Mixed Signal Oscilloscopes
300 MHz | 400 MHz | 500 MHz
HMO3000 Series
High sensitivity, multi-functionality and a great price – that’s what distinguishes the HAMEG HMO3000 oscilloscope series.

**Key facts**

- 4 GSa/s real time, 8 MPts memory
- Automatically or manually adjustable memory depth, segmented memory option (HOO14)
- MSO functionality included as standard (HOO3508/HO3516 logic probe with 8/16 channels required)
- Trigger modes: slope (A/B), pulse width, video, logic, risetime, runt, serial buses (optional), hold-off
- Serial bus trigger and hardware-accelerated decode incl. list view.
- Options: I2C + SPI + UART/RS-232 (HOO10/HOO11), CAN + LIN (HOO12)
- 28 auto-measurement parameters plus statistics, formula editor, ratio cursor
- 6-digit hardware counter
- FFT up to 64 kPts (dBm, dBV, Vrms)
- Pass/fail test based on masks, automatic search for user-defined events
- Display: 12 div. x-axis, 20 div. y-axis (Virtual Screen)
- 2x USB for mass storage, Ethernet/USB dual interface for remote control

**Intelligent user interface**
- To optimize the screen display, the instrument shows and hides menus
- Precise signal analysis
- FFT
- Setup
- FFT up to 500 MHz...

**Standard MSO functionality**
- Analyze analog channels plus up to an additional 16 digital channels
- Vertical sensitivity of up to 1 mV/div.

**Bus signal source**
- To create SPI, I2C, UART and counter test-signals
- Standard MSO functionality
- An additional 16 digital channels

**FFT**
- Superb FFT functionality
- FFT zoom up to 250,000 : 1

**Zoom**
- Memory zoom up to 250,000 : 1
- Vertical sensitivity of up to 1 mV/div.

**Fan**
- Maximum noise reduction by temperature-controlled fan

**Display**
- 16.5 cm (6.5”) LED-backlit TFT display
- 2x USB for mass storage, Ethernet/USB dual interface for remote control

**Application**

HAMEG INSTRUMENTS | HMO3000 SERIES

**How the HAMEG HMO3000 meets your needs**

**Engineering lab**
- Adjustable memory depth
- Advanced math functions available as standard, math on math possible
- Automeasurement for 28 user-defined parameters
- 6-digit hardware counter

**Analog circuit design**
- Low-noise amplifier and A/D converter
- 1 mV/div. sensitivity
- 50 Ω/1 MΩ input impedance, switchable
- Bandwidth upgrades via software options

**Embedded debugging**
- Mixed signal option (MSO) with 16 logic channels
- Serial bus trigger and hardware-accelerated decode
- 6-digit hardware counter

**Production environment**
- Remote control for automated data acquisition
- Pass/fail tests based on user-defined events with automatic output
- Automatic signal measurement at the push of a button
- USB/RS-232, Ethernet or GPIB (IEEE 488) interfaces

**General**
- Fast boot time
- Extended display size through Virtual Screen technology
- DVI-D output for external display

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

<table>
<thead>
<tr>
<th>500 MHz</th>
<th>400 MHz</th>
<th>300 MHz</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 channel</td>
<td>HMO3054</td>
<td>HMO3044</td>
</tr>
<tr>
<td>2 channel</td>
<td>HMO3052</td>
<td>HMO3042</td>
</tr>
</tbody>
</table>

Bandwidth Upgrade

Should your requirements change, then so does the HMO3000, as the 300 and 400 MHz models can be extended to 500 MHz bandwidth via software upgrades whenever required. This is done with option upgrade vouchers available at your dealer.

- For 300 MHz models with options HV352 (2 channel) and HV354 (4 channel).
- For 400 MHz models with options HV452 (2 channel) and HV454 (4 channel).

The voucher number and the serial number of your instrument enable you to generate the respective licence key directly on our dedicated web page http://voucher.hameg.com.

Key Facts

- Sampling rate per analog channel: 2 GS/s
- Maximum sampling rate: 4 GS/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.
Mixed Signal

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.

HAMEG is offering the new HMO3000 series exclusively as a mixed-signal oscilloscope. The great advantages of these instruments are best illustrated by taking a look at how ADCs (Analog Digital Converters) or DACs (Digital Analog Converters) are integrated. These transformer modules include an analog signal on the one side and a digital signal on the other side. As with HAMEG’s new HMO3000 series, MSOs allow developers to assess the time component of both signal types on one monitor. As shown in the image below the latency time of a DAC can be determined with one simple cursor measurement. Therefore a MSO allows developers to devote their full attention to the circuit without having to waste energy on the measurement setup.

HAMEG is focusing resolutely on the increasing significance of the mixed-signal oscilloscopes. Consequently, all HAMEG HMO oscilloscopes are full-scale MSOs, even the smaller models with a bandwidth as low as 70 MHz. As a result, HAMEG customers will not need to speculate if they should purchase an instrument with or without logic connectors. As the MSO functionality is invariably included, all instruments correspondingly offer a secure future. It is also unnecessary to initially activate the mixed-signal functions via software options, as is the case with other suppliers.

Specifications HMO3000

<table>
<thead>
<tr>
<th>Channel</th>
<th>8 channels per channel</th>
<th>4 MPts. (HMO3000 series)</th>
<th>1 MPts. (HMO compact series)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input Impedance</td>
<td>100 kΩ</td>
<td></td>
<td>&lt;4 pF</td>
</tr>
<tr>
<td>Max. input frequency</td>
<td>350 MHz</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max. input voltage</td>
<td>40 V (DC + peak AC)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Measuring category</td>
<td>CAT I</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cable length</td>
<td>approx. 1 m</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

HAMEG logic probes fit to all HMO series oscilloscopes

- No hardware lock to a specific device
- 8 logic channels available on each logic probe
- Signal threshold adjustable for each logic pod

More information: [www.hameg.com](http://www.hameg.com)
Due to the outstanding FFT functionality of the HMO series oscilloscopes, signals can also be analyzed 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.

**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 "rectangular" type that has been used in figure 4. Although this window type captures frequencies at a high degree of accuracy, it is also accompanied by more noise. In order to suppress this disturbing interference, users can for instance choose the Hanning window. The impact on the spectrum is visible in figure 5 (see device screen).
Segmented Memory

The segmented memory option HOO14 enables you to divide the available memory of your HMO3000 into up to 1000 segments. This procedure allows sampling rates of 200,000 Wfm/s, which makes it possible to capture rare anomalies occurring during many short events in quick succession. For the analysis of the recorded signals, all measurement functions of the HMO are available, including the Pass/Fail function.

You can upgrade to option HOO14 at any time with voucher HV114.

Specifications HOO14
- Acquisition memory divided into segments
- Maximum segments: 1000
- Minimum segment size: 5 kPts
- Maximum segment size: 2 MPts
- Re-arm time: < 3 µs
- Maximum Acquisition rate: 200,000 Wfm/s

Segment Player
Displays all recorded segments manually or automatically, all measurement functions including Pass/Fail can be used with recorded segments.

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 these 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

SPI bus trigger setup
CAN bus configuration
I²C bus hex decoding on the analog channel
CAN bus list display
I²C bus ASCII und binary
HEX decoded CAN bus signal

HOO10/HOO11
I²C/PCUART/RS-232 bus analysis for all oscilloscopes of the HMO series

HOO12
CAN/LIN bus analysis for all oscilloscopes of the HMO series
Backlight 500 cd/m² (LED)

Resolution 640 (H) x 480 (V) Pixel

Vertical System

HMO3052, HMO3054: 500 MHz
HMO3042, HMO3044: 400 MHz

HMO3004 series 4-channel mixed signal oscilloscope
HMO3002 series 2-channel mixed signal oscilloscope

DC gain accuracy 2 % of full scale

Rise time (computed)

Switchable

Analog channels

Display range in horizontal direction

with Virtual Screen usage 20 Div

Display range in vertical

Trace display pseudo-color, inverse intensity

Levels of brightness 32

Color depth 256 colors

HMO305x: < 0.700 ns
HMO304x: 400 MHz
HMO304x, HMO305x: 200 MHz

Thresholds TTL, CMOS, ECL, user-defined (-2 V to +8 V)

with logic probe (HO3508/HO3516)

XY/XYZ mode selectively all analog channels

Impedance

Input sensitivity

5 Vrms, max. 30 Vp

200 Vp

1MΩ

50mV ±2.5 V - 8 Div x sensitivity

variable stepping freely between calibrated steps

coarse stepping 12 calibrated steps, 1-2-5

all analog channels

1 mV/Div to 5 V/Div (1 MΩ and 50 Ω)

Auto level 5 Hz to 300/400/500 MHz

with auto level Linking peak value and trigger level,

external 0.5 Vpp to 10 Vpp

from 5mV/Div 0.8 Div

2mV/Div to 5mV/Div 1.0 Div

10 kHz)

adjustable between peak values of a signal

Sync. pulse polarity positive, negative

Polarity positive, negative, both

FunctionsPulse output for every acquisition trigger

Trigger/Auxiliary output (BNC)

Trigger level ±5 V

Impedance

Trigger coupling auto level AC, DC, HF

Trigger types

Pulse width > 150 ns (trigger event), > 0.5 µs (mask event, error output on mask violation)

Output level 3.8 V

Functions

Logic

equal, not equal, lower, higher, within/without

Mask definition Mask enclosing acquired waveform with

mask performed on waveforms

Sync. pulse polarity positive, negative

Polarity positive, negative

Actions

Mask definition

Pass/Fail comparison with an user-definied

Aging ±5,0 x 10⁻⁶ per year

Actions

Waveform update rate

Waveform update rate up to 5000 Wfm/s

Time range 4 ns to 8.5 s, resolution min. 0.5 ns

Source all analog channels, external (AC, DC)

Line line number selectable, all

Line line number selectable, all

Sync. pulse polarity positive, negative

Waveform update rate

Waveform update rate up to 5000 Wfm/s

Segment size 5 kPts to 2 MPts

Persistence afterglow min. 50 ms

REFRESH 1 ns/Div to 50 s/Div

VirtualScreen virtual display of 20 Div for all math, logic,

and logic channels pulse

waveform update rate, specific record length

Functions

Waveform arithmetics refresh, roll (loose/triggered), average (up to

401x457

Reference signals up to 4 references

Realtime sampling rate

100 kHz

Implementation, Frequency domain (FFT)

Frequency range 0.5 Hz to 300/400/500MHz

Resolution 6 digit

Voltage (Vpp, Vp+, Vp-, Vrms), frequency, period

Marker, crest factor

burst width, rise/fall time (80%, 90%), ratio

standard deviation, duty cycle (pos/neg), peak values (Vpp, Vp+, Vp-), mean/RMS/

ratio X, ratio Y, pulse and edge count (pos/

neg), standard deviation, delay, crest factor,

amplitude, phase, frequency, period, rise/fall

Trigger/edge

Source A, B, C

Source A, B, C

Source A, B, C

Trigger coupling

auto level AC, DC, HF

Trigger types

Pulse, Edge, Levels, all analog channels, external (AC, DC)

Frequency range DC to 300/400/500 MHz

HMO3052, HMO3054: 500 MHz
HMO3042, HMO3044: 400 MHz

Always single channel

(Trigger Event, Mask Event, Error)

Ref. signal polarity front, back

Masking defined

Waveform selection

Reference signals

Function

Complex analyzer

Functions

Module analysis

Functions

More information | www.hameg.com
**Technical Data**

**Connectors and ports**
- Interfaces
  - Functions: probe adjust, bus signal source, counter, Pattern Generator
  - Waveform arithmetics: refresh, envelope, average (up to 512)
  - Functions: addition, substraction, multiplication, division

**Functions probe adjust**
- Probe ADJ output: 1kHz, 1MHz square wave: 1.0Vpp

**Sources**
- All analog channels
- Cursor measurement: 2 horizontal cursors, previous/next peak
- Scale: dBm, dBV, Vrms
- Window: Hanning, Hamming, Rectangular, Blackman
- FFT length: 2 kpts, 4 kpts, 8 kpts, 16 kpts, 32 kpts, bis

**Frequency Analysis (FFT)**
- Parameters: frequency span, center frequency, vertical scale, vertical position
- Functions: Simultaneous display of math.
- Number of equations: 5 equations per formula set
- Number of formula sets: 5 formula sets
- Storage location: Math. Memory
- Sources: all analog channels, user-defined constants
- Editing: formula editor, menu-driven

**Applications**
- Bus Signal Source (4Bit) I2C (100 kBit/s, 400 kBit/s, SPI
- Random pattern (4Bit): frequency: 1 kHz, 1 MHz
- Counter (4Bit): frequency: 1 kHz, 1 MHz

**Validity period**
- During acquisition: Statistics: number of completed tests, test duration
- During mass storage: (FAT16/32) 2 x USB-Host (Typ A)
- After 30 minutes warm-up: rel. humidity 5 % to 80 % (without condensation)

**Power supply**
- AC supply: 100 V to 240 V, 50 Hz to 60 Hz, CAT-II
- Power consumption: 4-channel models max. 90 W, 2-channel models max. 70 W

**Environmental data**
- Operating temperature range: +5 °C to +40 °C
- Storage temperature range: -20 °C to +70 °C
- Mechanical data:
  - Dimensions: 285 mm (W) x 220 mm (H) x 175 mm (D)
  - Weight: 3.6 kg

**Interfaces**
- Options: 4-channel models max. 90 W, 2-channel models max. 70 W
- External monitor interface: DVI-D (480p, 60Hz), HDMI compatible
- Optional interfaces:
  - HO720 dual interface: USB-Device (Typ B) / IEEE-488 (GPIB)
  - HO730 Ethernet/USB dual-interface card, galvanically isolated
  - HO740 interface: IEEE-488 (GPIB) interface

**Recommended Accessories**

**Accessories included:**
- HMO3000 Series (all models)
- Line cord, printed operating manual
- CSV, TXT, HRT formats: BIN (MSB/LSB), FLT (MSB/LSB), CSV, TXT, HRT
- Other: screenshots on external USB memory, available file formats: SCP, HDS
- Other: traces on external USB memory, available file formats: BIN (MSB/LSB), FLT (MSB/LSB), CSV, TXT, HRT
- Other: device settings on internal file system or external USB
- Other: memory, available file formats: SCP, HDS
- Other: settings, languages and help functions

**Accessories**
- Recommended Accessories
  - 4RU 19" rackmount kit
  - 400 MHz passive probe (for 400/300 MHz oscilloscopes)
  - 500 MHz passive probe (for 400/300 MHz oscilloscopes)
  - 4 RU 19" rackmount kit (for 500 MHz oscilloscopes)
  - 500 MHz passive probe (for 500 MHz oscilloscopes)
  - 1 GHz active probe (for 500 MHz oscilloscopes)
  - Active differential high voltage probe
  - 4 RU 19" rackmount kit
  - Active differential high voltage probe
  - 4 RU 19" rackmount kit
  - Active differential high voltage probe
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  - Active differential high voltage probe
  - 4 RU 19" rackmount kit

**Purchasing a HMO3000 Series (all models) only available when purchasing a HMO3000 (100 MHz / 400 MHz models).**

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**Data Sheet:**
- HMO series 3000
- HMO serie 3000
- 300-500 MHz

**Languages:**
- Handbuch (Deutsch)
- Manual (English)

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**Other:**
- **Mixed Signal Oscilloscope**
  - HMO series 3000
  - 300-500 MHz

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**Accessories**
- Recommended Accessories
  - 4RU 19" rackmount kit
  - HZ040 Active differential probe (200 MHz / 10:1, 3.5 pF, 1 MΩ)
  - HZ041 Active differential probe (500 MHz / 10:1, 1 MΩ)
  - HZ050 AC/DC current probe 30 A, DC to 100 kHz
  - HZ051 AC/DC current probe 100/1000 A, DC to 2 kHz
  - HZ035 500 MHz passive probe 10:1 with automatic identification

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[Image 564x374 to 686x453]
[Image 565x246 to 686x326]
[Image 576x507]