HAMEG Instruments
A Rohde&Schwarz Company

250MHz 4 Channel Digital Oscilloscope
HMO2524

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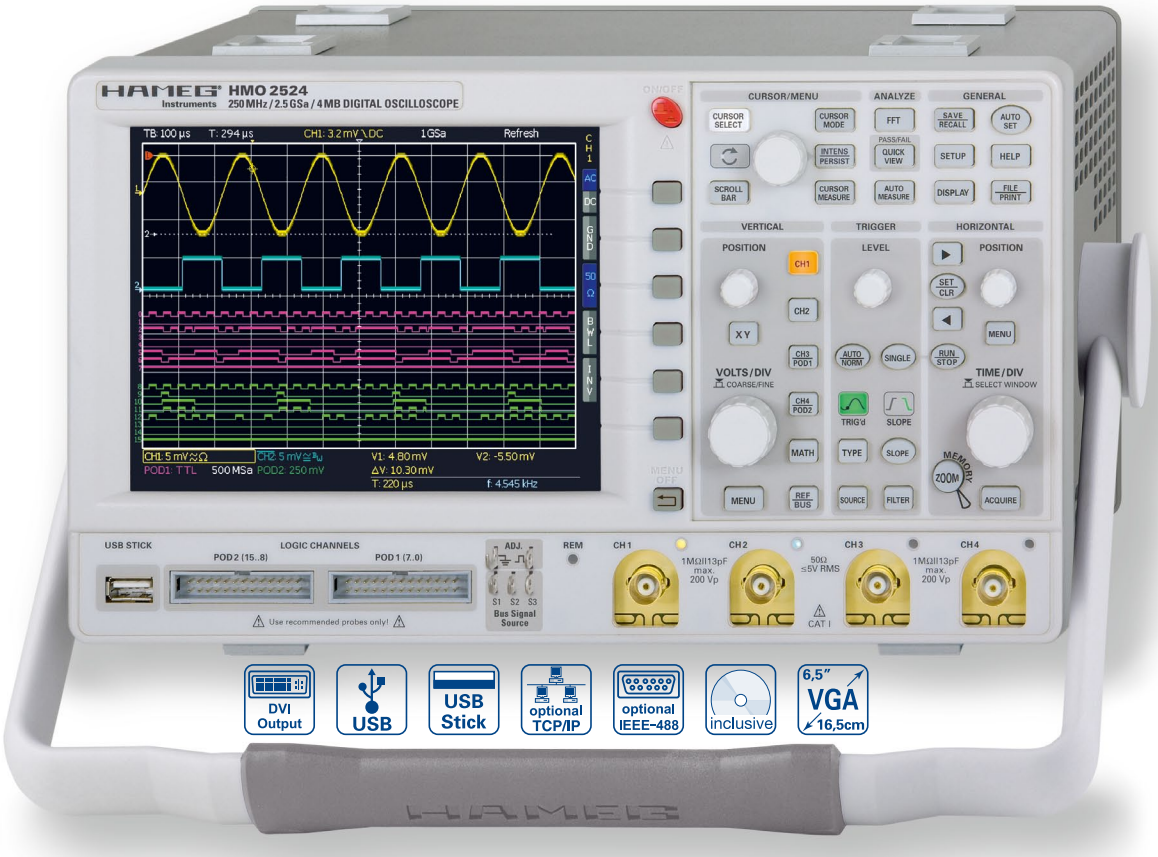
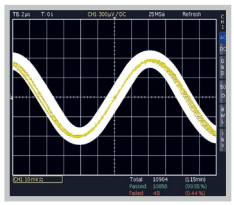
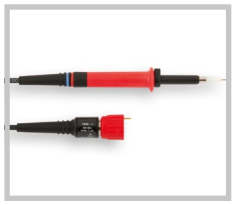


Mask Test



Passive Probe 1000:1
HZO20



AC/DC Current Probe
100/1000A HZO51

- ☑ **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

250 MHz 4 Channel Digital Oscilloscope HMO2524

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

Display

Display:	16.5 cm (6.5") VGA Color TFT
Resolution:	640 x 480 Pixel
Backlight:	LED 400 cd/m²
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...CH3 LCH0...7 (with 1x Option HO3508) CH 1, CH2, LCH0...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
Pulse:	Positive, negative
Modes	equal, unequal, less than, greater than, within/without a range
Range	min. 8 ns, max. 134,217 ms, resolution from 8 ns until 1 µs
Sources:	CH 1, CH 2, Ext. [CH 1...CH 4]
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):	I²C/SPI/UART/RS-232
Source	LCH 0...LCH 15
Format	hexadecimal, binary
I²C	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, Filter
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, standard deviation
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-, standard deviation
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
I²C (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, Low-, High-pass filter
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

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, I²C, 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

HAMEG Instruments GmbH · Industriestr. 6 · D-63533 Mainhausen · Tel +49 (0) 6182 8000 · Fax +49 (0) 6182 800100 · www.hameg.com · info@hameg.com

HAMEG Instruments
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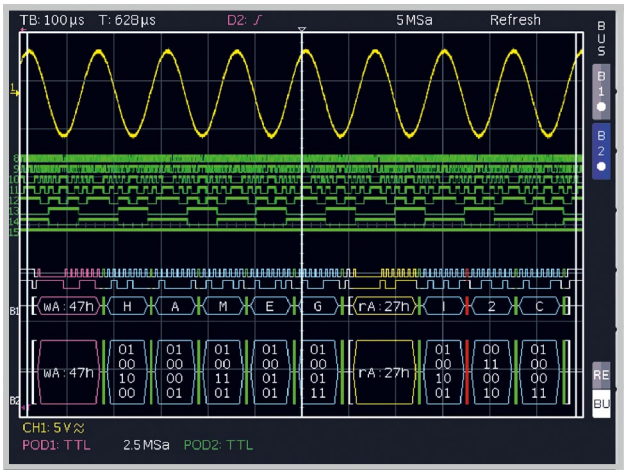
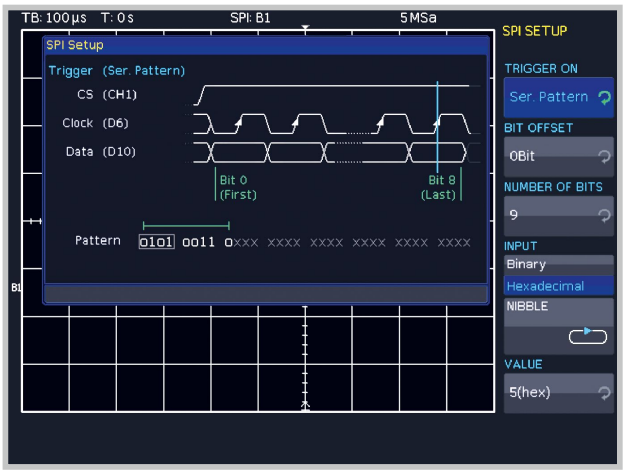
H0010 Serial Bus

for all Oscilloscopes of the HMO Series

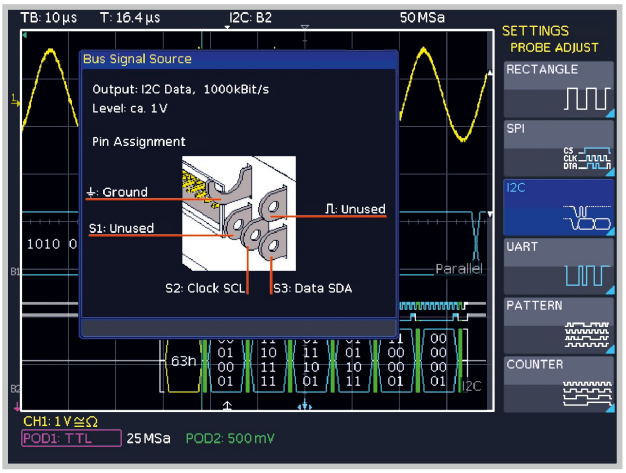
H0010



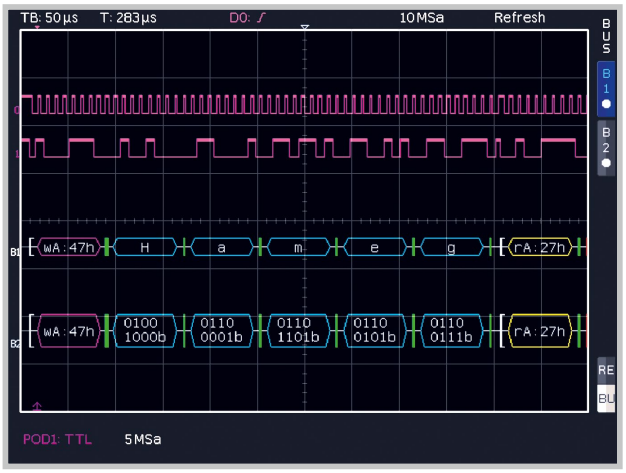
Mixed Signal and Bus Display



SPI Bus Trigger Setup



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

HO010 Serial Bus

	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

HAMEG Instruments GmbH · Industriestr. 6 · D-63533 Mainhausen · Tel +49 (0) 6182 8000 · Fax +49 (0) 6182 800100 · www.hameg.com · info@hameg.com