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Test & Measurement

- > sales
- > rentals
- > calibration
- > repair
- > disposal

Complimentary Reference Material

This PDF has been made available as a complimentary service for you to assist in evaluating this model for your testing requirements.

TMG offers a wide range of test equipment solutions, from renting short to long term, buying refurbished and purchasing new. Financing options, such as Financial Rental, and Leasing are also available on application.

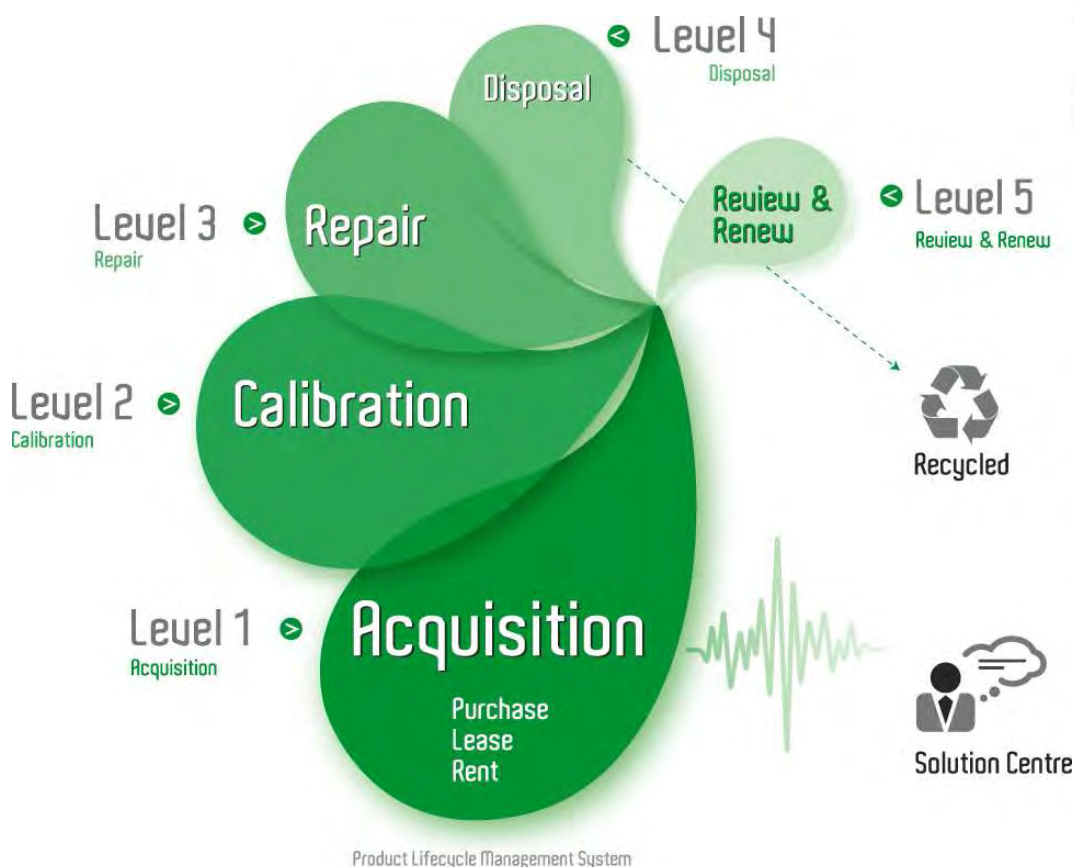
TMG will assist if you are unsure whether this model will suit your requirements.

Call TMG if you need to organise repair and/or calibrate your unit.

If you click on the "Click-to-Call" logo below, you can call us for FREE!

TMG Corporate Website

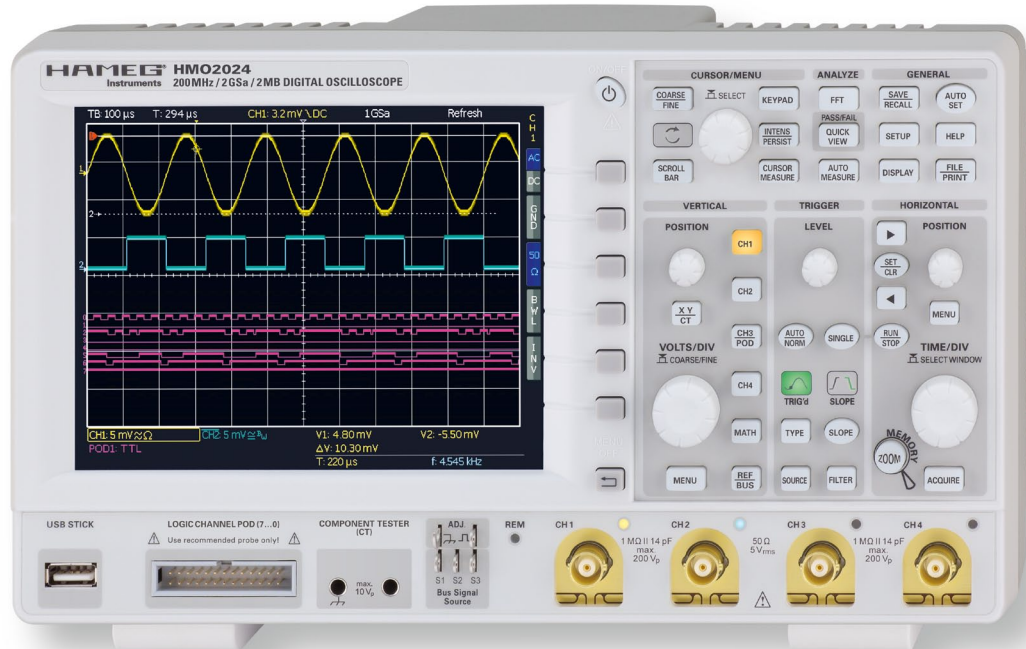
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200 MHz 2[4] Channel Digital Oscilloscope HMO2022 [HMO2024]



2 Channel Version
HMO2022



Side view



8 Channel
Logic Probe H03508



- ✓ 2GSa/s Real Time, Low Noise Flash A/D Converter (Reference Class)
- ✓ 2MPts Memory, Memory Zoom up to 50,000:1
- ✓ MSO (Mixed Signal Opt. H03508) with 8 Logic Channels
- ✓ Serial Bus Trigger and Hardware accelerated Decode, I²C, SPI, UART/RS-232 (Opt. H0010, H0011)
- ✓ 8 User definable Markers for easy Navigation
- ✓ Pass/Fail Test based on Masks
- ✓ Vertical Sensitivity 1mV/div., Offset Control $\pm 0.2... \pm 20V$
- ✓ 12div. x-Axis Display Range, 20div. y-Axis Display Range (VirtualScreen)
- ✓ Trigger Modes: Slope, Video, Pulsewidth, Logic, Delayed, Event
- ✓ Component Tester, 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

200 MHz 2 [4] Channel Digital Oscilloscope HMO2022 [HMO2024]

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/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 trace:	0...31

Vertical System	
Channels:	
DSO mode	CH 1, CH 2 [CH 1...CH 4]
MSO mode	CH 1, CH 2, LCH 0...7 (logic channels) [CH 1, CH 2, LCH 0...7, CH4] with Option HO3508
Auxiliary input:	Frontside [Rear side]
Function	Ext. Trigger
Impedance	1 M Ω 14 pF $\pm$ 2 pF
Coupling	DC, AC
Max. input voltage	100V (DC + peak AC)
XYZ-mode:	All analog channels on individual choice
Invert:	CH 1, CH 2 [CH 1...CH 4]
Y-bandwidth [-3 dB]:	200 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]:	<1.75 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 M Ω 14 pF $\pm$ 2 pF [50 Ω switchable]
Coupling	DC, AC, GND
Max. input voltage	200V (DC + peak AC), 50 Ω <5 V _{rms}
Measuring circuits:	Measuring Category I (CAT I), UL 61010B-1
Position range	$\pm$ 10 Divs
Offset control:	
1 mV, 2 mV	$\pm$ 0.2 V - 10 div. x Sensitivity
5...50 mV	$\pm$ 1 V - 10 div. x Sensitivity
100 mV	$\pm$ 2.5 V - 10 div. x Sensitivity
200 mV...2 V	$\pm$ 40 V - 10 div. x Sensitivity
5 V	$\pm$ 100 V - 10 div. x Sensitivity
Logic channels	With Option HO3508
Select. switching thresholds	TTL, CMOS, ECL, User -2...+8 V
Impedance	100 k Ω <4 pF
Coupling	DC
Max. input voltage	40V (DC + peak AC)

Triggering	
Analog channels:	
Automatic:	Linking of peakdetection and triggerlevel
Min. signal height	0.8 div.; 0.5 div. typ. [1.5 Div at $\leq$ 2 mV/Div]
Frequency range	5 Hz...250 MHz [5 Hz...120 MHz at $\leq$ 2 mV/Div]
Level control range	From peak- to peak+
Normal (without peak):	
Min. signal height	0.8 div.; 0.5 div. typ. [1.5 Div at $\leq$ 2 mV/Div]
Frequency range	0 Hz...250 MHz [0 Hz...120 MHz at $\leq$ 2 mV/Div]
Level control range	-10...+10 div from center of the screen
Operating modes:	Slope/Video/Logic/Pulses/Busses [optional]
Slope:	Rising, falling, both
Sources:	CH 1, CH 2, Line, Ext., LCH 0...7 [CH 1...CH 4, Line, Ext., LCH 0...7]
Coupling (Analog Channel):	AC: 5 Hz...250 MHz DC: 0...250 MHz HF: 30 kHz...250 MHz LF: 0...5 kHz Noise rejection: 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

Sources:	CH 1, CH 2, Ext. [CH 1...CH 4]
Logic:	AND, OR, TRUE, FALSE
Sources:	LCH 0...7
State	LCH 0...7 X, H, L
Pulses:	Positive, negative
Modes	equal, unequal, less than, greater than, within/without a range
Range	min. 32 ns, max. 10 s, resolution min. 8 ns
Sources:	CH 1, CH 2, [CH 1...CH 4]
Indicator for trigger action:	LED
Ext. Trigger via:	Auxiliary input 0.3V...10V _{pp}
2nd Trigger:	
Slope:	Rising, falling, both
Min. signal height	0.8 div.; 0.5 div. typ. [1.5 div at $\leq$ 2 mV/div]
Frequency range	0 Hz...250 MHz [0 Hz...120 MHz at $\leq$ 2 mV/div]
Level control range	-10...+10 div.
Operating modes:	
after time	32 ns...10 s
after incidence	1...2 ¹⁶
Busses [Opt. H0010]:	I ² C/SPI/UART/RS-232
Sources:	CH 1, CH 2, Ext., LCH 0...7 [CH 1...CH 4, Ext., LCH 0...7]
Busses [Opt. H0011]:	I ² C/SPI/UART/RS-232
Sources:	CH 1, CH 2, Ext. (for Chip Select at SPI) [CH 1...CH 4, Ext.] (for Chip Select at SPI)
Format	hexadecimal, binary
I ² C	Trigger on Start, Stop, Restart, NACK, Address (7 or 10 Bit), Data, Address and Data, up to 5 Mb/s
SPI	up to 32 Bit Data, Chip select (CS) pos. or neg., without CS, up to 12.5 Mb/s
UART/RS-232	up to 8 Bit Data, up to 31 Mb/s

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

Digital Storage	
Sampling rate [real time]:	2 x 1 GSa/s, 1 x 2 GSa/s [4 x 1 GSa/s, 2 x 2 GSa/s] Logic channels: 8 x 1 GSa/s
Memory:	2 x 1 MPts, 1 x 2 MPts [4 x 1 MPts, 2 x 2 MPts]
Operation modes:	Refresh, Average, Envelope, Peak-Detect Roll: free run/triggered, Filter, HiRes
Resolution [vertical]	8 Bit, (HiRes up to 10 Bit)
Resolution [horizontal]	40 ps
Interpolation:	Sinx/x, linear, Sample-hold
Persistence:	Off, 50 ms... ∞
Delay pretrigger:	0...8 Million x (1/samplerate)
posttrigger:	0...2 Million x (1/samplerate)
Display refresh rate:	Up to 2000 waveforms/s
Display:	Dots, vectors, „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...250 MHz	6 Digit resolution
Accuracy	50 ppm
Auto measurements:	Amplitude, standard deviation, V _{pp} , V _{p+} , V _{p-} , V _{rms} , V _{avg} , V _{top} , V _{base} , frequency, period, pulse count, t _{width+} , t _{width-} , t _{dutycycle+} , t _{dutycycle-} , t _{rise} , t _{fall} , pos. edge count, neg. edge count, pos. pulse count, neg. pulse count, trigger frequency, trigger period, phase, delay
Cursor measurements:	Δ V, Δ t, 1/ Δ t (f), V to Gnd, Vt related to Trigger point, ratio X and Y, pulse count, peak to peak, peak+, peak-, mean value, RMS value, standard deviation
Interface:	Dual-Interface USB type B/RS-232 (HO720), 2x USB type A (front- and rear side each 1x) max. 100 mA, DVI-D for ext. Monitor
Optional:	IEEE-488 (GPIB) (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
I²C (Opt. H0010, H0011)	color coded Read-, Write Address, Data, Start, Stop, acknowledge, missing acknowledge, Errors and Trigger condition
SPI (Opt. H0010, H0011)	color coded Data, Start, Stop, Errors and Trigger condition
UART/RS-232 (Opt. H0010, H0011)	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) 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	
Component tester	
Test voltage:	10V _P [open] typ.
Test current:	10 mA _P (short) typ.
Test frequency:	50 Hz/200 Hz typ.
Reference Potential:	Ground (safety earth)
Probe ADJ Output:	1 kHz/1 MHz square wave signal ~1V _{pp} (ta <4 ns)
Bus Signal Source	SPI, I ² C, UART, Parallel (4 Bit)
Internal RTC (Realtime clock):	Date and time for stored data
Line voltage:	100...240V, 50...60 Hz, CAT II
Power consumption:	Max. 45W, typ. 25W [max. 55W, typ. 35W]
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 140 mm
Weight:	<2.5kg

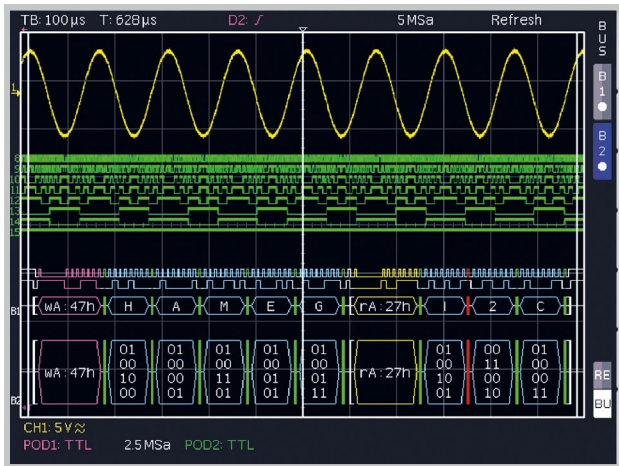
Accessories supplied: Line cord, Operating manual, 2 [4] Probes, 10:1 with attenuation ID (HZ010), CD

Recommended accessories:

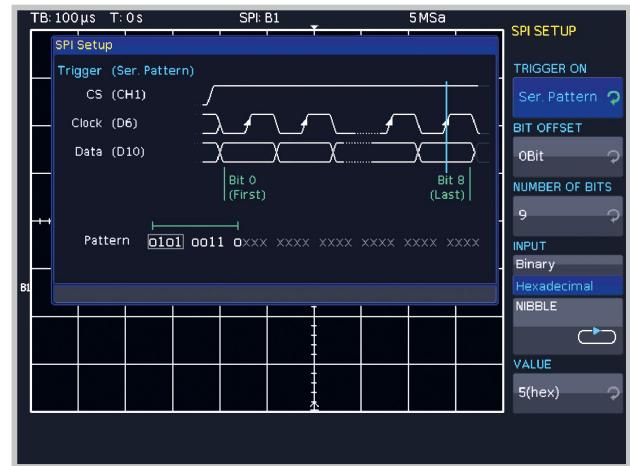
H0010	Serial bus trigger and hardware accelerated decode, I ² C, SPI, UART/RS-232 on Logic channels and Analog channels
H0011	Serial bus trigger and hardware accelerated decode, I ² C, SPI, UART/RS-232 on Analog channels
H03508	active 8 Channel Logic Probe
H0730	Dual-Interface Ethernet/USB
H0740	Interface IEEE-488 (GPIB) galvanically isolated
HZ091	4RU 19" Rackmount Kit
HZ090	Carrying Case for protection and transport
HZ020	High Voltage probe 1000:1 (400MHz)
HZ030	single ended active probe (1 GHz)
HZ050	AC/DC Currentprobe 20A, DC...100 kHz
HZ051	AC/DC Currentprobe 1000A, DC...20 kHz

H0010/H0011 Serial Bus

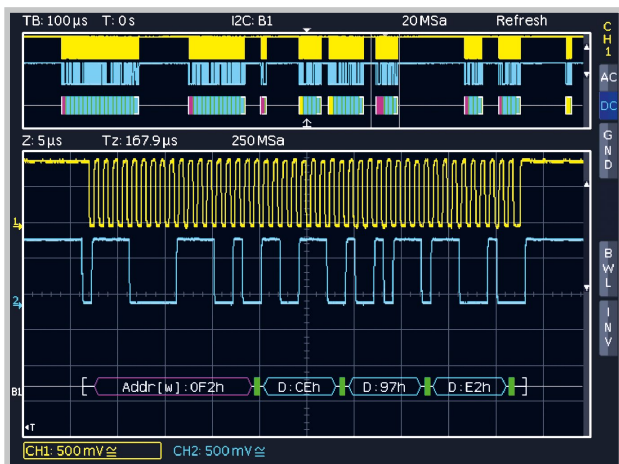
for all Oscilloscopes of the HMO Series



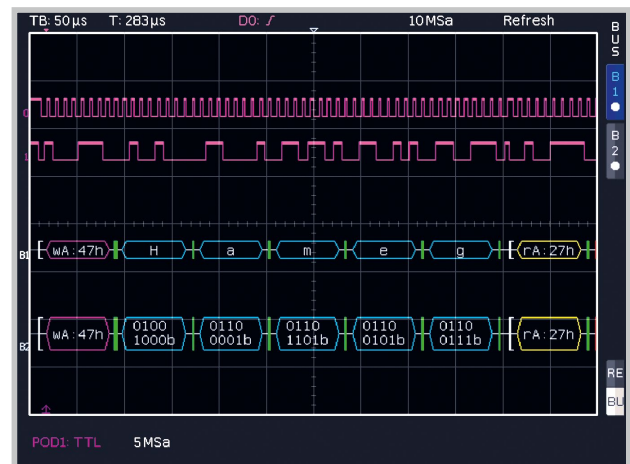
Mixed Signal and Bus Display



SPI Bus Trigger Setup



I²C Bus Hex decoding on the Analog Channel



I²C Bus ASCII and Binary

- ✓ H0010 via Analog Channels and/or Logic Channels, H0011 via Analog Channels
- ✓ 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

H0010/[H0011] Serial Bus			
I ² C Bus		SPI Bus	UART/RS-232 Bus
Bus Configuration			
Baud rates	up to 10Mb/s (HMO352x/2524)*, up to 5Mb/s (HMO72x...202x)	up to 25 Mb/s (HMO352x/2524)*, up to 12.5 Mb/s (HMO72x...202x)	300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200 Baud, up to 62.5 Mb/s (HMO352x/2524)*, up to 31 Mb/s (HMO72x...202x)
Number of Bit's	7 or 10Bit for Address ID 8Bit for Data	32Bit for Data	8Bit for Data 1, 1.5, 2Bit 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	H0010: digital Channel LCH0...15 (Opt. H03508) analog Channel* LCH1...2 [CH1...4] H0011: analog Channel LCH1...2 [CH1...4]	H0010: digital Channel LCH0...15 (Opt. H03508) analog Channel* LCH1...2, external Trigger Entry for Chip Select, [CH1...4] H0011: analog Channel LCH1...2, external Trigger Entry for Chip Select, [CH1...4]	H0010: digital Channel LCH0...15 (Opt. H03508) analog Channel* LCH1...2 [CH1...4] H0011: analog Channel LCH1...2 [CH1...4]
Event	7 or 10Bit Address ID 7 or 10Bit Address ID with 8Bit Data Start, Stop, Restart missing Acknowledge Adress ID without Acknowledge	Data packets up to 32Bit with positive or negative Chip Select or without Chip Select, (2-wire SPI)	Data packets up to 8Bit
Input format	Hexadecimal or Binary	Hexadecimal or Binary	Hexadecimal or Binary
Hardware accelerated Decode			
Source	H0010: digital Channel LCH0...15 (Opt. H03508) analog Channel* LCH1...2 [CH1...4] H0011: analog Channel LCH1...2 [CH1...4]	H0010: digital Channel LCH0...15 (Opt. H03508) analog Channel* LCH1...2, external Trigger Entry for Chip Select, [CH1...4] H0011: analog Channel LCH1...2, external Trigger Entry for Chip Select, [CH1...4]	H0010: digital Channel LCH0...15 (Opt. H03508) analog Channel* LCH1...2 [CH1...4] H0011: analog Channel LCH1...2 [CH1...4]
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

*Available for HMO352x/2524 from firmware 3.0

Differences H0010/H0011		
Feature	H0010	H0011
Logic channel (LC 0...LC 15) as source for serial bus trigger and decode	x	-
Analog channel (CH 1...CH 4) as source for serial bus trigger and decode	x	x
Time synchronous decode of two serial busses	x	-