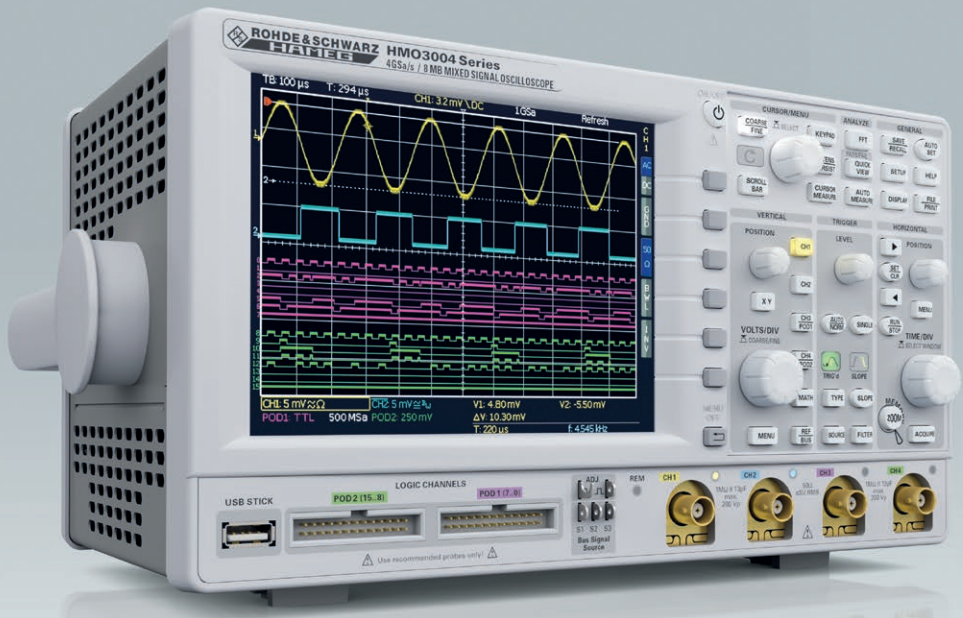
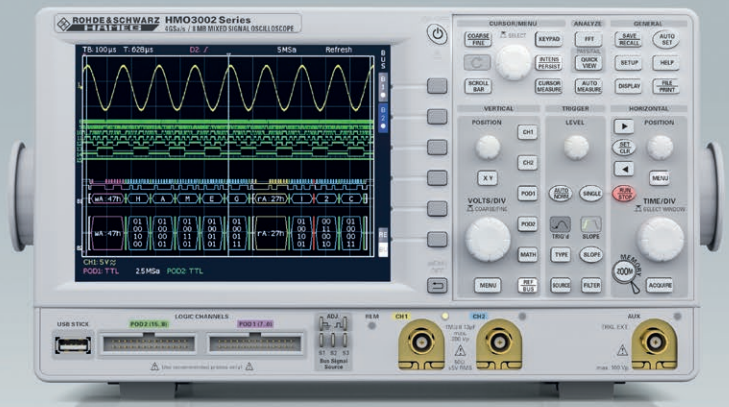
Mixed Signal Oscilloscopes

300 MHz | 400 MHz | 500 MHz

HMO3000 Series

HAMEG® Instruments
A Rohde&Schwarz Company





ROHDE&SCHWARZ

Elektronik
Product of the Year
2014
HMO3000
Winner in category
Test & Measurement

Precise signal analysis
4 GSamples/s sampling rate
8 MPoints memory

Intelligent user interface
To optimize the screen display, the instrument shows and hides menus

FFT
Superb FFT functionality

Quick view
At the push of a button the 16 most important values of the measured signal are permanently updated and displayed

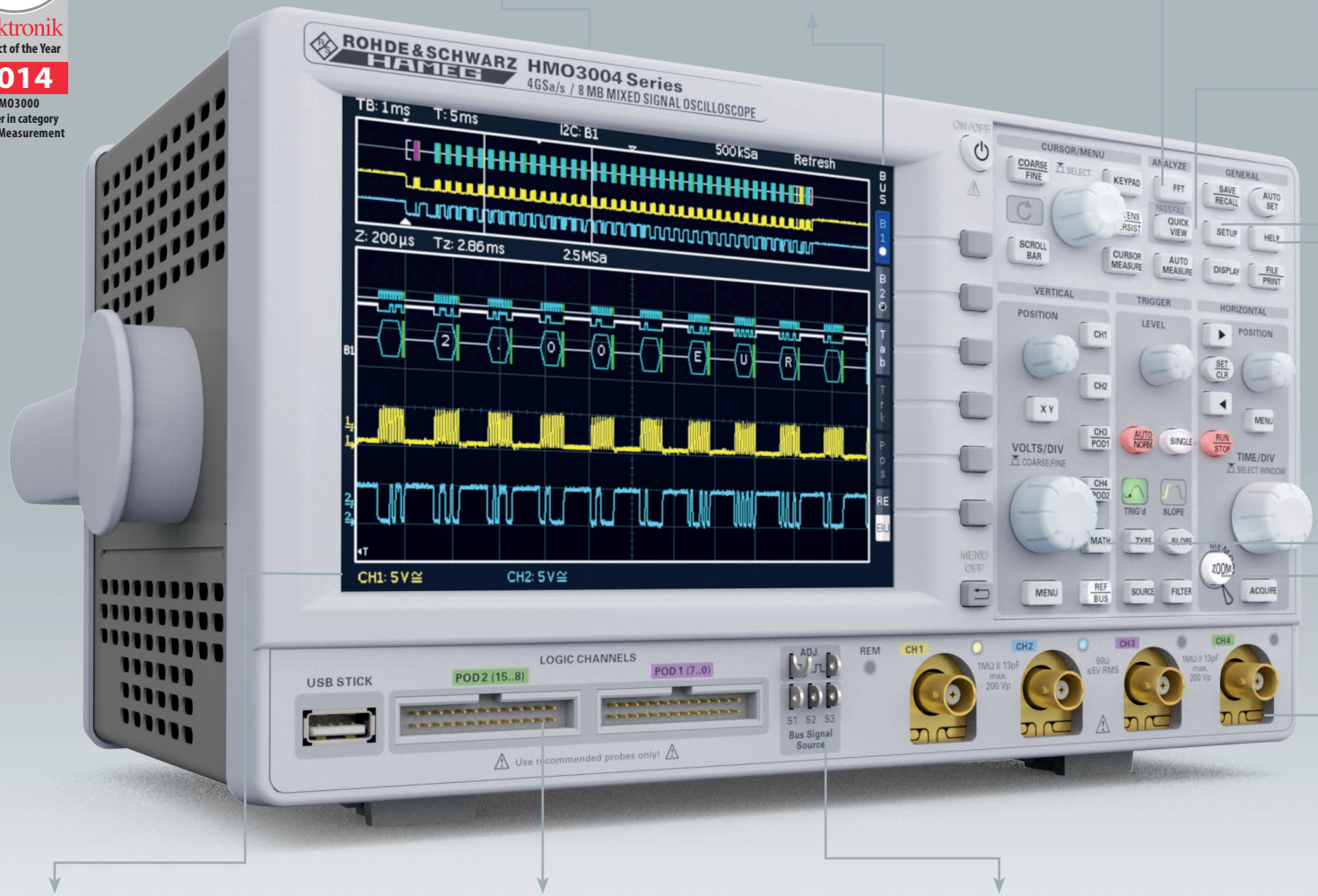
Setup
Intuitive, multi-lingual user menu

Help
Context-sensitive help

Math
Wide range of programmable math functions

Zoom
Memory zoom up to 250,000 : 1

Analog channels
Vertical sensitivity of up to 1mV/div.



HMO3004 Series, 500 MHz with 4 Channels

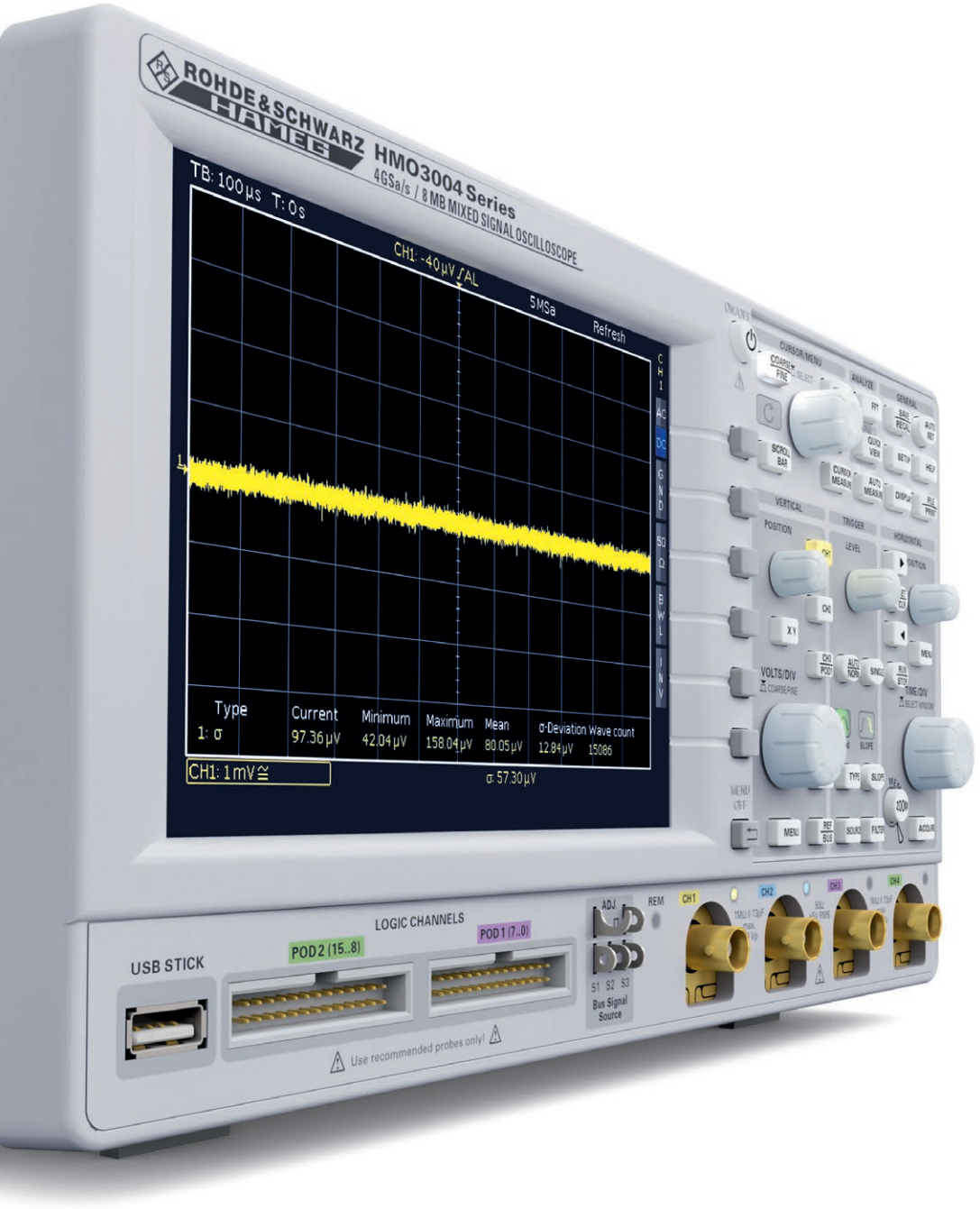
Display
Superb 16.5 cm (6.5") LED-backlit TFT display

Standard MSO functionality
Analyze analog channels plus up to an additional 16 digital channels

Bus signal source
To create SPI, I²C, UART and counter test-signals

Fan
Maximum noise reduction by temperature-controlled fan

USB | TCP/IP | optional RS-232 | optional IEEE-488 | 6.5" VGA 16.5 cm | DVI-D Output | 50Ω 1MΩ | Lab-VIEW | Software | Printed Manual



Precise Signal Analysis

An excellent sampling rate in combination with a large memory depth is the key for precise signal analysis. The highly resolved measurement data and the powerful zoom function expose even minor signal details.

Depending on their requirements users can choose between three 2-channel-versions and three 4-channel-versions with bandwidths between 300 and 500 MHz.

	500 MHz	400 MHz	300 MHz
4 channel	HMO3054	HMO3044	HMO3034
2 channel	HMO3052	HMO3042	HMO3032

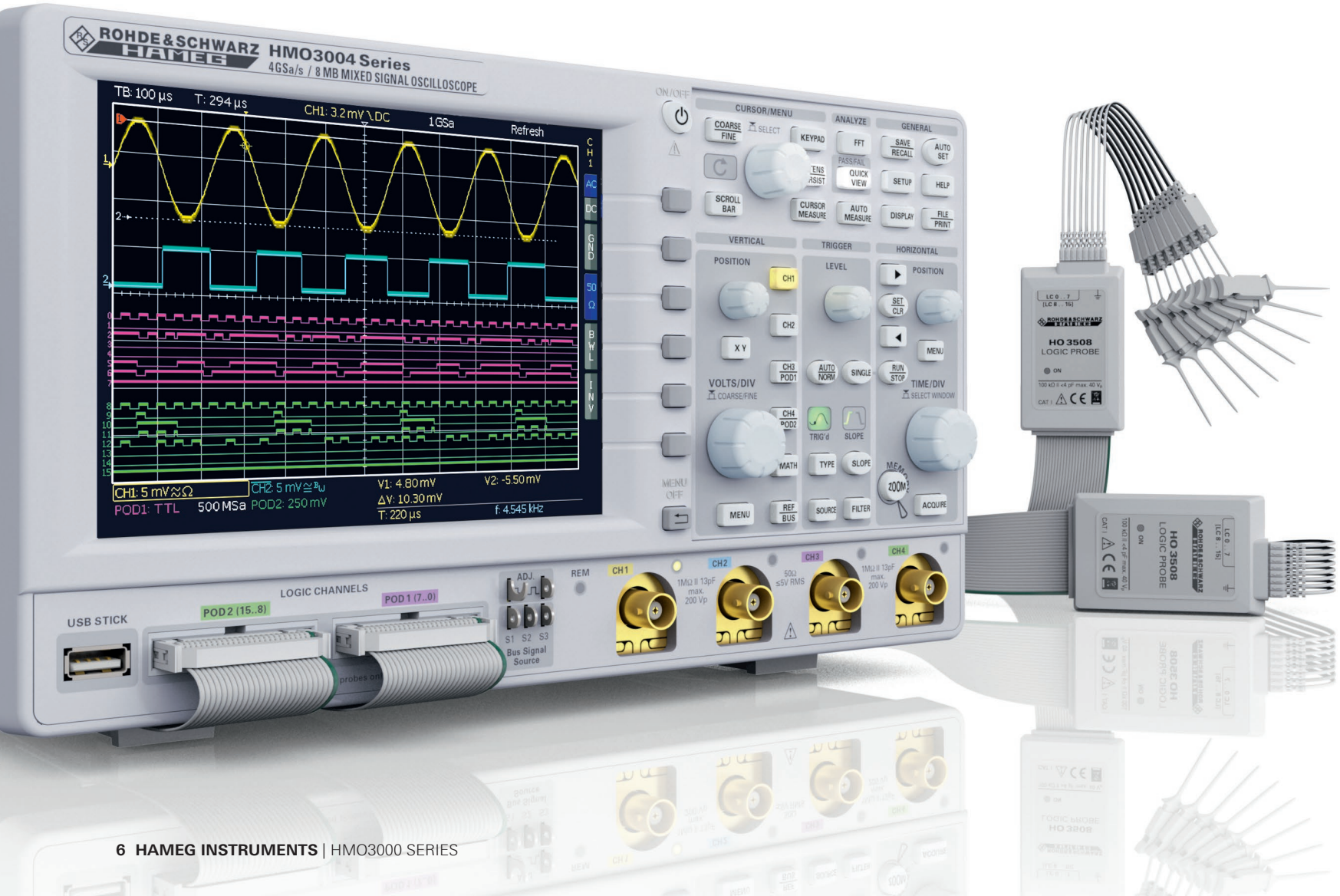
Key facts	
Sampling rate (per analog channel)	2 GSa/s
Maximum sampling rate	4 GSa/s
Memory depth per channel	4 MPts.
Maximum memory	8 MPts.
Maximum number of logic channels	16
Input impedance	1 MΩ / 50 Ω, switchable
V/div. @1 MΩ / 50 Ω	1 mV/div. to 5 V/div.

Video

HMO3000 product video:
Scan, click or go to
http://youtube.com/
HAMEGcom

Always a MSO

The mixed signal functionality is always included in the HMO3000 series with no software option being necessary to unlock it.



HAMEG logic probes are not linked to a specific instrument serial number. This allows their use with all digital HAMEG oscilloscopes in the HMO series.

Frequency Analysis

Due to the outstanding FFT functionality of the HMO series oscilloscopes signals can also be analysed in the frequency domain with up to 65,536 points. Additional practical tools such as cursor measurement as well as peak-detect-functions are also available. They allow engineers to complete their analysis significantly faster, also in the frequency domain.

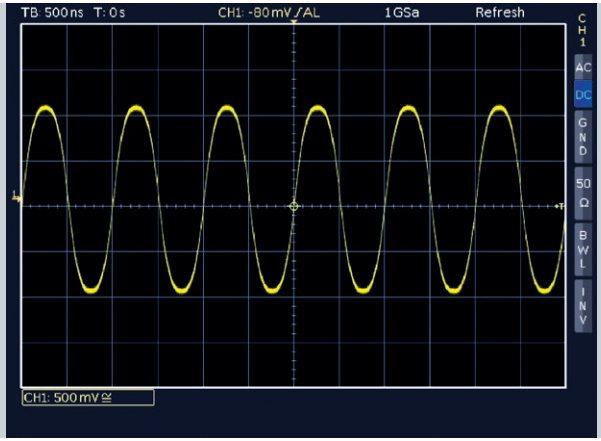


Figure 1: A sinusoid signal that at first sight appears undistorted

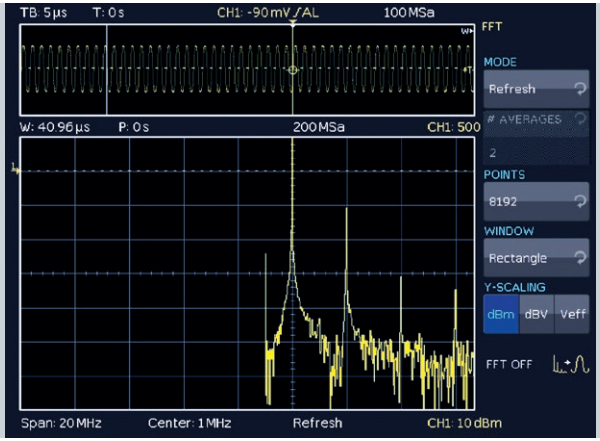


Figure 2: The frequency spectrum exposes the signal distortion

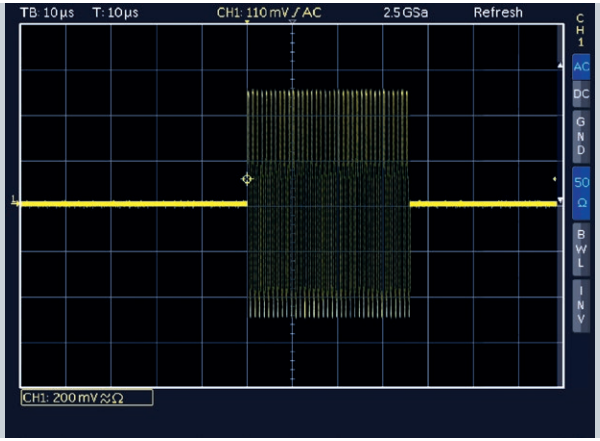


Figure 3

Easy analysis in frequency domain

Quite often the distortion of input signals cannot be detected with the naked eye. For instance, the sine wave signal displayed in figure 1 appears to be undistorted. Only the frequency spectrum (figure 2) - available with just one touch of a button - clearly displays additional harmonics that occur as harmonic oscillations for multiples of the basic frequency.

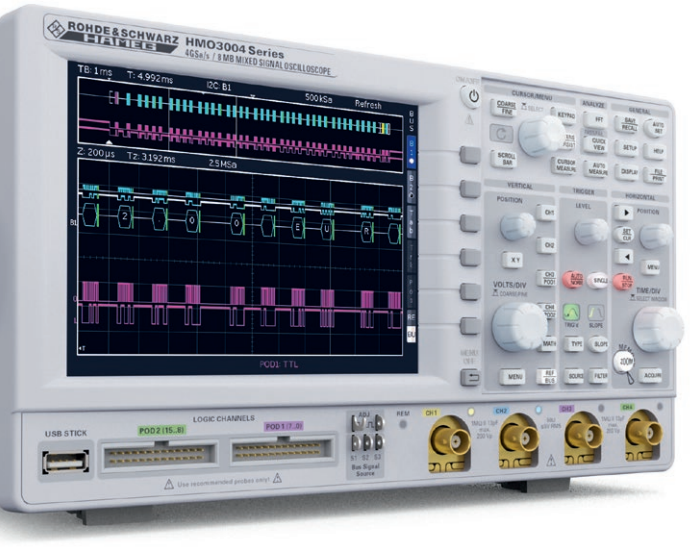
For non-periodic input signals most instruments offer the option to trigger the spectrum at just the right moment to then check it in “STOP” mode at a later time. However, at that point, many oscilloscopes with FFT functionality calculate the spectrum only once and store the result in the memory. The base time signal will no longer be used for the calculation. Consequently, an investigation of all parts of the signal will no longer be possible.

HMO series oscilloscopes work differently: Since FFT is also active for previously stored signals, it is possible to subsequently analyze any sections of those signals captured in single shot mode or stop mode with an adjustable window width. Figure 3 shows a sine burst signal in the time domain. Pushing the FFT button will switch the oscilloscope into the frequency domain. Users can choose between various measurement windows like the

Serial Bus Analysis

I²C, SPI, CAN or LIN – in terms of interaction with the outside world for embedded systems, it is safe to say that these are the most commonly used communication protocols. The new HMO3000 series by HAMEG Instruments offers you hardware-accelerated signal triggering and decoding for all of these protocols. You can upgrade your instrument via software licence keys with those functions required to develop your application:

- HOO10: Analysis of I²C, SPI and UART/RS-232 signals on analog and logic channels
- HOO11: Analysis of I²C, SPI and UART/RS-232 signals on all analog channels
- HOO12: Analysis of CAN and LIN signals on analog and logic channels

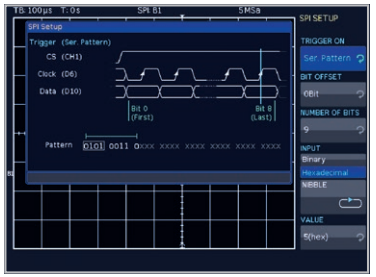


Serial bus trigger types:

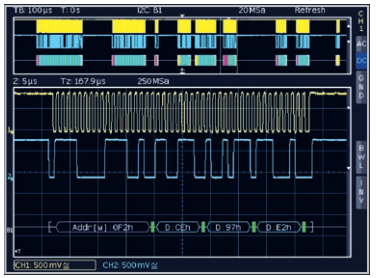
- I²C: Start, Stop, ACK, nACK, Address/Data
- SPI: Start, End, Serial Pattern (32Bit)
- UART/RS-232: Startbit, Frame Start, Symbol, Pattern
- LIN: Frame Start, Wake Up, Identifier, Data, Error
- CAN: Frame Start, Frame End, Identifier, Data, Error

HOO10/HOO11

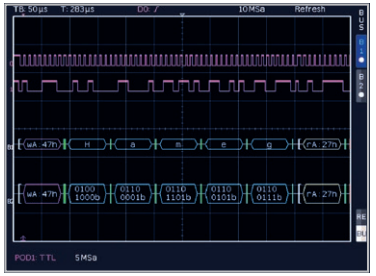
SPI/I²C/UART/RS-232 bus analysis for all oscilloscopes of the HMO series



SPI bus trigger setup



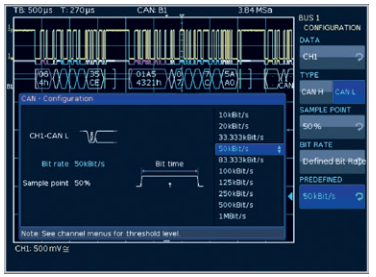
I²C bus hex decoding on the analog channel



I²C bus ASCII und binary

HOO12

CAN/LIN bus analysis for all oscilloscopes of the HMO series



CAN bus configuration

CAN bus list display

HEX decoded CAN bus signal

HMO3002 series 2-channel mixed signal oscilloscope
HMO3004 series 4-channel mixed signal oscilloscope
HMO3032, HMO3034: 300 MHz
HMO3042, HMO3044: 400 MHz
HMO3052, HMO3054: 500 MHz
from firmware version 5.405

Display	
Display	16.5 cm (6.5 ") VGA Color Display
Resolution	640 (H) x 480 (V) Pixel
Backlight	500 cd/m² (LED)
Display range in horizontal direction	
without menu bar	12 Div (600 Pixel)
with menu bar	10 Div (500 Pixel)
Display range in vertical direction	8 Div (400 Pixel)
with Virtual Screen usage	20 Div
Color depth	256 colors
Levels of brightness	32
Trace display	pseudo-color, inverse intensity
Button brightness	light, dark

Vertical System	
DSO mode	
2-channel models	CH1, CH2
4-channel models	CH1, CH2, CH3, CH4
MSO mode	
2-channel models	CH1, CH2, POD1, POD2
4-channel models	CH1, CH2, CH3|POD1, CH4|POD2
Analog channels	
Y-bandwidth (-3dB)	
(1mV, 2mV)/Div	HMO303x: 180 MHz HMO304x, HMO305x: 200 MHz
(5mV bis 5V)/Div	HMO303x: 300 MHz HMO304x: 400 MHz HMO305x: 500 MHz
Lower AC bandwidth	2 Hz
Bandwidth limitation (switchable)	about 20 MHz
Rise time (computed)	
HMO303x	< 1.166 ns
HMO304x	< 0.875 ns
HMO305x	< 0.700 ns
DC gain accuracy	2 % of full scale
Input sensitivity	
all analog channels	1 mV/Div to 5 V/Div (1 MΩ and 50 Ω)
coarse stepping	12 calibrated steps, 1-2-5
variable stepping	freely between calibrated steps
Impedance	1 MΩ II 13 pF ±2 pF (50 Ω switchable)
Coupling	DC, AC, GND
Max. input voltage	(derates at 20 db/decade to $5V_{rms}$ above 100 kHz)
1MΩ	$200V_p$
50Ω	$5V_{rms}$, max. $30V_p$
Position range	±8 Div (from center of screen)
Offset control	
1mV, 2mV	±0.2 V - 8 Div x sensitivity
5mV to 20mV	±1.0 V - 8 Div x sensitivity
50mV	±2.5 V - 8 Div x sensitivity
100mV, 200mV	±20 V - 8 Div x sensitivity
500mV to 5V	±50 V - 8 Div x sensitivity
XY/XYZ mode	selectively all analog channels
Inversion	selectively all analog channels
Logic channels	with logic probe (HO3508/HO3516)
Thresholds	TTL, CMOS, ECL, user-defined (-2 V to +8 V)
Impedance	100 kΩ || 4 pF
Coupling	DC
Max. input voltage	$40V_p$

Trigger System	
Trigger mode	
Auto	Triggers automatically also without any specific trigger event
Normal	Triggers only on specific trigger events
Single	Triggers once on a trigger event
Trigger indicator	Screen and panel (LED)
Trigger sensitivity	
up to 2mV/Div	1.5 Div
2mV/Div to 5mV/Div	1.0 Div
from 5mV/Div	0.8 Div
external	$0.5V_{pp}$ to $10V_{pp}$
Trigger level setting	
with auto level	Linking peak value and trigger level, adjustable between peak values of a signal
without auto level	±8 Div (from center of screen)
external	±5 V
Trigger coupling	
Auto level	5 Hz to 300/400/500 MHz
AC	5 Hz to 300/400/500 MHz
DC	DC to 300/400/500 MHz
HF	30 kHz to 300/400/500 MHz
selectable filters	
LF	DC to 5 kHz, selectable in DC and auto level mode
low-pass (noise rejection)	200 MHz, selectable in AC, DC, HF and auto level mode
Trigger hold-off	50 ns to 10 s
External trigger input (BNC)	
Impedance	1 MΩ || 14 pF ±2 pF
Sensitivity	$0.5V_{pp}$ to $10V_{pp}$
Trigger level	±5 V
Max. input voltage	$100V_p$
Coupling	DC, AC
Trigger/Auxiliary output (BNC)	
Functions	Pulse output for every acquisition trigger event, error output on mask violation
Output level	3.8 V
Pulse polarity	positive
Pulse width	> 150 ns (trigger event), > 0.5 µs (mask violation)
Trigger types	
Edge	
Direction	increasing, decreasing, both
Trigger coupling	auto level AC, DC, HF
Switchable filters	LF, noise rejection
Sources	all analog and digital channels, mains, external (AC, DC)
Edge A/B	
Direction	increasing, decreasing, both
Source: A, B	all analog channels, external (AC, DC)
Frequency range	DC to 300/400/500 MHz
min. signal amplitude	0.8 Div
Trigger level range (seperately adjustable with different sources)	±8 Div (from center of screen)
external	±5.0 V
Trigger coupling	
State A	auto level, AC, DC, HF LF, low-pass
State B	
same sources	as state A
different sources	DC, HF low-pass
Trigger setting	
time based	16 ns to 8.589 s, resolution min. 4 ns
event based	1 to 2^{16} events
Pulse width	
Polarity	positive, negative

during acquisiton	Statistics: number of completed tests, number of passes / failed acquisition (absolute and in percent), test duration

Waveform Maths	
Quickmath	
Functions	addition, substraction, multiplication, division
Sources	2 analog channels
Mathematics	
Functions	addition, substraction, multiplication, division, minimum / maximum, square, square root, absolute value, pos/neg wave, reciprocal, inverse, log10/ln, derivation, integration, filter (lowpass/highpass)
Editing	formula editor, menu-driven
Sources	all analog channels, user-defined constants
Storage location	Math. Memory
Number of formula sets	5 formula sets
Number of equations	5 equations per formula set
Simultaneous display of math. Functions	1 formula set with max. 4 equations
Frequency Analysis (FFT)	
Parameters	frequency span, center frequency, vertical scale, vertical position
FFT length	2 kpts, 4 kpts, 8 kpts, 16 kpts, 32 kpts, bis 64 kpts
Window	Hanning, Hamming, Rectangular, Blackman
Scale	dBm, dBV, V_{rms}
Waveform arithmetics	refresh, envelope, average (up to 512)
Cursor measurement	2 horizontal cursors, previous/next peak search
Sources	all analog channels

Pattern Generator	
Functions	probe adjust, bus signal source, counter, random pattern
Probe ADJ output	1 kHz, 1 MHz square wave: 1.0V_{pp} (tr < 4ns)
Bus Signal Source (4Bit)	I^2C (100 kBit/s, 400 kBit/s, 1 MBit/s), SPI (100 kBit/s, 250 kBit/s, 1 MBit/s), UART (9600 Bit/s, 115,2 kBit/s, 1 MBit/s)
Counter (4Bit)	frequency: 1 kHz, 1 MHz direction: incrementing
Random pattern (4Bit)	frequency: 1 kHz, 1 MHz

Interfaces	
Connectors and ports	
for mass storage (FAT16/32)	2 x USB-Host (Typ A)
for remote control	HO730 dual interface: Ethernet (RJ-45) / USB-Device (Typ B)
optional interfaces	HO720 dual interface: USB-Device (Typ B) / RS-232 HO740 interface: IEEE-488 (GPIB)
external monitor interface	DVI-D (480p, 60Hz), HDMI compatible

General Data	
Application memory	8MB for references, formulas, device settings, languages and help functions
Save/Recall	
device settings	on internal file system or external USB memory, available file formats: SCP, HDS
reference waveforms	on internal file system or external USB memory, available file formats: BIN (MSB/LSB), FLT (MSB/LSB), CSV, TXT, HRT
traces	on external USB memory, available file formats: BIN (MSB/LSB), FLT (MSB/LSB), CSV, TXT, HRT
data	display or acquisition data
sources	single or all analog channels
screenshots	on external USB memory, available file formats: BMP, GIF, PNG
math equation sets	on internal file system or external USB memory
Realtime Clock (RTC)	date and time
Power supply	
AC supply	100 V to 240 V, 50 Hz to 60 Hz, CAT-II
Power consumption	
2-channel models	max. 70 W
4-channel models	max. 90 W
Safety	in line with IEC 61010-1 (ed. 3), IEC 61010-2-30 (ed. 1), EN 61010-1, EN 61010-2-030 , CAN/CSA-C22.2 No. 61010-1-12 , CAN/CSA-C22.2 No. 61010-2-030-12 ,UL Std. No. 61010-1 (3rd Edition) , UL61010-2-030
Temperature	
Operating temperature range	+5 °C to +40 °C
storage temperature range	-20 °C to +70 °C
rel. humidity	5 % to 80 % (without condensation)
Mechanical data	
Dimensions	285 mm (W) x 220 mm (H) x 175 mm (D)
Weight	3.6 kg

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

Accessories included:
HO730 Ethernet/USB dual-interface card, Line cord, printed operating manual, 2/4 probes (amount=number of channels), 10:1 with attenuation ID (HZ350 400/300 MHz, HZ355 500 MHz), software-CD

HO730

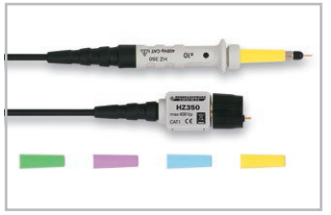
Dual interface card ethernet/USB (inluded in

Printed operating manual and software-CD

HZ350

400 MHz passive probe

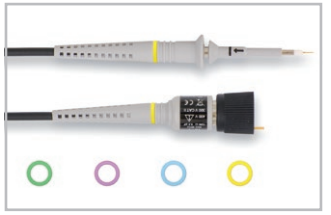
(for 400/300 MHz oscilloscopes)



HZ355

500 MHz passive probe

(for 500 MHz oscilloscopes)



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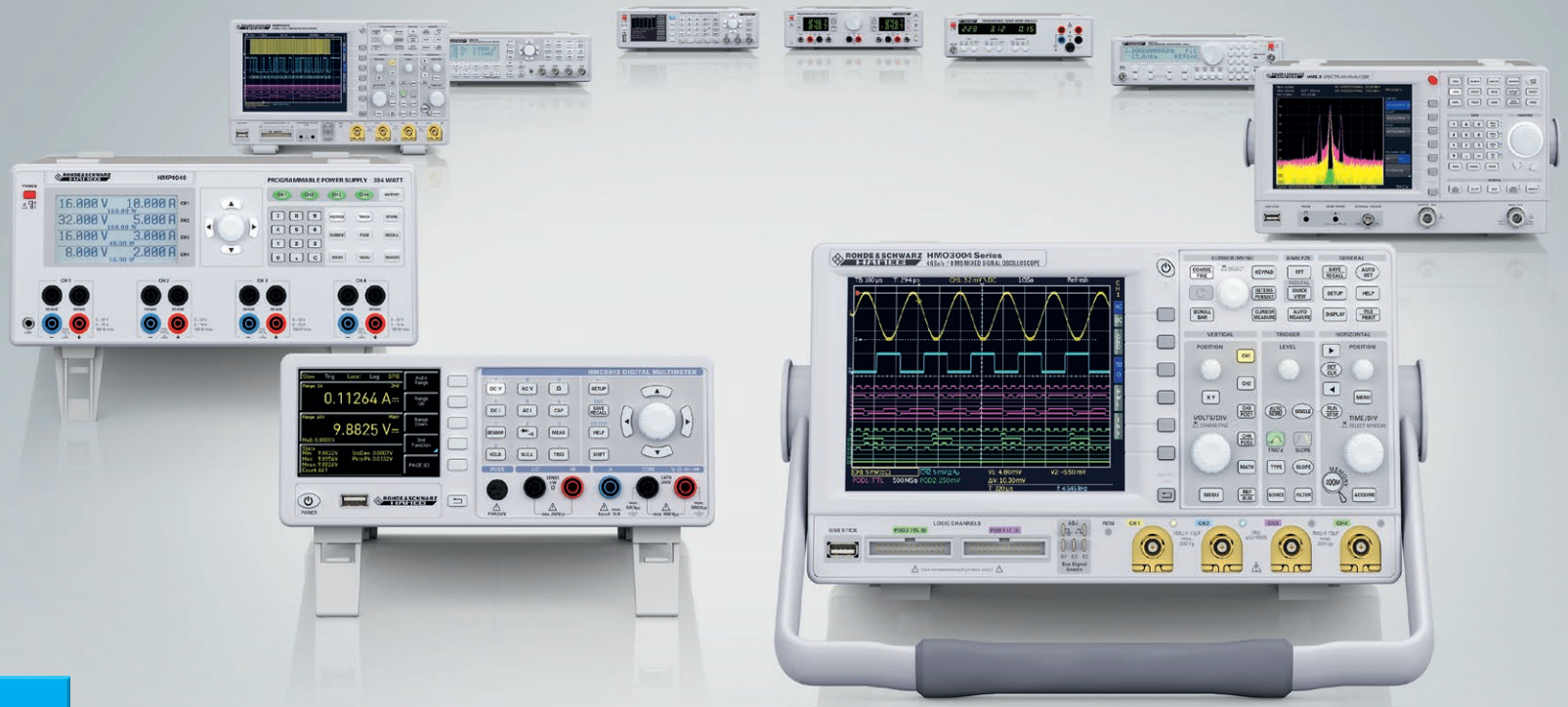

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