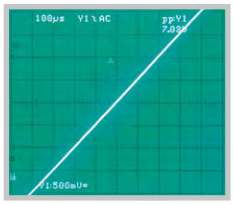
Full Screen Display of 50MHz Sine Wave



Rise-Time Measurement with Cursor

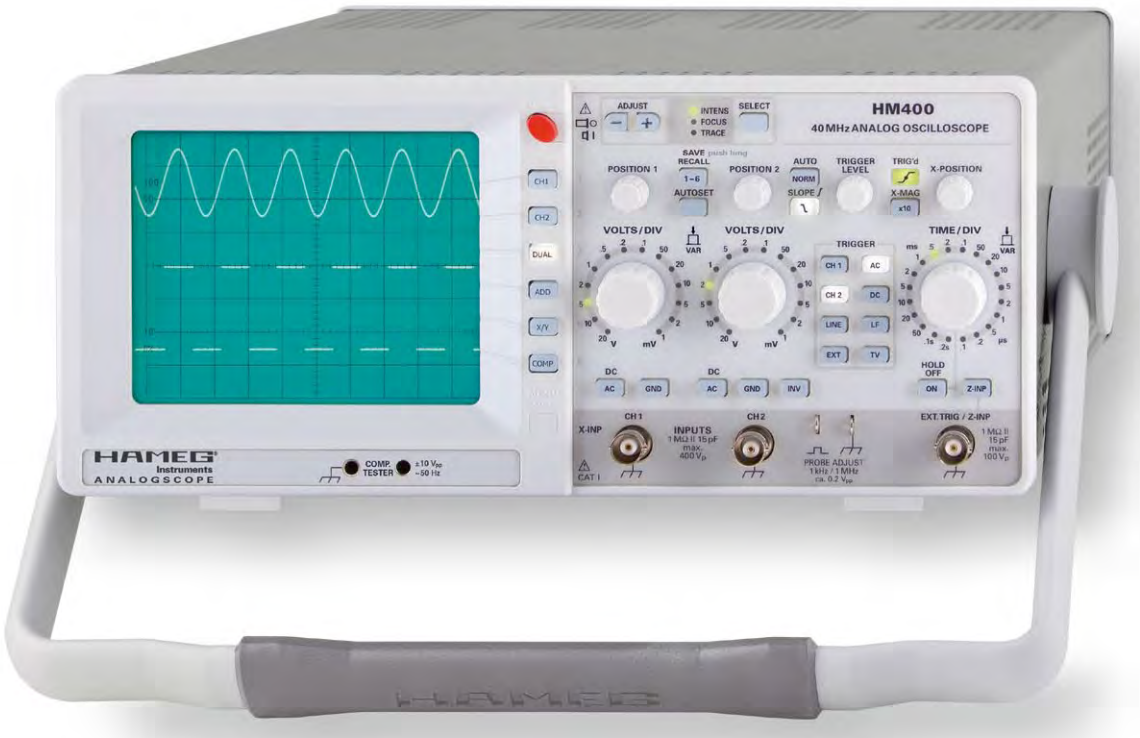


Optimum Deflection Linearity

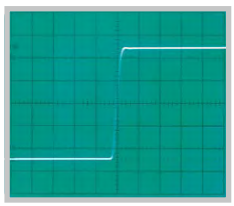


HM400

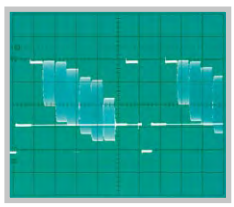
40MHz Analog Oscilloscope
HM400



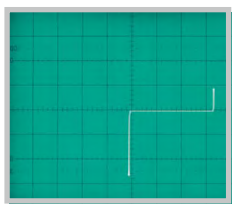
No Signal Distortion
resulting from Overshoot



Line triggered composite
Video Signal



Characteristic of a Z-Diode
with Component Test Mode



- ☑ **Reference-Class in Sensitivity and Input Voltage Range**
- ☑ 2 Channels with Deflection Coefficients 1mV/div....20V/div., variable up to 50V/div.
- ☑ Time Base 100ns/div....0.2s/div., with X Magnification to 10ns/div.
- ☑ Low Noise Measuring Amplifiers with high Pulse Fidelity and minimum Overshoot
- ☑ Peak to Peak Trigger for stable Triggering 0...50MHz at 0.5div. Signal Level (up to 80MHz at 1div.)
- ☑ Autoset, Save/Recall Memories for 6 Instrument Settings
- ☑ Yt- and XY-Mode with Z-Input for Intensity Modulation
- ☑ Component Characterisation with Component Tester (two Terminal Network Measurement) for use within Service etc.
- ☑ Low Power Consumption, no Fan

See page 63 for technical specifications or www.hameg.com/HM400

Spectrum Analysis

HAMEG
Spectrum Analysis

Change of paradigms in measurement technology

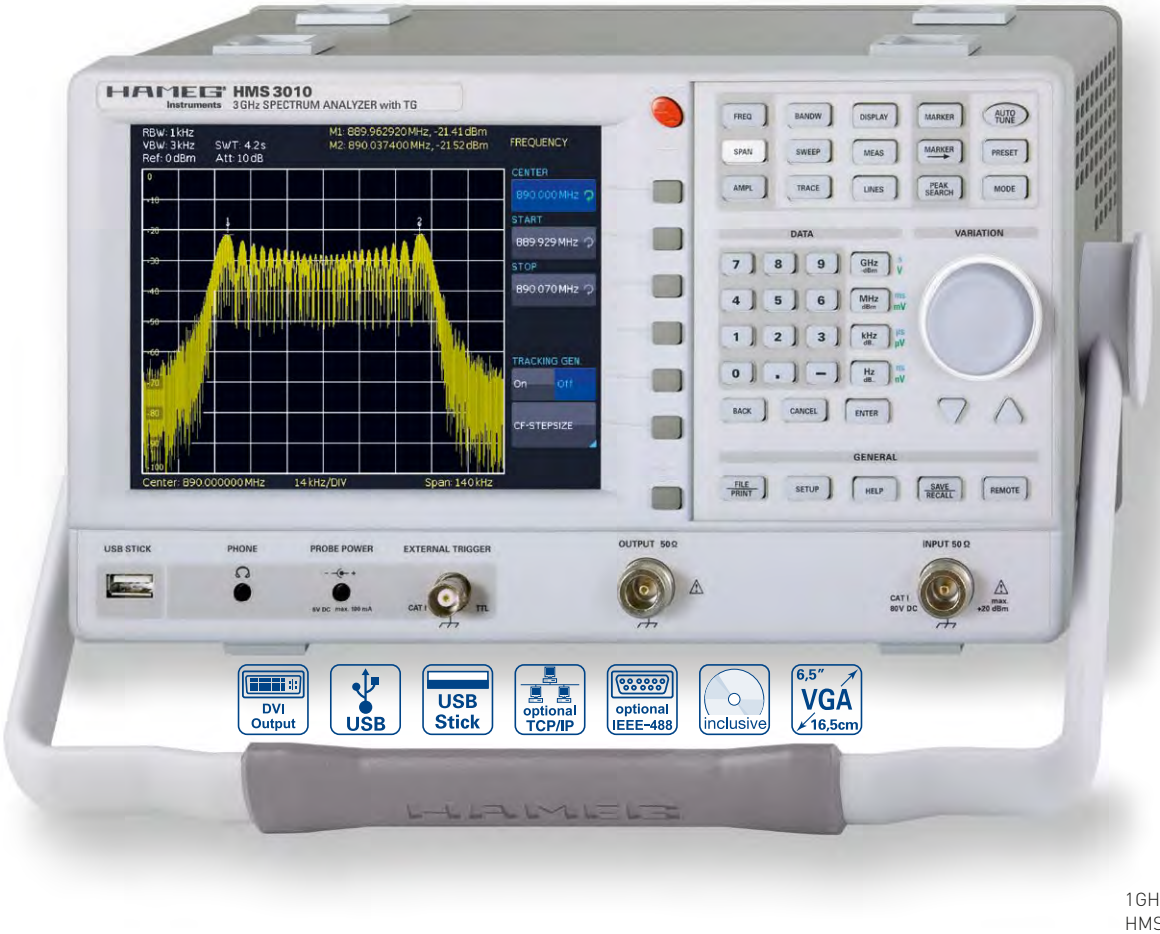
With the introduction of the modern HMS series spectrum analyzers, HAMEG started a change of paradigms in the design lab. Until a short time ago, this measurement technology was unaffordable for most users. HAMEG Instruments puts an end to this exclusivity by offering the HMS series – according to its tradition of delivering high performance measurement technology at a fair price. During the design, a practically oriented concept of instrument operation took highest priority so that the user can forget about the complex theory behind spectrum analysis. The increasing wide-spread use of wireless applications as well as the requirement for minimizing electromagnetic emissions from high performance digital systems caused a change of approach in design labs and test sites. While signal analysis in the time domain is well established, spectrum analysis is now starting to find its place on the lab bench.

The scope of applications of a spectrum analyzer in R & D, test sites, service and EMI testing is wide. Spectrum analyzers can display signals up into the GHz range. By employing the superhet receiver principle and using logarithmic signal processing and a logarithmically scaled display, their sensitivity exceeds that of oscilloscopes by more than 3 orders of magnitude and the dynamic range is markedly larger (>80 dB).

Caution – the sensitive measuring input is 50 ohms and easily destroyed! (Observe the maximum input power whenever measuring higher power signals!) It is hence recommended, whenever analysing unknown signals, to provide protective measures, e.g. to insert an attenuator of sufficient power rating at the input. When measuring signals with spectrum analyzers in the frequency domain, the phase information is lost, but in many practical applications this information is not required.

Spectrum analysis with HAMEG spectrum analyzers features a frequency range of up to 3 GHz and a large dynamic range; for transmission measurements instruments with a tracking generator are available which are easy to operate. Integrated interfaces for fast data communication with an external pc including free software for EMI pre-compliance test measurement functions, as well as the availability of a vast range of optional accessories (e.g. near-field probes for diverse measurements) promote HAMEG spectrum analyzers to be the „ideal partners" for a variety of applications including EMI tests and measurements on wireless systems such as UMTS, GSM, TETRA, DBV-T, Bluetooth, WLAN etc, ...

1GHz [3GHz] Spectrum Analyzer
HMS1000 [HMS3000]



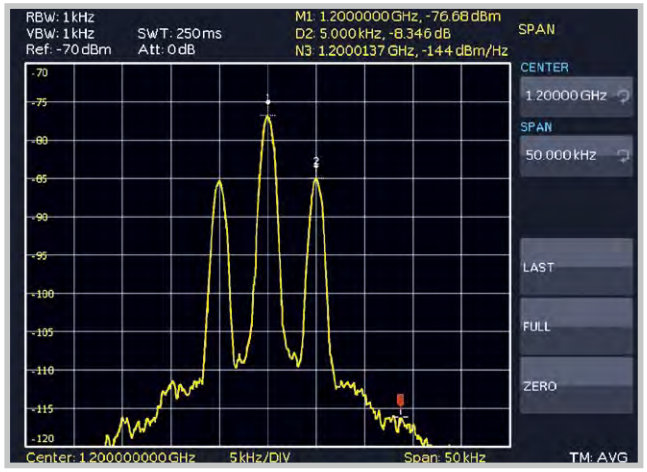
- ☑ Frequency Range 100kHz... 1GHz [3GHz]
- ☑ Tracking Generator HMS1010 [HMS3010] -20...0dBm
- ☑ Amplitude Measurement Range -114...+20dBm
  DANL -125dBm [-135dBm] with Preamp. Option HO3011
- ☑ Sweep Time 20ms...1000s
- ☑ Resolution Bandwidth 1kHz [100Hz]...1MHz in 1–3 Steps,
  200kHz (-3dB); additional [200Hz], 9kHz, 120kHz, 1MHz (-6dB)
- ☑ Spectral Purity <-100dBc/Hz (@100kHz)
- ☑ Video Bandwidth 10Hz...1MHz in 1–3 Steps
- ☑ Integrated AM and FM Demodulator (Phone and int. Speaker)
- ☑ Detectors: Auto-, Min-, Max-Peak, Sample, RMS, Quasi-Peak
- ☑ 8 Marker with Delta Marker, miscellaneous Peak Functions
- ☑ Crisp 16.5cm (6.5") TFT VGA Display, DVI Output
- ☑ 3 x USB for Mass-Storage, Printer and Remote Control
  optional IEEE-488 (GPIB) or Ethernet/USB Interface

See page 75 for technical specifications or www.hameg.com/HMS1010 [www.hameg.com/HMS3010]

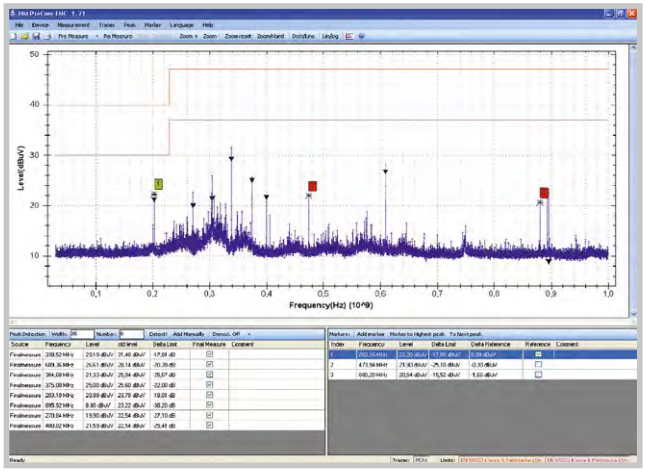
1GHz Spectrum Analyzer
HMS1000 without TG

3GHz EMI Near Field Probe
Set HZ550L

VSWR Test Unit HZ547



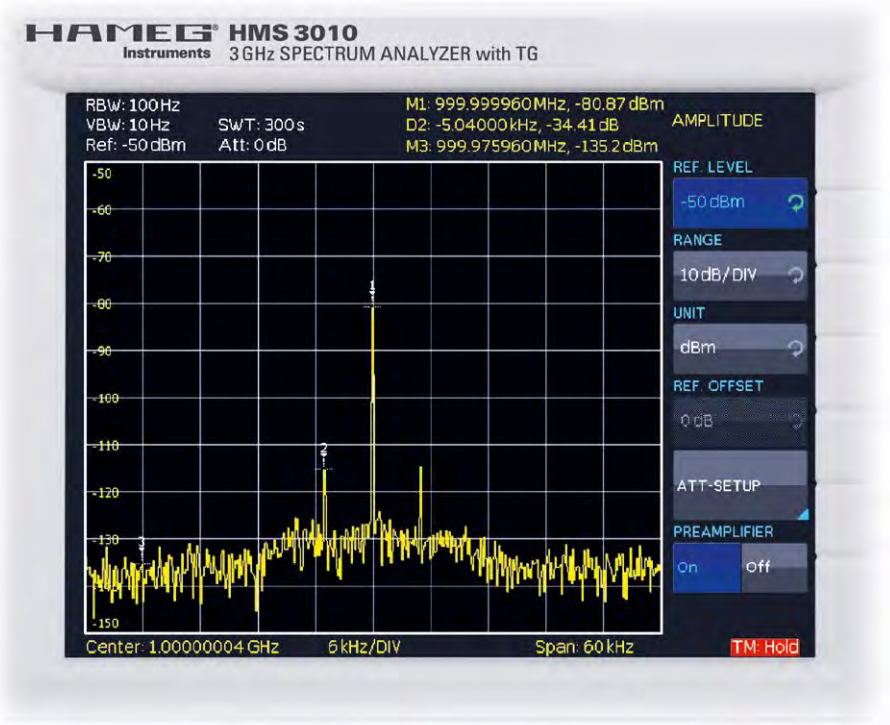
Absolut Marker M1; Delta Marker D2; Noise Marker N3



Screenshot of the free Pre-Compliance EMI PC Software

HO3011 Preamplifier

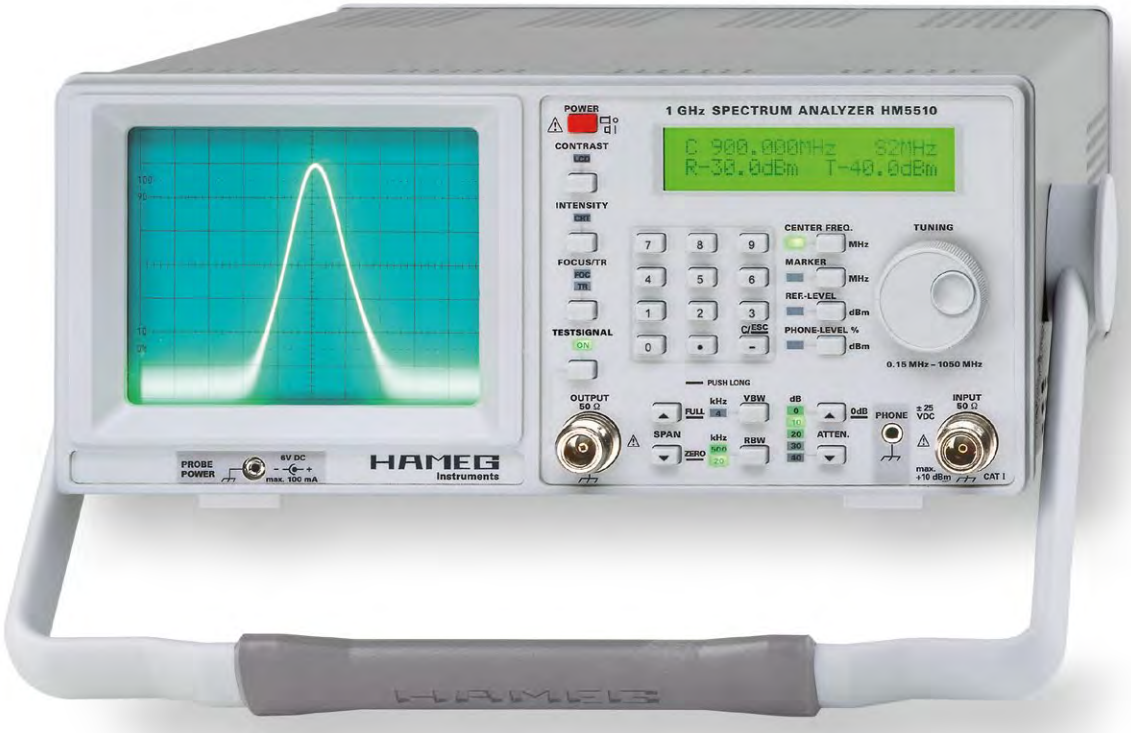
for all Spectrum Analyzer of the HMS Series



HO3011

- ☑ Preamplifier Option for HMS1000, HMS1010, HMS3000, HMS3010 (Licence Key)
- ☑ DANL -125 dBm typ. (1 kHz RBW) for HMS1000 and HMS1010
  DANL -135 dBm typ. (100 Hz RBW) for HMS3000 and HMS3010

1 GHz Spectrum Analyzer
HM5510

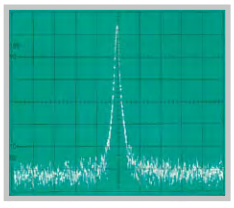


HM5510

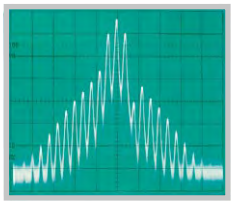
- ☑ Frequency Range 150kHz...1GHz
- ☑ Amplitude Measurement Range -100...+10dBm
- ☑ Phase synchronous, Direct Digital Frequency Synthesis (DDS)
- ☑ Resolution Bandwidths (RBW): 20kHz and 500kHz
- ☑ Keypad for Frequency and Amplitude Setting
- ☑ Analog Signal Processing and Display
- ☑ Test Signal Output

See page 74 for technical specifications or www.hameg.com/HM5510

Unmodulated RF Signal



Amplitude-modulated RF Signal

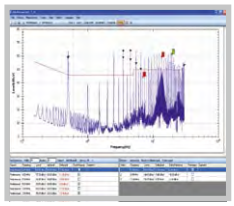


Line Impedance Stabilization Network HM6050-2

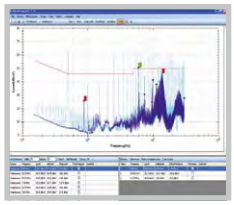
- ☑ Measurement of Line-conducted Interference within the Range from 9kHz...30MHz (CISPR 16)
- ☑ Switchable Transient Limiter
- ☑ Artificial Hand Connector

HM6050-2K
(UK Version, 230V)
HM6050-2S
(US Version, 115V)

Measurement
of Line-conducted
Interference: Fail



Measurement
of Line-conducted
Interference: Pass



Technical Specifications at 23°C ±2°C

Frequency Range:	9kHz...30MHz
Impedance Characteristics:	Z = 50Ω || (50µH + 5Ω), Error <20% under terms of VDE 876T1
Max. Current:	16A
Line Voltage/Frequency:	230V/50...60Hz, CAT II
Artificial Hand:	220pF + 511Ω
PE (switchable):	50µH || 50Ω

Transient Limiter

Frequency Range:	150kHz...30MHz
Transmission Loss:	10dB (+1.5/-0.5dB)

Connectors

Measurement Output:	50Ω BNC
Power Supply Socket for DUT:	Standard German (UK, US) electrical cases
Artificial Hand:	4mm banana socket
Power Cable:	fixed

Miscellaneous

Operating Temperature:	10...40°C
Power Supply:	HM6050-2D (DE Version) 230V ±10%, 50...60Hz HM6050-2K (UK Version) 230V ±10%, 50...60Hz HM6050-2S (US Version) 115V ±10%, 50...60Hz
Safety Class:	Safety class I (IEC1010-1/VDE 0411)
Dimensions and Weight:	285 x 125 x 380mm (W x H x D), approx. 6kg

HZ540/HZ550 EMV Near-Field Probe Set up to 3GHz

Image
HZ550L

HZ540 and HZ550 EMI-Near Field Probe Sets

The HZ540/550 are the ideal toolkits for the investigation of RF electromagnetic fields. They are indispensable for EMI pre-compliance testing during product development, prior to third party testing. The sets include 3 or 5 hand-held probes with built-in pre-amplifier covering the frequency range from <1MHz to approx. 3000MHz.

The probes of the basic set HZ540 include one magnetic field probe, one electric field probe, and a high impedance probe. In addition to the HZ550 features an optional µ-magnetic field probe and a passive radiation probe. All probe outputs are matched to the 50Ω inputs of spectrum analyzers or RF-receivers.

HZ550

Probe Set HZ540 (Basic Set)

HZ551	Electrical Field Probe
Frequency range:	<1MHz to approx. 3GHz
Directional sensitivity:	omnidirectional Sensitive to electrical fields
Output impedance:	50Ω; SMA-connector
Power supply:	$6V_{dc}$/80mA (directly by HAMEG Spectrum Analyzer)

HZ552	Magnetic Field Probe
Frequency range:	<30MHz to approx. 3GHz
Directional sensitivity:	similar to frame antenna Sensitive to changing magnetic fields
Output impedance:	50Ω; SMA-connector
Power supply:	$6V_{dc}$/50mA (directly by HAMEG Spectrum Analyzer)

HZ553	High Impedance Probe
Frequency range:	<1MHz to approx. 3GHz
Input capacity:	<2pF II approx. 250kΩ
Attenuation:	between 10:1 and 30:1
Max. input voltage:	$10V_{pp}$ (without significant distortion)
Max. voltage of a non-insulated conductor:	30V
Output impedance:	50Ω; SMA-connector
Power supply:	$6V_{dc}$/80mA (directly by HAMEG Spectrum Analyzer)

Physical dimensions:	13 x 27 x 70mm (W x H x D) (+ antenna at HZ551)
HZ540 consists of:	HZ551 Electrical Field Probe HZ552 Magnetic Field Probe HZ553 High Impedance Probe 1 SMA to N-Cable 1.2m Case Manual

Probe Set HZ550

HZ554	Magnetic Field Probe (small sensor)
Frequency range:	<50MHz to approx. 3GHz
Directional sensitivity:	Sensitive to changing magnetic fields High spatial resolution due to very small sensor area
Max. voltage of a non-insulated conductor:	30V
Output impedance:	50Ω; SMA-connector
Power supply:	$6V_{dc}$/50mA

HZ556	Radiation Probe
Frequency range:	<30MHz to approx. 3GHz
Directional sensitivity:	like frame antenna Radiation of changing magnetic fields
Max. input power:	0.5W (short term)
Output impedance:	50Ω; SMA-connector
Power supply:	not required; passive probe

Physical dimensions:	13 x 27 x 70mm (W x H x D) (+ antenna at HZ551)
HZ550 consists of:	1 HZ540 Basic Set 1 HZ554 Magnetic Field Probe 1 HZ556 Radiation Probe 1 SMA to N-Cable 1.2m

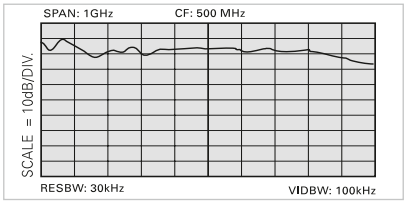
Probe Set HZ540L and HZ550L

HZ540L = HZ540 (without HZ553) + HZ555 Low Capacitance Probe
HZ550L = HZ550 (without HZ553) + HZ555 Low Capacitance Probe

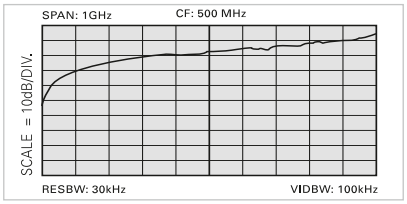
HZ555	**Low Capacitance Probe**
Frequency range:	approx. 400kHz...3GHz
Input impedance:	<0.2pF // 250kΩ
Attenuation:	10:1
Max. input voltage:	$5V_{pp}$
Max. voltage of a non-insulated conductor:	30V
Output impedance:	50Ω; SMA-connector
Power supply:	$6V_{dc}$/80mA

HZ530 EMV Near-Field Probe Set up to 1GHz

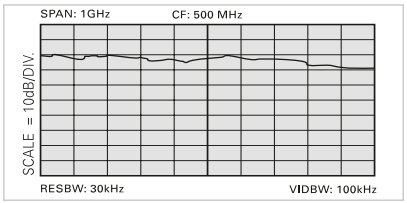
Typical frequency response E-field probe



Typical frequency response H-field probe



Typical frequency response high-impedance probe



Technical specifications at 23°C ±2°C

Frequency Range:	100kHz...1GHz
Supply Voltage:	$6V_{dc}$ from Spectrum Analyzer or batteries, 4x Mignon/AA, not included
Supply Current:	approx. 10...24mA DC
Probe Dimensions:	40 x 90 x 195mm (W x H x D)
Cases:	plastic, internal electrical shielding
Set includes:	1 E-field probe 1 H-field probe 1 high-impedance probe 1 BNC cable 1.5m 1 power cable Operator's Manual Robust carrying case

The HZ530 Probe Set consists of three active broadband probes for EMI diagnosis. The probes are designed for connection to a HAMEG spectrum analyzer with input impedance of 50Ω. The probes can be powered by the spectrum analyzer or batteries. The slim format ensures easy access to the test object even in cramped test environments.

The H-field probe provides a signal that is proportional to the magnetic field strength to the spectrum analyzer. This makes it possible to localize sources of interference with relatively high precision.

The high-impedance probe can be used to determine interference levels on contacts, lines and printed circuit boards.

The E-field probe is the most sensitive of the three probes. It can be used to assess the total effect of shielding and filtering in a tested unit.

Power Supplies

HAMEG
Power Supplies

Keeping things simple – One for All

The power supplies market is highly partitioned. The user is faced with a seemingly unlimited number of models with diverse specifications, the result being the accumulation of a whole assembly of power supplies in the design lab or test site, the better part of which are rarely used.

HAMEG Instruments' two types of power supplies (**HM8143** and **HMP4040**) cover numerous applications; each type excels by being universally applicable, simple to operate, its compactness, and an unexcelled price/performance ratio. Test sites especially value this advantage because universal instruments minimize set-up times. The power supply portfolio consists in total of 6 types in order to also care for smaller budgets.

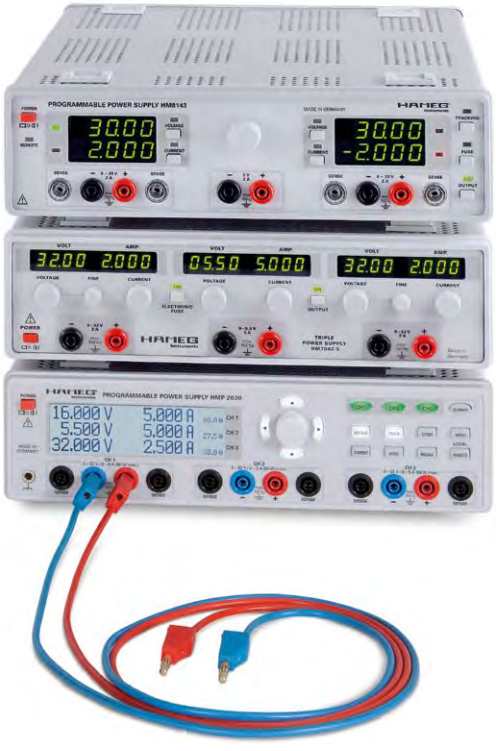
In the **HMP** series there are two 200 W and two 400 W types available which cover the range of 0...32 V and up to 10 A, depending on the number of channels required. This series is based on a classical concept with a mains transformer, high efficiency electronic pre regulators and linear post regulators. This concept yields the high power in the smallest space with the highest efficiency. The HMP series further excels by its intelligent power management which allows higher currents (e.g. up to 10 A) at medium voltages (e.g. up to 16 V) to be made available. Excellent low residual ripple voltages (150 μV_{rms}) are realized even at full power output.

The high adjustment and back-reading resolution of up to 1 mV/0.1 mA fulfills even the strictest requirements. Last but not least there is the **EasyArb** function available on all channels which allows you to program simple arbitrary voltage and current waveforms.

The **HM8143** resides in the 130 W class and is unique in its class with its two 0...32 V/2 A two-quadrant outputs which can operate as source and **sink** outputs. It also features an arbitrary function, and its output voltage may be modulated via an external input. In the past 20 years, literally thousands of users, predominately in test sites, used this type and its predecessor, the HM8142, taking advantage of its flexibility to realize numerous applications.

The **HM7042-5** with 2 x 0...32 V/2 A and 0...5.5 V/5 A is our best selling power supply for many years and became indispensable in many labs.

All power supplies feature galvanically isolated floating overload and short-circuit proof outputs and may be connected in series or in parallel, thus making very high currents and voltages available. A precondition is the common electronic fuse which disconnects all channels simultaneously in case of a fault. The HMP series also provides an extended **FuseLink** system which allows individual logic combinations.



Programmable 3[4] Channel High-Performance Power Supply HMP4030 [HMP4040]

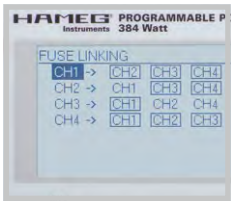
USB · RS-232 · optional TCP/IP · optional IEEE-488 · inclusive · Lab-VIEW

- ☑ 3 x 0...32V/0...10A 384W max.
  [4 x 0...32V/0...10A 384W max.]
- ☑ 384W Output Power realized by intelligent Power Management
- ☑ Low Residual Ripple: <150µV_{rms} due to linear Post Regulators
- ☑ High Setting- and Read-Back Resolution of 1mV up to 0.2mA
- ☑ Keypad for direct Parameter Entry
- ☑ Galvanically isolated, earth-free and short circuit protected Output Channels
- ☑ Advanced Parallel- and Serial Operation via V/I Tracking
- ☑ EasyArb Function for free definable V/I Characteristics
- ☑ FuseLink: Individual Channel Combination of Electronic Fuses
- ☑ Free adjustable Overvoltage Protection (OVP) for all Outputs
- ☑ All Parameters clearly displayed via LCD/Glowing Buttons
- ☑ Rear Connectors for all Channels including Sense
- ☑ USB/RS-232 Interface, optional Ethernet/USB or IEEE-488 (GPIB)

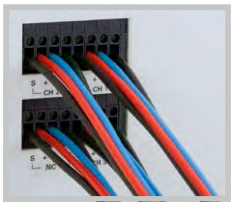
See page 77 for technical specifications or www.hameg.com/HMP4030 [www.hameg.com/HMP4040]

3 Channel Version
HMP4030

Individual Linking of single Channels using FuseLink



Rear Outputs for simple Integration in Rack Systems



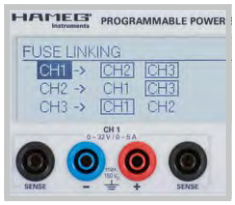
HMP2030

Programmable 2[3] Channel High-Performance Power Supply HMP2020 [HMP2030]

USB · RS-232 · optional TCP/IP · optional IEEE-488 · inclusive · Lab-VIEW

2 Channel Version HMP2020

Individual Linking of single Channels using FuseLink



Rear Outputs for simple Integration in Rack Systems

- ☑ 1 x 0...32V/0...10A 1 x 0...32V/0...5A 188W max. [3 x 0...32V/0...5A 188W max.]
- ☑ 188W Output Power realized by intelligent Power Management
- ☑ Low Residual Ripple: <150µV_{rms} due to linear Post Regulators
- ☑ High Setting- and Read-Back Resolution of 1mV up to 0.1mA
- ☑ Galvanically isolated, earth-free and short circuit protected Output Channels
- ☑ Advanced Parallel- and Serial Operation via V/I Tracking
- ☑ EasyArb Function for free definable V/I Characteristics
- ☑ FuseLink: Individual Channel Combination of Electronic Fuses
- ☑ Free adjustable Overvoltage Protection (OVP) for all Outputs
- ☑ All Parameters clearly displayed via LCD/Glowing Buttons
- ☑ Rear Connectors for all Channels including Sense
- ☑ USB/RS-232 Interface, optional Ethernet/USB or IEEE-488 (GPIB)

See page 77 for technical specifications or www.hameg.com/HMP2020 [www.hameg.com/HMP2030]

Triple Power Supply
HM7042-5

- ☑ 2 x 0...32V/0...2A 1 x 0...5.5V/0...5A
- ☑ High-Performance and inexpensive Laboratory Power Supply
- ☑ Floating, overload and short-circuit proof Outputs
- ☑ Separate Voltage and Current Displays for each Output
  4 Digits at Channel 1+3; 3 Digits at Channel 2
- ☑ Display Resolution:
  10mV/1mA at Channel 1+3; 10mV/10mA at Channel 2
- ☑ Protection of sensitive Loads by Current Limit or Electronic Fuse
- ☑ Pushbutton for Activating/Deactivating all Outputs
- ☑ Low Residual Ripple, high Output Power, very good Regulation
- ☑ Parallel (up to 9A) and Series (up to 69.5V) Operation
- ☑ Temperature-controlled Fan

See page 76 for technical specifications or www.hameg.com/HM7042

HZ42 19" Rackmount Kit 2RU

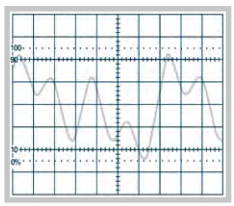
Silicone Test Cable HZ10S

HM8143

Arbitrary Power Supply
HM8143

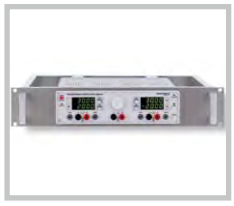
USB · RS-232 · optional IEEE-488 · inclusive

AF Arbitrary Signal



HO880 IEEE-488 (GPIB) Interface (Option)

HZ42 19" Rackmount Kit 2RU



- ☑ 2 x 0...30V/0...2A 1 x 5V/0...2A
- ☑ Display Resolution 10mV/1mA
- ☑ Parallel (up to 6A) and Series (up to 65V) Operation
- ☑ Electronic Load up to 60W per Channel (max. 2A)
- ☑ Arbitrary Waveform Power Supply (4096 Points, 12 Bit): Creation of customized Waveforms
- ☑ Software for Remote Control and for Creation of Arbitrary Waveforms
- ☑ Electronic Fuse and Tracking Mode for 30V Outputs
- ☑ External Modulation of Output Voltages: Input Voltage 0...10V, Bandwidth 50kHz
- ☑ SENSE Lines for Compensation of the Voltage drop across the Cables
- ☑ Multimeter Mode for all adjustable Outputs
- ☑ Galvanically isolated USB/RS-232 Interface, optional IEEE-488 (GPIB) in HM8143G

See page 76 for technical specifications or www.hameg.com/HM8143

Oscilloscopes

Spectrum Analysis

Power Supplies

Programmable Measuring Instruments Series 8100

Modular System Series 8000

Options

Accessories

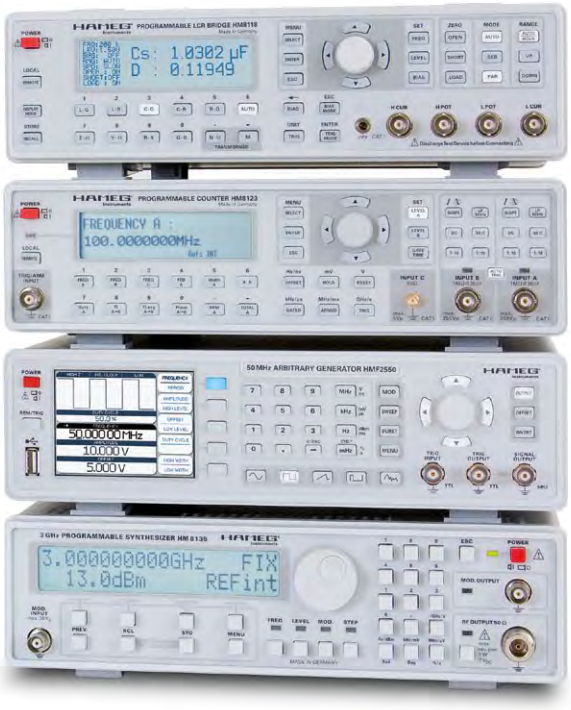
Specifications

HAMEG Programmable Measuring Instruments Series 8100

HAMEG Programmable Measuring Instruments Series 8100...

...are ideally suited for test installations in production and automated tests in laboratories. They support either an USB/RS-232, or an IEEE-488 (GPIB) interface and thus may be easily integrated in any test system. In combination with other HAMEG remote controlled instruments high performance test systems may be easily and cost effectively set up. Of course, any of these instruments can be operated manually and used in laboratories.

The 6½ Digit Precision Multimeter **HM8112-3**, the 8kW Power Meter **HM8115-2**, the LCR Bridge **HM8118**, the 3GHz Universal Counter **HM8123** as well as the new 25MHz and 50MHz Arbitrary Function Generators **Series HMF** are high performance precision measuring instruments for research and development labs, industry, universities, test and production facilities as well as for service. The RF signal generators **HM8134-3** and **HM8135** are high precision synthesizers with a frequency range of 1Hz to 1.2GHz respectively 3GHz. The 12.5MHz Function Generator **HM8150** uses direct digital frequency synthesis (DDS) for the generation of stable low distortion signals and guarantees optimum performance.



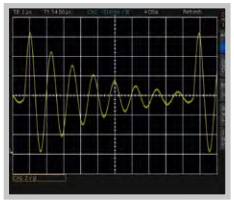
25MHz [50MHz] Arbitrary Function Generator HMF2525 [HMF2550]

USB | RS-232 | USB Stick | optional TCP/IP | optional IEEE-488 | inclusive

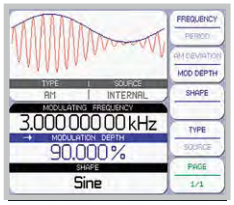
- ☑ Frequency Range 10µHz...25MHz [50MHz]
- ☑ Output Voltage 5mV$_{pp}$...10V$_{pp}$ (into 50Ω) DC Offset ±5mV...5V
- ☑ Arbitrary Waveform Generator: 250MSa/s, 14Bit, 256kPts
- ☑ Sine, Square, Pulse, Triangle, Ramp, Arbitrary Waveforms incl. Standard Curves (white Noise, Cardiac etc.)
- ☑ Total harmonic Distortion 0.04% (f <100kHz)
- ☑ Burst, Sweep, Gating, external Trigger
- ☑ Rise Time <8ns, in Pulse Mode 8...500ns Variable-Edge-Time
- ☑ Pulse Mode: Frequency Range 100µHz...12.5MHz [25MHz], Pulse Width 10ns...999s, Resolution 5ns
- ☑ Modulation Modes AM, FM, PM, PWM, FSK (int. and ext.)
- ☑ 10MHz Timebase: ±1ppm TCXO, rear I/O BNC Connector
- ☑ Front USB Connector: Recall of Waveforms
- ☑ 8.9cm (3.5“) TFT: crisp Representation of the Waveform and all Parameters
- ☑ USB/RS-232 Dual-Interface, optional Ethernet/USB or IEEE-488 (GPIB)

See page 85 for technical specifications or www.hameg.com/HMF2525 [www.hameg.com/HMF2550]

Generation of complex Waveforms with 256kPts in 14Bit



All Parameters at a Glance on the 3.5“ TFT and interactive Softkeys



Ethernet/USB-Interface HO730 for industrial Use (Option)

6½-Digit Precision Multimeter
HM8112-3

USB · RS-232 · optional IEEE-488 · Lab-VIEW

HM8112-3S: Multimeter with built-in Scanner Card (8+1 Channels, 2- and 4-Wire)

HZ42 19" Rackmount Kit 2RU

Precise Temperature Measurement with Sensor

- ☑ 6½-Digit Display (1,200,000 Counts)
- ☑ Resolution: 100nV, 100pA, 100µΩ, 0.01°C/F
- ☑ DC Basic Accuracy 0.003%
- ☑ 2-Wire/4-Wire Measurements
- ☑ Measurement Intervals adjustable from 0.1...60s
- ☑ Up to 100 Measurements transmitted to PC per Second
- ☑ True RMS Measurement, AC and DC+AC
- ☑ Mathematic Functions: Limit Testing, Minimum/Maximum, Average and Offset
- ☑ Temperature Measurements with Platinum (PT100/PT1000) and Ni (K and J types) Sensors
- ☑ Internal Data Logger for up to 32,000 Measurement Results
- ☑ Offset Correction
- ☑ Galvanically isolated USB/RS-232 Interface, optional IEEE-488 (GPIB)
- ☑ Optional: Scanner Card (8+1 Channels each 2- and 4-Wire)

See page 78 for technical specifications or www.hameg.com/HM8112

8kW Power Meter
HM8115-2

USB · RS-232 · optional IEEE-488 · Lab-VIEW

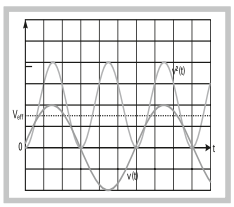
HM8115-2

- ☑ Wide Measurement Range 1mW...8kW
- ☑ Voltage Range 100mV...500V, Current Range 1mA...16A
- ☑ Frequency Range DC...1kHz
- ☑ Simultaneous Voltage, Current and Power Display
- ☑ Display of apparent, effective and reactive Power
- ☑ Power Factor Display
- ☑ Autoranging, simple Operation
- ☑ Monitor Output (BNC) representing the instantaneous Active Power
- ☑ Suitable for Measurements on Frequency Converters
- ☑ Software for Remote Control and Data Acquisition included
- ☑ Galvanically isolated USB/RS-232 Interface, optional IEEE-488 (GPIB)

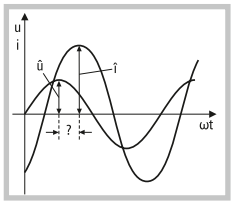
See page 79 for technical specifications or www.hameg.com/HM8115

HZ815 Power Adapter

RMS Value



Active Power



HM8118

200kHz LCR-Bridge
HM8118

HZ188 4 Wire SMD
Test Fixture
(included in Delivery)

HZ184 Kelvin Clip Leads
(included in Delivery)

HZ181 4 Wire Test Fixture
with Shorting Plate

- ☑ Basic Accuracy 0.05%
- ☑ Measurement Functions L, C, R, |Z|, X, |Y|, G, B, D, Q, Θ, Δ, M, N
- ☑ Test Frequencies 20Hz...200kHz
- ☑ Up to 12 Measurements per Second
- ☑ Parallel and Series Mode
- ☑ Binning Interface HO118 (optional) for automatic Sorting of Components
- ☑ Internal programmable Voltage and Current Bias
- ☑ Transformer Parameter Measurement
- ☑ External Capacitor Bias up to 40V
- ☑ Kelvin Cable and 4 Wire SMD Test Adapter included in Delivery
- ☑ Galvanically isolated USB/RS-232 Interface, optional IEEE-488 (GPIB)

See page 80 for technical specifications or www.hameg.com/HM8118

3GHz Programmable Counter HM8123

USB · RS-232 · optional IEEE-488 · Lab-VIEW

- ☑ Measurement Range 0Hz...3GHz
- ☑ 2 Measurement Inputs DC...200MHz, 1 Measurement Input 100MHz...3GHz
- ☑ Input Impedance A/B: 1MΩ/50Ω (switchable), Sensitivity 25mV$_{rms}$
- ☑ Input Impedance C: 50Ω, Sensitivity 30mV$_{rms}$
- ☑ 400MHz Time Base with 0.5ppm Stability
- ☑ 10-Digit Resolution at 10s Gate Time
- ☑ 9 Measurement Functions, external Gate and Arming
- ☑ Input for external Time Base (10MHz)
- ☑ Standard: TCXO (Temperature Stability: ±0.5 x 10^{-6})
  Optional: OCXO (Temperature Stability: ±1 x 10^{-8})
- ☑ Intuitive One-Pushbutton Operation each Function directly addressable
- ☑ Galvanically isolated USB/RS-232 Interface, optional IEEE-488 (GPIB)

See page 81 for technical specifications or www.hameg.com/HM8123

HZ33, HZ34
Test Cable BNC/BNC

HZ42 19" Rackmount Kit 2RU

HZ20 Connector
BNC to 4mm Socket

HM8134-3

1.2GHz RF-Synthesizer
HM8134-3

USB RS-232 optional IEEE-488

- ☑ Outstanding Frequency Range 1Hz...1.2GHz
- ☑ Output Power -127...+13dBm
- ☑ Frequency Resolution 1Hz (Accuracy 0.5ppm)
- ☑ Input for external Time Base (10MHz)
- ☑ Modulation Modes: AM, FM, Pulse, Φ, FSK, PSK
- ☑ Rapid Pulse Modulation: typ. 200ns
- ☑ Internal Modulator (Sine Wave, Square Wave, Triangle, Sawtooth) 10Hz...150kHz
- ☑ High spectral Purity
- ☑ 10 Configuration Memories including Turn-On Configuration
- ☑ Standard: TCXO (Temperature Stability: ±0.5 x 10^{-6})
  Optional: OCXO (Temperature Stability: ±1 x 10^{-8})
- ☑ Galvanically isolated USB/RS-232 Interface, optional IEEE-488 (GPIB)

See page 82 for technical specifications or www.hameg.com/HM8134

HZ42 19" Rackmount Kit 2RU

HO880 IEEE-488 (GPIB) Interface (Option)

3GHz RF-Synthesizer
HM8135

USB RS-232 optional IEEE-488

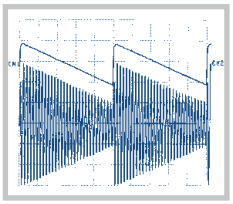
HM8135

- ☑ Outstanding Frequency Range 1Hz...3GHz
- ☑ Output Power -135...+13dBm
- ☑ Frequency Resolution 1Hz (Accuracy 0.5ppm)
- ☑ Input for external Time Base (10MHz)
- ☑ Modulation Modes: AM, FM, Pulse, Φ, FSK, PSK
- ☑ Rapid Pulse Modulation: typ. 200ns
- ☑ Internal Modulator (Sine Wave, Square Wave, Triangle, Sawtooth) 10Hz...200kHz
- ☑ High spectral Purity
- ☑ 10 Configuration Memories including Turn-On Configuration
- ☑ Standard: TCXO (Temperature Stability: ±0.5 x 10^{-6})
  Optional: OCXO (Temperature Stability: ±1 x 10^{-8})
- ☑ Galvanically isolated USB/RS-232 Interface, optional IEEE-488 (GPIB)

See page 83 for technical specifications or www.hameg.com/HM8135

HO880 IEEE-488 (GPIB) Interface (Option)

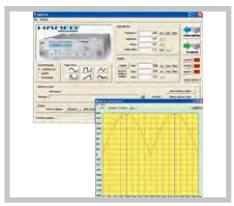
Internal Modulation Source



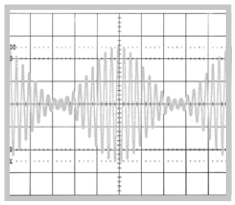
12.5MHz Arbitrary Function Generator HM8150

USB · RS-232 · optional IEEE-488 · inclusive · Lab-VIEW

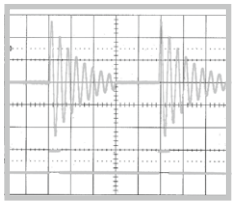
Gated Sine Wave, PC-Software included



Amplitude-modulated Sine Wave



Triggered Arbitrary Signal



- ☑ Frequency Range 10mHz...12.5MHz
- ☑ Output Voltage 10mV$_{pp}$...10V$_{pp}$ (into 50Ω)
- ☑ Waveforms: Sine Wave, Square Wave, Triangle, Pulse, Sawtooth, Arbitrary
- ☑ Rise and Fall Time <10ns
- ☑ Pulsewidth Adjustment: 100ns...80s
- ☑ Arbitrary Waveform Generator 40MSa/s
- ☑ Burst, Gating, External Triggering, Sweep
- ☑ Software for Remote Control and for Creation of Arbitrary Waveforms
- ☑ External Amplitude Modulation (Bandwidth 20kHz)
- ☑ Intuitive Operation with one touch of a Button – quick Change of Signals
- ☑ Galvanically isolated USB/RS-232 Interface, optional IEEE-488 (GPIB)

See page 84 for technical specifications or www.hameg.com/HM8150

HAMEG
Modular System Series 8000

In many years of practical application...

...the HAMEG Modular System Series 8000 has proven its value to the customer. The advantages of this Modular System have been demonstrated by several 100,000 modules sold. The unexcelled price-performance ratio and the enormous flexibility of the plug-in system allow you to adapt your measurement setups quickly and cost effectively to changing requirements. You save space by stacking up to 5 instruments. This will offer you 10 instruments in a minimum of space. The top covers of the instruments feature receptacles for the feet of the instrument above. The mainframes thus cannot move and may also be stacked together with other HAMEG instruments like power supplies, spectrum analyzers and oscilloscopes.

The blank module **HM800** is available for your own designs to be integrated with the other measuring instruments. The power supply voltages necessary are available from the mainframe. Especially for schools and training centers the Modular System Series 8000 offers a cost effective flexible alternative to conventional measuring equipments. As the mainframe **HM8001-2** allows the simultaneous operation of two modules in any combination most often a single such basic unit will be all that is needed for a student in a laboratory. The modules necessary will be issued to the students depending on the requirements of the specific exercise.

The Modular System Series 8000 offers, in addition to the mainframe **HM8001-2** and the blank module **HM800**, the 4¾-Digit Programmable Multimeter **HM8012**, the LCR-Meter **HM8018**, the 1.6GHz Universal Counter **HM8021-4**, the 10MHz Function Generator **HM8030-6** and the Triple Power Supply **HM8040-3**.

Mainframe
HM8001-2

The Mainframe is supplied without the Modules shown in the Illustration

HM8001-2

- ☑ Basic Unit for Modules of the Modular System Series 8000
- ☑ Power Supply for 2 Modules
- ☑ DC Voltages electronically regulated, floating and short-circuit proof
- ☑ Power Transformer with thermal Fuse
- ☑ Up to 5 Mainframes can be stacked
- ☑ Module HM800 for customized Instrument Construction available
- ☑ 4 BNC Connectors on the Rear Panel of the HM8001-2 (Option HO801) provide for Signal Transmission to or from HM8021-4 and HM8030-6 Modules

See page 86 for technical specifications or www.hameg.com/HM8001

Modular System

HM8001-2 Mainframes can be stacked up to 5 Units high

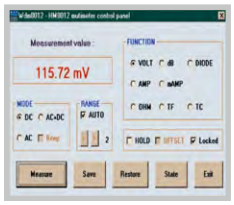
Option HO801 – 4 BNC Connectors on Rear Panel

HM8012

4¾-Digit Programmable Multimeter HM8012

HZ15 (included)

WDM8012 Software (included)



inclusive

RS-232

Mainframe HM8001-2 required for Operation

- ☑ 4¾-Digit Display with 50,000 Counts
- ☑ Basic Accuracy 0.05%
- ☑ Max. Resolution: 10µV, 0.01dBm, 10nA, 10mΩ, 0.1°C
- ☑ Offset Function/Relative Value Measurement
- ☑ RS-232 Interface and Software included

See page 86 for technical specifications or www.hameg.com/HM8012

HM8018

LCR-Meter HM8018

Option HZ19 SMD Test Tweezers

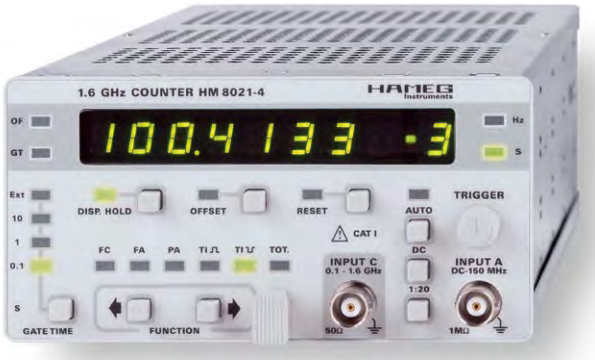
Option HZ18 Kelvin Test Lead

Mainframe HM8001-2 required for Operation

- ☑ Measurement Functions: L, C, R, Θ, Q/D, |Z|
- ☑ Basic Accuracy 0.2%
- ☑ 5 Measurement Frequencies: 100Hz, 120Hz, 1kHz, 10kHz, 25kHz
- ☑ Max. Resolution: 0.001Ω, 0.001pF, 0.01µH
- ☑ 2- and 4-Wire Measurement, parallel and series Mode

See page 87 for technical specifications or www.hameg.com/HM8018

1.6GHz Universal Counter HM8021-4



Mainframe HM8001-2
required for Operation

HZ33, HZ34
Test Cable BNC/BNC

- ☑ Measurement Range 0Hz...1.6GHz
- ☑ 10MHz Time Base with 1ppm Stability (TCXO)
- ☑ Input A: Input Impedance 1MΩ, Sensitivity 20mV$_{rms}$
  Input C: Input Impedance 50Ω, Sensitivity 30mV$_{rms}$
  8-Digit Resolution for 10s Measuring Time
- ☑ Time Interval Resolution up to 10ps
- ☑ External Gate Input (with Option HO801)

See page 88 for technical specifications or www.hameg.com/HM8021

HM8021-4

10MHz Function Generator HM8030-6

Option HO801, page 41

Mainframe HM8001-2
required for Operation

- ☑ Frequency Range 50mHz...10MHz,
  Output Voltage up to 10V$_{pp}$ (into 50Ω)
- ☑ Waveforms: Sine Wave, Triangle, Square Wave, Pulse, DC
- ☑ Distortion Factor <0.5% up to 1MHz,
  Rise and Fall Time typ. 15ns
- ☑ Internal and external Sweep, FM (with HO801)
- ☑ Surge- and short-circuit-proof Output

See page 88 for technical specifications or www.hameg.com/HM8030

HM8030-6

HM8040-3

Triple Power Supply
HM8040-3

Mainframe HM8001-2
required for Operation

Silicone Test Lead HZ10R

- ☑ 2 x 0...20V/0.5A 1 x 5V/1A
- ☑ 3-Digit switchable Displays (Display Resolution 0.1V/1mA)
- ☑ Pushbutton for Activating/Deactivating all Outputs
- ☑ Adjustable Current Limiting and Electronic Fuse
- ☑ Low Residual Ripple and Low Noise

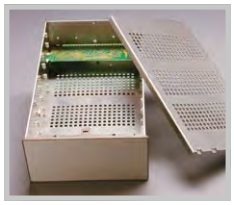
See page 89 for technical specifications or www.hameg.com/HM8040

HM800

Blank Module
HM800

Mainframe HM8001-2
required for Operation

Open Blank Module



- ☑ Module for customized Instrument Construction
- ☑ Guide Rails for Mounting Circuit Boards at 4 different Levels
- ☑ Plastic Front Panel for easy Processing
- ☑ Power is supplied by the Mainframe HM8001-2
- ☑ Available Supply Voltages, Load Capability
  see Manual of HM800

www.hameg.com/HM800

Options

HO79-6 Multifunction Interface

- ☑ Bidirectional Data Transfer
  SCPI programming Commands
  Direct printing of the Signal (without PC)
- ☑ **IEEE-488 Interface**
  IEEE-488 (GPIB) compliant Socket (24-pin)
  Talk-only mode
  Device Mode (Address selectable from 1 to F)
- ☑ **RS-232 Interface** full Duplex (V.24)
  9-pin Connection to D-Sub Socket
  Automatic Baud Rate recognition
  Baud Rate from 1,200...115,200 Baud
- ☑ **Parallel Interface** (Centronics)
  25-pin Connection to D-Sub Socket
  PostScript, HPGL, PCL and EPSON
- ☑ For the Oscilloscope HM507

IEEE-488 I(GPIB)
Interface Cable HZ72

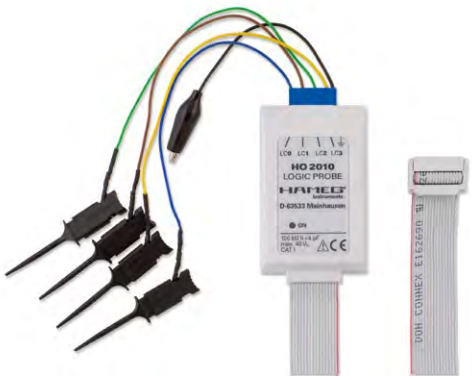
HO118 Binning Interface

The binning interface option HO118 within the HM8118 enables the LCR bridge to control an external binning hardware in order to physically sort components according to the measurement result and the user defined limits. Data lines for eight sorting bins are provided, as well as output and input control lines (ALARM, INDEX, EOM, and TRIG). This option is useful for production testing, component matching or other tests where similar components must be compared to each other. The binning feature is an automatic process which simplifies the sorting, eliminating the need to manually compare the parameters. A maximum of 9 binning configurations can be set using the store/recall feature. Binning configurations can also be entered using the communication interface.

Technical Specifications

I/O Connector:	D-Sub 25 socket
Output signal:	Negative TRUE, OC (open collector), opto-isolated, selectable pull-ups. Imax 15mA @V_{ce} <1V, V_{ce} max.: 40V pass bins: BIN 0...5 for primary parameter fail bins: BIN 6 for secondary parameter BIN 7 for general failure bin
Index:	Analog measurement complete
EOM:	Full measurement complete
Alarm:	Notification that an error was detected
TRIG:	External opto-isolated trigger input, selectable pull-up, U_{max} 15V, falling edge, pulse width >10µs

HO2010 Logic Probe



Multi pin connector for connection of the logic probe

Measurement with the Logic Probe

- ☑ Logic Probe HO2010 for the CombiScopes® HM2008
- ☑ With the Logic Probe four Logic Channels (LCH 0...LCH 3) are available in Digital Mode
- ☑ 1 bit Signal Representation on the Oscilloscope, either binary or hexadecimal
- ☑ The Threshold can be adjusted for all 4 Logic Channels together on the Oscilloscope
- ☑ The active Logic Channel will be indicated by a LED on the Logic Probe

Specifications

Channels:	4
Input Impedance:	100kΩ II <4pF
Max. Input Voltage:	40V (DC + peak AC)
Measuring Category:	I
Cable Length:	approx. 1m

HO3508 [HO3516] Logic Probe for all Oscilloscopes of the HMO Series

Multi pin Connector for Connection of the Logic Probe

Measurement with the Logic Probe

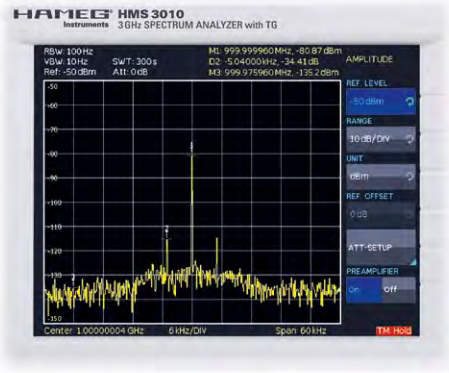
- ☑ Logic Probe HO3508 for MSO Extension, also available in a double Package as HO3516 (2 x HO3508)
- ☑ With the Logic Probe HO3508, 8 Logic Channels (LCH 0...LCH 7 or LCH 8...LCH 15) are available in MSO Mode
- ☑ The Display on the Oscilloscope will be either as individual Channels or as a Bus Display
- ☑ Decoding may be in the ASCII, Binary, Decimal or Hexadecimal Formats
- ☑ The Threshold can be adjusted for 8 Logic Channels as a Group at the Oscilloscope
- ☑ The Activation of the Logic Channels is indicated by a LED on the Logic Probe

Specifications HO3508

Channels:	8
Input Impedance:	100kΩ II <4pF
Max. Input Frequency:	350MHz
Max. Input Voltage:	40V (DC + peak AC)
Measuring Category:	I
Cable Length:	approx. 1m

HO3011 Preamplifier

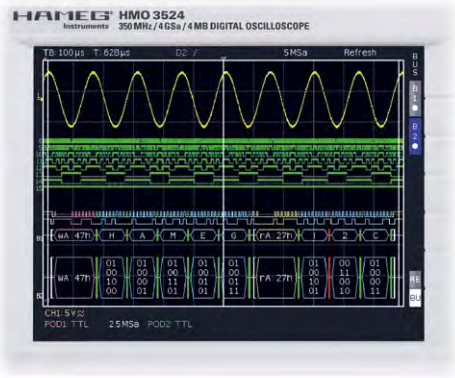
for all Spectrum Analyser of the HMS Series



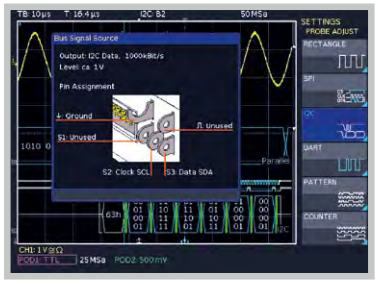
- ☑ Preamplifier Option for HMS1000, HMS1010, HMS3000, HMS3010 (Licence Key)
- ☑ DANL -125 dBm typ. (1 kHz RBW) for HMS1000 and HMS1010
  DANL -135 dBm typ. (100 Hz RBW) for HMS3000 and HMS3010

HO010 Serial Bus

for all Oscilloscopes of the HMO Series

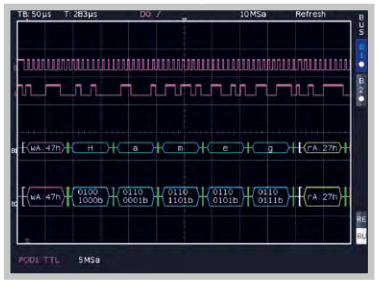


Setting of the internal Bus Signal Source of the HMO2524

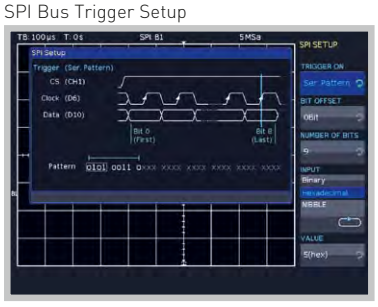


- ☑ I²C, SPI, UART/RS-232 Bus Trigger and Decode
- ☑ Hardware accelerated Decode in Realtime
- ☑ Color Coded Display of the Content for intuitive Analysis and easy Overview
- ☑ More Details of the decoded Values come visible with increasing Zoom Factor
- ☑ Bus Display with synchronous Display of the Data and may be Clock Signal
- ☑ Decode into ASCII, Binary, Hexadecimal or Decimal Format
- ☑ Up to four Lines to show the decoded Values comfortable
- ☑ Powerful Trigger to isolate specific Messages
- ☑ Option for all Oscilloscopes of the HMO Series, retrofittable

I²C Bus ASCII and Binary



SPI Bus Trigger Setup



See page 90 for technical specifications or www.hameg.com/HO010

HO010

HO730 Dual Ethernet/USB Interface

- ☑ Ethernet 10/100MBit/s
- ☑ Additionally integrated Web Server
- ☑ Screenshot Function using Web Server
- ☑ USB 2.0 standard, USB Type B Connector
- ☑ For mounting into Oscilloscopes HM1008, HM1508, HM1008-2, HM1500-2, HM1508-2, HM2005-2, HM2008, Series HMF, HMO, HMP and HMS

TCP/IP USB

HO740 IEEE-488 (GPIB) Interface

- ☑ 24-pin Connection in accordance with IEEE-488 (GPIB) (Socket)
- ☑ Galvanic Separation of Test Device and Interface
- ☑ For mounting into Oscilloscopes HM1008, HM1508, HM1008-2, HM1500-2, HM1508-2, HM2005-2, HM2008, Series HMF, HMO, HMP and HMS

IEEE-488

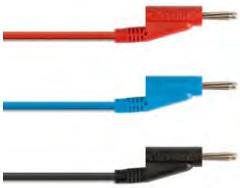
HO880 IEEE-488 (GPIB) Interface

- ☑ 24-pin Connection in accordance with IEEE-488 (GPIB) (Socket)
- ☑ Galvanic Separation of Test Device and Interface
- ☑ Up to 15 Devices on one IEEE-488 (GPIB) Bus
- ☑ For installation in Programmable Measuring Instruments Series 81XX, as well as included in Delivery of HM7044G

IEEE-488

Accessories

HZ10 Silicone Test Lead



Silicone test lead with stackable banana plugs.

Length:	1.0m
Packaging unit:	set of 5
HZ10R	color: red
HZ10B	color: blue
HZ10S	color: black

HZ15 PVC Test Lead

PVC test lead with test probes and sheathed banana plugs.

Color:	black and red
Length:	1.0m
Packaging unit:	1 piece per color

HZ16 Test Cable with micro-clamps

Silicone-test lead with BNC plug to miniature clamp probe.

Packaging unit:	1 piece

HZ17 Kelvin Test Lead

Kelvin test lead (4-wire) with test probe,
5-pin DIN connector for HM8018.

Packaging unit:	1 piece

HZ18 Kelvin Test Lead

Kelvin test lead (4-wire) with gold-plated alligator clip,
5-pin DIN connector and shielding mass, for HM8018.

Packaging unit:	1 piece

HZ19 SMD Test Tweezers

Kelvin test lead (4-wire) with SMD test tweezers,
5-pin DIN connector for HM8018.

Packaging unit:	1 piece

HZ31 Test Cable 50Ω

Test cable 50Ω, BNC to BNC angle connector.

Length:	1.0m
Packaging unit:	1 piece

HZ32 Test Cable

Test cable, BNC to 4mm banana plug.

Length:	1.0m
Packaging unit:	1 piece

HZ33/HZ34 Test Cable 50Ω

Test cable 50Ω, BNC to BNC, BNC straight plug.

Length:	0.5m – HZ33
Packaging unit:	1 piece
Length:	1.0m – HZ34
Packaging unit:	1 piece

HZ33S/HZ34S Test Cable 50Ω

Test cable 50Ω, BNC to BNC socket, insulated.

Length:	0.5m – HZ33S
Packaging unit:	1 piece
Length:	1.0m – HZ34S
Packaging unit:	1 piece

HZ20 Adapter Plug

Adapter BNC plug/4mm banana socket.

Description:	BNC plug with 2 x 4mm sockets
Packaging unit:	1 piece

HZ21 Adapter Plug

Adapter N male to BNC female.

Description:	N male to BNC female
Packaging unit:	1 piece

HZ22 Feed-Through Termination 50Ω

50Ω feed-through termination, 1GHz, 2 Watt.

Description:	BNC plug BNC socket
Packaging unit:	1 piece

HZ24 Attenuators 50Ω

One set of 50Ω attenuators with 3/6/10/20dB attenuation (1GHz, 1 Watt) and 1 HZ22.

Packaging unit:	1 set

HZ26 BNC-T-Adapter

BNC-T-Adapter UG274, 50Ω.

Description:	1 BNC plug to 2 BNC sockets
Packaging unit:	1 piece

HZ72 IEEE-488 Interface Cable

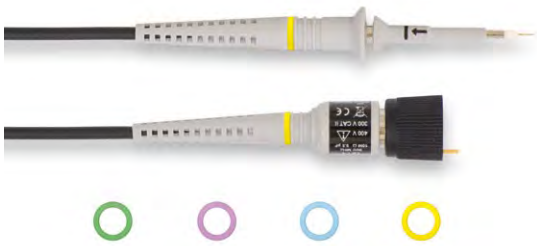
IEEE-488 bus interface cable double-shielded
90° angle, stackable.

Length:	2.0m

HZ154 Probe 1:1/10:1

Attenuation ratio:	1:1
Switchable:	10:1
Bandwidth:	10/100MHz
Rise time :	<35/3.5ns
Input impedance:	1/10MΩ II 82/12pF
Max. Voltage:	(10:1) 600V (DC + peak AC)
LF compensation:	1 Trimmer at 10:1
RF compensation:	2 Trimmer at 10:1
Cable length:	1.2m
Measuring category:	CAT I

HZ355 Probe 10:1



Attenuation ratio:	10:1
Bandwidth:	500MHz
Rise time:	<700ps
Input impedance:	10MΩ II 9.5pF
Max. Voltage:	400V (DC + peak AC)
LF compensation:	1 Trimmer
RF compensation:	2 Trimmer
Cable length:	1.3m
Probe factor identification:	automatically after plugging
Measuring category:	CAT I

HZ350 Probe 10:1

Attenuation ratio:	10:1
Bandwidth:	350MHz
Rise time:	<1.0ns
Input impedance:	10MΩ II 12pF
Max. Voltage:	400V (DC + peak AC)
LF compensation:	1 Trimmer
RF compensation:	2 Trimmer
Cable length:	1.2m
Probe factor identification:	automatically after plugging
Measuring category:	CAT I

HZ200 Probe 10:1

Attenuation ratio:	10:1
Bandwidth:	250MHz
Rise time:	<1.4ns
Input impedance:	10MΩ II 12pF
Max. Voltage:	400V (DC + peak AC)
LF compensation:	1 Trimmer
RF compensation:	2 Trimmer
Cable length:	1.2m
Probe factor identification:	automatically after plugging
Measuring category:	CAT I

HZ51 Probe 10:1

Attenuation ratio:	10:1
Bandwidth:	150MHz
Rise time:	<2.4ns
Input impedance:	10MΩ II 12pF
Max. Voltage:	600V (DC + peak AC)
LF compensation:	1 Trimmer
RF compensation:	1 Trimmer
Cable length:	1.2 m
Measuring category:	CAT I

HZ52 Probe 10:1

Attenuation ratio:	10:1
Bandwidth:	250MHz
Rise time:	<1.4ns
Input impedance:	10MΩ II 10pF
Max. Voltage:	600V (DC + peak AC)
LF compensation:	1 Trimmer
RF compensation:	2 Trimmer
Cable length:	1.2m
Measuring category:	CAT I

HZ53 Probe 100:1

Attenuation ratio:	100:1
Bandwidth:	100MHz
Rise time:	<3.5ns
Input impedance:	100MΩ II 4.5pF
Max. Voltage:	1200V (DC + peak AC)
LF compensation:	1 Trimmer
Cable length:	1.2m
Measuring category:	CAT I

HZO20 Probe 1000:1

Attenuation ratio:	1000:1
Bandwidth:	400MHz
Rise time:	<900ps
Input impedance:	50MΩ II 7.5pF
Max. Voltage:	1000V_{rms}
LF compensation:	1 Trimmer
RF compensation:	1 Trimmer
Cable length:	1.3m
Probe factor identification:	automatically after plugging
Measuring category:	CAT II

HZO30 Probe 10:1

Attenuation ratio:	10:1
Bandwidth:	1GHz
Rise time:	600ps
Input impedance:	1MΩ II 0.9pF
Max. Input Voltage:	20V
Input Dynamic Range:	±8V
Cable length:	1.3m
Oscilloscope Input Coupling:	50Ω

HZ100 Differential Probe 20:1/200:1

Technical specifications at 23°C ±2°C

Differential input voltage (DC + peak AC) max.:	±700V
Max. input voltage per input:	$600V_{rms}$
Attenuation ratio:	20:1
Switchable:	200:1
Bandwidth:	30/40MHz
Rise time:	12/9ns
Input impedance:	8MΩ II 1.2pF
Output impedance:	50Ω
Max. output Voltage:	±3.5V at 1MΩ
Max. noise:	2mV
Accuracy after 1min:	±3% (18...30°C)
Common mode rejection DC/AC 1MHz:	70dB/>50dB
Inputs (CAT III):	2 safety connectors
Input leads:	2 test leads 50cm with spring hooks
Battery operation:	9V battery 6LR61
Input for an external power supply:	$12...14V_{dc}$/30mA

HZ109 Differential Probe 1:1/10:1

Technical specifications at 23°C ±2°C

Differential input voltage (DC + peak AC) max.:		±3,5V/35V
Max. input voltage per input:		$100V_{rms}$
Attenuation ratio:		1:1
Switchable:		10:1
Bandwidth:		30/40MHz
Rise time:		12/9ns
Input impedance:		8MΩ II 1.2pF
Output impedance:		50Ω
Max. output Voltage:		±3.5V at 1MΩ
Max. background noise	at x1:	$<8mV_{rms}$
	at x10:	$<2mV_{rms}$
Accuracy after 1min:		±3% (18...30°C)
Common mode rejection DC/AC 1MHz:		70dB/>50dB
Inputs (CAT III):		2 safety connectors
Input leads:		2 test leads 50cm with spring hooks
Battery operation:		9V battery 6LR61
Input for an external power supply:		$12...14V_{dc}$/30mA

HZ115 Differential Probe 100:1/1000:1

Technical specifications at 23°C ±2°C

Differential input voltage (AC_{rms}):	1000V
(DC + peak AC) max.:	±1400V*)
Max. input voltage per input:	±1400V*)
Attenuation ratio:	100:1
Switchable:	1000:1
Bandwidth:	20/30MHz
Rise time:	17/12ns
Input impedance:	60MΩ II 1.5pF
Output impedance:	50Ω
Max. output Voltage:	±1.5V at 1MΩ
Max. background noise:	2mV
Accuracy after 1min:	±3% (18...30°C)
Common mode rejection DC/AC 1MHz:	70dB/>50dB
Inputs (CAT III):	2 safety connectors
Input leads:	2 test leads 75cm with safety test clips
Battery operation:	9V battery 6LR61
Input for an external power supply:	$12...14V_{dc}$/30mA

*) due to test clip 1000V CAT III

HZO50 AC/DC Current Probe 30A

This AC/DC Current Probe is used to measure currents from 1mA to 30A over a broad frequency range. The measurement principle is based on the Hall Effect that registers the magnetic field generated by the current flow. Even for complex waveforms a high degree of measurement accuracy is achieved. The output voltage is proportional to the measured current and well suited to be displayed on an oscilloscope. The current probe complies with the safety standards defined in IEC/EN 61010.

Current measurement

Specifications

Measurement range:	$\pm 20A_{rms}/30A_{p}$
Accuracy:	±1% from measurement value ±2mA
Bandwidth:	DC...100kHz (0.5dB)
Resolution:	±1mA
Output Voltage:	100mV/A
Load impedance:	>100kΩ II ≤100pF
Max. Voltage:	$300V_{rms}$ (AC or DC)
Output cable/Connector:	2m (50Ω)/BNC
Measuring category:	CAT III

HZO51 AC/DC Current Probe 100/1000A

This AC/DC Current Probe is used to measure currents from 100mA to 1000A over a broad frequency range. The measurement principle is based on the Hall Effect that registers the magnetic field generated by the current flow. Even for complex waveforms a high degree of measurement accuracy is achieved. The output voltage is proportional to the measured current and well suited to be displayed on an oscilloscope. The current probe complies with the safety standards defined in IEC/EN 61010.

Current measurement

Specifications

Measurement range:	±100A/1000A
Accuracy:	±1% from measurement value ±0.1A/±0.5A
Bandwidth:	DC...20kHz
Resolution:	±100mA/±500mA
Output Voltage:	10mV/A/1mV/A
Load impedance:	>100kΩ II ≤100pF
Max. Voltage:	$300V_{rms}$ (AC or DC)
Output cable/Connector:	2m (50Ω)/BNC
Measuring category:	CAT III

HZ525 Termination

Frequency range:	DC...6GHz
Impedance:	50Ω
VSWR:	1.05 (DC...1GHz)
	1.1 (1...4GHz)
	1.2 (4...6GHz)
Power:	1W avr.
Connection:	N-male

HZ575 Converter

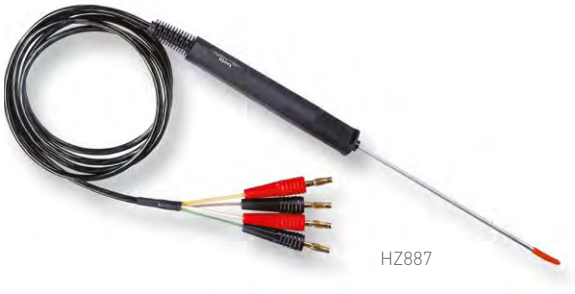
HZ575 is a 75Ω to 50Ω converter enabling measurement in 75Ω systems in connection with 50Ω input impedance spectrum analyzers. The 75Ω input is a 75Ω BNC socket which is AC coupled internally. The output is a 50Ω N male connector which is DC coupled. HZ575 can also be used for reverse operation converting 50Ω to 75Ω.

Specifications

Frequency Range:	5MHz...1.2GHz
Insertion loss:	less than 1dB
Max. Level/Voltage	
at 75Ω connector:	+10dBm/±20V_{dc}
at 50Ω connector:	+10dBm/0V_{dc}
Dimensions:	25 x 25 x 58mm (W x H x D)
Weight:	100g

HZ812/HZ887 PT100 Temperature Probe

HZ812



HZ887

The HZ812 and HZ887 Temperature Probes are immersion sensors with a platinum test resistance of PT100. They ensure excellent precision over a broad temperature range. The probes are of robust construction, waterproof and also suitable for use in air or dusty environments. The technical specifications apply for immersion depths of at least 60mm.

The probe is connected to the measuring instrument either with a 2-pin connection using a grounded plug (HZ812) or with a 4-pin connection via a 4mm banana plug (HZ887). The length of the connector cable is 1.2m for both probes.

HZ812 is suitable for use in combination with HM8012
HZ887 is suitable for use in combination with HM8112

Technical specifications in accordance with EN60751 (formerly IEC751)

Probe diameter:	4mm
Measurement range:	-50...+400°C
Accuracy, Class A:	±(0.2% of the reading + 0.15°C)
t_{99} (s):	12s (time required to display 99% of the temperature change)
Connection HZ812:	Grounded plug, 4mm, 1.2m PVC cable
Connection HZ887:	4mm banana plug, 1.2m PVC cable

Accuracy, HZ812 in combination with HM8012:

-50°C <T° <200°C	±(0.2% of reading +0.25°C)
200°C <T° <400°C	±(0.2% of reading +0.45°C)

Temperature measurement HZ887 in combination with HM8112-3

HZ181 4 Terminal Test Fixture including Shorting Plate

4 Terminal Test Fixture including Shorting Plate (for HM8118) for evaluation of lead type devices.

HZ184 4 Terminal Kelvin Test Cable

The 4 Terminal Kelvin Test Cable with Kelvin clips (for HM8118, included in delivery) makes it possible to measure odd-shaped components that cannot be measured with conventional fixtures.

HZ186 4 Terminal Transformer Test Cable

Transformer Test Cable (for HM8118) for transformer measurements.

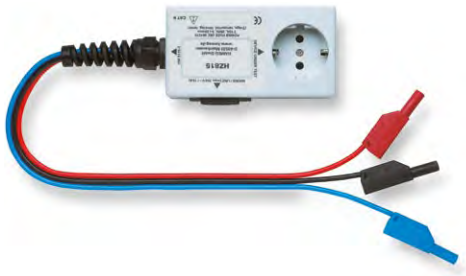
HZ188 4 Terminal SMD Component Test Fixture

4 Terminal SMD Component Test Fixture (for HM8118, included in delivery) for evaluation of SMD components.

HZ809 Test Adapter for Modular System Series 8000

Test adapter for the testing and repair of insert modules for Modular System Series 8000 outside the mainframe HM8001-2. The module connection terminals in the basic unit are led through 1 to 1. The modules can then be operated outside the mainframe while the housing is open.

HZ815 Power Adapter for HM8115-2



Adapter for simplified measurement of power consumption, line voltage and current consumption of mains operated consumers (3-wire grounding-type plug or European standard plug) using the HM8115-2 Power Meter.

HZ520 Plug-in Antenna

Telescopic Antenna for RF reception

BNC connector

HZ547 VSWR Bridge

This unit is used to measure the voltage standing wave ratio (VSWR) and the reflection coefficient of a device under test with an impedance of 50Ω.

Typical test objects include attenuators, terminations, frequency switches, amplifiers, cables and mixers.

Frequency range:	100kHz...3GHz
Impedance:	50Ω
Directivity:	>28dB (100...300kHz) >35dB (300kHz...1GHz) >30dB (1...3GHz)
Reflection loss at DUT port:	>20dB
Insertion loss IN → OUT:	20dB (100...300kHz)
IN → OUT:	18dB (300kHz...3GHz)
IN → DUT:	1.7dB
DUT → OUT:	16dB
Max. Power Dissipation:	+26dBm
Connectors:	N (female)
Dimensions:	150 x 68 x 29.5mm (W x H x D), without connectors)
Weight:	approx. 650g
Temperature range:	+10...+45°C
Accessories supplied:	HZ525 (Termination 50Ω 1W), N male to N male (2 ea.), Carrying case 265 x 225 x 50mm (W x H x D)

Technical specifications: (typical values) see www.hameg.com/HZ547

HZ547 connected with HMS3010

HZ560 Transient Limiter

The HZ560 Transient Limiter protects the input circuits of spectrum analyzers and test receivers.

The input of the Transient Limiter is connected via BNC cable to the signal source. The output can be connected directly to the spectrum analyzer.

Frequency range:	150kHz...30MHz a = 10dB + 1.5/-0.5dB at f <1kHz a ≥90dB at f <10kHz a ≥50dB
Insertion loss:	10dB (+1.5/-0.5dB)
Max. input level:	+33dBm (2W, average)
Max. input voltage:	$\pm 50V_{dc}$
VSWR:	1.5:1 or better
Connections:	BNC (input and output)
Dimensions:	67 x 32 x 32mm (W x H x D)

Technical specifications at 23°C ±2°C

HZ42 2RU 19“ Rackmount Kit

For mounting HAMEG instruments with a case height of 75mm (for Series 8100, HM8143, HM7042-5, HM8001-2, HMP2020, HMP2030 and HMF Series).

Dimensions (W x D):	440 x 360mm plus overhang of the instrument
2 RU:	88mm

Please order instruments, which are installed into HZ42, with note “without housing feet”, as otherwise the feet must be dismounted before installation.

HZ43 3RU 19“ Rackmount Kit

For mounting HAMEG instruments with a case height of 125mm (for HM2005, HM303-6, HM504-2, HM507, HM5510, HM5014-2, HM5530, HM6050-2, HM7044, HMP4030, HMP4040).

Dimensions (W x D):	440 x 360mm plus overhang of the instrument
3 RU:	132.5mm

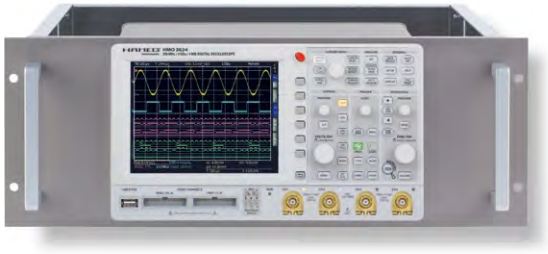
Please order instruments, which are installed into HZ43, with note “without housing feet”, as otherwise the feet must be dismounted before installation.

HZ45 4RU 19“ Rackmount Kit

For mounting HAMEG instruments with a case height of 125mm (for HM400, HM1000, HM1000-2, HM1008, HM1008-2, HM1500, HM1500-2, HM1508, HM1508-2, HM2005-2, HM2008).

Dimensions (W x D):	440 x 360mm plus overhang of the instrument
4 RU:	177mm

HZ46 4RU 19“ Rackmount Kit



For mounting HAMEG instruments with a case height of 175mm (for HMO and HMS Series).

Dimensions (W x D):	440 x 170mm plus overhang of the instrument
4 RU:	177mm

HZ99 Carrying Case

We recommend the HZ99 Carrying Case for protection and transport of oscilloscopes (HMO series) and spectrum analyzers (HMS series). The instruments can be transported conveniently and safely in the case. An extra pocket provides space for test gear and accessories.
Running the device while inside the case is not permitted.

Specifications

40 MHz Analog Oscilloscope HM400

Product description, page 14

Vertical Deflection	
Operating Modes:	Channel 1 or 2 only Channels 1 and 2 (alternate or chopped) Sum or Difference of CH 1 and CH 2
Invert:	CH 2
XY Mode:	CH 1 (X) and CH 2 (Y)
Bandwidth (-3 dB):	
DC, 5 mV/div....20 V/div.:	0...40 MHz
AC, 5 mV/div....20 V/div.:	2 Hz...40 MHz
DC, 1...2 mV/div.:	0...10 MHz
AC, 1...2 mV/div.:	2 Hz...10 MHz
Rise Time (calculated):	<35 ns (1...2 mV/div.) <8.75 ns (5 mV/div....20 V/div.)
Deflection Coefficient:	1–2–5 Sequence ±5 % (1...2 mV/div.) ±3 % (5 mV/div....20 V/div.)
Variable (uncalibrated):	>2.5:1 to >50 V/div.
Input Impedance:	1 MΩ II 15 pF
Input Coupling:	DC, AC, GND (ground)
Max. Input Voltage:	400 V (DC + peak AC)

Triggering	
Automatic:	Linking of peakdetection and triggerlevel
Min. signal height	0.5 div.
Frequency range	5 Hz...50 MHz
Level control range	From peak- to peak+
Normal (without peak)**:**	
Min. signal height	0.5 div.
Frequency range	0...50 MHz
Level control range	-10....+10 div.
Slope:	Rising or falling
Sources:	Channel 1 or 2, Line and External
Coupling:	AC (5 Hz...80 MHz), DC (0...80 MHz), LF (0...1.5 kHz)
Trigger Indicator:	LED
External Trigger:	
Input Impedance:	1 MΩ II 15 pF
External Trigger Signal:	0.3 V_{pp} ≤5 V, DC (0...50 MHz), AC (20 Hz...50 MHz)
Max. input voltage:	100 V (DC + peak AC)
Active TV sync. separator:	Field and Line, +/-

Horizontal Deflection	
Time Base:	100 ns/div.....0.2 s/div (1–2–5 Sequence)
Accuracy:	±3 %
Variable (uncalibrated)**:**	>2.5:1 to >1.25 s/div.
X Magnification x10:	up to 10 ns/div.
Accuracy:	±5 %
Hold-Off Time:	variable to approx. 10:1
XY	
Bandwidth X amplifier:	0...2.5 MHz (-3 dB)
XY Phase shift <3°:	<120 kHz

Operation/Readout/Control	
Manual:	via controls and buttons
Autoset:	automatic signal related parameter settings
Save and Recall:	6 instrument parameter settings

Component Tester	
Test Voltage:	approx. 7 V_{rms} (open circuit)
Test Current:	max. 7 mA_{rms} (short-circuit)
Test Frequency:	approx. 50 Hz
Test Connection:	2 banana jacks 4 mm Ø One test circuit lead is grounded via protective earth (PE)

Miscellaneous	
CRT:	D14-363GY, 8 x 10 div. with internal graticule
Acceleration Voltage:	approx. 2 kV
Trace Rotation:	adjustable on front panel
Z-Input (Intens. modulation)**:**	max. +5 V (TTL), 10 kHz
Probe ADJ Output:	1 kHz/1 MHz Square Wave Signal approx. 0.2 V_{pp} (tr <5 ns) for probe adjustment
Power Supply (Mains)**:**	105...253 V, 50/60 Hz ±10 %, CAT II
Power Consumption:	approx. 30 Watt at 230 V/50 Hz
Safety class:	Safety class I (EN61010-1)
Operating temperature:	+5...+40 °C
Storage temperature:	-20...+70 °C
Rel. humidity:	5...80 % (non condensing)
Dimensions (W x H x D)**:**	285 x 125 x 380 mm
Weight:	approx. 4.8 kg

All data valid at 23 °C after 30 minutes warm-up.

Accessories supplied: Line Cord, Operators Manual, 2 Probes 1:1/10:1 (HZ154) with LF/HF adjustment

Recommended accessories:

HZ20	Adapter, BNC to 4 mm banana
HZ33	Test cable 50 Ω, BNC/BNC, 0.5 m
HZ34	Test cable 50 Ω, BNC/BNC, 1 m
HZ45	19¨-Rackmount Kit 4RU
HZ51	Probe 10:1 (150 MHz)
HZ52	Probe 10:1 RF (250 MHz)
HZ53	Probe 100:1 (100 MHz)
HZ100	Differential probe 20:1/200:1
HZ109	Differential probe 1:1/10:1
HZ115	Differential probe 100:1/1000:1
HZ200	Probe 10:1 with auto attenuation ID (250 MHz)
HZ350	Probe 10:1 with automatically identification (350 MHz)
HZ355	Slimline probe 10:1 with automatically identification (500 MHz)
HZO20	High voltage probe 1000:1 (400 MHz,1000 V_{rms})
HZO30	Active probe 1 GHz (0.9 pF, 1 MΩ, including many accessories)
HZO50	AC/DC Current probe 20 A, DC...100 kHz
HZO51	AC/DC Current probe 1000 A, DC...20 kHz

50 MHz Analog Oscilloscope HM504-2

Product description, page 13

Vertical Deflection	
Operating Modes:	Channel 1 or 2 only Channels 1 and 2 (alternate or chopped) Sum or Difference of CH 1 and CH 2
Invert:	CH 2
XY Mode:	CH 1 (X) and CH 2 (Y)
Bandwidth:	2 x 0...50 MHz (-3 dB)
Rise Time:	<7 ns
Deflection Coefficient:	1–2–5 Sequence
1...2 mV/div.:	±5 % (0...10 MHz (-3 dB))
5 mV/div....20 V/div.:	±3 % (0...50 MHz (-3 dB))
Variable (uncalibrated):	>2.5:1 to >50 V/div.
Input Impedance:	1 MΩ II 15 pF
Input Coupling:	DC, AC, GND (ground)
Max. Input Voltage:	400 V (DC + peak AC)

Triggering	
Automatic (Peak to Peak)**:**	20 Hz...100 MHz (≥5 mm)
Normal with Level Control:	0...100 MHz (≥5 mm)
Slope:	Rising or falling
Sources:	Channel 1 or 2, CH 1/CH 2 alternate (≥8 mm), Line and External
Coupling:	AC (10 Hz...100 MHz), DC (0...100 MHz), HF (50kHz...100 MHz), LF (0...1.5 kHz)
Trigger Indicator:	LED
Triggering after Delay:	with Level Control and Slope selection
External Trigger Signal:	≥0.3 V_{pp} (0...50 MHz)
Active TV sync. separator:	Field and Line, +/-

Horizontal Deflection	
Time Base:	50 ns/div....0.5 s/div. (1–2–5 Sequence)
Accuracy:	±3 %
Variable (uncalibrated)**:**	>2.5:1 to >1.25 s/div.
X Magnification x10:	up to 10 ns/div. (±5 %)
Accuracy:	±5 %
Delay (selectable)**:**	200 ns...140 ms (variable)
Hold-Off Time:	variable to approx. 10:1

XY	
Bandwidth X amplifier:	0...3 MHz (-3 dB)
XY Phase shift <3°:	<120 kHz

Operation/Readout/Control

Manual:	via controls
Autoset:	automatic signal related parameter settings
Save and Recall:	9 instrument parameter settings
Readout:	display of menu, parameters, cursors and results
Autom. Measurement:	Freq./Period, V_{dc}, V_{pp}, V_{p+}, V_{p-}, Trigger Level
Cursor Measurement:	Δt, 1/Δt, tr, ΔV, V to GND, Gain, Ratio X and Y
Frequency counter:	4 digit (0.01 % ±1 digit) 0.5 Hz...100 MHz
Interface:	RS-232 (Device control and Parameter query, no CRT content transfer possible)

Component Tester

Test Voltage:	approx. 7 V_{rms} (open circuit)
Test Current:	max. 7 mA_{rms} (short-circuit)
Test Frequency:	approx. 50 Hz
Test Connection:	2 banana jacks 4 mm Ø

One test circuit lead is grounded via protective earth (PE)

Miscellaneous

CRT:	D14-363GY, 8 x 10 div. with internal graticule
Acceleration Voltage:	approx. 2 kV
Trace Rotation:	adjustable on front panel
Z-input (Intens. modulation)**:**	max. + 5 V (TTL)
Calibrator Signal (Square Wave)**:**	0.2 V, 1 Hz...1 MHz (tr <4 ns), DC
Power Supply (Mains):	105...253 V, 50/60 Hz ±10 %, CAT II
Power Consumption:	approx. 34 Watt at 230 V/50 Hz
Safety class:	Safety class I (EN61010-1)
Operating temperature:	+5...+40 °C
Storage temperature:	-20...+70 °C
Rel. humidity:	5...80 % (non condensing)
Dimensions (W x H x D)**:**	285 x 125 x 380 mm
Weight:	approx. 5.4 kg

All data valid at 23 °C after 30 minutes warm-up.

Accessories supplied: Line Cord, Operators Manual and Software for Windows on CD-ROM, 2 Probes 1:1/10:1 (HZ154),

Recommended accessories:

HZ14	Interface cable (serial) 1:1
HZ20	Adapter, BNC to 4 mm banana
HZ33	Test cable 50 Ω, BNC/BNC, 0.5 m
HZ34	Test cable 50 Ω, BNC/BNC, 1 m
HZ43	19''-Rackmount Kit 3RU
HZ51	Probe 10:1 (150 MHz)
HZ52	Probe 10:1 RF (250 MHz)
HZ53	Probe 100:1 (100 MHz)
HZ100	Differential probe 20:1/200:1
HZ109	Differential probe 1:1/10:1
HZ115	Differential probe 100:1/1000:1
HZ200	Probe 10:1 with auto attenuation ID (250 MHz)
HZ350	Probe 10:1 with automatically identification (350 MHz)
HZ355	Slimline probe 10:1 with automatically identification (500 MHz)
HZO20	High voltage probe 1000:1 (400 MHz,1000 V_{rms})
HZO30	Active probe 1 GHz (0.9 pF, 1 MΩ, including many accessories)
HZO50	AC/DC Current probe 20 A, DC...100 kHz
HZO51	AC/DC Current probe 1000 A, DC...20 kHz

50 MHz CombiScope® HM507
Product description, page 11

Vertical Deflection

Operating Modes:	Channel 1 or 2 only Channels 1 and 2 (alternate or chopped) Sum or Difference of CH 1 and CH 2
Invert:	CH 2
XY Mode:	via CH 1 (X) and CH 2 (Y)
Bandwidth:	2 x 0...50 MHz (-3 dB)
Rise Time:	<7 ns
Deflection Coefficients:	1–2–5 Sequence
1...2 mV/div.:	±5 % (0...10 MHz (-3 dB))
5 mV/div....20 V/div.:	±3 % (0...50 MHz (-3 dB))
Variable (uncalibrated):	>2.5: 1 to >50 V/div.
Input Impedance:	1 MΩ II 15 pF
Coupling:	DC, AC, GND (ground)
Max. Input Voltage:	400 V (DC + peak AC)

Triggering

Automatic (Peak to Peak):	20 Hz...100 MHz (≥5 mm)
Normal with Level Control:	0...100MHz (≥5 mm)
Slope:	Rising or falling
Sources:	Channel 1 or 2, CH 1/CH 2 alternate (≥8 mm) Line and External
Coupling:	AC (10 Hz...100 MHz), DC (0...100 MHz), HF (50 kHz...100 MHz), LF (0...1.5 kHz)
Trigger Indicator:	with LED
Triggering after Delay:	with Level Control and Slope selection
External Trigger Signal:	≥0.3 V_{pp} (0...50 MHz)
Active TV sync. separator:	Field and Line, +/-

Horizontal Deflection

Analog	
Time Base:	50 ns/div....0.5 s/div. (1–2–5 Sequence)
Accuracy:	±3 %
Variable (uncalibrated):	>2.5:1 to >1.25 s/div.
X-Magnification x10:	up to 10 ns/div. (±5 %)
Accuracy:	±5 %
Delay (selectable):	200 ns...140 ms (variable)
Hold-Off Time:	variable to approx. 10:1
XY Mode	
Bandwidth X amplifier:	0...3 MHz (-3 dB)
XY Phase shift <3°:	<120 kHz
Digital	
Time Base:	100 ns/div....100 s/div. (1–2–5 Sequence)
Accuracy:	±2 %
X-Magnification x10:	up to 20 ns/div.
Accuracy:	±2 %
XY Mode	
Bandwidth X Amplifier:	0...50 MHz (-3 dB)
XY Phase shift <3°:	<10 MHz

Digital Storage

Operating Modes:	Refresh, Roll, Single, XY, Envelope, Average, Random Sampling
Interpolation:	Linear Dot Join Function
Sampling Rate (Real Time):	max 100 MSa/s, 8 bit Flash A/D Converter
Sampling Rate (Random):	2 GSa/s relative
Post/Pre-Trigger:	-10....+10 div. (continuous)
Display Refresh Rate:	max. 180/s
Bandwidth:	2 x 0...50 MHz (-3 dB)
Signal Memory:	3 x 2k x 8 bit
Reference Signal Memory:	3 x 2k x 8 bit
Mathematical Signal Memory:	3 x 2k x 8 bit
Resolution (dots/div.) Yt Mode:	X: 200/div., Y: 25/div.
Resolution (dots/div.) XY Mode:	X: 25/div., Y: 25/div.

Operation/Readout/Control

Manual:	via controls
Autoset:	automatic signal related parameter settings
Save and Recall:	9 user defined parameter settings
Readout:	display of menu, parameters, cursors and results
Auto Measurements:	
Analog mode:	Frequency, Period, V_{dc}, V_{pp}, V_{p+}, V_{p-}
also in digital mode:	V_{rms}, V_{avg}
Cursor Measurements:	
Analog mode:	ΔV, Δt, 1/Δt (f), tr, V to GND, ratio X and Y
also in digital mode:	Pulse count, Vt related to Trigger Point, Peak to Peak, Peak+, Peak-
Frequency counter:	4 digit (0.01 % ±1 digit) 0.5 Hz...100 MHz
Interface (standard fitting):	RS-232 (Control, Signal Data)
Interface Option:	HO79-6 (IEEE-488, RS-232, Centronics)

Component Tester

Test Voltage:	approx. 7 V_{rms} (open circuit)
Test Current:	max. 7 mA_{rms} (short-circuit)
Test Frequency:	approx. 50 Hz

Test Connection:	2 banana jacks 4 mm Ø

One test circuit lead is grounded via protective earth (PE)

Miscellaneous	
CRT:	D14-363GY, 8 x 10 div. with internal graticule
Acceleration Voltage:	approx. 2 kV
Trace Rotation:	adjustable on front panel
Z-Input (Intens. modulation, analog):	max. +5 V (TTL)
Calibrator Signal (Square Wave):	0.2 V, 1 Hz...1 MHz (tr <4 ns), DC
Power Supply (Mains):	105...253 V, 50/60 Hz ±10 %, CAT II
Power Consumption:	approx. 42 Watt at 230V/50 Hz
Safety class:	Safety class I (EN61010-1)
Operating temperature:	+5...+40 °C
Storage temperature:	-20...+70 °C
Rel. humidity:	5...80 % (non condensing)
Dimensions (W x H x D):	285 x 125 x 380 mm
Weight:	approx. 6.0 kg

All data valid at 23 °C after 30 minutes warm-up.

Accessories supplied: Line Cord, Operators Manual and Software for Windows on CD-ROM, 2 Probes 1:1/10:1 (HZ154),

Recommended accessories:

HO79-6	Multifunction Interface
HZ14	Interface cable (serial) 1:1
HZ20	Adapter, BNC to 4 mm banana
HZ33	Test cable 50 Ω, BNC/BNC, 0.5 m
HZ34	Test cable 50 Ω, BNC/BNC, 1 m
HZ43	19¨-Rackmount Kit 3RU
HZ51	Probe 10:1 (150 MHz)
HZ52	Probe 10:1 RF (250 MHz)
HZ53	Probe 100:1 (100 MHz)
HZ72	GPIB-Cable 2 m
HZ100	Differential probe 20:1/200:1
HZ109	Differential probe 1:1/10:1
HZ115	Differential probe 100:1/1000:1
HZ200	Probe 10:1 with auto attenuation ID (250 MHz)
HZ350	Probe 10:1 with automatically identification (350 MHz)
HZ355	Slimline probe 10:1 with automatically identification (500 MHz)
HZO20	High voltage probe 1000:1 (400 MHz,1000 V_{rms})
HZO30	Active probe 1 GHz (0.9 pF, 1 MΩ, including many accessories)
HZO50	AC/DC Current probe 20 A, DC...100 kHz
HZO51	AC/DC Current probe 1000 A, DC...20 kHz

100 MHz CombiScope® HM1008-2

Product description, page 10

Vertical Deflection	
Channels:	
Analog:	2
Digital:	2
Operating Modes:	
Analog:	CH 1 or CH 2 separate, DUAL (CH 1 and CH 2 alternate or chopped), Addition
Digital:	CH 1 or CH 2 separate, DUAL (CH 1 and CH 2), Addition
X in XY-Mode:	CH 1
Invert:	CH 1, CH 2
Bandwidth (-3 dB):	2 x 0...100 MHz
Rise time:	<3.5 ns
Bandwith limiting (selectable):	approx. 20 MHz (5 mV/div....20 V/div.)
Deflection Coefficients (CH1, 2):	14 calibrated steps
1...2 mV/div. (10 MHz)	±5 % (0...10 MHz (-3 dB))
5 mV...20 V/div.	±3 % (1–2–5 sequence)
variable (uncalibrated):	>2.5:1 to >50 V/div.
Inputs CH 1, 2:	
Input Impedance:	1 MΩ II 15 pF
Coupling:	DC, AC, GND (ground)
Max. Input Voltage:	400 V (DC + peak AC)
Y Delay Line (analog):	70 ns
Measuring Circuits:	Measuring Category I
Analog mode only:	
Auxiliary input:	
Function (selectable):	Extern Trigger, Z (unblank)
Coupling:	AC, DC
Max. input voltage:	100 V (DC +peak AC)

Triggering	
Analog and Digital Mode	
Automatic (Peak to Peak):	
Min. signal height:	5 mm
Frequency range:	10 Hz...200 MHz
Level control range:	from Peak- to Peak+
Normal (without peak):	
Min. signal height:	5 mm
Frequency range:	0...200 MHz
Level control range:	-10...+10 div.
Operating modes:	Slope/Video
Slope:	Rising, falling, both
Sources:	CH 1, CH 2, alt. CH 1/2 (≥8 mm, analog mode only), Line, Ext.
Coupling:	**AC:** 10 Hz...200 MHz **DC:** 0...200 MHz **HF:** 30 kHz...200 MHz **LF:** 0...5 kHz Noise Rej. switchable
Video:	pos./neg. Sync. Impulse
Standards:	525 Line/60 Hz Systems 625 Line/50 Hz Systems
Field:	even/odd/both
Line:	all/line number selectable
Source:	CH 1, CH 2, Ext.
Indicator for trigger action:	LED
External Trigger via:	AUX (0.3 V_{pp}, 150 MHz)
Coupling:	AC, DC
Max. input voltage:	100 V (DC +peak AC)
Digital mode	
Pre/Post Trigger:	-100...+400 % related to complete memory
Analog mode	
2nd Trigger	
Min. signal height:	5 mm
Frequency range:	0...200 MHz
Coupling:	DC
Level control range:	-10...+10 div.

Horizontal Deflection	
Analog mode	
Operating modes:	A, ALT (alternating A/B), B
Time base A:	50 ns/div....0.5 s/div. (1–2–5 sequence)
Time base B:	50 ns/div....20 ms/div. (1–2–5 sequence)
Accuracy A and B:	±3 %
X Magnification x10:	to 5 ns/div.
Accuracy:	±5 %
Variable time base A/B:	1:2.5
Hold Off time:	var. 1:10 (LED-Indication)
Bandwidth X-Amplifier:	0...3 MHz (-3 dB)
X Y phase shift <3°:	<220 kHz
Digital mode	
Time base range (1–2–5 sequence)	
Refresh Mode:	5 ns/div....20 ms/div.
with Peak Detect:	2...20 ms/div. (min. Pulse Width 10 ns)
Roll Mode:	50 ms/div....50 s/div.
Accuracy time base	
Time base:	50 ppm
Display:	±1 %
Memory Zoom:	max. 40,000:1
Bandwidth X-Amplifier:	0...100 MHz (-3 dB)
XY phase shift <3°:	<100 MHz

Digital Storage	
Sampling rate (real time):	max. 2 x 500 MSa/s or 1 GSa/s interleaved
Sampling rate (random sampling):	10 GSa/s
Bandwidth:	2 x 0...100 MHz (random)
Memory:	1 MPts-Samples per channel
Operating modes:	Refresh, Average, Envelope/Roll (Free Run/Triggered), Peak-Detect
Resolution (vertical):	8 Bit (25 Pts/div.)
Resolution (horizontal):	
Yt:	11 Bit (200 Pts/div.)
XY:	8 Bit (25 Pts /div.)
Interpolation:	Sinx/x, Dot Join (linear)
Delay:	1 Million x 1/Sampling Rate to 4 Million x 1/Sampling Rate

Display refresh rate:	max.170/s at 1 MPts
Display:	Dots (acquired points only), Vectors (partly interpolated), optimal (complete memory weighting and vectors)
Reference Memories:	9 with 2 kPts each (for recorded signals)
Display:	2 signals of 9 (free selectable)

FFT Mode	
Display X:	Frequency Range
Disaplay Y:	True rms value of spectrum
Scaling:	Linear or logarithmic
Level display:	dBV, V
Window:	Square, Hanning, Hamming, Blackman
Control:	Center frequency, Span
Marker:	Frequency, Amplitude
Zoom (frequency axis):	up to x20

Operation/Measuring/Interfaces	
Operation:	Menu (multilingual), Autoset, help functions (multilingual)
Save/Recall (instrument parameter settings):	9
Signal display:	max. 4 traces
analog:	CH 1, 2 (Time Base A) in combination with CH 1, 2 (Time Base B)
digital:	CH 1, 2 and ZOOM or Reference or Mathematics)
USB Memory-Stick:	
Save/Recall external:	
Instrument settings and Signals:	CH 1, 2, ZOOM, Reference and Mathematics
Screen-shot:	as Bitmap
Signal display data (2k per channel)**:**	Binary (orig. ADC-Data), Text (ASCII-Format), CSV (Spread Sheet)
Frequency counter:	
6 digit resolution:	1...200 MHz
5 digit resolution:	0.5 Hz...1 MHz
Accuracy:	50 ppm
Auto Measurements:	
Analog mode:	Frequency, Period, V_{dc}, V_{pp}, V_{p+}, V_{p-}
also in digital mode:	V_{rms}, V_{avg}
Cursor Measurements:	
Analog mode:	Δt, 1/Δt (f), tr, ΔV, V to GND, ratio X, ratio Y
plus in digital mode:	V_{pp}, V_{p+}, V_{p-}, V_{avg}, V_{rms}, pulse count
Resolution Readout/Cursor:	1000 x 2000 Pts, Signals: 250 x 2000
Interfaces (plug-in):	USB/RS-232 (HO720)
Optional:	IEEE-488, Ethernet/USB

Mathematic functions	
Number of Formula Sets:	5 with 5 formulas each
Sources:	CH 1, CH 2, Math 1 – Math 5
Targets:	5 math. memories, Math 1...5
Functions:	ADD, SUB, 1/X, ABS, MUL, DIV, SQ, POS, NEG, INV
Display:	max. 2 math. memories (Math 1...5)

Display	
CRT:	D14-375GH
Display area (with graticule):	8 div. x 10 div.
Acceleration voltage:	approx. 14 kV

General Information	
Component tester	
Test voltage:	approx. 7 V_{rms} (open circuit), approx. 50 Hz
Test current:	max. 7 mA_{rms} (short circuit)
Reference Potential:	Ground (safety earth)
Probe ADJ Output:	1 kHz/1 MHz square wave signal 0.2 V_{pp} (tr <4 ns)
Trace rotation:	electronic
Line voltage:	105...253 V, 50/60 Hz ±10 %, CAT II
Power consumption:	47 Watt at 230 V, 50 Hz
Protective system:	Safety class I (EN61010-1)
Operating temperature:	+5...+40 °C
Storage temperature:	-20...+70 °C
Rel. humidity:	5...80 % (non condensing)
Dimensions (W x H x D)**:**	285 x 125 x 380 mm
Weight:	5.6 kg

All data valid at 23 °C after 30 minutes warm-up.

Accessories supplied: Line cord, Operating manual, 2 Probes 10:1 with attenuation ID (HZ200), Windows Software for control and data transfer

Recommended accessories:

HO730	Dual-Interface Ethernet/USB
HO740	Interface IEEE-488 (GPIB)
HZ13	Interface cable (USB) 1.8 m
HZ14	Interface cable (serial) 1:1
HZ20	Adapter, BNC to 4 mm banana
HZ33	Test cable 50 Ω, BNC/BNC, 0.5 m
HZ34	Test cable 50 Ω, BNC/BNC, 1 m
HZ45	19¨-Rackmount Kit 4RU
HZ51	Probe 10:1 (150 MHz)
HZ52	Probe 10:1 RF (250 MHz)
HZ53	Probe 100:1 (100 MHz)
HZ72	GPIB-Cable 2 m
HZ100	Differential probe 20:1/200:1
HZ109	Differential probe 1:1/10:1
HZ115	Differential probe 100:1/1000:1
HZ200	Probe 10:1 with auto attenuation ID (250 MHz)
HZ350	Probe 10:1 with automatically identification (350 MHz)
HZ355	Slimline probe 10:1 with automatically identification (500 MHz)
HZO20	High voltage probe 1000:1 (400 MHz, 1000 V_{rms})
HZO30	Active probe 1 GHz (0.9 pF, 1 MΩ, including many accessories)
HZO50	AC/DC Current probe 20 A, DC...100 kHz
HZO51	AC/DC Current probe 1000 A, DC...20 kHz

150 MHz Analog Oscilloscope HM1500-2

Product description, page 12

Vertical Deflection	
Channels:	2
Operating Modes:	CH 1 or CH 2 separate, DUAL (CH 1 and CH 2 alternate or chopped), Addition
XY-Mode:	CH 1
Invert:	CH 1, CH 2
Bandwidth (-3 dB):	2 x 0...150 MHz
Rise time:	<2.3 ns
Bandwith limiting (selectable)**:**	approx. 20 MHz (5 mV/div....20 V/div.)
Deflection Coefficients (CH 1,2):	14 calibrated steps
1...2 mV/div.:	±5 % (0...10 MHz (-3 dB))
5 mV...20 V/div.:	±3 % (1–2–5 sequence)
variable (uncalibrated)	>2.5:1 to >50 V/div.
Inputs CH 1, 2:	
Input Impedance:	1 MΩ II 15 pF
Coupling:	DC, AC, GND (ground)
Max. Input Voltage:	400 V (DC + peak AC)
Y Delay Line:	70 ns
Measuring Circuits:	Measuring Category I
Auxiliary input:	
Function (selectable)**:**	Extern Trigger, Z (unblank)
Coupling:	AC, DC
Max. input voltage:	100 V (DC + peak AC)

Triggering	
Automatic (Peak to Peak):	
Min. signal height:	5 mm
Frequency range:	10 Hz...250 MHz
Level control range:	from Peak- to Peak+
Normal (without peak)	
Min. signal height:	5 mm
Frequency range:	0...250 MHz
Level control range:	-10...+10 div.
Operating modes:	Slope/Video
Slope:	Rising, falling, both
Sources:	CH 1, CH 2, alt. CH 1/2 (≥8 mm), Line, Ext.
Coupling:	**AC:** 10Hz...250 MHz **DC:** 0...250 MHz **HF:** 30 kHz...250 MHz **LF:** 0...5 kHz Noise Rej. switchable
Video:	pos./neg. Sync. Impulse
Standards:	525 Line/60 Hz Systems 625 Line/50 Hz Systems
Field:	even/odd/both

Line:	all/line number selectable
Source:	CH 1, CH 2, Ext.
Indicator for trigger action:	LED
External Trigger via:	Auxiliary Input (0.3 V_{pp}, 150 MHz)
Coupling:	AC, DC
Max. input voltage:	100 V (DC + peak AC)
2nd Trigger	
Min. signal height:	5 mm
Frequency range:	0...250 MHz
Coupling:	DC
Level control range:	-10...+10 div.

Horizontal Deflection

Operating modes:	A, ALT (alternating A/B), B
Time base A:	50 ns/div....0.5 s/div. (1–2–5 sequence)
Time base B:	50 ns/div....20 ms/div. (1–2–5 sequence)
Accuracy A and B:	±3 %
X Magnification x10:	to 5 ns/div.
Accuracy:	±5 %
Variable time base A/B:	1:2.5
Hold Off time:	var. 1:10 LED-Indication
Bandwidth X-Amplifier:	0...3 MHz (-3 dB)
XY phase shift <3°:	<220 kHz

Operation/Measuring/Interfaces

Operation:	Autoset, Menu and help functions (multilingual)
Save/Recall (instrument parameter settings):	9
Signal display:	max. 4 traces CH 1, 2 (Time Base A) in combination with CH 1, 2 (Time Base B)
Frequency counter:	
6 digit resolution:	1...250 MHz
5 digit resolution:	0.5 Hz...1 MHz
Accuracy	50 ppm
Auto Measurements:	Frequency, Period, V_{dc}, V_{pp}, V_{p+}, V_{p-}
Cursor Measurements:	Δt, 1/Δt (f), tr, ΔV, V to GND, ratio X, ratio Y
Resolution Readout/Cursor:	1000 x 2000 Pts
Interfaces:	RS-232 (Device control and Parameter query, no CRT content transfer possible)
Optional:	Dual-Interface USB/RS232, IEEE-488 (GBIP) Dual-Interface Ethernet/USB

Display

CRT:	D14-375GH
Display area (with graticule):	8 div. x 10 div.
Acceleration voltage:	approx. 14 kV

General Information

Component tester:	
Test voltage:	approx. 7 V_{rms} (open circuit), approx. 50 Hz
Test current:	max. 7 mA_{rms} (short circuit)
Reference Potential:	Ground (safety earth)
Probe ADJ Output:	1 kHz/1 MHz square wave signal 0.2 V_{pp} (tr <4 ns)
Trace rotation:	electronic
Line voltage:	105...253 V, 50/60 Hz ±10 %, CAT II
Power consumption:	37 Watt at 230 V, 50 Hz
Protective system:	Safety class I (EN61010-1)
Operating temperature:	+5...+40 °C
Storage temperature:	-20...+70 °C
Rel. humidity:	5...80 % (non condensing)
Dimensions (W x H x D)**:**	285 x 125 x 380 mm
Weight:	5.6 kg

All data valid at 23 °C after 30 minutes warm-up.

Accessories supplied: Line cord, Operating manual, 2 Probes 10:1 with attenuation ID (HZ200)

Recommended accessories:

HO730	Dual-Interface Ethernet/USB
HO740	Interface IEEE-488 (GPIB)
HZ13	Interface cable (USB) 1.8 m
HZ14	Interface cable (serial) 1:1
HZ20	Adapter, BNC to 4 mm banana
HZ33	Test cable 50 Ω, BNC/BNC, 0.5 m
HZ34	Test cable 50 Ω, BNC/BNC, 1 m
HZ45	19¨-Rackmount Kit 4RU
HZ51	Probe 10:1 (150 MHz)
HZ52	Probe 10:1 RF (250 MHz)
HZ53	Probe 100:1 (100MHz)
HZ72	GPIB-Cable 2 m
HZ100	Differential probe 20:1/200:1
HZ109	Differential probe 1:1/10:1
HZ115	Differential probe 100:1/1000:1
HZ154	Standard probe 1:1/10:1
HZ350	Probe 10:1 with automatically identification (350 MHz)
HZ355	Slimline probe 10:1 with automatically identification (500 MHz)
HZO20	High voltage probe 1000:1 (400 MHz, 1000 V_{rms})
HZO30	Active probe 1 GHz (0.9 pF, 1 MΩ, including many accessories)
HZO50	AC/DC Current probe 20 A, DC...100 kHz
HZO51	AC/DC Current probe 1000 A, DC...20 kHz

150 MHz Mixed Signal CombiScope® HM1508-2

Product description, page 10

Vertical Deflection

Channels:	
Analog:	2
Digital:	2 + 2 Logic Channels
Operating Modes:	
Analog:	CH 1 or CH 2 separate, DUAL (CH 1 and CH 2 alternate or chopped), Addition
Digital:	Analog Signal Channels CH 1 or CH 2 separate, DUAL (CH 1 and CH 2), Addition Logic Signal Channels: CH 3 and CH 4
X in XY-Mode:	CH 1
Invert:	CH 1, CH 2
Bandwidth (-3 dB):	2 x 0...150 MHz
Rise time:	<2.3 ns
Bandwith limiting (selectable)**:**	approx. 20 MHz (5 mV/div....20 V/div.)
Deflection Coefficients (CH1, 2):	14 calibrated steps
1...2 mV/div. (10 MHz)	±5 % (0...10 MHz (-3dB))
5 mV...20 V/div.	±3 % (1–2–5 sequence)
variable (uncalibrated):	>2.5:1 to >50 V/div.
Inputs CH 1, 2:	
Input Impedance:	1 MΩ II 15 pF
Coupling:	DC, AC, GND (ground)
Max. Input Voltage:	400 V (DC + peak AC)
Y Delay Line (analog):	70 ns
Measuring Circuits:	Measuring Category I
Digital mode only:	
Logic Channels:	CH 3, CH 4
Select. switching thresholds:	TTL, CMOS, ECL
User definable thresholds:	3
within the range:	-2...+3 V
Analog mode only:	
Auxiliary input:	CH 4: 100 V (DC + peak AC)
Function (selectable):	Extern Trigger, Z (unblank)
Coupling:	AC, DC
Max. input voltage:	100 V (DC + peak AC)

Triggering

Analog and Digital Mode	
Automatic (Peak to Peak):	
Min. signal height:	5 mm
Frequency range:	10 Hz...250 MHz
Level control range:	from Peak- to Peak+
Normal (without peak):	
Min. signal height:	5 mm
Frequency range:	0...250 MHz
Level control range:	-10...+10 div.
Operating modes:	Slope/Video/Logic
Slope:	Rising, falling, both
Sources:	CH 1, CH 2, alt. CH 1/2 (≥8 mm, analog mode only), Line, Ext.
Coupling:	**AC:** 10 Hz...250 MHz **DC:** 0...250 MHz **HF:** 30 kHz...250 MHz **LF:** 0...5 kHz Noise Rej. switchable
Video:	pos./neg. Sync. Impulse
Standards:	525 Line/60 Hz Systems 625 Line/50 Hz Systems
Field:	even/odd/both

Line:	all/line number selectable
Source:	CH 1, CH 2, Ext.
Indicator for trigger action:	LED
External Trigger via:	CH 4 (0.3 V_{pp}, 150 MHz)
Coupling:	AC, DC
Max. input voltage:	100 V (DC + peak AC)
Digital mode:	
Logic:	AND/OR, TRUE/FALSE
Source:	CH 1 or 2, CH 3 and CH 4
State:	X, H, L
Pre/Post Trigger:	-100...+400 % related to complete memory
Analog mode	
2nd Trigger	
Min. signal height:	5 mm
Frequency range:	0...250 MHz
Coupling:	DC
Level control range:	-10...+10 div.

Horizontal Deflection

Analog mode	
Operating modes:	A, ALT (alternating A/B), B
Time base A:	50 ns/div....0.5 s/div. (1–2–5 sequence)
Time base B:	50 ns/div....20 ms/div. (1–2–5 sequence)
Accuracy A and B:	±3 %
X Magnification x10:	to 5 ns/div.
Accuracy:	±5 %
Variable time base A/B:	cont. 1:2.5
Hold Off time:	var. 1:10 LED-Indication
Bandwidth X-Amplifier:	0...3 MHz (-3 dB)
X Y phase shift <3°:	<220 kHz
Digital mode	
Time base range (1–2–5 sequence)	
Refresh Mode:	5 ns/div....20 ms/div.
with Peak Detect:	2...20 ms/div. (min. Pulse Width 10 ns)
Roll Mode:	50 ms/div....50 s/div.
Accuracy time base	
Time base:	50 ppm
Display:	±1 %
Memory Zoom:	max. 50,000:1
Bandwidth X-Amplifier:	0...150 MHz (-3 dB)
XY phase shift <3°:	<100 MHz

Digital Storage

Sampling Rate (real time):	Analog channels: max. 2 x 500 MSa/s or 1 x 1 GSa/s (interleaved); Logic Channels: 2 x 500 MSa/s
Sampling Rate (random sampling):	10 GSa/s
Bandwidth:	2 x 0...150 MHz (random)
Memory:	2 x 1 MPts (analog); 2 x 1 MPts (logic)
Operating modes:	Refresh, Average, Envelope/ Roll: Free Run/Triggered, Peak-Detect
Resolution (vertical):	8 Bit (25 Pts/div.)
Resolution (horizontal):	
Yt:	11 Bit (200 Pts/div.)
XY:	8 Bit (25 Pts/div.)
Interpolation:	Sinx/x, Dot Join (linear)
Delay:	1 Million x 1/Sampling Rate to 4 Million x 1/Sampling Rate
Display refresh rate:	max.170/s at 1 MPts
Display:	Dots (acquired points only), Vectors (partly interpolated), optimal (complete memory weighting and vectors)
Reference Memories:	9 with 2 kPts each (for recorded signals)
Display:	2 signals of 9 (free selectable)

FFT Mode

Display X:	Frequency Range
Disaplay Y:	True rms value of spectrum
Scaling:	Linear or logarithmic
Level display:	dBV, V
Window:	Square, Hanning, Hamming, Blackman
Control:	Center frequency, Span
Marker:	Frequency, Amplitude
Zoom (frequency axis):	up to x20

Operation/Measuring/Interfaces

Operation:	Menu (multilingual), Autoset, help functions (multilingual)
Save/Recall (instrument parameter settings):	9
Signal display:	max. 4 traces
analog:	CH 1, 2 (Time Base A) in combination with CH 1, 2 (Time Base B)
digital:	CH 1, 2 and CH 3, 4 or ZOOM or Reference or Mathematics
USB Memory-Stick:	
Save/Recall external:	
Instrument settings and Signals:	CH 1, 2 and CH 3, 4 or ZOOM or Reference or Mathematics
Screen-shot:	as Bitmap
Signal display data (2 k per channel):	Binary (SCPI-Data), Text (ASCII-Format), CSV (Spread Sheet)
Frequency counter:	
6 digit resolution:	1...250 MHz
5 digit resolution:	0.5 Hz...1 MHz
Accuracy:	50 ppm
Auto Measurements:	
Analog mode:	Frequency, Period, V_{dc}, V_{pp}, V_{p+}, V_{p-}
also in digital mode:	V_{rms}, V_{avg}
Cursor Measurements:	
Analog mode:	Δt, 1/Δt (f), tr, ΔV, V to GND, ratio X, ratio Y
plus in digital mode:	V_{pp}, V_{p+}, V_{p-}, V_{avg}, V_{rms}, pulse count
Resolution Readout/Cursor:	1000 x 2000 Pts, Signals: 250 x 2000
Interfaces (plug-in):	USB/RS-232 (HO720)
Optional:	IEEE-488, Ethernet/USB

Mathematic functions

Number of Formula Sets:	5 with 5 formulas each
Sources:	CH 1, CH 2, Math 1 – Math 5
Targets:	5 math. memories, Math 1...5
Functions:	ADD, SUB, 1/X, ABS, MUL, DIV, SQ, POS, NEG, INV
Display:	max. 2 math. memories (Math 1...5)

Display

CRT:	D14-375GH
Display area (with graticule):	8 div. x 10 div.
Acceleration voltage:	approx. 14 kV

General Information

Component tester	
Test voltage:	approx. 7 V_{rms} (open circuit), approx. 50 Hz
Test current:	max. 7 mA_{rms} (short circuit)
Reference Potential:	Ground (safety earth)
Probe ADJ Output:	1 kHz/1 MHz square wave signal 0.2 V_{pp} (tr <4 ns)
Trace rotation:	electronic
Line voltage:	105...253 V, 50/60 Hz ±10 %, CAT II
Power consumption:	47 Watt at 230 V, 50 Hz
Protective system:	Safety class I (EN61010-1)
Operating temperature:	+5...+40 °C
Storage temperature:	-20...+70 °C
Rel. humidity:	5...80 % (non condensing)
Dimensions (W x H x D):	285 x 125 x 380 mm
Weight:	5.6 kg

Valid at 23 °C after a 30 minute warm-up period.

Accessories supplied: Line cord, Operating manual, 4 Probes 10:1 with attenuation ID (HZ200), Windows Software for control and data transfer

Optionales accessories:

HO730	Dual-Interface Ethernet/USB
HO740	Interface IEEE-488 (GPIB)
HZ13	Interface cable (USB) 1.8 m
HZ14	Interface cable (serial) 1:1
HZ20	Adapter, BNC to 4 mm banana
HZ33	Test cable 50 Ω, BNC/BNC, 0.5 m
HZ34	Test cable 50 Ω, BNC/BNC, 1 m
HZ45	19¨-Rackmount Kit 4RU
HZ51	Probe 10:1 (150 MHz)
HZ52	Probe 10:1 RF (250 MHz)
HZ53	Probe 100:1 (100 MHz)
HZ72	GPIB-Cable 2 m
HZ100	Differential probe 20:1/200:1
HZ109	Differential probe 1:1/10:1
HZ115	Differential probe 100:1/1000:1
HZ154	Standard probe 1:1/10:1
HZ350	Probe 10:1 with automatically identification (350 MHz)
HZ355	Slimline probe 10:1 with automatically identification (500 MHz)
HZO20	High voltage probe 1000:1 (400 MHz, 1000 V_{rms})

HZO30	Active probe 1 GHz (0.9 pF, 1 MΩ, including many accessories)
HZO50	AC/DC Current probe 20 A, DC...100 kHz
HZO51	AC/DC Current probe 1000 A, DC...20 kHz

200 MHz Analog Oscilloscope HM2005-2

Product description, page 12

Vertical Deflection

Channels:	2
Operating Modes:	CH 1 or CH 2 separate, DUAL (CH 1 and CH 2 alternate or chopped), Addition
X in XY-Mode:	CH 1
Invert:	CH 1, CH 2
Bandwidth (-3 dB):	2 x 0...200 MHz
Rise time:	<1.75 ns
Bandwidth Limiter (switchable)**:**	approx. 20 MHz (1 mV/div....5 V/div.)
Deflection Coefficients (CH 1, 2):	12 calibrated steps
1...2 mV/div.:	±3 % (0...100 MHz (-3 dB))
5 mV...5 V/div.:	±3 % (1–2–5 sequence)
variable (uncalibrated):	>1mV/div....5V/div., continuous
Inputs CH 1, 2:	
Impedance:	1 MΩ II 13 pF
Coupling:	DC, AC, 50Ω, GND (ground)
Max. Input Voltage:	250 V (DC + peak AC), 50 Ω <5 V_{rms}
Y Delay Line (analog):	70 ns
Measuring Circuits:	Measuring Category I
Auxiliary input:	
Function (selectable):	Ext. Trigger, Z (unblank)
Coupling (Ext. Trig./Z):	all/AC, DC
Max. input voltage:	100 V (DC + peak AC)

Triggering

Automatic (Peak to Peak):	
Min. signal height:	5 mm
Frequency range:	10 Hz...250 MHz
Level control range:	from Peak- to Peak+
Normal (without peak):	
Min. signal height:	5 mm
Frequency range:	0...250 MHz
Level control range:	-10...+10 div.
Operating modes:	Slope/Video
Slope:	Rising, falling, both
Sources:	CH 1, CH 2, alt. CH 1/2 (≥8 mm), Line, Ext.
Coupling:	**AC:** 10 Hz...250 MHz **DC:** 0...250 MHz **HF:** 30 kHz...250 MHz **LF:** 0...5 kHz Noise Rej. switchable
Video:	pos./neg. Sync. Impulse
Standards:	525 Line/60 Hz Systems 625 Line/50 Hz Systems
Field:	even/odd/both
Line:	all/line number selectable
Source:	CH 1, CH 2, Ext.
Indicator for trigger action:	LED
External Trigger via:	AUXILIARY INPUT (0.3 V_{pp}, 0...200 MHz)
Coupling:	AC, DC
Max. input voltage:	100 V (DC + peak AC)
2nd Trigger	
Min. signal height:	5 mm
Frequency range:	0...250 MHz
Coupling:	DC
Level control range:	-10...+10 div.

Horizontal Deflection

Time Base	
Operating modes:	A, ALT (alternating A/B), B
Time base A:	20 ns/div....0.5 s/div. (1–2–5 sequence)
Time base B:	20 ns/div....20 ms/div. (1–2–5 sequence)
Accuracy A and B:	±3 %
X Magnification x10:	to 2 ns/div.
Accuracy:	±5 %
Variable time base A/B:	1:2.5
Hold Off time:	var. 1:10 (LED-Indication)
XY Mode	
Bandwidth X-Amplifier:	0...3 MHz (-3 dB)
XY phase shift:	<3° <220 kHz

Operation/Measuring/Interfaces

Operation: Menu (multilingual), Autoset, Help functions (multilingual)	
Save/Recall internal:	9 Instrument parameter settings
Signal sources:	CH 1, CH 2
Frequency counter:	
6 digit resolution:	>1...250 MHz
5 digit resolution:	0.5 Hz...1 MHz
Accuracy:	50 ppm
Auto Measurements:	Frequency, Period, V_{dc}, V_{pp}, V_{p+}, V_{p-}
Cursor Measurements:	Δt, 1/Δt (f), tr, ΔV, V to GND, ratio X, ratio Y
Resolution Readout/Cursor:	1000 x 2000 Pts
Interfaces:	RS-232 (Device control and Parameter query, no CRT content transfer possible)

Display

CRT:	D14-375GH
Display area (with graticule):	8 div. x 10 div.
Acceleration voltage:	approx. 14 kV

General Information

Component tester	
Test voltage:	approx. 7 V_{rms} (open circuit), approx. 50 Hz
Test current:	max. 7 mA_{rms} (short circuit)
Reference Potential:	Ground (safety earth)
Probe ADJ Output:	1 kHz/1 MHz square wave signal 0.2 V_{pp} (tr <4 ns)
Trace rotation:	electronic
Line voltage:	105...253 V, 50/60 Hz ±10 %, CAT II
Power consumption:	42 Watt at 230 V, 50 Hz
Protective system:	Safety class I (EN61010-1)
Operating temperature:	+5...+40 °C
Storage temperature:	-20...+70 °C
Rel. humidity:	5...80 % (non condensing)
Dimensions (W x H x D)**:**	285 x 125 x 380 mm
Weight:	5.6 kg

All data valid at 23 °C after 30 minutes warm-up.

Accessories supplied: Line Cord, Operators Manual and Software for Windows on CD-ROM, 2 Probes 10:1 (HZ200)

Recommended accessories:

HO730	Dual-Interface Ethernet/USB
HO740	Interface IEEE-488 (GPIB)
HZ13	Interface cable (USB) 1.8 m
HZ14	Interface cable (serial) 1:1
HZ20	Adapter, BNC to 4 mm banana
HZ33	Test cable 50 Ω, BNC/BNC, 0.5 m
HZ34	Test cable 50 Ω, BNC/BNC, 1 m
HZ45	19¨-Rackmount Kit 4RU
HZ51	Probe 10:1 (150 MHz)
HZ52	Probe 10:1 RF (250 MHz)
HZ53	Probe 100:1 (100 MHz)
HZ72	GPIB-Cable 2 m
HZ100	Differential probe 20:1/200:1
HZ109	Differential probe 1:1/10:1
HZ115	Differential probe 100:1/1000:1
HZ154	Standard probe 1:1/10:1
HZ350	Probe 10:1 with automatically identification (350 MHz)
HZ355	Slimline probe 10:1 with automatically identification (500 MHz)
HZO20	High voltage probe 1000:1 (400 MHz,1000 V_{rms})
HZO30	Active probe 1 GHz (0.9 pF, 1 MΩ, including many accessories)
HZO50	AC/DC Current probe 20 A, DC...100 kHz
HZO51	AC/DC Current probe 1000 A, DC...20 kHz

200 MHz Mixed Signal CombiScope® HM2008

Product description, page 9

Vertical Deflection

Channels:	
Analog:	2

Digital:	2 + (additionally with Option HO2010) 4 Logic Channels
Operating Modes:	
Analog:	CH 1 or CH 2 separate, DUAL (CH 1 and CH 2 alternate or chopped), Addition
Digital:	Analog Signal Channels: CH 1 or CH 2 separate, DUAL (CH 1 and CH 2) or Addition. Logic Signal Channels (LCH 0...3) switchable.
X in XY-Mode:	CH 1
Invert:	CH 1, CH 2
Bandwidth (-3 dB):	2 x 0...200 MHz
Rise time:	<1.75 ns
Bandwidth Limiter (switchable):	approx. 20 MHz (1 mV/div....5 V/div.)
Deflection Coefficients (CH 1, 2):	12 calibrated steps
1...2 mV/div.:	±3 % (0...100 MHz (-3 dB))
5 mV...5V/div.:	±3 % (1–2–5 sequence)
variable (uncalibrated):	>1 mV/div....5 V/div., continuous
Inputs CH 1, 2:	
Impedance:	1 MΩ II 13 pF
Coupling:	DC, AC, 50 Ω, GND (ground)
Offset control:	
1 mV, 2 mV	±0.2 V
5...50 mV	±1 V
100 mV...5 V	±20 V
Max. Input Voltage:	250 V (DC + peak AC), 50 Ω <5 V_{rms}
Y Delay Line (analog):	70 ns
Measuring Circuits:	Measuring Category I
Analog mode only:	
Auxiliary input:	
Function (selectable):	Ext. Trigger, Z (unblank in analog mode)
Coupling (Ext. Trig./Z):	all/AC, DC
Max. input voltage:	100 V (DC + peak AC)
Digital mode only:	
Logic Channels in combination with Option HO2010:	
Quantity	4 (LCH 0...3)
Select. switching thresholds:	TTL, CMOS, ECL (common for all)
User definable thresholds:	2
within the range:	-2...+8 V (common for all)

Triggering

Analog and Digital Mode	
Automatic (Peak to Peak):	
Min. signal height:	5 mm
Frequency range:	10 Hz...250 MHz
Level control range:	from Peak- to Peak+
Normal (without peak):	
Min. signal height:	5 mm
Frequency range:	0...250 MHz
Level control range:	-10...+10 div.
Operating modes:	Slope/Video/Logic
Slope:	Rising, falling, both
Sources:	CH 1, CH 2, alt. CH 1/2 (≥8 mm, analog mode only), Line, Ext.
Coupling:	**AC:** 10 Hz...250 MHz **DC:** 0...250 MHz **HF:** 30 kHz...250 MHz **LF:** 0...5 kHz Noise Rej. switchable
Video:	pos./neg. Sync. Impulse
Standards:	525 Line/60 Hz Systems 625 Line/50 Hz Systems
Field:	even/odd/both
Line:	all/line number selectable
Source:	CH 1, CH 2, Ext.
Indicator for trigger action:	LED
External Trigger via:	AUXILIARY INPUT (0.3 V_{pp}, 0...200 MHz)
Coupling:	AC, DC
Max. input voltage:	100 V (DC + peak AC)
Digital mode:	
Pre/Post Trigger:	-100...+400 % relative to complete memory
Logic (with Option HO2010):	AND/OR, TRUE/FALSE
Source:	Logic Channel 0...3
State:	X, H, L
Analog mode:	
2nd Trigger	
Min. signal height:	5 mm
Frequency range:	0...250 MHz
Coupling:	DC
Level control range:	-10...+10 div.

Horizontal Deflection

Analog Time Base	
Operating modes:	A, ALT (alternating A/B), B
Time base A:	20 ns/div....0.5 s/div. (1–2–5 sequence)
Time base B:	20 ns/div...20 ms/div. (1–2–5 sequence)
Accuracy A and B:	±3 %
X Magnification x10:	to 2 ns/div.
Accuracy:	±5 %
Variable time base A/B:	cont. 1:2.5
Hold Off time:	var. 1:10 (LED-Indication)
Analog XY Mode	
Bandwidth X-Amplifier:	0...3 MHz (-3 dB)
XY phase shift:	<3° <220 kHz
Digital Time Base	
Time base range (1–2–5 sequence)	
Refresh Mode:	2 ns/div....50 s/div.
with Peak Detect:	500 ns/div....50 s/div. (min. Pulse Width 10 ns)
Roll Mode:	50 ms/div....50 s/div.
Accuracy time base	
Time coefficient:	50 ppm
Display:	±1 %
Memory Zoom:	max. 100,000:1
Digital XY Mode	
Bandwidth X-Amplifier:	0...200 MHz (-3 dB)
XY phase shift:	<3° <200 MHz

Digital Storage

Sampling Rate (real time):	Analog channels: 2 x 1 GSa/s or 1 x 2 GSa/s (interleaved); Logic Channels: max. 4 x 500 MSa/s
Sampling Rate (random sampling):	20 GSa/s (1-Channel mode) 25 GSa/s (2-Channel mode)
Bandwidth:	2 x 0...200 MHz (Random)
Memory:	2 x 2 MPts (analog); 4 x 2 MPts (logic)
Operating modes:	Refresh, Average, Envelope, Roll: Free Run/Triggered, Peak-Detect
Resolution (vertical):	8 Bit (25 Pts/div.)
Resolution (horizontal):	
Yt:	11 Bit (200 Pts/div.)
XY:	8 Bit (25 Pts/div.)
Interpolation:	Sinx/x, Dot Join (linear)
Delay:	2 Million x (1/Sampling Rate; max.) 8 Million x (1/Sampling Rate; max.)
Display refresh rate:	max.170/s at 2 MPts
Display:	Dots (acquired points only), Vectors (interpolation), Optimal (complete memory weighting and vector display)
Reference Memories:	9 with 2 kPts each (for recorded signals)
Display:	2 signals of 9 (freely selectable)

FFT Mode

Display X:	Frequency Range
Display Y:	True rms value of spectrum
Scaling:	Linear or logarithmic
Level display:	dBV, V
Window:	Square, Hanning, Hamming, Blackman
Control:	Center frequency, Span
Marker:	Frequency, Amplitude
Zoom (frequency axis):	up to x20

Operation/Measuring/Interfaces

Operation: Menu (multilingual), Autoset, Help functions (multilingual)	
Save/Recall internal:	
analog:	9 Instrument parameter settings
digital:	9 Signals (each 2k) incl. instrument parameters
Signal sources:	CH 1, CH 2, LCH 0...3, ZOOM, Reference 1...9 or Mathematics
Signal display:	max. 6 traces
USB Memory-Stick:	
Save/Recall external:	
Instrument settings and Signals:	CH 1, CH 2, LCH 0...3, ZOOM, Reference 1...9 or Mathematics
Screen-shot:	as Bitmap
Signal display data (2k per channel):	Binary (SCPI-Data), Text (ASCII-Format), CSV (Spread Sheet)
Frequency counter:	
6 digit resolution:	1...250 MHz

5 digit resolution:	0.5 Hz...1 MHz
Accuracy:	50 ppm
Auto Measurements:	
Analog mode:	Frequency, Period, V_{dc}, V_{pp}, V_{p+}, V_{p-}
plus in digital mode:	V_{rms}, V_{avg}
Cursor Measurements:	
Analog mode:	Δt, 1/Δt (f), tr, ΔV, V to GND, ratio X, ratio Y
plus in digital mode:	V_{pp}, V_{p+}, V_{p-}, V_{avg}, V_{rms}, pulse count
Resolution Readout/Cursor:	1000 x 2000 Pts, Signals: 250 x 2000
Interfaces (plug-in):	USB/RS-232 (HO720)
Optional:	IEEE-488, Ethernet/USB

Mathematic functions	
Number of Formula Sets:	5 with 5 formulas each
Sources:	CH 1, CH 2, Math 1–Math 5
Targets:	5 math. memories (Math 1...5)
Functions:	ADD, SUB, 1/X, ABS, MUL, DIV, SQ, POS, NEG, INV
Display:	max. 2 math. memories (Math 1...5)

Display	
CRT:	D14-375GH
Display area (with graticule):	8 div. x 10 div.
Acceleration voltage:	approx. 14 kV

General Information	
Component tester	
Test voltage:	approx. 7 V_{rms} (open circuit), approx. 50 Hz
Test current:	max. 7 mA_{rms} (short circuit)
Reference Potential:	Ground (safety earth)
Probe ADJ Output:	1 kHz/1 MHz square wave signal 0.2 V_{pp} (tr <4 ns)
Trace rotation:	electronic
Line voltage:	105...253 V, 50/60 Hz ±10 %, CAT II
Power consumption:	48 Watt at 230 V, 50 Hz
Protective system:	Safety class I (EN61010-1)
Operating temperature:	+5...+40 °C
Storage temperature:	-20...+70 °C
Rel. humidity:	5...80 % (non condensing)
Dimensions (W x H x D):	285 x 125 x 380 mm
Weight:	5.6 kg

All data valid at 23 °C after 30 minutes warm-up.

Accessories supplied: Line cord, manual, 2 probes 10 :1 with automatic identification of the attenuation ratio (HZ200), Windows software for instrument control and data transfer.

Recommended accessories:

HO730	Dual interface Ethernet/USB
HO740	IEEE-488 (GPIB) interface
HO2010	4 Channel Logic Probe
HZ13	Interface cable (USB) 1.8 m
HZ14	Interface cable (serial) 1:1
HZ20	Adapter, BNC to 4 mm banana
HZ33	Test cable 50 Ω, BNC/BNC, 0.5 m
HZ34	Test cable 50 Ω, BNC/BNC, 1 m
HZ45	19¨-Rackmount Kit 4RU
HZ51	Probe 10:1 (150 MHz)
HZ52	Probe 10:1 RF (250 MHz)
HZ53	Probe 100:1 (100 MHz)
HZ72	GPIB-Cable 2 m
HZ100	Differential probe 20:1/200:1
HZ109	Differential probe 1:1/10:1
HZ115	Differential probe 100:1/1000:1
HZ154	Probe 1:1/10:1 (10/100 MHz)
HZ350	Probe 10:1 with automatically identification (350 MHz)
HZ355	Slimline probe 10:1 with automatically identification (500 MHz)
HZO20	High voltage probe 1000:1 (400 MHz,1000 V_{rms})
HZO30	Active probe 1 GHz (0.9 pF, 1 MΩ, including many accessories)
HZO50	AC/DC Current probe 20 A, DC...100 kHz
HZO51	AC/DC Current probe 1000 A, DC...20 kHz

250 MHz 4 Channel Digital Oscilloscope HMO2524

Product description, page 7

Display	
Display:	16.5 cm (6.5") VGA Color TFT
Resolution:	640 x 480 Pixel
Backlight:	LED 400 cd/m^2
Display area for curves:	
without menu	400 x 600 Pixel (8 x 12 div.)
with menu	400 x 500 Pixel (8 x 10 div.)
Color depth:	256 colors
Intensity steps per channel:	0...31

Vertical System	
Channels:	
DSO mode	CH 1...CH 4
MSO mode	CH 1...CH 3 LCH 0...7 (with 1x Option HO3508) CH 1, CH 2, LCH 0...15 (with 2x Option HO3508)
Auxiliary input:	Rear side
Function	Ext. Trigger
Impedance	1 MΩ || 13 pF ±2 pF
Coupling	DC, AC
Max. input voltage	100 V (DC + peak AC)
XYZ-mode:	All analog channels on individual choice
Invert:	CH 1...CH 4
Y-bandwidth (-3 dB):	250 MHz (5 mV...5 V)/div. 100 MHz (1 mV, 2 mV)/div.
Lower AC bandwidth:	2 Hz
Bandwidth limiter (switchable):	approx. 20 MHz
Rise time (calculated):	<1.5 ns
DC gain accuracy	2 %
Input sensitivity:	12 calibrated steps
CH 1...C H4	1 mV/div....5 V/div. (1–2–5 Sequence)
Variable	Between calibrated steps
Inputs CH1...CH4:	
Impedance	1 MΩ II 13 pF ±2 pF (50 Ω switchable)
Coupling	DC, AC, GND
Max. input voltage	200 V (DC + peak AC), 50 Ω <5 V_{rms}
Measuring circuits:	Measuring Category I (CAT I)
Position range	±10 Divs
Offset control:	
1 mV, 2 mV	±0.2 V
5...50 mV	±1 V
100 mV...5 V	±20 V
Logic channels	With Option HO3508
Select. switching thresholds	TTL, CMOS, ECL, 2x User -2...+8 V
Impedance	100 kΩ || <4 pF
Coupling	DC
Max. input voltage	40 V (DC + peak AC)

Triggering	
Analog channels:	
Automatic:	Linking of peakdetection and triggerlevel
Min. signal height	0.8 div; 0.5 div typ.
Frequency range	5 Hz...300 MHz
Level control range	From peak- to peak+
Normal (without peak):	
Min. signal height	0.8 div; 0.5 div typ.
Frequency range	0...300 MHz
Level control range	-10....+10 div.
Operating modes:	Slope/Video/Logic/Pulse/Busses (optional)
Slope:	Rising, falling, both
Sources:	CH 1...CH 4, Line, Ext., LCH 0...15
Coupling:	**AC:** 5 Hz...300 MHz **DC:** 0...300 MHz **HF:** 30 kHz...300 MHz **LF:** 0...5 kHz Noise rejection: 100 MHz LPF switchable
Video:	
Standards	PAL, NTSC, SECAM, PAL-M, SDTV 576i, HDTV 720p, HDTV 1080i, HDTV 1080p
Fields	Field 1, field 2, both
Line	All, selectable line number
Sync. Impulse	Positive, negative
Source	CH 1...CH 4
Logic:	AND, OR, TRUE, FALSE

Source	LCH 0...15
State	LCH 0...15 X, H, L
Indicator for trigger action:	LED
Ext. Trigger via:	Auxiliary input 0.3 V...10 V_{pp}
2nd Trigger:	
Slope	Rising, falling, both
Min. signal height	0.8 div.; 0.5 div. typ.
Frequency range	0...300 MHz
Level control range	-10....+10 div.
Operating modes:	
after time	20 ns...0.1 s
after incidence	$1...2^{16}$
Busses (Opt. HO010):	I^2C/SPI/UART/RS-232
Source	LCH 0...LCH 15
Format	hexadecimal, binary
I^2C	Trigger on Start, Stop, Restart, NACK, Adress (7 or 10 Bit), Data, Adress and Data, up to 10 Mb/s
SPI	up to 32 Bit Data, Chip select (CS) pos. or neg., without CS, up to 25 Mb/s
UART/RS-232	up to 8 Bit Data, up to 62.5 Mb/s

Horizontal System

Domain representation:	Time, Frequency (FFT), Voltage (XY)
Representation Time Base:	Main-window, main- and zoom-window
Memory Zoom:	Up to 100,000:1
Accuracy:	15 ppm
Time Base:	
Refresh operating modes	2 ns/div....20 ms/div.
Roll operating modes	50 ms/div....50 s/div.

Digital Storage

Sampling rate (real time)**:**	4 x 1.25 GSa/s, 2 x 2.5 GSa/s Logic channels: 16 x 1.25 GSa/s
Sampling rate (random)**:**	25 GSa/s (n/a to logic channels)
Memory:	4 x 2 MPts, 2 x 4 MPts
Operation modes:	Refresh, Average, Envelope, Peak-Detect Roll: free run/triggered, Smooth
Resolution (vertical)	8 Bit
Resolution (horizontal)	
Yt Mode	50 Pts./div.
XY Mode	8 Bit
Interpolation:	Sinx/x (CH 1...CH 4), Pulse (LCH 0...15)
Persistence:	Off, 50 ms...∞
Delay pretrigger:	0...2 Million x (1/samplerate)
posttrigger:	0...8 Million x (1/samplerate)
Display refresh rate:	Up to 2500 waveforms/s
Display:	Dots, vectors (interpolation), „persistence"
Reference memories:	typ. 10 Traces

Operation/Measuring/Interfaces

Operation:	Menu-driven (multilingual), Autoset, help functions (multilingual)
Save/Recall memories:	typ. 10 complete instrument parameter settings
Frequency counter:	
0.5 Hz...300 MHz	6 Digit resolution
Accuracy	15 ppm
Auto measurements:	Frequency, Period, pulse count, V_{pp}, V_{p+}, V_{p-}, V_{rms}, V_{avg}, V_{top}, V_{base}, t_{width+}, t_{width-}, $t_{dutycycle+}$, $t_{dutycycle-}$, t_{rise}, t_{fall}, pos. edge count, neg. edge count, pos. pulse count, neg. pulse count
Cursor measurements:	ΔV, Δt, 1/Δt (f), V to Gnd, Vt related to Trigger point, ratio X and Y, pulse count, peak to peak, peak+, peak-
Interface:	Dual-Interface USB/RS-232 (HO720), USB-Stick (frontside), USB-Printer (rear side) for Postscript Printer, DVI-D for ext. monitor
Optional:	IEEE-488 (HO740), Ethernet/USB (HO730)

Display functions

Marker:	up to 8 user definable markers for easy navigation
VirtualScreen:	virtual Display with 20 div. vertical for all Math-, Logic-, Bus- and Reference Signals
Busdisplay:	up to 2 busses, user definable, parallel or serial busses (option), decode of the bus value in ASCII, binary, decimal or hexa-decimal, up to 4 lines
Parallel	logic channels can also be used as source for bus definition
I^2C (Opt. HO010)	color coded Read-, Write Adress, Data, Start, Stop, missing acknowledge, Errors and Trigger condition
SPI (Opt. HO010)	color coded Data, Start, Stop, Errors and Trigger condition
UART/RS-232 (Opt. HO010)	color coded Data, Start, Stop, Errors and Trigger condition

Mathematic functions

Number of formula sets:	5 formula sets with up to 5 formulas each
Sources:	All channels and math. memories
Targets:	Math. memories
Functions:	ADD, SUB, 1/X, ABS, MUL, DIV, SQ, POS, NEG, INV, INTG, DIFF, SQR, MIN, MAX, LOG, LN
Display:	Up to 4 math. memories with label

Pass/Fail functions

Sources:	Analog channels
Type of test:	Mask around a signal, userdefined tolerance
Functions:	Stop, Beep, screen shot, (screen print-out), output to printer and/or pulse on the Y output for pass or fail, event counting up to 4 billion, including the number and the percentage of pass and fail events.

General Information

Probe ADJ Output:	1 kHz/1 MHz square wave signal approx. 1 V_{pp} (ta <4 ns)
Bus Signal Source:	Three outputs (frontside) which generate a selection of serial or parallel data for test and training purposes
Internal RTC (Realtime clock)**:**	Date and time for stored data
Line voltage:	105...253 V, 50/60 Hz, CAT II
Power consumption:	Max. 70 Watt at 230 V, 50 Hz
Protective system:	Safety class I (EN61010-1)
Operating temperature:	+5...+40 °C
Storage temperature:	-20...+70 °C
Rel. humidity:	5...80 % (non condensing)
Dimensions (W x H x D)**:**	285 x 175 x 220 mm
Weight:	3.6 kg

All data valid at 23 °C after 30 minute warm-up

Accessories supplied: Line cord, Operating manual, 4 Probes, 10:1 with attenuation ID (HZ350), CD

Recommended accessories:

HO010	Serial bus trigger and hardware acelerated decode, I^2C, SPI, UART/RS-232 on Logic channels
HO3508	active 8 Channel Logic Probe
HO3516	2 x HO3508, active 8 Channel Logic Probes
HO730	Dual-Interface Ethernet/USB
HZ99	Carrying Case for protection and transport
HZ46	4RU 19¨ Rackmount Kit
HZ355DU	Upgrade from 2x HZ350 to 2x HZ355
HZ355	Slimline Probe 10:1 with automatically identification
HZ355DU	Upgrade from 2x HZ350 to 2x HZ355
HZO20	High Voltage probe 1000:1 (400 MHz)
HZO30	single ended active probe (1 GHz)
HZO50	AC/DC Currentprobe 20 A, DC...100 kHz
HZO51	AC/DC Currentprobe 1000 A, DC...20 kHz

350 MHz 2 [4] Channel Digital Oscilloscope HMO3522 [HMO3524]

Product description, page 6

Display

Display:	16.5 cm (6.5") VGA Color TFT
Resolution:	640 x 480 Pixel
Backlight:	LED 400 cd/m^2
Display area for curves:	
without menu	400 x 600 Pixel (8 x 12 div.)
with menu	400 x 500 Pixel (8 x 10 div.)

Color depth:	256 colors
Intensity steps per channel:	0...31

Vertical System

Channels:	
DSO mode	CH 1, CH 2 [CH 1...CH 4]
MSO mode	CH 1, CH 2, LCH 0...15 (logic channels) with 2 x Option HO3508
Auxiliary input:	Frontside [Rear side]
Function	Ext. Trigger
Impedance	1 MΩ || 13 pF ±2 pF
Coupling	DC, AC
Max. input voltage	100 V (DC + peak AC)
XYZ-mode:	All analog channels on individual choice
Invert:	CH 1, CH 2 [CH 1...CH 4]
Y-bandwidth (-3 dB):	350 MHz (5 mV...5 V)/div. 100 MHz (1 mV, 2 mV)/div.
Lower AC bandwidth:	2 Hz
Bandwidth limiter (switchable)**:**	approx. 20 MHz
Rise time (calculated)**:**	<1 ns
DC gain accuracy	2 %
Input sensitivity:	12 calibrated steps
CH 1, CH 2 [CH 1...CH 4]	1 mV/div....5 V/div. (1–2–5 Sequence)
Variable	Between calibrated steps
Inputs CH 1, CH 2 [CH 1...CH 4]:	
Impedance	1 MΩ II 13 pF ±2 pF (50 Ω switchable)
Coupling	DC, AC, GND
Max. input voltage	200 V (DC + peak AC), 50 Ω <5 V_{rms}
Measuring circuits:	Measuring Category I (CAT I)
Position range	±10 Divs
Offset control:	
1 mV, 2 mV	±0.2 V
5...50 mV	±1 V
100 mV...5 V	±20 V
Logic channels	With Option HO3508
Select. switching thresholds	TTL, CMOS, ECL, 2x User -2...+8 V
Impedance	100 kΩ || <4 pF
Coupling	DC
Max. input voltage	40 V (DC + peak AC)

Triggering

Analog channels:	
Automatic:	Linking of peakdetection and triggerlevel
Min. signal height	0.8 div; 0.5 div typ.
Frequency range	5 Hz...400 MHz
Level control range	From peak- to peak+
Normal (without peak)**:**	
Min. signal height	0.8 div; 0.5 div typ.
Frequency range	0...400 MHz
Level control range	-10...+10 div.
Operating modes:	Slope/Video/Logic/Pulse/Busses (optional)
Slope:	Rising, falling, both
Sources:	CH 1, CH 2, Line, Ext., LCH 0...15 [CH 1...CH 4, Line, Ext., LCH 0...15]
Coupling:	**AC:** 5 Hz...400 MHz **DC:** 0...400 MHz **HF:** 30 kHz...400 MHz **LF:** 0...5 kHz Noise rejection: 100 MHz LPF switchable
Video:	
Standards	PAL, NTSC, SECAM, PAL-M, SDTV 576i, HDTV 720p, HDTV 1080i, HDTV 1080p
Fields	Field 1, field 2, both
Line	All, selectable line number
Sync. Impulse	Positive, negative
Source	CH 1, CH 2, Ext. [CH 1...CH 4]
Logic:	AND, OR, TRUE, FALSE
Source	LCH 0...15
State	LCH 0...15 X, H, L
Indicator for trigger action:	LED
Ext. Trigger via:	Auxiliary input 0,3 V...10 V_{pp}
2nd Trigger:	
Slope	Rising, falling, both
Min. signal height	0.8 div.; 0.5 div. typ.
Frequency range	0...400 MHz
Level control range	-10...+10 div.
Operating modes:	
after time	20 ns...0.1 s
after incidence	$1...2^{16}$
Busses (Opt. HO010):	I^2C/SPI/UART/RS-232
Source	LCH 0...LCH 15
Format	hexadecimal, binary
I^2C	Trigger on Start, Stop, Restart, NACK, Adress (7 or 10 Bit), Data, Adress and Data, up to 10 Mb/s
SPI	up to 32 Bit Data, Chip select (CS) pos. or neg., without CS, up to 25 Mb/s
UART/RS-232	up to 8 Bit Data, up to 62.5 Mb/s

Horizontal System

Domain representation:	Time, Frequency (FFT), Voltage (XY)
Representation Time Base:	Main-window, main- and zoom-window
Memory Zoom:	Up to 100,000:1
Accuracy:	15 ppm
Time Base:	
Refresh operating modes	1 ns/div....20 ms/div.
Roll operating modes	50 ms/div....50 s/div.

Digital Storage

Sampling rate (real time):	2 x 2 GSa/s, 1 x 4 GSa/s [4 x 2 GSa/s, 2 x 4 GSa/s] Logic channels: 16 x 1 GSa/s
Sampling rate (random)**:**	50 GSa/s (n/a to logic channels)
Memory:	2 x 2 MPts, 1 x 4 MPts [4 x 2 MPts, 2 x 4 MPts]
Operation modes:	Refresh, Average, Envelope, Peak-Detect Roll: free run/triggered, Smooth
Resolution (vertical)	8 Bit
Resolution (horizontal)	
Yt Mode	50 Pts./div.
XY Mode	8 Bit
Interpolation:	Sinx/x (CH 1...CH 4), Pulse (LCH 0...15)
Persistence:	Off, 50 ms...∞
Delay pretrigger:	0...2 Million x (1/samplerate)
posttrigger:	0...8 Million x (1/samplerate)
Display refresh rate:	Up to 2500 waveforms/s
Display:	Dots, vectors (interpolation), „persistence"
Reference memories:	typ. 10 Traces

Operation/Measuring/Interfaces

Operation:	Menu-driven (multilingual), Autoset, help functions (multilingual)
Save/Recall memories:	typ. 10 complete instrument parameter settings
Frequency counter:	
0.5 Hz...350 MHz	6 Digit resolution
Accuracy	15 ppm
Auto measurements:	Frequency, Period, pulse count, V_{pp}, V_{p+}, V_{p-}, V_{rms}, V_{avg}, V_{top}, V_{base}, t_{width+}, t_{width-}, $t_{dutycycle+}$, $t_{dutycycle-}$, t_{rise}, t_{fall}, pos. edge count, neg. edge count, pos. pulse count, neg. pulse count
Cursor measurements:	ΔV, Δt, 1/Δt (f), V to Gnd, Vt related to Trigger point, ratio X and Y, pulse count, peak to peak, peak+, peak-
Interface:	Dual-Interface USB/RS-232 (HO720) USB-Stick (frontside) USB-Printer (rear side) for Postscript Printer DVI-D for ext. monitor
Optional:	IEEE-488 (HO740), Ethernet/USB (HO730)

Display functions

Marker:	up to 8 user definable marker for easy navigation
VirtualScreen:	virtual Display with 20 div. vertical for all Math-, Logic-, Bus- and Reference Signals
Busdisplay:	up to 2 busses, user definable, parallel or serial busses (option), decode of the bus value in ASCII, binary, decimal or hexadecimal, up to 4 lines
Parallel	logic channels can also be used as source for bus definition
I^2C (Opt. HO010)	color coded Read-, Write Adress, Data, Start, Stop, acknowledge, missing acknowledge, Errors and Trigger condition
SPI (Opt. HO010)	color coded Data, Start, Stop, Errors and Trigger condition

UART/RS-232 (Opt. HO010)	color coded Data, Start, Stop, Errors and Trigger condition

Mathematic functions	
Number of formula sets:	5 formula sets with up to 5 formulas each
Sources:	All channels and math. memories
Targets:	Math. memories
Functions:	ADD, SUB, 1/X, ABS, MUL, DIV, SQ, POS, NEG, INV, INTG, DIFF, SQR, MIN, MAX, LOG, LN
Display:	Up to 4 math. memories with label

Pass/Fail functions	
Sources:	Analog channels
Type of test:	Mask around a signal, userdefined tolerance
Functions:	Stop, Beep, screen shot (screen print-out) and/or output to printer for pass or fail, event counting up to 4 billion, including the number and the percentage of pass and fail events

General Information	
Probe ADJ Output:	1 kHz/1 MHz square wave signal ~0.2 V_{pp} (ta <4 ns)
Internal RTC (Realtime clock):	Date and time for stored data
Line voltage:	105...253 V, 50/60 Hz, CAT II
Power consumption:	Max. 70 Watt at 230 V, 50 Hz
Protective system:	Safety class I (EN61010-1)
Operating temperature:	+5...+40 °C
Storage temperature:	-20...+70 °C
Rel. humidity:	5...80 % (non condensing)
Dimensions (W x H x D):	285 x 175 x 220 mm
Weight:	3.6 kg

All data valid at 23 °C after 30 minute warm-up.

Accessories supplied: Line cord, Operating manual, 2 (4) Probes, 10:1 with attenuation ID (HZ350), CD

Recommended accessories:

HO010	Serial bus trigger and hardware acelerated decode, I^2C, SPI, UART/RS-232 on Logic channels
HO3508	active 8 Channel Logic Probe
HO3516	2 x HO3508, active 8 Channel Logic Probes
HO730	Dual-Interface Ethernet/USB
HO740	Interface IEEE-488 (GPIB) galvanically isolated
HZ355	Slimline Probe 10:1 with automatically identification
HZ355DU	Upgrade from 2x HZ350 to 2x HZ355
HZ46	4RU 19¨ Rackmount Kit
HZ99	Carrying Case for protection and transport
HZO20	High Voltage probe 1000:1 (400 MHz)
HZO30	single ended active probe (1 GHz)
HZO50	AC/DC Currentprobe 20 A, DC...100 kHz
HZO51	AC/DC Currentprobe 1000 A, DC...20 kHz

1 GHz Spectrum Analyzer HM5510

Product description, page 19

Frequency Characteristics	
Frequency Range:	0.15 MHz...1.05 GHz
Stability:	±5 ppm
Aging:	±1 ppm/year
Frequency Resolution:	1 kHz (6½-digit in readout)
Center Frequency Range:	0...1.05 GHz
LO Frequency Generation:	TCXO with DDS (Digital Frequency Synthesis)
Span Setting Range:	Zero-Span and 1...1000 MHz (1–2–5 Sequence)
Marker:	
Frequency Resolution:	1 kHz, 6½-digit,
Amplitude Resolution:	0.5 dB, 3½-digit
Resolution Bandwidths (RBW) @ 3 dB:	500 kHz and 20 kHz
Video filter (VBW):	4 kHz
Sweep Time:	20 ms

Amplitude Characteristics (Marker Related) 150 kHz...1 GHz	
Measurement Range:	-100...+10 dBm
Scaling:	10 dB/div.
Display Range:	80 dB (10 dB/div.)
Amplitude Frequency Response (at 10 dB Attn., Zero Span and RBW 500 kHz, Signal -20 dBm):	±3 dB
Display (CRT):	8 x 10 division
Amplitude Scale:	logarithmic
Display Units:	dBm
Parameter Display (LCD):	2 Lines x 20 Characters, Center Frequency, Span, Marker Frequency, Reference Level, Marker Level
Input Attenuator Range:	0...40 dB (10 dB increments)
Tolerance of input attenuator:	±2 dB relative to 10 dB position
Max. Input Level (continuous)	
10...40 dB attenuation:	+20 dBm (0.1 W)
0 dB attenuation:	+10 dBm
Max. DC Voltage:	±25 V
Max. Reference Level:	-50...+10 dBm
Reference Level Accuracy rel. to 500 MHz, 10 dB Attn., Zero Span and RBW 500 kHz:	±2 dB
Min. Average Noise Level:	approx. -100 dBm (RBW 20 kHz)
Intermodulation Ratio (3rd Order):	typical >75 dBc (2 Signals: 200 MHz, 203 MHz, -3 dB below Reference Level)
Harmonic Distortion Ratio (2nd harm.):	typical >75 dBc (200 MHz, Reference Level)
Bandwidth Dependent Amplitude Error rel. to RBW 500 kHz and Zero Span:	±1 dB

Inputs/Outputs	
Measurement Input:	N-socket
Input Impedance:	50 Ω
VSWR: (Attn. ≥10 dB)	typ. 1.5:1
Supply Voltage for Probes (HZ530):	6 V_{dc}
Audio output (phone):	3.5 mm Ø jack
Test Signal output:	N-socket, output Impedance 50 Ω
Frequency:	10 MHz
Level	0 dBm (±3 dB)

Functions	
Keyboard Input:	Center Frequency, Reference Level,
Rotary Encoder Input:	Center Frequency, Reference Level, Testsignal output Level, Marker, Intensity (CRT), Contrast (LCD)

General information	
CRT:	D14-363GY, 8 x 10 div. with internal graticule
Acceleration Voltage:	approx. 2 kV
Trace Rotation:	adjustable on front panel
Power Supply:	105...253 V, 50/60 Hz ±10 %, CAT II
Power Consumption:	approx. 31 W at 230 V/50 Hz
Safety class:	Safety class I (EN61010-1)
Operating temperature:	+5...+40 °C
Storage temperature:	-20...+70 °C
Rel. humidity:	5...80 % (non condensing)
Dimensions (W x H x D):	285 x 125 x 380 mm, with adjustable, lockable tilt handle
Weight:	approx. 5.6 kg

All data valid at 23 °C after 30 minutes warm-up.

Accessories supplied: Line Cord, Operators Manual, 2x HZ21 Adapter Plug (N-plug with BNC socket)

Recommended accessories:

HZ20	Adapter, BNC to 4 mm banana
HZ33	Test cable 50 Ω, BNC/BNC, 0.5 m
HZ34	Test cable 50 Ω, BNC/BNC, 1 m
HZ43	19¨-Rackmount Kit 3RU
HZ520	Antenna
HZ525	50 Ω-Termination, N plug
HZ530	Near Field Probe Set for EMI Diagnosis
HZ560	Transient Limiter
HZ575	Converter 75 Ω to 50 Ω
HZO30	Active probe 1 GHz (0.9 pF, 1 MΩ, including many accessories)

1 GHz Spectrum Analyzer HMS1000, HMS1010 (with TG) [3 GHz Spectrum Analyzer HMS3000, HMS3010 (with TG)]

Product description, page 17

Frequency	
Frequency range:	
HMS1000, HMS1010	100 kHz...1 GHz
HMS3000, HMS3010	100 kHz...3 GHz
Temperature stability:	±2 ppm (0...30 °C)
Aging:	±1 ppm/year
Frequency counter (from SW 2.0)**:**	
Resolution	1 Hz
Accuracy	±(Frequency x tolerance of reference)
Span setting range:	
HMS1000, HMS1010	0 Hz (zero span) and 1 kHz...1 GHz
HMS3000, HMS3010	0 Hz (zero span) and 100 Hz...3 GHz
Spectral purity, SSB phase noise:	
30 kHz from carrier (500 MHz, +20...30 °C)	<-85 dBc/Hz
100 kHz from carrier (500M Hz, +20...30 °C)	<-100 dBc/Hz
1 MHz from carrier (500MHz, +20...30 °C)	<-120 dBc/Hz
Sweep time:	
Span = 0 Hz	20 ms...100 s
Span > 0 Hz	20 ms...1000 s, min. 20 ms/600 MHz
Resolution bandwidths (-3 dB)**:**	
HMS1000, HMS1010	1 kHz...1 MHz in 1–3 steps, 200 kHz
HMS3000, HMS3010	100 Hz...1 MHz in 1–3 steps, 200 kHz
Tolerance:	
≤300kHz	±5 % typ.
1MHz	±10 % typ.
Resolution bandwidths (-6 dB)**:**	
HMS1000, HMS1010	9 kHz, 120 kHz, 1 MHz
HMS3000, HMS3010	200 Hz, 9 kHz, 120 kHz, 1 MHz
Video bandwidths:	10 Hz...1 MHz in 1–3 steps

Amplitude	
Display range:	Average noise level displayed up to +20 dBm
Amplitude measurement range:	Typ. -114...+20 dBm
Max. permissible DC at HF input:	80 V
Max. power at HF input:	20 dBm, 30 dBm for max. 3 Min.
Intermodulation free range:	
TOI products, 2x -20 dBm (-10 dBm ref. level)	66 dB typ. (typ. +13 dBm third-order intercept)
(at distance between signals ≤2 MHz)	60 dB typ. (+10 dBm TOI)
(at distance between signals >2 MHz)	66 dB typ. (typ. +13 dBm TOI)
DANL (Displayed average noise level)**:**	
(RBW 1 kHz, VBW 10 Hz, ref. level ≤-30 dBm 10 MHz...1 GHz resp. 3 GHz)	-105 dBm, typ. -114 dBm
With Preamp.	HMS1000/HMS1010: -125dBm typ. (1 kHz RBW) HMS3000/HMS3010: -135dBm typ. (100Hz RBW)
Inherent spurious:	
(ref. level ≤-20 dBm, f >30 MHz, RBW ≤100 kHz)	<-80 dBm
Input related spurious:	
(Mixer level ≤-40 dBm, carrier offset >1 MHz)	-70 dBc typ., -55 dBc (2...3 GHz)
2nd harmonic receive frequency	
(mixer level -40 dBm):	-60 dBc typ.
Level display:	
Reference level	-80...+20 dBm in 1 dB steps
Display range	100 dB, 50 dB, 20 dB, 10 dB, linear
Logarithmic display scaling	dBm, dBµV, dBmV
Linear display scaling	Percentage of reference level (from SW 2.0)
Measured curves:	1 curve and 1 memory curve
Trace mathematics:	A-B (curve-stored curve), B-A
Detectors:	Auto-, Min-, Max-Peak, Sample, RMS, Average, Quasi-Peak
Failure of level display: (ref. level to ref. level-50 dB, 20...30 °C)	<1.5 dB, typ. 0.5 dB

Marker/Deltamarker	
Number of marker:	8
Marker functions:	Peak, next peak, minimum, center = marker, frequency, reference level = marker level, all marker on peak
Marker displays:	Normal (level, lin. & log.), delta marker, noise marker, (frequency) counter (from SW 2.0)

Inputs/Outputs	
HF Input	N socket
Input Impedance:	50 Ω
VSWR (10 MHz...1 GHz/3 GHz)**:**	<1.5 typ.
Output tracking generator:	
(HMS1010/HMS3010)	N socket
Output Impedance:	50 Ω
Frequency range:	5 MHz...1 GHz (3 GHz)
Output level:	-20...0 dBm, in 1 dB steps
Trigger and external reference input:	BNC female, selectable
Trigger voltage	TTL
Reference frequency	10 MHz
Essential level (50 Ω)	10 dBm
Supply output for field probes:	6 V_{dc}, max. 100 mA (2.5 mm DIN jack)
Audio output (Phone):	3.5 mm DIN jack
Demodulation	AM and FM (internal speaker)

Miscellaneous	
Display:	16.5 cm (6.5") TFT Color VGA Display
Save/Recall memory:	10 complete device settings
Trigger:	Free run, Video Trigger (from SW 2.0), Single Trigger, external Trigger
Interfaces:	Dual-Interface USB/RS-232 (HO720), USB-Stick (frontside), USB-Printer (rear side), DVI-D for ext. monitor
Power supply:	105...253 V, 50/60 Hz, CAT II
Power consumption:	Max. 40 Watt at 230 V, 50 Hz
Protection class:	Safety class I (EN61010-1)
Operating temperature:	+5...+40 °C
Storage temperature:	-20...+70 °C
Rel. humidity:	5...80 % (non condensing)
Dimensions (W x H x D)**:**	285 x 175 x 220 mm
Weight:	3.6 kg

All data valid at 23 °C after 30 minute warm-up

Accessories supplied: Line cord, Operating manual, CD, HZ21 Adapter plug, N plug to BNC socket (2x HMS1010/3010)

Recommended accessories:

HO730	Dual-Interface Ethernet/USB
HO740	Interface IEEE-488 (GPIB), galvanically isolated
HO3011	Preamplifier -135 dBm DANL (100 Hz RBW)
HZ13	Interface cable (USB) 1.8 m
HZ14	Interface cable (serial) 1:1
HZ20	Adapter, BNC to 4 mm banana
HZ33	Test cable 50 Ω, BNC/BNC, 0.5 m
HZ34	Test cable 50 Ω, BNC/BNC, 1 m
HZ46	4RU 19" Rackmount Kit
HZ72	GPIB-Cable 2 m
HZ99	Carrying Case for protection and transport
HZ520	Plug-in Antenna with BNC connection
HZ525	50 Ω-Termination, N plug
HZ530	Near-Field Probe Set 1 GHz for EMV diagnostics
HZ540/550	Near-Field Probe Set 3 GHz for EMV diagnostics
HZ540L/550L	Near-Field Probe Set 3 GHz for EMV diagnostics
HZ547	3 GHz VSWR Bridge for HMS1010, HMS3010
HZ560	Transient limiter
HZ575	75/50 Ω Converter
HZO30	active probe 1 GHz (0.9 pF, 1 MΩ, including many accessories)

Triple Power Supply HM7042-5

Product description, page 27

Outputs	
2 x 0...32 V/2 A and 0...5.5 V/5A	ON/OFF pushbutton control, SMPS followed by a linear regulator, floating outputs for parallel/serial operation, current limit and electronic fuse.

Channel 1+3 (32 V)	
Range:	2 x 0...32V, continuously adjustable 2 knobs (coarse/fine)
Ripple:	≤100 µV_{rms} (3 Hz...300 kHz)
Current:	max. 2 A
Current limit/electronic fuse:	0...2 A, continuously adjustable (knob)
Recovery time (10...90 % load variation)	
	80 µs within ±1 mV of nominal value
	30 µs within ±10 mV of nominal value
	0 µs within ±100 mV of nominal value
Max. transient deviation:	typ. 75 mV
Recovery time (50 % basic load, 10 % load variation)	
	30 µs within ±1 mV of nominal value
	5 µs within ±10 mV of nominal value
	0 µs within ±100 mV of nominal value
Max. transient deviation:	typ. 17 mV
Display	
7-segment LED:	32.00V (4 digit)/2.000 A (4 digit)
Resolution:	0.01 V/1 mA
Display accuracy:	±3 digit voltage/±4 digit current
LED:	indicates current limit

Channel 2 (5.5 V)	
Range:	0...5.5 V, continuously adjustable (knobs)
Ripple:	≤100 µV_{rms} (3 Hz...300 kHz)
Current:	max. 5 A
Current limit/electronic fuse:	0...5 A, continuously adjustable (knob)
Recovery time (10...90 % load variation):	
	80 µs within ±1 mV of nominal value
	10 µs within ±100 mV of nominal value
Max. transient deviation:	typ. 170 mV
Recovery time (50 % basic load, 10 % load variation):	
	30 µs within ±1 mV of nominal value
	15 µs within ±10 mV of nominal value
	0 µs within ±100 mV of nominal value
Max. transient deviation:	typ. 60 mV
Display	
7-segment LED:	5.50 V (3 digit)/5.00 A (3 digit)
Resolution:	0.01 V/10 mA
Display accuracy:	±3 digit voltage/±1 digit current
LED:	indicates current limit

Maximum ratings	
Max. voltage applicable to output terminals:	
CH 1 + CH 3:	33 V
CH 2:	6 V
Reverse voltage:	max. 0.4 V
Reverse current:	max. 5 A
Voltage to earth:	max. 150 V

Miscellaneous	
Safety class:	Safety class I (EN61010-1)
Mains supply:	115...230 V ±10 %; 50/60 Hz, CAT II
Mains Fuse:	115 V: 2x 5 A slow blow 5x 20 mm 230 V: 2x 2.5 A slow blow 5x 20 mm
Power consumption:	max. 330 VA/250 W
Operating temperature:	+5...+40 °C
Storage temperature:	-20...+70 °C
Rel. humidity:	5...80 % (non condensing)
Dimensions (W x H x D):	285 x 75 x 365 mm
Weight:	approx. 7.4 kg

All data valid at 23 °C after 30 minutes warm-up.

Accessories supplied: Operator's Manual and power cable
Recommended accessories:
HZ10S 5 x silicone test lead (measurement connection in black)
HZ10R 5 x silicone test lead (measurement connection in red)
HZ10B 5 x silicone test lead (measurement connection in blue)
HZ42 19'' Rackmount Kit 2RU

Arbitrary Power Supply HM8143

Product description, page 28

Outputs	
2 x 0...30 V/2 A 1 x 5 V/2 A	On/off pushbutton control, Floating outputs (allowing parallel and series operation), current limit, electronic fuse, tracking mode

Channels 1+3 (0...30 V)	
Output voltage:	2 x 0...30 V
Setting resolution:	10 mV
Setting accuracy:	±3 digits (typ. ±2 digit)
Measurement accuracy:	±3 digits (typ. ±2 digit)
Residual ripple:	<5 mV_{rms} (3 Hz...300 kHz)
Recovery time (10...90 % load variation)	
	45 µs within ±1 mV of nominal value
	16 µs within ±100 mV of nominal value
Max. transient deviation:	typ. 800 mV
Recovery time (50 % basic load, 10 % load variation)	
	30 µs within ±1 mV of nominal value
	10 µs within ±100 mV of nominal value
Max. transient deviation:	typ. 120 mV
Compensation of line resistances (SENSE):	up to 300 mV
Output current:	2 x 0...2 A
Setting resolution:	1 mA
Setting accuracy:	±3 digits (typ. ±2 digit)
Measurement accuracy:	±3 digits (typ. ±2 digit)
Recovery time:	<100 µs

Channel 2 (5 V)	
Accuracy:	5 V ±50 mV
Output current:	max. 2 A
Ripple:	≤100 µV_{rms} (3 Hz...300 kHz)
Recovery time (10...90 % load variation)	
	30 µs within ±1 mV of nominal value
	0 µs within ±100 mV of nominal value
Max. transient deviation:	typ. 60 mV
Recovery time (50 % basic load, 10 % load variation)	
	30 µs within ±1 mV of nominal value
	0 µs within ±100 mV of nominal value
Max. transient deviation:	typ. 20 mV

Arbitrary Function (Channel 1 only)	
Number of points:	max. 4096
Resolution:	12 Bit
Parameters of points:	Dwell time and Voltage
Dwell time:	100 µs...60 s
Repetition rate:	1...255 and continuous

Inputs:	
Modulation input (BNC socket):	0...10 V
Accuracy:	1 % of full scale
Modulations bandwidth (-3 dB):	>50 kHz
Slew rate (dV/dt):	1 V/µs
Trigger input (BNC socket):	Triggering the arbitrary function
Level:	TTL

Miscellaneous	
Max. voltage applicable to output terminals	
CH 1 + CH 3:	30 V
CH 2:	5 V
Voltage to earth:	max. 150 V
Display:	4x 4-digit 7-segment LEDs
Interface:	USB/RS-232 (HO820), IEEE-488 (option)
Protection class:	I acc. to EN 61010 (IEC 61010) with protective earth
Power supply:	115...230 V ±10 %; 50/60 Hz, CAT II
Mains fuse:	115 V: 2 x 6 A slow blow 5 x 20 mm 230 V: 2 x 3.15 A slow blow 5 x 20 mm
Power consumption:	approx. 300 VA

Operating temperature:	+5...+40 °C
Storage temperature:	-20...+70 °C
Rel. humidity:	5...80 % (non condensing)
Dimensions (W x H x D)**:**	285 x 75 x 365 mm
Weight:	approx. 9 kg

All data valid at 23 °C after 30 minutes warm-up.

Accessories supplied: Operator's Manual and power cable, Software CD
Recommended accessories:

HO880	IEEE-488 (GPIB) Interface (galvanically isolated)
HZ10S	5 x silicone test lead (measurement connection in black)
HZ10R	5 x silicone test lead (measurement connection in red)
HZ10B	5 x silicone test lead (measurement connection in blue)
HZ13	Interface cable (USB) 1.8 m
HZ14	Interface cable (serial) 1:1
HZ42	19'' Rackmount Kit 2RU
HZ72	GPIB-Cable 2 m

Programmable 2 Channel High Performance Power Supply HMP2020 [Programmable 3 Channel High Performance Power Supply HMP2030]

Product description, page 26

Outputs

Advanced parallel and series operation: simultaneously switch on/off of active channels via "Output" button, common voltage- and current control using tracking mode (individual channel linking), individual mapping of channels which shall be affected by FuseLink overcurrent protection (switch-off), all channels galvanically isolated and independant from protective earth.

HMP2020	1 x 0...32 V/0...10 A	1 x 32 V/0...5 A
HMP2030	3 x 0...32 V/0...5 A	
Output terminals:	4 mm safety sockets frontside, Screw-type terminal rear side (4 units per channel)	
Output power:	188 W max.	
Compensation of lead resistances (Sense)**:**	1 V	
Overvoltage/overcurrent protection (OVP/OCP)**:**	Adjustable for each channel	
Electronic fuse:	Adjustable for each channel, combinable via FuseLink	
Response time:	<10 ms	

32 V channels

Output values:		
HMP2020	1 x 0...32 V/0...10 A, (5 A at 32 V, 160 W max.) 1 x 0...32 V/0...5 A, (2,5 A bei 32 V, 80 W max.)	
HMP2030	3 x 0...32 V/0...5 A, (2.5 A at 32 V, 80 W max.)	
Resolution:		
Voltage	1 mV	
Current HMP2030	<1 A: 0.1 mA; ≥1 A: 1 mA	
Current HMP2020	<1 A: 0.2 mA; ≥1 A: 1 mA, (10 A Channel, CH1) <1 A: 0,2 mA; ≥1 A: 1 mA, (5 A Channel, CH2)	
Setting accuracy:		
Voltage	<0.05 % + 5 mV (typ. ±2 mV)	
Current HMP2030	<0.1 % + 5 mA (typ. ±0.5 mA at I <500 mA)	
Current HMP2020	<0.1 % + 5 mA (typ. ±1 mA at I <500 mA), (10 A Channel, CH1)	
Current HMP2020	<0.1 % + 5 mA (typ. ±0,5 mA at I <500 mA), (5 A Channel, CH2)	
Measurement accuracy:		
Voltage	<0.05 % + 2 mV	
Current HMP2030	<500 mA: <0.05 % + 0.5 mA, typ. ±0.2 mA	
Current HMP2030	≥500 mA: <0.05 % + 2 mA, typ. ±1 mA	
Current HMP2020	<500 mA: <0,05 % + 0,5 mA, typ. ±0,5 mA, (10 A Channel, CH1)	
Current HMP2020	<500 mA: <0,05 % + 0,5 mA, typ. ±0,2 mA, (5 A Channel, CH2)	
Current HMP2020	≥500 mA: <0,05 % + 2 mA, typ. ±2 mA, (10 A Channel, CH1)	
Current HMP2020	≥500 mA: <0,05 % + 2 mA, typ. ±1 mA, (5 A Channel, CH1)	
Residual ripple	3 Hz...100 kHz	3 Hz...20 MHz
Voltage	<150 μV_{rms}	1.5 mV_{rms} typ.
Current	<1 mA_{rms}	

Stabilisation at load change (10...90 %)**:**	
Voltage	<0.01 % + 2 mV
Current	<0.01 % + 250 µA
Stabilisation at line voltage variation (±10 %)**:**	
Voltage	<0.01 % + 2 mV
Current	<0.01 % + 250 µA
Entire load regulation: (at 10...90 % load peak, balance time to match within 10 mV V_{nom})	<100 µs

Arbitrary Function EasyArb

Parameters of points:	Voltage, current, time
Number of points:	128
Dwell time:	10 ms...60 s
Repetition rate:	Continuously or burst mode with 1...255 repetitions
Trigger:	Manually via keyboard or via Interface

Maximum ratings

Reverse voltage:	33 V max.
Reverse polarized voltage:	0.4 V max.
Max. permitted current in case of reverse voltage:	5 A max.
Voltage to earth:	150 V max.

Miscellaneous

Temperature coefficient/°C:	
Voltage	0.01 % + 2 mV
Current	0.02 % + 3 mA
Display:	240 x 64 Pixel LCD (full graphical)
Memory:	Non volatile memory for 3 Arbitrary function and 10 device settings
Interface:	Dual-Interface USB/RS-232 (HO720)
Process time:	<50 ms
Protection class:	Safety class I (EN61010-1)
Power supply:	115...230 V±10 %; 50/60 Hz, CAT II
Mains fuse:	Microfuse 5 x 20 mm slow blow 115 V: 2 x 6 A 230 V: 2 x 3.15 A
Power consumption:	350 VA max.
Operating temperature:	+5...+40 °C
Storage temperature:	-20...+70 °C
Rel. humidity:	5...80 % (non condensing)
Dimensions (W x H x D)**:**	285 x 75 x 365 mm
Weight:	8,5 kg

All data valid at 23 °C after 30 minutes warm-up.

Accessories supplied: Line cord, Operating manual, CD
Recommended accessories:

HO730	Dual-Interface Ethernet/USB
HO740	Interface IEEE-488 (GPIB), galvanically isolated
HZ10S	5 x silicone test lead (measurement connection in black)
HZ10R	5 x silicone test lead (measurement connection in red)
HZ10B	5 x silicone test lead (measurement connection in blue)
HZ13	Interface cable (USB) 1.8 m
HZ14	Interface cable (serial) 1:1
HZ42	2RU 19'' Rackmount Kit
HZ72	GPIB-Cable 2 m

Programmable 3 Channel High Performance Power Supply HMP4030 [Programmable 4 Channel High Performance Power Supply HMP4040]

Product description, page 25

Outputs

Advanced parallel and series operation: simultaneously switch on/off of active channels via "Output" button, common voltage- and current control using tracking mode (individual channel linking), individual mapping of channels which shall be affected by FuseLink overcurrent protection (switch-off), all channels galvanically isolated and independant from protective earth.

HMP4030	3 x 0...32 V/0...10 A
HMP4040	4 x 0...32 V/0...10 A

Output terminals:	4 mm safety sockets frontside Screw-type terminal rear side (4 units per channel)
Output power:	384 W max.
Compensation of lead resistances (Sense)**:**	1 V
Overvoltage/overcurrent protection (OVP/OCP)**:**	Adjustable for each channel
Electronic fuse:	Adjustable for each channel, combinable via FuseLink
Response time:	<10 ms

32 V channels		
Output values:		
HMP4030	3 x 0...32 V/0...10 A, (5 A at 32 V, 160 W max.)	
HMP4040	4 x 0...32 V/0...10 A, (5 A at 32 V, 160 W max.)	
Resolution:		
Voltage	1 mV	
Current	<1 A: 0.2 mA; ≥1 A: 1 mA	
Setting accuracy:		
Voltage	<0.05 % + 5 mV (typ. ±2 mV)	
Current	<0.1 % + 5 mA (typ. ±1 mA at I <500 mA)	
Measurement accuracy:		
Voltage	<0.05 % + 2 mV	
Current	<500 mA: <0.05 % + 1 mA, typ. ±0.5 mA	
Current	≥500mA: <0.05 % + 2 mA, typ. ±2 mA	
Residual ripple	3 Hz...100 kHz	3 Hz...20 MHz
Voltage	<150 μV_{rms}	1.5 mV_{rms} typ.
Current	<1 mA_{rms}	
Stabilisation at load change (10...90 %)**:**		
Voltage	<0.01 % + 2 mV	
Current	<0.01 % + 250 µA	
Stabilisation at line voltage variation (±10 %)**:**		
Voltage	<0.01 % + 2 mV	
Current	<0.01 % + 250 µA	
Entire load regulation: (at 10...90 % load peak, balance time to match within 10 mV V_{nom})	<100 µs	

Arbitrary Function EasyArb	
Parameters of points:	Voltage, current, time
Number of points:	128
Dwell time:	10 ms...60 s
Repetition rate:	Continuously or burst mode with 1...255 repetitions
Trigger:	Manually via keyboard or via Interface

Maximum ratings	
Reverse voltage:	33 V max.
Reverse polarized voltage:	0.4 V max.
Max. permitted current in case of reverse voltage:	5 A max.
Voltage to earth:	150 V max.

Miscellaneous	
Temperature coefficient/°C:	
Voltage	0.01 % + 2 mV
Current	0.02 % + 3 mA
Display:	240 x 128 Pixel LCD (full graphical)
Memory:	Non volatile memory for 3 Arbitrary function and 10 device settings
Interface:	Dual-Interface USB/RS-232 (HO720)
Process time:	<50 ms
Protection class:	Safety class I (EN61010-1)
Power supply:	115...230 V±10 %; 50/60 Hz, CAT II
Mains fuse:	Microfuse 5 x 20 mm slow blow 115 V: 2 x 10 A 230 V: 2 x 5 A
Power consumption:	550 VA max.
Operating temperature:	+5...+40 °C
Storage temperature:	-20...+70 °C
Rel. humidity:	5...80 % (non condensing)
Dimensions (W x H x D)**:**	285 x 125 x 365 mm
Weight:	approx. 10 kg

All data valid at 23 °C after 30 minutes warm-up.

Accessories supplied: Line cord, Operating manual, CD

Recommended accessories:

HO730	Dual-Interface Ethernet/USB
HO740	Interface IEEE-488 (GPIB), galvanically isolated
HZ10S	5 x silicone test lead (measurement connection in black)
HZ10R	5 x silicone test lead (measurement connection in red)
HZ10B	5 x silicone test lead (measurement connection in blue)
HZ13	Interface cable (USB) 1.8 m
HZ14	Interface cable (serial) 1:1
HZ43	3RU 19'' Rackmount Kit
HZ72	GPIB-Cable 2 m

6½-Digit Precision Multimeter HM8112-3

Product description, page 32

DC specifications		
Ranges:	0.1 V; 1 V; 10 V; 100 V; 600 V	
Input impedance		
0.1 V, 1.0 V:	>1 GΩ	
10 V, 100 V, 600 V:	10 MΩ	
Accuracy:	Values given are in ±(% of reading (rdg.) + % of full scale (f.s.))	

Range	1 year; % rdg.	23 °C ±2 °C % f.s.	Temp. coefficient 10...21 °C + 25...40 °C
0,1 V	0,005	0,0006	0,0008
1,0 V	0,003	0,0006	0,0008
10,0 V	0,003	0,0006	0,0008
100,0 V	0,003	0,0006	0,0008
600,0 V	0,004	0,0006	0,0008

Integration time:	0.1 s	1...60 s
Display range:	120.000 digit	1,200.000 digit
600 V range:	60.000 digit	600.000 digit
Resolution:	1 µV	100 nV
Zero point		
Temperature drift:	better than 0.3 µV/°C	
Long-term stability:	better than 3 µV for 90 days	

AC specifications	
Measurement ranges:	0.1 V; 1 V; 10 V; 100 V; 600 V
Measurement method:	true rms DC or AC coupled (not in 0.1 V range)
Input impedance:	
0.1 V, 1 V:	1 GΩ II <60 pF
10...600 V:	10 MΩ II <60 pF
Response time:	1.5 sec to within 0.1 % of reading
Accuracy:	For sine wave signals >5 % of full scale

Values given are in ±(% of reading + % of full scale); 23 °C ±2 °C for 1 year

Range	20 Hz...1 kHz	1...10 kHz	10...50 kHz	50...100 kHz	100...300 kHz
0.1 V	0.1+0.08	5+0.5 (5 kHz)			
1.0 V	0.08+0.08	0.15+0.08	0.3+0.1	0.8+0.15	7+0.15
10.0 V	0.08+0.08	0.1+0.08	0.3+0.1	0.8+0.15	4+0.15
100.0 V	0.08+0.08	0.1+0.08	0.3+0.1	0.8+0.15	
600.0 V	0.08+0.08	0.1+0.08			

Temperature coefficient 10...21 °C and 25...40 °C; (% rdg. + % f.s.)		
at 20 Hz...10 kHz:	0.01 + 0.008	
at 10...100 kHz:	0.08 + 0.01	
Crest factor:	7:1 (max. 5x range)	
Integration time:	0.1s	1...60s
Display range:	120.000 digit	1,200.000 digit
600 V range:	600.00 digit	600.000 digit
Resolution:	1 µV	100 nV
Overload protection:		
(V/Ω-HI to V/Ω-LO) and to chassis:		
Measurement ranges:	all	
all the time	850 V_{peak} or 600 V_{dc}	
Maximum input voltage LOW against chassis/safety earth:	250 V_{rms} at max. 60 Hz or 250 V_{dc}	

Current specifications	
Ranges:	100 µA; 1 mA; 10 mA; 100 mA; 1 A

Integration time:	0.1 s		1...60 s
Display ranges:	120.000 digit		1,200.000 digit
1 A range:	100.000 digit		1,000.000 digit
Resolution:	1 nA		100 pA
Accuracy:	DC	45 Hz...1 kHz	1...5 kHz
(1 year; 23 °C ±2 °C)	0.02 + 0.002	0.1 + 0.08	0.2 + 0.08
Temperature coefficient/°C:	10...21 °C		25...40 °C
(%rdg. + %f.s.)	0.002+ 0.001		0.01+ 0.01
Voltage:	<600 mV...1.5 V		
Response time:	1.5 s to within 0.1 % of reading		
Crest factor:	7:1 (max. 5 x range)		
Input protection:	fuse, FF 1 A 250 V		

Resistance

Ranges:	100 Ω, 1 kΩ, 10 kΩ, 100 kΩ, 1 MΩ, 10 MΩ	
Integration time:	0.1 s	1...60 s
Display ranges:	120.000 digit	1,200.000 digit
Resolution:	1 mΩ	100 µΩ
Accuracy:	Values given are in ±(% of reading. + % of full scale)	

Range	1 year; %rdg	23 °C ±2 °C %f.s.	Temp. coefficient/°C 10...21 °C	25...40 °C
100 Ω	0.005	0.0015	0.0008	0.0008
1 kΩ	0.005	0.001	0.0008	0.0008
10 kΩ	0.005	0.001	0.0008	0.0008
100 kΩ	0.005	0.001	0.0008	0.0008
1 MΩ	0.05	0.002	0.002	0.002
10 MΩ	0.5	0.02	0.01	0.01

Measurement current:	**Range**	**Current**
	100 Ω, 1 kΩ	1 mA
	10 kΩ	100 µA
	100 kΩ	10 µA
	1 MΩ	1 µA
	10 MΩ	100 nA
max. measurement voltage:	approx. 3 V	
Overload protection:	250 V_p	

Temperature measurement

PT100/PT1000 (EN60751):	2- and 4-wire measurement
Range:	-200...+800 °C
Resolution:	0.01 °C; measurement current 1 mA
Accuracy:	±(0.05 °C + sensor tolerance + 0.08 K)
Temperature coefficient 10...21 °C and 25...40 °C:	<0.0018 °C/°C
NiCr-Ni (K-type)	
Range:	-270...+1,372 °C
Resolution:	0.1 °C
Accuracy:	±(0.7 % rdg. + 0.3 K)
NiCr-Ni (J-type)	
Range:	-210...+1,200 °C
Resolution:	0.1 °C
Accuracy:	±(0.7 % rdg. + 0.3 K)

Frequency and period specifications

Range:	1 Hz...100 kHz
Resolution:	0.00001...1 Hz
Accuracy:	0.05 % of reading
Measurement time:	1...2 s

Interface

Interface:	USB/RS-232 (HO820), IEEE-488 (option)
Functions:	Control/Data fetch
Inputs:	Function, range, integration time, start command
Outputs:	Measurement results, function, range, integration time (10 ms...60 s)

Miscellaneous

Time to change range or function	
approx. 125 ms with DC voltage, DC current, resistance	
approx. 1 s with AC voltage, AC current	
Memory:	30,000 readings/128 kB
Safety class:	Safety class I (EN 61010)
Power supply:	105...254 V~; 50/60 Hz, CAT II
Power consumption:	approx. 8 W
Operating temperature:	+5...+40 °C
Storage temperature:	-20...+70 °C
Rel. humidity:	5...80 % (non condensing)
Dimensions (W x H x D):	285 x 75 x 365 mm
Weight:	approx. 3 kg

All data valid at 23 °C after 30 minutes warm-up.

Accessories supplied: Line cord, Operating manual, PVC test lead (HZ15), Interface cable (HZ14)

Recommended accessories:

HO112	Scanner Card (Installation only ex factory) as HM8112-3S
HO880	IEEE-488 (GPIB) Interface (galvanically isolated)
HZ10S	5 x Silicone test lead black
HZ10R	5 x Silicone test lead red
HZ10B	5 x Silicone test lead blue
HZ13	Interface cable (USB) 1.8 m
HZ33	Test cable 50 Ω, BNC/BNC, 0.5 m
HZ34	Test cable 50 Ω, BNC/BNC, 1 m
HZ42	19" Rackmount kit 2RU
HZ72	GPIB-Cable 2 m
HZ887	Temperature probe

8 kW Power Meter HM8115-2

Product description, page 33

Voltage	**True RMS voltage measurement (AC+DC)**		
Ranges:	50 V	150 V	500 V
Resolution:	0.1 V	1 V	1 V
Accuracy:	20 Hz...1 kHz:		±(0.4 % + 5 digit)
	DC:		±(0.6 % + 5 digit)
Input impedance:	1 MΩ II 100 pF		
Crest factor:	max. 3.5 at full scale		
Input protection:	max. 500 V_p		

Current	**True RMS current measurement (AC+DC)**		
Ranges:	160 mA	1.6 A	16 A
Resolution:	1 mA	1 mA	10 mA
Accuracy:	20 Hz...1 kHz:		±(0.4 % + 5 digit)
	DC:		±(0.6 % + 5 digit)
Crest factor:	max. 4 at full scale		
Input protection:	fuse, FF 16A 6.3 x 32mm (superfast)		

Active power measurement						
Ranges:	8 W	24 W	80 W	240 W	800 W	2400 W	8000 W
Resolution:	1 mW	10 mW	10 mW	100 mW	100 mW	1 W	1 W
Accuracy:	20 Hz...1 kHz:						±(0.8 % + 10 digit)
	DC:						±(0.8 % + 10 digit)
Display:	4-digit, 7-segment LED						

Reactive power measurement					
Ranges:	8 var	24 var	80 var	240/800 var	2400/8000 var
Resolution:	10 mvar	100 mvar	100 mvar	1 var	1 var
Accuracy:	20...400 Hz: ±(2.5 % + 10 digit + 0.02x P) P = active power				
Display:	4-digit, 7-segment LED				

Apparent power measurement					
Ranges:	8 VA	24 VA	80 VA	240/800 VA	2400/8000 VA
Resolution:	1 mVA	10 mVA	10 mVA	100 mVA	1 VA
Accuracy:	20 Hz...1 kHz:				±(0.8 % + 5 digit)
Display:	4-digit, 7-segment LED				

Power factor measurement	
Display:	0.00...+1.00
Accuracy:	50...60 Hz: ±(2 % + 3 digit) (sine wave) voltage and current >1/10 of full scale

Monitor output (analog)	
Connection:	BNC connector (galvanic isolation to test circuit and RS-232 interface)
Reference potential:	protective earth
Level:	1 V_{ac} at full scale (2400/8000 digit)
Accuracy:	typ. 5 %
Output impedance:	approx. 10 kΩ
Bandwidth:	DC...1 kHz
Protected up to:	±30 V

Functions and displays	
Measurement functions:	voltage, current, power, power factor
Range selection:	automatic/manual
Overrange alarm:	visual and acoustic
Display resolution	
Voltage:	3-digit, 7-segment LED
Current:	4-digit, 7-segment LED
Power:	4-digit, 7-segment LED
Power factor:	3-digit, 7-segment LED

Interface	
Interface:	USB/RS-232 (HO820), IEEE-488 (option)
Connection RS-232:	D-sub connector (galvanic isolation to test circuit and monitor output)
Protocol:	Xon/Xoff
Data rate:	9600 Baud
Functions:	control/data fetch

Miscellaneous	
Safety Class:	Safety Class I (EN 61010)
Power supply:	115...230 V ±10 %, 50/60Hz, CAT II
Power consumption:	approx. 15 W at 50 Hz
Operating temperature:	+5...+40 °C
Storage temperature:	-20...+70 °C
Rel. humidity:	5...80 % (non condensing)
Dimensions (W x H x D)**:**	285 x 75 x 365 mm
Weight:	approx. 4 kg

All data valid at 23 °C after 30 minutes warm-up.

Accessories supplied: Line cord, Operating manual, software

Recommended accessories:

HO880	IEEE-488 (GPIB) Interface (galvanically isolated)
HZ10S	5 x silicone test lead black
HZ10R	5 x silicone test lead red
HZ10B	5 x silicone test lead blue
HZ13	Interface cable (USB) 1.8 m
HZ14	Interface cable (serial) 1:1
HZ33	Test cable 50 Ω, BNC/BNC, 0.5 m
HZ34	Test cable 50 Ω, BNC/BNC, 1 m
HZ42	19" Rackmount kit 2RU
HZ72	GPIB-Cable 2 m
HZ815	Socket adapter

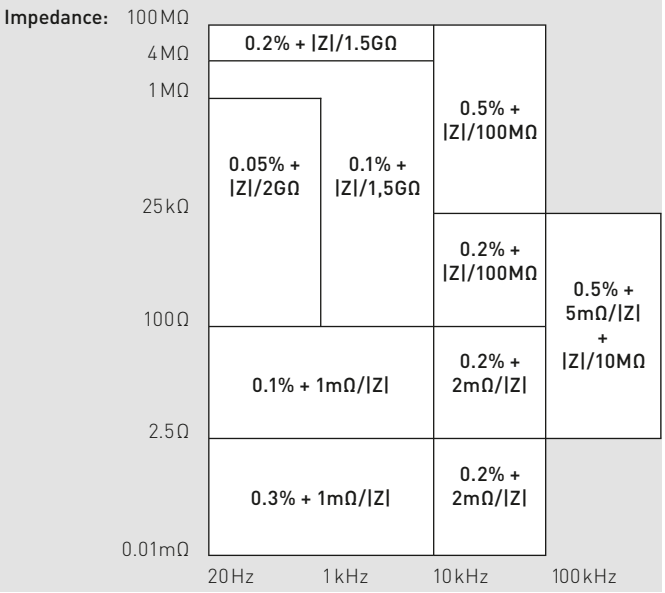
LCR-Bridge HM8118

Product description, page 34

Conditions	
Test signal voltage:	1 V
Open and short corrections performed	
Measurement time:	SLOW

Display	
Measurement modes:	Auto, L+Q, L+R, C+D, C+R, R+Q, Z+θ, Y+θ, R+X, G+B, N-θ, M
Equivalent circuits:	Auto, Series or Parallel
Parameters displayed:	Value, Deviation or % Deviation
Averaging:	2...99 measurements

Accuracy	
Primary Parameter:	Basic accuracy (Test voltage: 1.0 V, measurement SLOW/MEDIUM, autoranging mode, constant voltage OFF, bias off). For FAST mode double the basic accuracy values



Secondary Parameter:

Basic accuracy D, Q:	±0.0001 @ f = 1 kHz
Phase angle:	±0.005° @ f = 1 kHz

Ranges	
|Z|, R, X:	0.01 mΩ...100 MΩ
|Y|, G, B:	10 nS...1000 S
C:	0.01 pF...100 mF
L:	10 nH...100 kH
D:	0.0001...9.9999
Q:	0.1...9999.9
θ:	-180...+180°
Δ:	-999.99...999.99 %
M:	1 µH...100 H
N:	0.95...500

Measurement conditions and functions	
Test frequency:	20 Hz...200 kHz (69 steps)
Frequency accuracy:	±100 ppm
AC test signal level:	50 mV_{rms}...1.5 V_{rms}
Resolution:	10 mV_{rms}
Drive level accuracy:	±(5 % + 5 mV)
Internal Bias Voltage:	0...+5.00 V_{dc}
Resolution:	10 mV
External Bias Voltage:	0...+40 V_{dc} (fused 0.5 A)
Internal Bias Current:	0...+200 mA
Resolution:	1 mA
Ranging:	Auto and Hold
Trigger:	Continuous, manual or external via interface, Binning Interface or Trigger Input
Trigger delay time:	0...999 ms in 1 ms steps
Measurement time (f ≥1 kHz)	
FAST	70 ms
MEDIUM	125 ms
SLOW	0.7 s

Other Instrument Functions	
Test signal level monitor:	Voltage, current
Error Correction:	Open, Short, Load
Save/Recall:	9 instrument settings
Front-end Protection:	$V_{max} < \sqrt{2/C}$ @ V_{max} <200 V, C in Farads (1 Joule of stored energy)
Low Potential and Low Current Guarding:	Ground, Driven Guard or Auto (fused)
Constant Voltage Mode (25 Ω source)	
Temperature effects:	
R, L or C:	±5 ppm/°C
Interface:	USB/RS-232 (HO820), IEEE-488 (option)
Safety Class:	Safety Class I (EN61010-1)
Power supply:	110...230 V ±10 %, 50/60 Hz, CAT II
Power consumption:	approx. 20 Watt
Operating temperature:	+5...+40 °C
Storage temperature:	-20...+70 °C
Rel. humidity:	5...80 % (non condensing)

Dimensions (W x H x D):	285 x 75 x 365 mm
Weight:	approx. 4 kg

All data valid at 23 °C after 30 minutes warm-up.

Accessories supplied: Line cord, Operating manual, HZ184 4 Terminal Kelvin Test Cable and HZ188 4 Terminal SMD Component Test Fixture

Recommended accessories:

HO118	Binning Interface
HO880	IEEE-488 (GPIB) Interface (galvanically isolated)
HZ13	Interface cable (USB) 1.8 m
HZ14	Interface cable (serial) 1:1
HZ33	Test cable 50 Ω, BNC/BNC, 0.5 m
HZ34	Test cable 50 Ω, BNC/BNC, 1 m
HZ42	19" Rackmount kit 2RU
HZ72	GPIB-Cable 2 m
HZ181	4 Terminal Test Fixture including Shorting Plate
HZ186	4 Terminal Transformer Test Cable

3 GHz Programmable Counter HM8123

Product description, page 35

Input characteristics (Input A and B)

Connection:	BNC socket	
Frequency range:		
0...200 MHz	(DC-coupled)	
10 Hz...200 MHz	(1 MΩ, AC-coupled)	
500 kHz...200 MHz	(50 Ω, AC-coupled)	
Input impedance:	1 MΩ II 30 pF or 50 Ω (switchable)	
Attenuation:	1:1, 1:10, 1:100 (selectable)	
Sensitivity: (normal triggering)		
0...80 MHz	25 mV_{rms} (sine wave), 80 mV_{pp} (pulse)	
80...200 MHz	65 mV_{rms} (sine wave)	
20 Hz...80 MHz	50 mV_{rms} (sine wave, auto trigger)	
Trigger (programmable via encoder or software)		
Attenuation:	**Trigger level:**	**Resolution:**
1:1	0...±2 V	1 mV
1:10	0...±20 V	10 mV
1:100	0...±200 V	100 mV
Max. input voltage:		
Input 1 MΩ:	250 V (DC + AC_{peak}) from 0...440 Hz decreasing to 8 V_{rms} at 1 MHz	
Input 50 Ω:	5 V_{rms}	
Minimum pulse duration:	<5 ns for single pulse	
Input noise:	(typ.) 100 µV	
Auto trigger (AC coupling):	trigger point: 50 % of peak-to-peak value	
Trigger slope:	Rising or falling	
Filter:	100 kHz low-pass filter (switchable)	

Input characteristics (Input C)

Connection:	SMA socket
Frequency range:	100 MHz...3 GHz
Input sensitivity:	up to 1 GHz: 30 mV_{rms} (typ. 20 mV_{rms}) 1...3 GHz: 100 mV_{rms} (typ. 80 mV_{rms})
Input impedance:	50 Ω nominal
Max. input voltage:	5 V (DC + AC_{peak})

Input characteristics

	External Reset	**Reference**	**Gate/Arming**
Input impedance:	5 kΩ	500 Ω	5 kΩ
Max. input voltage:	±30 V	±20 V	±30 V
Input sensitivity:	-	typ. 2 V_{pp}	-
High level:	>2 V	-	>2 V
Low level:	<0.5 V	-	<0.5 V
Min. pulse duration:	200 ns	-	50 ns
Input frequency:	-	10 MHz	-
Min. eff. gate time:	-	-	20 µs

Measurement functions

Frequency A/B/C; period duration A; width A; totalize A; RPM A; frequency ratio A:B; time interval A:B; time interval A:B (average); phase A to B; Duty cycle A; burst measurements

Frequency measurement (Inputs A, B, C)

Frequency range:	0...200 MHz (3 GHz)
LSD:	(1.25x 10^{-8}s x frequency)/measurement time
Resolution:	1 LSD
Accuracy:	±(resolution/frequency ±time inaccuracy ±trigger error[2]/measurement time)

Period duration measurement

Range:	5 ns...10,000 s
LSD:	(1.25 x 10^{-8}s x period)/measurement time
Resolution:	1 LSD
Accuracy:	±resolution/period ±(trigger error[2]/measurement time)

Totalization A

	(manual control)	**(external control)**
Range:	0...200 MHz	0...200 MHz
Min. pulse duration:	10 ns	10 ns
LSD:	1 count	±1 count
Resolution:	LSD	LSD
Accuracy:	(resolution ±ext. gate time error x frequency A)/total	
Pulse resolution:	10 ns	10 ns
Ext. gate error:	-	100 ns

Time interval/Average time interval

(Input A = start; input B = stop)

LSD:	10 ns (0,1 ps...10 ns in „average" mode)	
Resolution:	1 LSD	
Accuracy:	±(resolution + trigger error[2] + system error)/time interval ±time base uncertainty (system error: ≤4 ns)	
Number of average:	N = 1...25	LSD = 10 ns
	N = 26...2,500	LSD = 1 ns
	N = 2,501...250,000	LSD = 100 ps
	N = 250,001...25,000,000	LSD = 10 ps
	N = >25,000,000	LSD = 0.1 ps

RPM measurement

NPR[1] presetting:	1...65,535 pulses per revolution
Gate time:	330 ms fixed
LSD:	7.5x 10^{-8} x revolution speed
Resolution:	1 LSD
Accuracy:	±(trigger error[2]/0.33) ±time base error

Offset

Range:	Covers the entire measurement range
Resolution:	Same resolution as in normal measurement. If the gate time is changed in the offset mode, the offset resolution is the reference value resolution or the current reading resolution (whichever is less precise).

Gate time

Range:	1 ms...65 s
Resolution:	1 ms
External gate time:	min. 20 µs

Time base

Frequency:	400 MHz clock rate; 10 MHz crystal
Temperature stability (0...50 °C):	TCXO (standard): ±0,5x 10^{-6} OCXO (HO85): ±1x 10^{-8}
Aging TCXO:	<0.27 ppm per month, 0.05 ppm per day
Aging OCXO:	≤±1x 10^{-9}/day
External Reference:	10 MHz ±20 ppm

Miscellaneous

Interface:	USB/RS-232 (HO820), IEEE-488 (optional)
Safety class:	Safety Class I (EN61010-1)
Display:	LCD display (83 x 21 mm)
Power supply:	115...230 V ±10 %, 45/60 Hz, CAT II
Power consumption:	approx. 20 Watt
Operating temperature:	+5...+40 °C
Storage temperature:	-20...+70 °C
Rel. humidity:	5...80 % (non condensing)
Dimensions (W x H x D):	285 x 75 x 365 mm
Weight:	approx. 4 kg

All data valid at 23 °C after 30 minutes warm-up.

[1] NPR=number of pulses per revolution

[2] Trigger error= ±noise input (V_{pp})/slew rate of the input signal

Accessories supplied: Line cord, Operating manual, software
Recommended accessories:

HO85	OCXO (Installation only ex factory)
HO880	IEEE-488 (GPIB) Interface (galvanically isolated)
HZ13	Interface cable (USB) 1.8 m
HZ14	Interface cable (serial) 1:1
HZ20	Adapter plug
HZ24	Attenuators 50 Ω
HZ33	Test cable 50 Ω (BNC-BNC) 0.5 m
HZ34	Test cable 50 Ω (BNC-BNC) 1.0 m
HZ42	19'' Rackmount kit 2RU
HZ72	GPIB-Cable 2 m

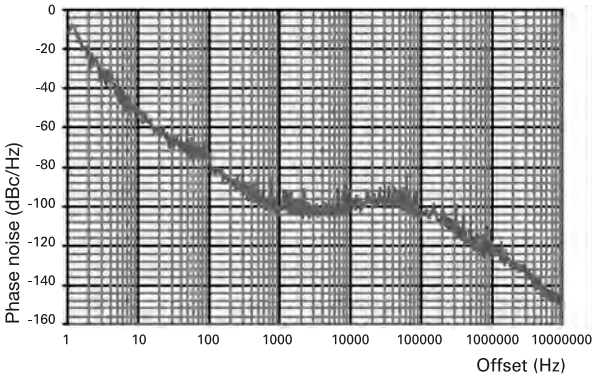
1.2 GHz RF-Synthesizer HM8134-3

Product description, page 36

Frequency	
Range:	1 Hz...1200 MHz
Resolution:	1 Hz
Settling time:	<10 ms

Frequency Reference 10 MHz	
Standard: TCXO	
Temperature stability (0...50 °C):	≤±0.5 ppm
Aging:	≤±1 ppm/year
Option: OCXO (HO85)	
Temperature stability (0...50 °C):	≤±1x 10^{-8}
Aging:	≤±1x 10^{-9}/day
Internal reference output:	(rear panel)
Level:	TTL
External reference input:	(rear panel)
Level:	>0 dBm
Frequency:	10 MHz ±20 ppm

Spectral purity (without modulation)	
Harmonics:	≤-35 dBc
Non-harmonics:	≤-55 dBc (>15 kHz from carrier)
Phase noise:	(at 20kHz from carrier)
f <16 MHz:	≤-120dBc/Hz
16 MHz ≤f <250 MHz:	≤-94 dBc/Hz
250 MHz ≤f <500 MHz:	≤-105 dBc/Hz
500 MHz ≤f <1000 MHz:	≤-100 dBc/Hz
1000 MHz ≤f <1200 MHz:	≤-95 dBc/Hz
Residual FM:	≤6.5 Hz (at 1 GHz in 0,3...3 kHz bandwidth)
Residual AM:	typ. <0.06 % (in 0.03...20 kHz bandwidth)



(Typical phase noise at 1 GHz)

Output level	
Range:	-127...+13 dBm
Resolution:	0.1 dB
Display-Offset for ext. Attn.:	0.0...30.0 dB in 0.1 dB steps
Precision:	
for level >-57 dBm:	≤±0.5 dB
for level <-57 dBm:	≤±(0.5 dB + (0.2x (-57 dBm - level))/10)
Impedance:	50 Ω
V.S.W.R.:	≤2

Modulation sources	
Internal:	10 Hz...150 kHz sine wave, 10 Hz...20 kHz square wave, triangle, sawtooth
Resolution:	10 Hz
External:	(input on front panel)
Impedance:	10 kΩ II 50 pF
Input level:	$2V_{pp}$ for full scale
Coupling:	AC or DC
Output:	(on front panel)
Level:	$2V_{pp}$
Impedance:	1 kΩ

Amplitude modulation (Level ≤ +7 dBm)	
Source:	internal or external
Modulation depth:	0...100 %
Resolution:	0.1 %
Accuracy:	±4 % of reading ±0.5 % (AM-depth ≤80 %, f_{mod} ≤40 kHz)
Ext. frequency resp. (to -1 dB):	10 Hz...50 kHz for AC
Distortion:	<2 % (AM-depth ≤60 %, f_{mod} ≤1 kHz) <6 % (AM-depth ≤80 %, f_{mod} <20 kHz)

Frequency modulation	
Source:	internal or external
Deviation:	±200 Hz...400 kHz (depending on frequency band)
Resolution:	100 Hz
Accuracy:	±3 % + res. FM (f_{mod} ≤5 kHz) ±7 % + res. FM (5 kHz <f_{mod} <100 kHz)
Ext. frequency response: (to -1 dB)	
DC coupling:	0...100 kHz
AC coupling:	10 Hz...100 kHz
Distortion:	<1 % for deviation ≥50 kHz at 1 kHz <3 % for deviation ≥10 kHz at 1 kHz

Phase modulation	
Source:	internal or external
Deviation:	
<16 MHz:	0...3.14 rad
>16 MHz:	0...10 rad
Resolution:	0.01 rad
Accuracy:	±5 % to 1 kHz + residual PM
Ext. frequency response: (to -1 dB)	
DC coupling:	0...100 kHz
AC coupling:	10 Hz...100 kHz
Distortion:	<3 % for f_{mod} = 1 kHz and deviation = 10 rad

FSK modulation	
Range (F0...F1):	16...1200 MHz
Mode:	2 FSK levels
Data source:	external
Max. rate:	10 kbit/s
Shift (F1...F0):	0...10 MHz
Resolution:	100 Hz
Accuracy:	see under FM

PSK modulation	
Mode:	2 PSK levels
Data source:	external
Max. rate:	10 kbit/s
Shift (Ph1...Ph0):	
<16 MHz:	0...±3.14 rad
>16 MHz:	0...±10 rad
Resolution:	0.01 rad
Accuracy:	see under PM

Pulse modulation	
Source:	external (rear panel)
Dynamic range:	>80 dB
Rise/fall times:	<50 ns
Delay:	<100 ns
Max. frequency:	2.5 MHz
Input level:	TTL

Sweep mode	
Range:	1...1200 MHz
Depth:	500 Hz...1199 MHz
Sweep time:	20 ms...5 s
Trigger:	internal

Protective functions

The synthesizer is protected against reverse power applied on RF output up to 1 W for a 50 Ω source and against any DC source up to ±7 V. The protection disconnects the output until manually reset by operator.

Miscellaneous

Interface:	USB/RS-232 (HO820), IEEE-488 (optional)
Configuration memories:	10
Safety class:	Safety Class I (EN61010-1)
Power supply:	115...230 V ±10 %, 50/60 Hz, CAT II
Power consumption:	approx. 40 VA
Operating temperature:	+5...+40 °C
Storage temperature:	-20...+70 °C
Rel. humidity:	5...80 % (non condensing)
Dimensions (W x H x D):	285 x 75 x 365 mm
Weight:	approx. 5 kg

All data valid at 23 °C after 30 minutes warm-up.

Accessories supplied: Line cord, Operating manual

Recommended accessories:

HO85	OCXO temperature stability ±1x 10^{-8}
HO880	IEEE-488 (GPIB) Interface (galvanically isolated)
HZ13	Interface cable (USB) 1.8 m
HZ14	Interface cable (serial) 1:1
HZ20	Adapter, BNC to 4 mm banana
HZ21	Adapter plug
HZ24	Attenuator Set 50 Ω (3/6/10/20 dB)
HZ33	Test Cable 50 Ω (BNC-BNC) 0.5 m
HZ34	Test Cable 50 Ω (BNC-BNC) 1.0 m
HZ42	19'' Rackmount kit 2RU
HZ72	GPIB-Cable 2 m

3 GHz RF-Synthesizer HM8135

Product description, page 37

Frequency

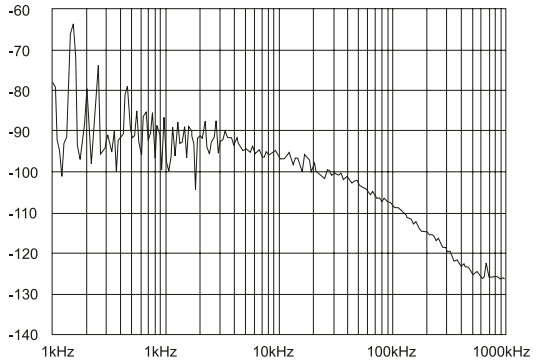
Range:	1 Hz...3 GHz
Resolution:	1 Hz
Settling time:	<10 ms

Frequency Reference 10 MHz

Standard: TCXO	
Temperature stability (0...50 °C):	≤±0.5 ppm
Aging:	≤±1 ppm/year
Option: OCXO (HO85)	
Temperature stability (0...50 °C):	≤±1x 10^{-8}
Aging:	≤±1x 10^{-9}/day
Internal reference output:	(rear panel)
Level:	TTL
External reference input:	(rear panel)
Level:	>0 dBm
Frequency:	10 MHz ±20 ppm

Spectral purity (without modulation)

Harmonics:	≤-35 dBc
Non-harmonics:	≤-50 dBc (>15 kHz from carrier)
Sub-harmonics:	≤-50 dBc
Phase noise:	(at 20 kHz from carrier)
f <16 MHz:	≤-120 dBc/Hz
16 MHz ≤f <250 MHz:	≤-95 dBc/Hz
250 MHz ≤f <500 MHz:	≤-105 dBc/Hz
500 MHz ≤f <1000 MHz:	≤-100 dBc/Hz
1 GHz ≤f <2 GHz:	≤-95 dBc/Hz
2 GHz ≤f <3 GHz:	≤-90 dBc/Hz
Residual FM:	typ. <4 Hz; ≤6.5 Hz (in 0.3...3 kHz bandwidth)
Residual AM:	typ. <0.06 % (in 0.03...20 kHz bandwidth)



(Typical phase noise at 1 GHz)

Output level

Range:	-135...+13 dBm
Resolution:	0.1 dB
Display-Offset for ext. Attn.:	0.0...30.0 dB in 0.1 dB steps
Precision f <1.5 GHz; level >-120 dBm	
for level >-57 dBm:	≤±0.5 dB
for level <-57 dBm:	≤±(0.5 dB + (0.2x (-57 dBm - level))/10)
Precision f >1.5 GHz; level >-120 dBm	
for level >-57 dBm:	≤±0.7 dB
for level <-57 dBm:	≤±(0.7 dB + (0.5x (-57 dBm - level))/10)
Impedance:	50 Ω
V.S.W.R.:	f ≤1 GHz: ≤1.5
	f >1 GHz: ≤2.5

Modulation sources

Internal:	10 Hz...200 kHz sine wave
	10 Hz...20 kHz square wave, triangle, sawtooth
Resolution:	10 Hz
External:	Input on front panel
Impedance:	10 kΩ II 50 pF
Input level:	2 V_{pp} for full scale
Coupling:	AC or DC
Output:	Front panel
Level	2 V_{pp}
Impedance:	1 kΩ

Amplitude modulation (Level ≤+7 dBm)

Source:	Internal or external
AM-depth:	0...100 %
Resolution:	0.1 %
Accuracy:	±4 % displayed rate ±0.5 %
	(AM-depth ≤80 %, f_{mod} ≤50 kHz)
Ext. frequency resp. (to -1 dB):	10 Hz...100 kHz for AC
Distortion:	<2 % (AM-depth ≤60 %, f_{mod} ≤1 kHz)
	<6 % (AM-depth ≤80 %, f_{mod} <20 kHz)

Frequency modulation

Source:	internal or external
Deviation:	±200 Hz...400 kHz
	(depending on frequency band)
Resolution:	100 Hz
Accuracy:	±3 % + residual FM (f_{mod} ≤5 kHz)
	±7 % + residual FM (5 kHz <f_{mod} <100 kHz)
Ext. frequency response: (to -1 dB):	
DC coupling:	0...100 kHz
AC coupling:	100 Hz...100 kHz
Distortion:	<1 % for deviation ≥50 kHz at 1 kHz
	<3 % for deviation ≥10 kHz

Phase modulation

Source:	internal or external
Deviation:	
<16 MHz:	0...3.14 rad
>16 MHz:	0...10 rad
Resolution:	0.01 rad
Accuracy:	±5 % to 1 kHz + residual PM
Ext. frequency response (to -1dB):	
DC coupling:	0...100 kHz
AC coupling:	100 Hz...100 kHz
Distortion:	<3 % for f_{mod} = 1 kHz and deviation = 10 rad

FSK modulation	
Range (F0...F1):	16 MHz...3 GHz
Mode:	2 FSK levels
Data source:	external
Max. rate:	10 kbit/s
Shift (F1...F0):	0...10 MHz
Resolution:	100 Hz
Accuracy:	see under FM

PSK modulation	
Mode:	2 PSK levels
Data source:	external
Max. rate:	10 kbit/s
Shift (Ph1...Ph0):	
<16 MHz:	0...±3.14 rad
>16 MHz:	0...±10 rad
Resolution:	0.01 rad
Accuracy:	see under PM

Pulse modulation	
Source:	external (rear panel)
Dynamic range:	
f <2 GHz:	>80 dB
f >2 GHz:	>55 dB
Rise/fall times:	<50 ns (typ. <10 ns)
Delay:	<100 ns
Max. frequency:	2.5 MHz (typ. 5 MHz)
Input level:	TTL

Sweep mode	
Range:	1...3000 MHz
Depth:	500 Hz...2999 MHz
Sweep time:	20 ms...5 s
Trigger:	internal

Protective functions

The synthesizer is protected against reverse power applied on RF output up to 1 W for a 50 Ω source and against any DC source up to ±7 V. The protection disconnects the output until manually reset by operator.

Miscellaneous	
Interfaces:	USB/RS-232 (HO820), IEEE-488 (option)
Configuration memories:	10
Safety class:	Safety Class I (EN61010-1)
Power supply:	115...230 V ±10 %, 50/60 Hz, CAT II
Power consumption:	approx. 40 VA
Operating temperature:	+5...+40 °C
Storage temperature:	-20...+70 °C
Rel. humidity:	5...80 % (non condensing)
Dimensions (W x H x D):	285 x 75 x 365 mm
Weight:	approx. 5 kg

All data valid at 23 °C after 30 minutes warm-up.

Accessories supplied: Line cord, Operating manual
Recommended accessories:

HO85	OCXO temperature stability ±1x 10^{-8}
HO880	IEEE-488 (GPIB) Interface (galvanically isolated)
HZ13	Interface cable (USB) 1.8 m
HZ14	Interface cable (serial) 1:1
HZ20	Adapter, BNC to 4 mm banana
HZ21	Adapter plug
HZ24	Attenuator Set 50 Ω (3/6/10/20 dB)
HZ33	Test Cable 50 Ω (BNC-BNC) 0.5 m
HZ34	Test Cable 50 Ω (BNC-BNC) 1.0 m
HZ42	19'' Rackmount kit 2RU
HZ72	GPIB-Cable 2 m

12.5 MHz Arbitrary Function Generator HM8150

Product description, page 38

Frequency	
Range:	10 mHz...12.5 MHz
Resolution:	5 digit, max. 10 mHz
Accuracy:	±(1 digit + 5 mHz)
Temperature coefficient:	0.5 ppm/°C
Aging:	2 ppm/year

Waveforms Sine wave	
Frequency range:	10 mHz...12.5 MHz
Amplitude:	20 mV_{pp}...20 V_{pp} (open circuit)
Harmonic Distortion @ 1 V_{pp}:	
f <500 kHz:	-65 dBc
500 kHz ≤f <5 MHz:	-50 dBc
5 MHz ≤f ≤12.5 MHz:	-40 dBc
Total Harmonic Distortion @ 1 V_{pp}:	
f <100 kHz:	typ. 0.05%
Spurious (Non-Harmonic) @ 1 V_{pp}:	
f <500 kHz:	-65 dBc
500 kHz ≤f ≤12.5 MHz:	-65 dBc + 6 dBc/octave

Square wave	
Frequency range:	10 mHz...12.5 MHz
Amplitude:	20 mV_{pp}...20 V_{pp} (open circuit)
Rise/fall time:	<10 ns
Overshoot:	<5 % (Vout ≤200 mV)
Symmetry:	50 % ±(5 % +10 ns)

Pulse	
Frequency range:	10 mHz...5 MHz
Amplitude:	10 mV_{pp}...+10 V_{pp} or -10 mV_{pp}...-10 V_{pp}
Rise/fall time:	<10 ns
Pulse width:	100 ns...80 s
Duty cycle:	max. 90 %

Sawtooth	
Frequency range:	10 mHz...25 kHz
Amplitude:	20 mV_{pp}...20 V_{pp} (open circuit)
Linearity:	better than 1 %

Triangle	
Frequency range:	10 mHz...250 kHz
Amplitude:	20 mV_{pp}...20 V_{pp} (open circuit)
Linearity:	better than 1 %

Arbitrary generator	
Frequency range:	10 mHz...250 kHz
Amplitude:	20 mV_{pp}...20 V_{pp} (open circuit)
Output rate:	40 MSa/s
Resolution:	X: 1024 (10 bit), Y: 1024 (10 bit) or X: 4096 (12 bit), Y: 4096 (12 bit)

Inputs	
Gate/Trigger:	BNC connector
Impedance:	5 kΩ II 100 pF
Max. input voltage:	±30 V
Modulation Input:	BNC connector
Impedance:	10 kΩ
Max. input voltage:	±30 V

Outputs		
Signal output:	BNC connector, short circuit proof, ext. voltage up to ±15 V	
Impedance:	50 Ω	
Output voltage:	Range 1:	2.1...20 V_{pp} (open circuit)
	Range 2:	0.21...2.0 V_{pp} (open circuit)
	Range 3:	20...200 mV_{pp} (open circuit)
Resolution:	Range 1:	100 mV
	Range 2:	10 mV
	Range 3:	1 mV
Setting accuracy (1 kHz):	Range 1:	±2 %
	Range 2:	±3 %
	Range 3:	±4 %
	3 % additional for pulse and square wave	
Frequency response:	<100 kHz	±0.2 dB
	0.1...12.5 MHz:	±0.5 dB
Offset error:	Range 3:	±50 mV
Display:	2½ digits (LCD)	
Trigger output:	BNC connector	
Level:	5 V/TTL	
Impedance:	50 Ω	
Sawtooth output:	BNC connector	
Output voltage:	0...5 V, synchronous to sweep	
Impedance:	1 kΩ	

DC offset

Output voltage:	Range 1:	-7.5...+7.5 V (open circuit)
	Range 2:	-0.75...+0.75 V (open circuit)
	Range 3:	-75...+75 mV (open circuit)
	$V_{ac\,range}$ + 2x $V_{offset\,range}$ ≤ $V_{range\,max.}$	

Sweep (internal)

Setting of start and stop frequency	
Internal sweep:	all waveforms
Sweep time:	linear, 20 ms...100 s continuous or triggered (ext. signal, interface)

Amplitude Modulation:

Modulation via external signal	
Modulations depth:	0...100 %
Bandwidth:	DC...20 kHz (-3 dB)

Gate (asynchronuous)

Modulation on/off via external TTL signal	
Delay time:	<150 ns
Input singal:	TTL

Trigger Function (synchronuous)

Burst mode via ext. trigger input or interface	
Frequency range:	<500 kHz

Miscellaneous

Interface:	USB/RS-232 (HO820), IEEE-488 (optional)
Display:	16 characters, LCD with backlight
Memory:	for the last device settings and for 1 arbitrary signal
Safety Class:	Safety Class I (EN61010-1)
Power supply:	115...230 V ±10 %; 50/60 Hz, CAT II
Power consumption:	approx. 20 Watt
Operating temperature:	+5...+40 °C
Storage temperature:	-20...+70 °C
Rel. humidity:	5...80 % (non condensing)
Dimensions (W x H x D):	285 x 75 x 365 mm
Weight:	approx. 5 kg

All data valid at 23 °C after 30 minutes warm-up.

Accessories supplied: Line cord, Operating manual, software

Recommended accessories:

HO880	IEEE-488 (GPIB) Interface (galvanically isolated)
HZ13	Interface cable (USB) 1.8 m
HZ14	Interface cable (serial) 1:1
HZ20	Adapter, BNC to 4 mm banana
HZ24	Attenuator Set 50 Ω (3/6/10/20 dB)
HZ33	Test Cable 50 Ω (BNC-BNC) 0.5 m
HZ34	Test Cable 50 Ω (BNC-BNC) 1.0 m
HZ42	19'' Rackmount kit 2RU
HZ72	GPIB-Cable 2 m

25 MHz Arbitrary Function Generator HMF2525
50 MHz Arbitrary Function Generator HMF2550

Product description, page 31

Frequency

HMF2525:	10 µHz...25 MHz
HMF2550:	10 µHz...50 MHz
Temperature stability:	1 ppm (18...28 °C)
Aging (after 1 year):	±1 ppm (25 °C)

Amplitude

Output voltage:	5 mV_{pp}...10 V_{pp} (into 50 Ω)
	10 mV_{pp}...20 V_{pp} (open circuit)
Resolution:	1 mV (into 50 Ω)
Setting accuracy:	±(1 % of control + 1 mV_{pp}) at 1 kHz
Frequency response:	f <10 MHz: <±0.1 dB
	10 MHz ≤f <25 MHz: <±0.2 dB
	25 MHz ≤f <50 MHz: <±0.4 dB (Sine)
DC offset:	
Voltage range (AC + DC)	±5 mV...5 V (into 50 Ω)
	±10 mV...10 V (open circuit)
Accuracy	±2 % of offset
	±0.5 % of signal level
	±2 mV
	±1 mV/MHz
Units:	V_{pp}, dBm

Waveform Sine Wave

Total harmonic distortion (1 V_{pp}):	
f <100 kHz:	<-70 dBc
100 kHz ≤f <10 MHz	<-55 dBc
10 MHz ≤f <25 MHz	<-40 dBc
f ≥25 MHz	<-37 dBc
Spurious: (Non-harmonics 1 V_{pp})	
f <1 MHz:	-70dBc
1 MHz <f <50 MHz	-70dBc + 6dB/Octave
Total harmonic distortion	
(f ≤100 kHz):	0.04 % typ.
Phase noise:	
(10 MHz, 10 kHz Offset, 1 V_{pp})	<-115 dBc/Hz typ.

Waveform Rectangle

Rise/fall time:	<8 ns
Overshoot:	<3 % typ.
Symmetry (50 % duty):	1 % + 5 ns
Jitter (RMS):	<1 ns typ.

Waveform Pulse

Frequency range:	
HMF2525	100 µHz...12.5 MHz
HMF2550	100 µHz...25 MHz
Amplitude:	5 mV...+5 V respectively -5 mV...-5 V (into 50 Ω)
Rise/fall time:	<8 ns, variable up to 500 ns
Pulse width:	10 ns...999 s
Resolution:	5 ns
Jitter (RMS):	<500 ps typ.
Overshoot:	<3 % typ.

Waveform Rampe, Triangle

Frequency range:	
HMF2525	10 µHz...5 MHz
HMF2550	10 µHz...10 MHz
Symmetry:	0...100 %
Linearity:	
f <250 kHz	<0.1 % typ.
f ≥250 kHz	<2 % typ.

Waveform Arbitrary

Frequency range:	
HMF2525	10 µHz...12.5 MHz
HMF2550	10 µHz...25 MHz
Sample rate:	250 MSa/s
Amplitude resolution:	14 Bit
Bandwidth (-3 dB):	>50 MHz
Signal length:	Up to 256 kPts
Non-volatile memory:	
HMF2525	512 kPts
HMF2550	1 MPts
Predefined waveforms:	Exponential rise/fall, white Noise, Cardiac

Inputs and Outputs

Signal output:	BNC socket (frontside), short-circuit-proof, ext. voltage ±15 V max.
Impedance	50 Ω
Gate/Trigger input:	BNC socket (frontside)
Impedance	5 kΩ || 100 pF
Level	TTL (protected up to ±30 V)
Edge	Positive/negative (selectable)
Pulse width	Min. 100 ns
Trigger output:	BNC socket (frontside)
Impedance	50 Ω
Edge	Positive TTL level impulse
Frequency	10 MHz max.
Modulation input:	BNC socket (rear side)
Impedance	10 kΩ
Max. input voltage	±5 V for full scale
Bandwidth (-3 dB)	DC...50 kHz (sample with 250 kSa/s)
Reference input:	BNC socket (rear side)
Impedance	1 kΩ
Frequency	10 MHz ±100 kHz
Input voltage	TTL

Reference output:	BNC socket (rear side)
Impedance	50 Ω
Frequency	10 MHz
Output voltage	1.65 V_{pp} (into 50 Ω)
Ramp output:	BNC socket (rear side)
Impedance	200 Ω
Output voltage	0...5 V, synchronous with sweep

Sweep

Signals:	All
Type:	linear/log.
Direction:	up/down
Sweep time:	1 ms...500 s

Burst

Signals:	All
Type:	Triggered, 1...50,000 cycles, endless or Gate controlled
Start/stop phase:	-360...+360 °
Trigger source:	Manual, internal or external via Trigger source or interface
Internal Trigger period:	1 µs...500 s

Modulation

Waveform modulation:	AM, FM, PM (Sine), PWM, FSK
Waveform carrier:	All (without pulse)
Internal modulation (ripple):	Sine, Rectangle, Triangle, Ramp, Arbitrary with up to 4096 Pts.
Internal modulation frequency:	10 µHz...50 kHz
Ext. modulation bandwidth (-3 dB)**:**	DC...50 kHz (sampled with 250 kSa/s)
Amplitude modulation:	
Modulation depth	0...100 %
Frequency modulation:	
Frequency deviation	Max. 10 MHz
Phase modulation:	
Phase deviation	-180...+180 °
Pulse width modulation:	
Deviation	0...100 % of the pulse width

Miscellaneous

Display:	3,5" color TFT QVGA 65 k colors
Interface:	Dual-Interface USB/RS-232 (HO720)
Save/Recall memory:	10 complete set-ups
Protection class:	Safety class I (EN61010-1)
Power supply:	105...253 V, 50/60 Hz, CAT II
Power consumption:	approx. 30 Watt
Operating temperature:	+5...+40 °C
Storage temperature:	-20...+70 °C
Rel. humidity:	5...80 % (non condensing)
Dimensions (W x H x D)**:**	285 x 75 x 365 mm
Weight:	3.4 kg

All data valid at 23 °C after 30 minutes warm-up.

Accessories supplied: Line cord, Operating manual, CD
Recommended accessories:

HO730	Dual-Interface Ethernet/USB
HO740	Interface IEEE-488 (GPIB), galvanically isolated
HZ13	Interface cable (USB) 1.8 m
HZ14	Interface cable (serial) 1:1
HZ20	Adapter plug BNC plug - 4 mm safety sockets
HZ24	Attenuators 3/6/10 and 20 dB
HZ33	Test cable BNC plug - BNC plug 0.5 m
HZ34	Test cable BNC plug - BNC plug 1.0 m
HZ42	19" Rackmount kit 2RU
HZ72	GPIB-Cable 2 m

Mainframe HM8001-2

Product description, page 41

General information

Mainframe with power supply accommodates 2 modules

Power supply module

Details of available supply voltages and load capability:	refer to manual HM8001 (www.hameg.com)
2 x 8 V_{ac} max. 0.4 A each	
2 x 5 V_{dc} max. 1 A each	
4 x 20 V_{dc} max. 0.5 A each	
Voltages between 5 V and 20 V are programmable from each module (Polarity selectable)	
Available output power:	each module max. 25 Watt All DC voltages are electronically stabilized, floating and short-circuit proof. Current output of 2 HM8040-3 with HM8001-2: sum of all channels <2 A

Miscellaneous

Power switch (ON/OFF) located between the two modules on the front panel.

Safety class:	Safety Class I (EN61010-1)
Power supply:	115...230 V~ (50/60 Hz), CAT II
Max. permissible line fluctuation:	±10 %
Power consumption:	max. 110 W (with overload protection)
Operating temperature:	+5...+40 °C
Storage temperature:	-20...+70 °C
Rel. humidity:	5...80 % (non condensing)
Dimensions (W x H x D)**:**	285 x 75 x 365 mm
Weight:	approx. 4 kg

All data valid at 23 °C after 30 minutes warm-up.

Accessories supplied: Line cord, Operating manual
Recommended accessories:

HO801	4 BNC connectors
HZ42	19" Rackmount kit 2RU
HZ809	Test Adapter

4¾-Digit Programmable Multimeter HM8012

Product description, page 42

DC voltage

Measurement ranges:	500 mV, 5 V, 50 V, 500 V, 600 V
Resolution:	10 µV, 100 µV, 1 mV, 10 mV, 100 mV
Accuracy:	
5 V, 500 V, 600 V:	±(0.05 % of reading +0.002 % of full scale)
500 mV, 50 V:	±(0.05 % of reading +0.004 % of full scale)
Overload protection:	
V/Ω/T°/dB/ ⊣◀ to COM and to chassis:	850 V_p at max. 60 Hz or 600 V_{dc}
COM against chassis:	250 V_{rms} at max. 60 Hz or 250 V_{dc}
Input resistance:	
50 V, 500 V, 600 V:	10 MΩ II 90 pF
500 mV, 5 V:	>1 GΩ II 90 pF
Input current:	10 pA
Common mode rejection ratio:	≥100 dB (50/60 Hz ±0.5 %)
Serial mode rejection ratio:	≥60 dB (50/60 Hz ±0.5 %)

dB Mode

Accuracy:	±(0.02 dB + 2 digits) (display >-38.7 dBm)
Resolution:	0.01 dB above 18 % of rating

DC current

Measurement ranges:	500 µA, 5 mA, 50 mA, 500 mA, 10 A
Resolution:	10 nA, 100 nA, 1 µA, 10 µA, 1 mA
Accuracy:	
0.5...500 mA:	±(0.2 % of reading + 0.004 % of full scale)
10 A:	±(0.3 % of reading + 0.004 % of full scale)
Voltage drop:	
10 A range:	0.2 V max.
500 mA range:	2.5 V max.
other ranges:	0.7 V max.

AC voltage

Measurement ranges:	500 mV, 5 V, 50 V, 500 V, 600 V
Resolution:	10 µV, 100 µV, 1 mV, 10 mV, 100 mV
Accuracy 0.5...50 V:	

40 Hz...5 kHz:	±(0.4 % of reading + 0.07 % of full scale)
20 Hz...20 kHz:	±(1 % of reading + 0.07 % of full scale)
Accuracy 500 V and 600 V:	
40 Hz...1 kHz:	±(0.4 % of reading + 0.07 % of full scale)
20 Hz...1 kHz:	±(1 % of reading + 0.07 % of full scale)
Overload protection:	
V/Ω/T°/dB/ ⊣⊢ to COM and to chassis:	850 V_p at max. 60 Hz or 600 V_{dc}
COM against chassis:	250 V_{rms} at max. 60 Hz or 250 V_{dc}
Input impedance	
AC mode:	1 MΩ II 90 pF
AC + DC mode:	10 MΩ II 90 pF
Bandwidth at -3 dB:	80 kHz typical
dB mode:	20 Hz...20 kHz
Accuracy	
-23.8...59.8 dBm:	±0.2 dBm
Resolution:	0.01 dB above 9 mV
CMRR[1]:	≥60 dB (50/60 Hz ±0.5 %)
Crest factor:	7 max.

AC current	
Measurement ranges:	500 µA, 5 mA, 50 mA, 500 mA, 10 A
Resolution:	10 nA, 100 nA, 1 µA, 10 µA, 1 mA
Accuracy:	
0.5...500 mA:	±(0.7 % of reading + 0.07 % of f.s.) 40 Hz...5 kHz
10 A:	±(1 % of reading + 0.07 % of full scale)

AC + DC measurements
As shown for AC + 25 digit

Resistance		
Measurement ranges:	500 Ω, 5 kΩ, 50 kΩ, 500 kΩ, 5 MΩ, 50 MΩ	
Resolution:	10 mΩ, 100 mΩ, 1 Ω, 10 Ω, 100 Ω, 1 kΩ	
Accuracy:		
500 Ω...500 kΩ:	±(0.05 % of reading + 0.004 % of f.s.+50 mΩ)	
5...50MΩ:	±(0.3 % of reading + 0.004 % of full scale)	
Input protection max. 300 V_{rms}		
Measurement current:	500 Ω...5kΩ range:	1mA
	50 kΩ range:	100µA
	500 kΩ range:	10 µA
	5...50 MΩ range:	100 nA
Measurement voltage:	10 V typical for open inputs, depending on the value of resistance to be measured. Negative polarity of measurement voltage is across common terminal.	

Temperature	
2-wire resistance measurement	with linearization for PT100 sensors as per standard EN60751
Range:	-200...+500 °C
Resolution:	0.1 °C
Measurement current:	approx. 1 mA
Display:	in °C, °F
Accuracy:	±(0.4 °C + 0.0005 x T) from -200...+200 °C ±(0.5 °C + 0.0005 x T) from +200...+500 °C (T in °C, sensor tolerance not included)

Temperature coefficient: (reference 23 °C)		
V =	500 mV, 50 V	30 ppm/°C
	600 V range	80 ppm/°C
	other ranges	20 ppm/°C
V ~	600 V range	80 ppm/°C
	other ranges	50 ppm/°C
mA	all ranges	200 ppm/°C
mA~	all ranges	300 ppm/°C
Ω	5 MΩ, 50 MΩ ranges	200 ppm/°C
	other ranges	50 ppm/°C

Miscellaneous	
Power supply (from mainframe):	
+5 V	300 mA
-26 V	140 mA
Operating temperature:	+5...+40 °C
Storage temperature:	-20...+70 °C
Rel. humidity:	5...80 % (non condensing)
Dimensions (W x H x D) **(without 22-pole flat plug):**	135 x 68 x 228 mm
Weight:	approx. 0.5 kg

All data valid at 23 °C after 30 minutes warm-up.

Accessories supplied: Operator's Manual, Interface cable (HZ14), PVC test leads (HZ15), Software CD

Recommended accessories:

HZ10S	5 x silicone test lead (measurement connection in black)
HZ10R	5 x silicone test lead (measurement connection in red)
HZ10B	5 x silicone test lead (measurement connection in blue)
HZ812	PT100 Temperature probe

LCR-Meter HM8018

Product description, page 42

Measurement functions	
Measuring modes:	R, L, C, Θ, Q/D, |Z|
Equivalent circuits:	serial, parallel
Measuring method:	2-wire, 4-wire
Measuring ranges:	R: 0.001 Ω...99.9 MΩ C: 0.001 pF...99.9 mF L: 0.01 µH...9999 H Q: 0.0001...99.9 D: 0.0001...9.9999 Θ: (-180.00°)...(+180.00°)
Basic accuracy:	0.2 %
Measuring frequencies:	100 Hz, 120 Hz, 1 kHz, 10 kHz, 25 kHz
Freq. Accuracy:	±100 ppm (except 120 Hz: 120.2 Hz ±100 ppm)
Measuring voltage:	0.5 V_{rms} ±10 % (unloaded)
Measuring rate:	2 measurements/second
Range changing:	automatic, manual
DC Bias voltage:	1 V ±10 %
Zero setting:	Open/short circuit compensation
Compensation limits:	Short: R <10 Ω Z <15 Ω Open: Z >10 kΩ

Measurement accuracy	
with D <0.1 or Q >10:	C: $A_e = A_f (1 + C_x/C_{max} + C_{min}/C_x)$ L: $A_e = A_f (1 + L_x/L_{max} + L_{min}/L_x)$ Z: $A_e = A_f (1 + Z_x/Z_{max} + Z_{min}/Z_x)$ R: $A_e = A_f (1 + R_x/R_{max} + R_{min}/R_x)$
with D ≥0.1:	$A_e = \sqrt{1 + D_x^2}$
with the parameters:	C_x = Measurement value A_f = 0.2 % at f = 100 Hz, 120 Hz, 1 kHz A_f = 0.3 % at f = 10 kHz A_f = 0.5 % at f = 25 kHz

Parameter	Auto Range
C_{max}	160 µF/f
C_{min}	53 pF/f
L_{max}	480 H/f
Z_{max}, R_{max}	3 MΩ
Z_{min}, R_{min}	1 mΩ

Dissipation factor accuracy: $D_e = \pm \frac{A_e}{100}$

Quality factor accuracy: $Q_e = \frac{Q_x^2 \cdot D_e}{1 \pm D_x \cdot D_e}$

Phase angle accuracy: $\Theta_e = \frac{180}{\pi} \cdot \frac{A_e}{100}$

Display
5-digits 7-Segment LEDs with sign
Display Parameters:
Value **% Value** **Deviation** **% Offset** } Calculation from measurement value and reference value stored

Miscellaneous	
The inputs are short-circuit-proof and overvoltage protected up to 100 V_{dc} with a maximum energy consumption of 1 J. One configuration can be saved.	
Power supply (from mainframe):	+5 V/300 mA +5.2 V/50 mA -5.2 V/50 mA (∑ = 2 W)

Operating temperature:	+5...+40 °C
Storage temperature:	-20...+70 °C
Rel. humidity:	5...80 % (non condensing)
Dimensions (W x H x D) **(without 22-pole flat plug):**	135 x 68 x 228 mm
Weight:	approx. 0.5 kg

All data valid at 23 °C after 30 minutes warm-up.

Included in delivery: Operator's Manual
Recommended accessories:

HZ10S	5 x silicone test lead (measurement connection in black)
HZ10R	5 x silicone test lead (measurement connection in red)
HZ10B	5 x silicone test lead (measurement connection in blue)
HZ17	Kelvin test lead (4 wire) with probe tips
HZ18	Kelvin test lead (4 wire) with gold plated contacts
HZ19	Kelvin test lead (4 wire) with SMD-Test-tweezers

1.6 GHz Universal Counter HM8021-4

Product description, page 43

Measurement functions

Frequency A/C, Period A;
Totalize A;
Pulse width: ⎍ / ⎎ (averaged);
Totalize A during ext. gate

Input characteristics (Input A)

Frequency range:	
0...150 MHz:	DC-coupled
10 Hz...150 MHz:	AC-coupled
Sensitivity: (normal triggering)	
DC...80 MHz	20 mV_{rms} (sine wave)
	80 mV (pulse)
80...150 MHz	60 mV_{rms} (sine wave)
20 Hz...80 MHz (auto trig.)	50 mV_{rms} (sine wave)
Minimum pulse width:	5 ns
Input noise:	100 µV (typ.)
Coupling:	AC or DC (switchable)
Input impedance:	1 MΩ II 40 pF
Attenuator:	x1, x20 (switchable)
Max. input voltage:	
0...440 Hz:	400 V (DC + AC_{peak})
1 MHz:	decreasing to 8 V_{rms}

Input characteristics (Input C)

Frequency range:	100 MHz...1.6 GHz
Sensitivity:	
to 1.3 GHz:	30 mV (typ. 20 mV)
to 1.6 GHz:	100 mV (typ. 80 mV)
Input impedance:	50 Ω nominal
Coupling:	AC
Max. input voltage:	5 V (DC + AC_{peak})

Input characteristics (external gate)

Input impedance:	4.7 kΩ
Max. input voltage:	±30 V
High/low level:	>2 V/<0.5 V
Min. pulse duration:	50 ns
Min. effective gate time:	150 µs

Frequency measurement (Input A)

LSD:	(2.5 x 10^{-7} s x freq.)/measurement time
Resolution:	1 LSD

Period duration measurement

Range:	66.6 ns...10,000 s
LSD:	(2.5 x 10^{-7} s x period)/measurement time
Resolution:	1 LSD

Totalize (manual/external gated)

Range:	DC...20 MHz
Min. pulse duration:	25 ns
LSD:	1 count
Resolution:	LSD
Ext. gate error: in manual mode only	100 ns

Time interval (averaged)

LSD:	10 ps...100 ns
Resolution:	1 LSD

Offset

Range:	covers the entire measurement range

Gate time

(Gate time cannot be less than 1 period.)

Range:	100 ms...10 s in 3 steps
External gate time:	min. 150 µs

Timebase

Frequency:	10 MHz clock 10 MHz crystal
Accuracy (between 10 °C and 40 °C):	±5x 10^{-7}
Aging:	±3 ppm/15 years

Miscellaneous

Display:	8-digit 7-segment LED display with 7.65 mm digit height, sign and exponent
Power consumption:	approx. 7 Watt
Operating temperature:	+5...+40 °C
Storage temperature:	-20...+70 °C
Rel. humidity:	5...80 % (non condensing)
Dimensions (W x H x D):	135 x 68 x 228 mm
Weight:	approx. 0.6 kg

All data valid at 23 °C after 30 minutes warm-up.

Accessories supplied: Operator's Manual
Recommended accessories:

HZ20	Adapter, BNC to 4mm banana
HZ24	Attenuators 50 Ω (3/6/10/20 dB)
HZ33	Test Cable 50 Ω (BNC-BNC) 0.5 m
HZ34	Test Cable 50 Ω (BNC-BNC) 1.0 m

10 MHz Function Generator HM8030-6

Product description, page 43

Operating modes

Sine, square, triangle, pulse; free running, internal sweep or external frequency modulation, with or without DC offset

Frequency ranges

0.05 Hz...10 MHz in 8 ranges, variable: x0.09 to x 1.1 (12:1)

Frequency drift:	<0.5 %/hr or 0.8 %/24 hrs. at constant ambient temperature

Waveform characteristics

Sine wave distortion	
0.05 Hz...1 MHz:	max. 0.5 %
1...10 MHz:	max. 5 %
Square wave rise time:	typ. 15 ns
Overshoot:	<5 % (for termination into 50 Ω)
Triangle non-linearity:	<1 % (to 100 kHz)

Displays

Frequency:	5-digit, 7-segment LED, each 8 x 5 mm
Accuracy:	
up to 5 Hz:	±(3 % + 3 digits)
5 Hz...10 MHz:	±(5 x 10^{-5} + 1 digit)

LED indicators for mHz, Hz, kHz and s

Outputs

Signal output:	short-circuit proof
protected against ext. voltage up to ±45 V_{dc} max. (30 s)	
Impedance:	50 Ω
Output voltage:	10 V_{pp} into 50 Ω load; 20 V_{pp} (open circuit)

Attenuation:	max. 60 dB
2 attenuators:	each 20 dB ±0.2 dB
Variable:	0...20 dB
Amplitude error:	(sine wave/triangle)
0.5 Hz...0.5 MHz:	max. 0.2 dB
5 Hz...10 MHz:	max. 0.5 dB
DC offset:	variable (on/off, except pulse function)
into 50 Ω load:	max. ±2.5 V
in open circuit:	max. ±5 V
Trigger output:	square wave synchronous to approx. +5 V/TTL

FM input	
(VCF, BNC connector on rear panel of HM8001-2 and option HO801)	
Frequency deviation:	approx. 1:100
Input impedance:	6 kΩ II 25 pF
Input voltage:	max. ±30 V

Internal sweep	
Sweep speed:	20 ms...15 s
Sweep range:	approx. 1:100

Miscellaneous	
Power supply (from mainframe):	+5 V/200 mA +16 V/300 mA -16 V/250 mA (∑ = 9.8 W)
Operating temperature:	+5...+40 °C
Storage temperature:	-20...+70 °C
Rel. humidity:	5...80 % (non condensing)
Dimensions (W x H x D) **(without 22-pole flat plug):**	135 x 68 x 228 mm
Weight:	approx. 0.8 kg

All data valid at 23 °C after 30 minutes warm-up.

Accessories supplied: Operator's Manual
Recommended accessories:

HZ20	Adapter, BNC to 4 mm banana
HZ22	Feed-Through Termination 50 Ω
HZ33	Test Cable 50 Ω (BNC-BNC) 0.5 m
HZ34	Test Cable 50 Ω (BNC-BNC) 1.0 m

Triple Power Supply (module) HM8040-3

Product description, page 44

Outputs	
2 x 0...20 V/0,5 A and 5 V/1 A	Single pushbutton control of all outputs, linear regulators with overheating protection. Floating outputs for parallel/serial operation, current limit and electronic fuse

20 V Output	
Setting range:	2 x 0...20 V, continuously variable
Residual ripple:	≤1 mV_{rms}
Output current:	max. 0.5 A
Current limit/electronic fuse:	0...0.5 A continuously variable
Dynamic behaviour:	
Load change 10...90 % of full load	
Recovery time:	200 µs
Dyn. transient deviation:	typ. 2 mV
Dyn. output impedance:	3.75 mΩ
Load change at 50 % basic load and ±10 % of full load	
Recovery time:	150 µs
Dyn. transient deviation:	400 µV
Dyn. output impedance:	4 mΩ

5 V Output	
Range:	5 V ±0.5 V screwdriver adjustment
Ripple and noise:	≤1 mV_{rms}
Output current:	max. 1 A continuous, short-circuit-proof

Combined displays of 20 V outputs	
7-segment LED:	2 x 3-digit displays, each switchable for voltage and current (V, mA)
Resolution:	0.1 V/1 mA
Display accuracy:	±1 digit voltage/±4 digit current
LED:	current limit indication

Maximum limits	
Reverse voltage:	25 V, each output
Reverse current:	500 mA, each output
Voltage to ground:	100 V, each terminal
Temperature control:	If the inside temperature exceeds 75...80 °C, the HM8040-3 will be turned off.

Miscellaneous	
Safety class:	Safety class I (EN61010-1)
Power supply (from mainframe):	1 x 8 V/1 A 2 x 24 V/530 mA 1 x 5 V/400 mA 2 x 18 V_{ac}/100 mA (∑ = 40 W)
Current output of 2 HM8040-3 with HM8001-2:	sum of all channels <2 A
Operating temperature:	+5...+40 °C
Storage temperature:	-20...+70 °C
Rel. humidity:	5...80 % (non condensing)
Dimensions (W x H x D)**:**	135 x 68 x 228 mm
Weight:	approx. 1.07 kg

All data valid at 23 °C after 30 minutes warm-up.

Accessories supplied: Operator's Manual
Recommended accessories:

HZ10S	5 x silicone test lead (measurement connection in black)
HZ10R	5 x silicone test lead (measurement connection in red)
HZ10B	5 x silicone test lead (measurement connection in blue)

HO010 Serial Bus Option description, page 8

	I²C Bus	SPI Bus	UART/RS-232 Bus
Bus Configuration			
Baud rates	up to 10 Mb/s	up to 25 Mb/s	300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200 Baud, up to 62.5 Mb/s
Number of Bit's	7 or 10 Bit for Adress ID 8 Bit for Data	32 Bit for Data	8 Bit for Data 1, 1.5, 2 Bit for Stop Bit
Polarity	n/a	Chip select, positive or negative, or without Chipselect (2-wire SPI) Clock rising or falling edge Data High or Low active	High or Low active
Parity	n/a	n/a	none, odd or even
Trigger			
Source	digital Channel LCH 0...15 (Opt. HO3508)	digital Channel LCH 0...15 (Opt. HO3508)	digital Channel LCH 0...15 (Opt. HO3508)
Event	7 or 10 Bit Address ID 7 or 10 Bit Address ID with 8 Bit Data Start Stop Restart missing Acknowledge Adress ID without Acknowledge	Data packets up to 32 Bit with positive or negative Chip Select or without Chip Select, (2-wire SPI)	Data packets up to 8 Bit
Input format	Hexadecimal or Binary	Hexadecimal or Binary	Hexadecimal or Binary
Hardware accelerated Decode			
Source	digital Channel LCH 0...15 (Opt. HO3508)	digital Channel LCH 0...15 (Opt. HO3508)	digital Channel LCH 0...15 (Opt. HO3508)
Display	Bus display, color coded for Read Adress ID: Yellow Write Adress ID: Magenta Date: Cyan Start: White Stop: White ACK/NACK: Green/Red Error: Red Trigger Condition: Green up to four lines for decoded values, synchronous display of the Bit lines	Bus display, color coded for Date: Cyan Start: White Stop: White Error: Red Trigger Condition: Green up to four lines for decoded values, synchronous display of the Bit lines	Bus display, color coded for Date: Cyan Start: White Stop: White Error: Red Trigger Condition: Green up to four lines for decoded values, synchronous display of the Bit lines
Format	Adress ID: hexadecimal Data ASCII, binary, decimal, hexadecimal	n/a Data ASCII, binary, decimal, hexadecimal	n/a Data ASCII, binary, decimal, hexadecimal

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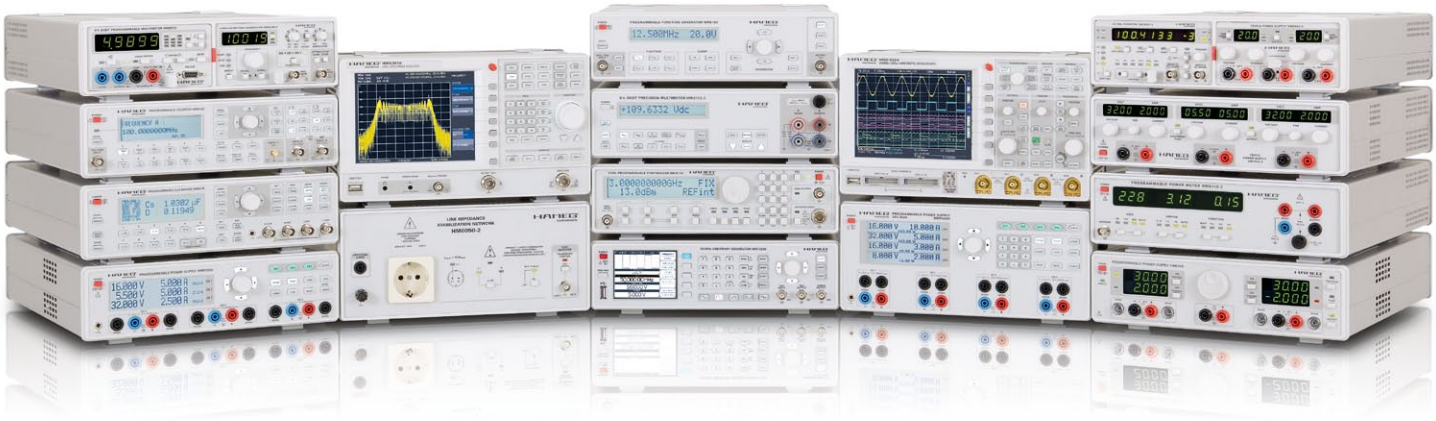

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