



# Oscilloscopes

THE NEW HMO 3000 SERIES

300 MHz | 400 MHz | 500 MHz

**Intelligent User Interface**

To optimize the screen display, the instrument shows and hides menus

**FFT**

Superb FFT functionality

**Quick View**

Automatic signal measurement at the push of a button

**Setup**

Intuitive, multi-lingual user menu

**Help**

Context-sensitive help

**Slope**

Direct selection of trigger edge at the push of a button

**Zoom**

Memory Zoom up to 200.000 : 1

**Analog Channels**

Vertical Sensitivity of just 1mV/div.

**Fan**

Maximum noise reduction by temperature-controlled fan

**Display**

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

**Logic Channels**

Connections for up to 16 logic channels

**Bus Signal Source**

To create SPI, I<sup>2</sup>C, UART and counter test-signals

**Math**

Wide range of programmable math functions




## THE NEW HMO 3000 SERIES

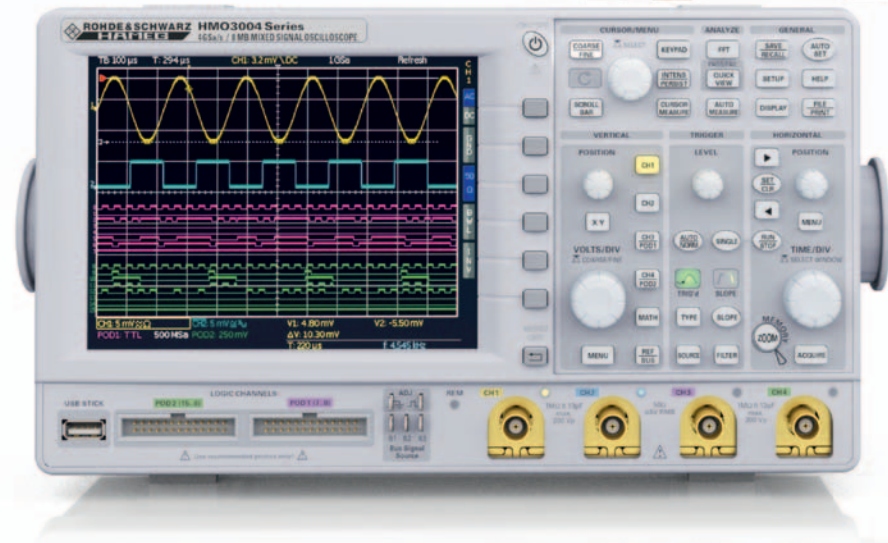
# up to 500 MHz...

The new HMO3000 series by HAMEG Instruments offers our usual excellent performance at an attractive price.

The standard MSO functionality allows you to analyze all analog channels plus up to an additional 16 digital channels.

The 6 different models are available in a bandwidth of 300 MHz to 500 MHz with 2 or 4 channels.

- 4GSa/s Real Time, Low Noise Flash A/D Converter
- 8MPts Memory,  Zoom up to 200,000:1
- MSO: Mixed Signal Option H03508 [H03516] with 8 [16] Logic Channels
- Serial Bus Trigger and Hardware accelerated Decode including List View. Options: I<sup>2</sup>C + SPI + UART/RS-232 (H0010/H0011), CAN + LIN (H0012)
- Vertical Sensitivity 1mV/div., Offset Control  $\pm 0.2... \pm 20V$
- 6-Digit Hardware Counter
- Real-Time FFT (dBm, dBV,  $V_{eff}$ ), up to 64 kPts
- Automatic Search for user-defined Events
- Pass/Fail Test based on Masks
- Auto-Measurement: max. 6 Parameters incl. Statistic, Formula Editor, Ratio Cursor
- Display Range: 12 div. x-Axis, 20 div. y-Axis (VirtualScreen)



- Trigger Modes: Slope, Video, Pulsewidth, Logic, Delayed, Event, Hold-Off
- Automatically or manually adjustable Memory Depth
- 3 x USB for Mass Storage and Remote Control



**UPGRADE AT ANY TIME!**

# Bandwidth Upgrade

All models in the HMO3000 series with 300 MHz or 400 MHz can be extended via software upgrades to 500 MHz bandwidth whenever required:

- For 300 MHz models with options H00352 (2 channels) and H00354 (4 channels).
- For 400 MHz models with options H00452 (2 channels) and H00454 (4 channels).

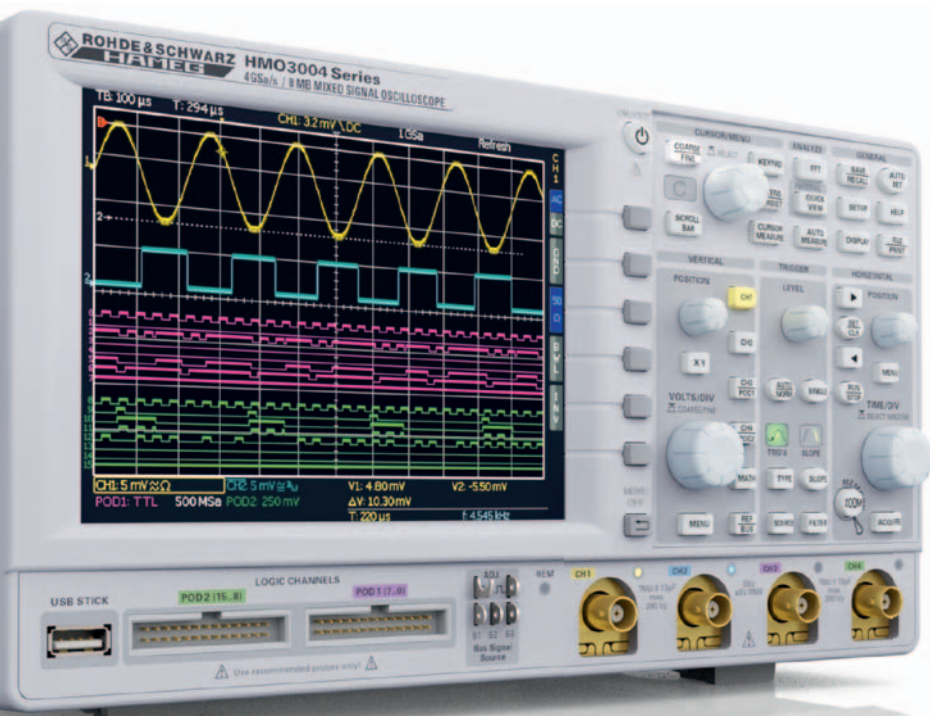
Options:

H00352 / H00354

300 MHz  
>>>  
500 MHz

H00452 / H00454

400 MHz  
>>>  
500 MHz



# 500 MHz

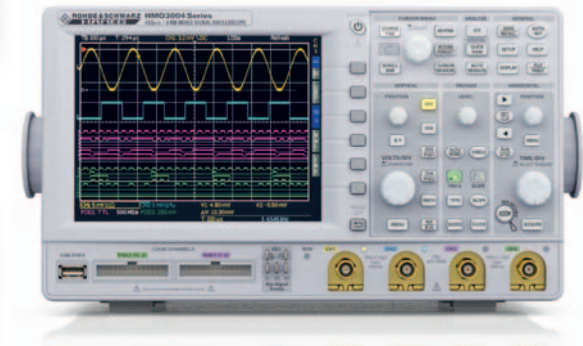
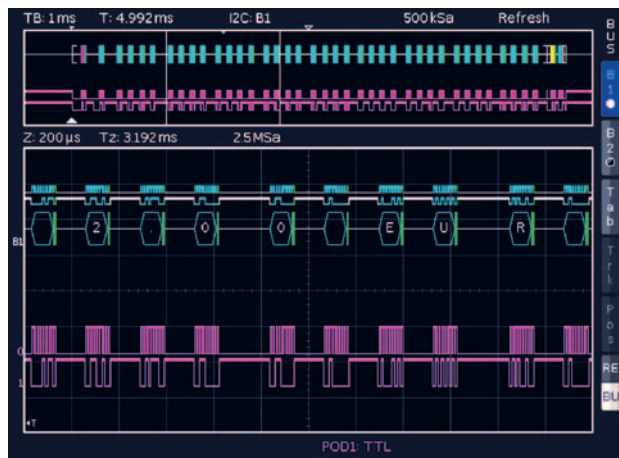
300 MHz | 400 MHz

## APPLICATION

# Serial Bus Analysis

I<sup>2</sup>C, 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:

- H0010: Analysis of I<sup>2</sup>C, SPI and UART/RS232 signals on analog and logic channels
- H0011: Analysis of I<sup>2</sup>C, SPI and UART/RS232 signals on all analog channels
- H0012: Analysis of CAN and LIN signals on analog and logic channels



The image shows an I<sup>2</sup>C communication between a machine controller and a payment unit, triggered to the start of a I<sup>2</sup>C data package. Furthermore, you can choose from a variety of additional trigger options:

- I<sup>2</sup>C: Start, Stop, ACK, nACK, Address/Data
- SPI: Start, End, Serial Pattern (32Bit)
- UART/RS232: Startbit, Frame Start, Symbol, Pattern
- LIN: Frame Start, Wake Up, Identifier, Data, Error
- CAN: Frame Start, Frame End, Identifier, Data, Error

**HMO3004 Series 4 Channel Digital Oscilloscope**  
**HMO3002 Series 2 Channel Digital Oscilloscope**  
**HMO3032 [HMO3034] 300MHz**  
**HMO3042 [HMO3044] 400MHz**  
**HMO3052 [HMO3054] 500MHz**

Display	
Display:	16.5cm [6.5"] VGA Color TFT
Resolution:	640 x 480 Pixel
Backlight:	LED 500 cd/m <sup>2</sup>
Display area for traces:	50 Pkt/div.
without menu	400 x 600 Pixel [8 x 12div.]
with menu	400 x 500 Pixel [8 x 10div.]
Color depth:	256 colors
Intensity steps per channel:	0...31
Channel display:	False color, inverse brightness
Bus display:	up to 2 busses, parallel busses, serial busses (option), decoding of the bus values in ASCII, binary, decimal or hexadecimal format; Table view of the decoded data
Virtual Screen	20 div. vertical for all Math-, Logic-, Bus- and Reference Signals
LED brightness:	2 steps

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 H03508
Auxiliary input:	Front side [Rear side]
Function	External Trigger
Impedance	1 MΩ    14 pF ±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 [-3dB]:	300/400/500 MHz [5 mV...5V]/div. 200 MHz [1 mV, 2 mV]/div.
Lower AC bandwidth:	2 Hz
Bandwidth limiter (switchable):	approx. 20 MHz
Rise time (calculated):	300 MHz: < 1.166 ns 400 MHz: < 0.875 ns 500 MHz: < 0.7 ns
DC gain accuracy:	2% of full scale
Input sensitivity:	12 calibrated steps
CH 1, CH 2 [CH 1...CH 4]	1mV/div...5V/div. [1-2-5 Stepping]
Variable	Between calibrated steps
Inputs CH 1, CH 2 [CH 1...CH 4]:	
Impedance	1 MΩ    13 pF ±2 pF [50 Ω switchable]
Coupling	DC, AC, GND
Max. input voltage	1 MΩ: 200V <sub>pp</sub> , 50 Ω < 5V <sub>rms</sub> , max. 30V <sub>p</sub>
Measuring circuits:	Measuring Category 0
Position range:	±8 divs
Offset control:	
1 mV, 2 mV	±0.2V - 8 div. * sensitivity
5 mV...20 mV	±1V - 8 div. * sensitivity
50 mV	±2.5V - 8 div. * sensitivity
100mV, 200mV	±20V - 8 div. * sensitivity

500 mV...5V	±50V - 8 div. * sensitivity
Logic channels:	With Option H03508/H03516
Select. switching thresholds	TTL, CMOS, ECL, 2 x User -2V...+8V
Impedance	100 kΩ    <4 pF
Coupling	DC
Max. input voltage	40V (DC + peak AC)

Triggering	
Trigger modes:	
Auto	Triggers automatically even when no trigger event occurs for a certain time
Norm	Always triggers when a trigger event occurs
Single	Triggers once on a trigger event
Trigger display:	LED
Trigger sensitivity:	
Intern	0.8 div. [1 div. for sensitivity <5 mV/div.]
Ext. trigger via	Auxiliary Input [Aux. Input rear side]
Ext. Sensitivity	0.5V...10V <sub>pp</sub>
Trigger level range:	
With auto level	Adjustability of the level between the peak values of the signal
Without auto level	-8 div...+8 div.
External	-5V...+5V
Trigger types:	
Slope:	
Slope direction	Rising, falling, both
Sources	CH 1, CH 2, Line, Ext [CH 1...CH 4, Line, Ext.]
Coupling	
Auto level	Adjustability of the level between the peak values of the signal, 5 Hz...300/400/400 MHz
AC	5 Hz...300/400/400 MHz
DC	0...300/400/400 MHz
HF	30 kHz...300/400/400 MHz
LF	0...5 kHz, selectable for DC, Auto level
Noise rejection (low-pass)	100 MHz, selectable for DC, AC, Auto level
Pulse width:	
Polarity	Positive, negative
Functions	ti>t, tik, ti=t, ti/=t, t1<tik<t2, not (t1<tik<t2)
Pulse duration	16 ns...8.589 s, resolution 4 ns/1 μs
Video	Pos./neg. sync. impulse
Standards	PAL, SECAM, NTSC, PAL-M, SDTV 576i, HDTV 720p, HDTV 1080i, HDTV 1080p
Fields	Upper, lower, both
Line	All, line number selectable
Source	CH 1, CH 2, Ext. [CH 1...CH 4]
Logic:	
Logic functions	AND, OR, WAHR, UNWAHR mit oder ohne Auswertung der Dauer der Logikverknüpfung
Duration functions	ti>t, tik, ti=t, ti/=t, t1<tik<t2, not (t1<tik<t2), Timeout
Duration	4 ns...1 s
Source	LC0...15
State	LC0...15 X, H, L
Serial Busses: (Options)	
I <sup>2</sup> C	Start, Stop, ACK, NACK, Address/Data
SPI	Start, End, Serial Pattern [32Bit]
UART/RS232	Startbit, Frame Start, Symbol, Pattern
LIN	Frame Start, Wake Up, Identifier, Data, Error

CAN	Frame Start, Frame End, Identifier, Data, Error
Trigger Holdoff:	50 ns...>10s
2 <sup>nd</sup> Trigger (B):	
Type	Slope trigger
Slope direction	Rising or falling
Min. signal height	0.8 div.
Source	CH 1, CH 2, Ext. [CH 1...CH 4]
Coupling (source B/=A):	DC, HF, NR
Coupling (source B=A):	see trigger A
Level (source B/=A):	-8 div...+8 div. (adjustable separately by A)
Level (source B=A):	see level A
Frequency range	0...300/400/500 MHz
Operating modes:	
Time based	16 ns...8,589 s, resolution 4 ns/1 μs
Event based	1...216

Horizontal System	
Domain representation:	Time, Frequency (FFT), Voltage (XY)
Representation Time Base:	Main-window, main- and zoom-window
Memory Zoom:	Up to 200,000:1
Time Base:	
Accuracy	15 ppm
Aging	±5 ppm/year
Refresh operating modes	1 ns/div...20 ms/div.
Roll operating modes	50 ms/div...50 s/div.
Deskew:	-62,5 ns...+61,5 ns
Step size	500 ps
Search functions:	Slope, Pulse, Peak, Rise-/Falltime, Runt
Marker:	up to 8 user definable marker for easy navigation; automatic marker function based on search criteria

Digital Storage	
Sampling rate:	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
Resolution (vertical):	8 Bit, HiRes 10 Bit
Memory:	2 x 4 MPTs [4 x 4 MPTs], 1x 8 MPTs [2 x 8 MPTs]
Operation modes:	Refresh, Average (1024), Envelope, Peak-Detect (500ps), Filter, Rol (free run/triggered from time base 50 ms/div. and slower), HiRes
Interpolation:	CH 1...CH 4: Sinx/x, Pulse, Linear; LC0...15: Pulse
Persistence:	Off, 50 ms...∞
Delay pretrigger:	0...4 Million x [1/samplerate], Interlaced x2
posttrigger	0...8.59 Billion x [1/samplerate]
Display refresh rate:	Up to 5,000 waveforms/s
Display:	Dots, vectors (interpolation), 'persistence'

Operation/Measuring/Interfaces	
Operation:	Menu-driven (multilingual), Autoset, help functions (multilingual)
Frequency counter:	
0.5 Hz...300/400/500 MHz	6 Digit resolution
Accuracy	15 ppm
Aging	±5 ppm/year



<b>Auto measurements:</b>	$V_{pp}$ , $V_{p+}$ , $V_{p-}$ , $V_{rms}$ , $V_{avg}$ , $V_{top}$ , $V_{base}$ , amplitude, phase, frequency, period, risetime 80/90%, falltime 80/90%, pos./neg. pulse width, pos./neg. duty cycle, standard deviation, delay, pos./neg. edge count, pos./neg. pulse count, trigger period, trigger frequency
<b>Statistic</b>	Min., max., mean, standard deviation, number of measurements for up to 6 Functions simultaneously
<b>Cursor measurements:</b>	$\Delta V$ , $\Delta t$ , $1/\Delta t$ (f), V to GND, Vt related to Trigger point, ratio X and Y, pulse count, edge count, peak to peak, peak+, peak-, mean value, RMS value, standard deviation, rise time, duty cycle
<b>Application memory:</b>	8MByte for references, device settings and formulars
<b>Interface:</b>	
<b>Internal</b>	2x USB-Host (type A) (1x front side, 1x rear side), Mass storage (FAT16/32)
<b>Exchangeable</b>	HO730 Dual-Interface Ethernet/USB-Device/RS-232 (type B)
<b>Video OUT:</b>	DVI-D (480p, 60Hz) for external display, HDMI compatible
<b>Trigger OUT:</b>	BNC (rear side), Modes: Trigger, Mask
<b>Optional:</b>	USB-Device/RS-232 Dual-Interface (HO720), IEEE-488 (GPIB) Interface (HO740)

<b>Mathematic functions</b>	
<b>Quickmath:</b>	ADD, SUB, MUL, DIV
<b>Editor for formula sets:</b>	Max. 5 formulas per formula set
<b>Label for:</b>	Math. memories
<b>Sources:</b>	All channels and math. Memories, constants
<b>Targets:</b>	Math. memories
<b>Functions:</b>	ADD, SUB, 1/X, ABS, MUL, DIV, SQ, POS, NEG, INV, SQR, MIN, MAX, LOG <sub>10</sub> , LN, Integral, Differential, High-pass filter, Low-pass filter
<b>Display:</b>	Up to 4 math. memories with label
<b>Mask test:</b>	Signal test (pass/fail) based on previously defined mask
<b>Quickview:</b>	Display of $V_{p+}$ , $V_{p-}$ , RMS value, rise time, fall time

<b>General Information</b>	
<b>Probe ADJ Output:</b>	1 kHz/1MHz square wave signal approx. 0,2V <sub>pp</sub> (ta <4 ns)
<b>Bus Signal Source (4Bit):</b>	SPI, I <sup>2</sup> C, UART, retangle, 4Bit counter, 4Bit random pattern
<b>Internal RTC (Realtime clock):</b>	Date and time for stored data
<b>Power consumption:</b>	100...240V, AC 50...60Hz, CAT II
<b>Protective system:</b>	Max. 70 [90] W
<b>Protective system:</b>	Safety class I (EN61010-1), CSA (pending)
<b>Operating temperature:</b>	+5...+40 °C
<b>Storage temperature:</b>	-20...+70 °C
<b>Rel. humidity:</b>	5...80% (non condensing)
<b>Theft protection:</b>	Kensington Lock
<b>Dimensions (W x H x D):</b>	285 x 175 x 220 mm
<b>Weight:</b>	3.6 kg

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

**Accessories supplied:** Line cord, printed operating manual, 2 [4] Probes, 10:1 with attenuation ID (HZ350 400/300MHz, HZ355 500MHz), Software-CD

<b>Recommended accessories:</b>	
H0010	Serial bus trigger and hardware accelerated decode, I <sup>2</sup> C, SPI, UART/RS-232 on Analog channels and Logic channel
H0011	Serial bus trigger and hardware accelerated decode, I <sup>2</sup> C, SPI, UART/RS-232 on Analog channels
H0012	Serial bus trigger and hardware accelerated decode, CAN, LIN on Logic channels and Analog channels
H03508	Active 8 Channel Logic Probe
H03516	2 x H03508, active 8 Channel Logic Probes
H0720	Dual-Interface USB-Device/RS-232
H0740	Interface IEEE-488 (GPIB), galvanically isolated
HZ46	4RU 19" Rackmount Kit
HZ99	Carrying Case for protection and transport
HZ355	Slimline Probe 10:1 with automatic identification
HZ355DU	Upgrade from 2 x HZ350 to 2 x HZ355
HZO20	High voltage probe 1000:1 (400MHz, 1000Vrms)
HZO30	Active probe 1GHz (0.9pF, 1M $\Omega$ , including many accessories)
HZO40	Active differential Probe 200MHz (10:1, 3,5pF, 1M $\Omega$ )
HZO41	Active differential Probe 800MHz (10:1, 1pF, 200k $\Omega$ )
HZO50	AC/DC Current probe 30A, DC...100kHz
HZO51	AC/DC Current probe 100/1000A, DC...20kHz

## Accessories

Carrying Case HZ99



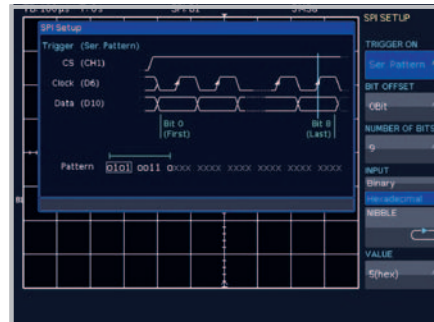
8 Channel Logic Probe H03508



Active Probe HZO30



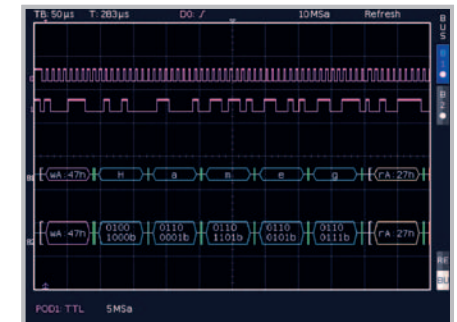
## H0010/H0011 SPI/I<sup>2</sup>C/UART Bus Analysis for all Oscilloscopes of the HMO Series



SPI Bus Trigger Setup

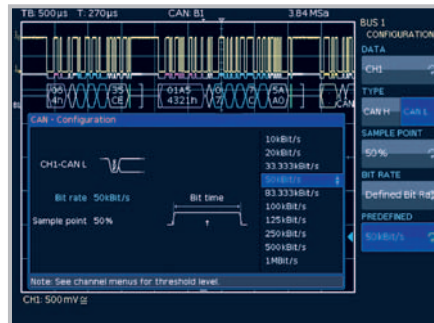


I<sup>2</sup>C Bus Hex Decoding on the Analog Channel



I<sup>2</sup>C Bus ASCII and Binary

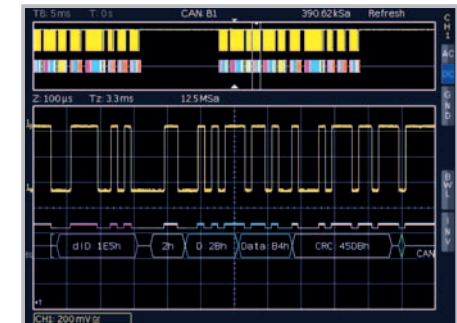
## H0012 CAN/LIN Bus Analysis for all Oscilloscopes of the HMO Series



CAN Bus Configuration



CAN Bus List Display



CAN Bus Hex

**NEW!! THE HMO3000 SERIES**

**Bandwidth Upgrade  
to 500 MHz  
available at any time**



**Great Value in Test & Measurement**



Please visit our website for further details and technical data or scan the QR code