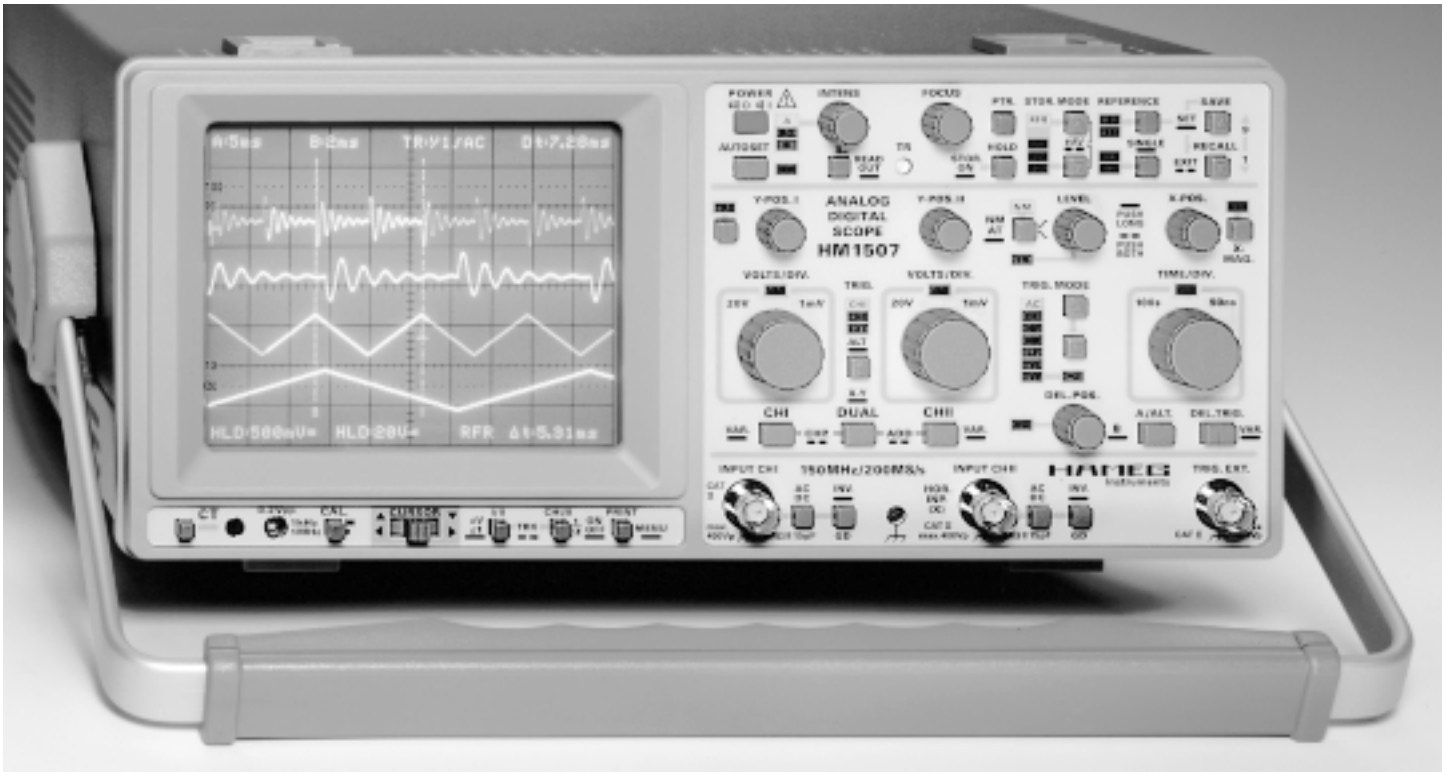
The new Analog-/ Digital Scope Generation from HAMEG

with Autoset, Save / Recall, Readout / Cursor and RS-232 Interface



Demands

Modern oscilloscopes must meet additional demands without neglecting the advantages of their predecessors. Oscilloscopes, which are user selectable between the analog and the digital mode, are undoubtedly the most versatile displaying instruments and meet this requirement. In spite of additional functions, such instruments must be user friendly and easy to operate.

The main demands for signal display and measurement are

- bright and sharp trace
- time base, single event capturing, XY and component test mode
- signal amplifiers with high bandwidth and wide dynamic range
- distortion free "probe tip to screen" signal display
- high input sensitivity with minimum noise
- wide range of Y and X deflection coefficients
- stable triggering with multiple coupling modes
- delayed time base mode with second trigger system
- automatic signal related instrument and CURSOR set up
- manual CURSOR supported measurement
- 8 bit low noise flash A/D converter for each channel
- 2048 byte displayable record length for each actual and reference signal
- high data acquisition and display rates
- refresh, envelope, average and roll mode
- pre and post trigger signal recording
- serial interface for PC supported documentation
- readout parameter display
- mu metal screened CRT display for highest resolution
- Calibrator signals for low and high frequency probe adjustment

Both instruments fulfill these and more unmentioned requirements.
For additional information please see the data sheets for HM407 and HM1507-2.

Solution

The following description explains some advantages of these oscilloscopes.

The excellent frequency response of the signal amplifiers and the stable triggering abilities from only 5mm peak-to-peak on the screen, enable the scope to display sine waves far beyond its -3dB frequency without any problems. With rectangular signals the instrument's own overshoot is less than 1%.

Both scopes contain a second trigger system to ensure stable triggering of even asynchronous signal components.

With its **second time base**, the **HM1507-2** scope is capable of displaying not only the signal itself but also a freely selectable expanded section in mixed mode, according to the time base and trigger delay settings. This function is available in both analog and digital modes. In contrast to analog operation there is no intensity reduction in digital mode, even if high expansion ratios are chosen.

Low noise **8 bit flash converters** are used to digitize the signals to be analyzed. A so called dot join function linearly connects successive points to display curves without any gap. Both scopes digitize and store any signal with more than 2000 samples per sweep. The well proven **CRT** is suitable to reproduce signals in this high horizontal resolution.

100MS/s (HM407) or **200MS/s** (HM 1507) allows a clear display of single shot (real time) events up to frequencies of 10MHz (HM407) or 20MHz (HM1507-2). To display variations of a signal over several samples it is recommended to use the envelope or the average mode. Another important feature is the pre/post trigger function that enables the user to analyze signal components that occur before/after the trigger event. **Two** full-size **reference memories** allow the comparison of signals with those already stored in memory.

When the **Autoset function** is enabled, **all** relevant **parameter settings** are performed by the scope's circuitry **automatically**. The Setup parameters and the measured values are clearly displayed on the screen in alphanumeric characters. Autoset also initiates automatic cursor settings for time and frequency measurement (digital only) as well as voltage measurement.

In analog and digital mode, the cursor functions enable the user to analyze a signal while watching the numeric readout for voltage difference, time difference, or frequency values. Another feature is the storage capability for nine complete parameter set ups, which may be stored and recalled simply by pressing the appropriate front panel key.

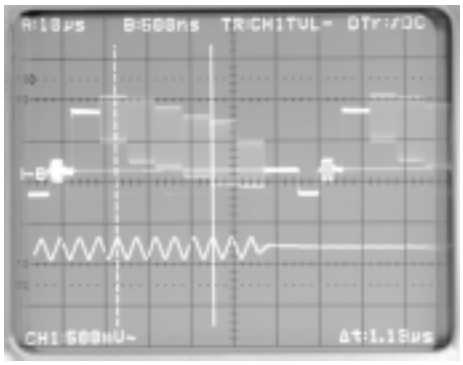
A remarkable feature of the two scopes is the built in calibrator - a **1kHz/1MHz square wave generator**. It allows frequent checking of the instrument's frequency response - from the probe tip to the display on the screen. It also permits high frequency alignment of the probes. Supported by an **On Screen Menu** some adjustments can be performed without opening the scope.

With all of the new **HAMEG** scope range, microprocessors manage the front panel inputs, calculations, and other control functions. In addition, **32 bit RISC processors** accelerate the digital signal processing.

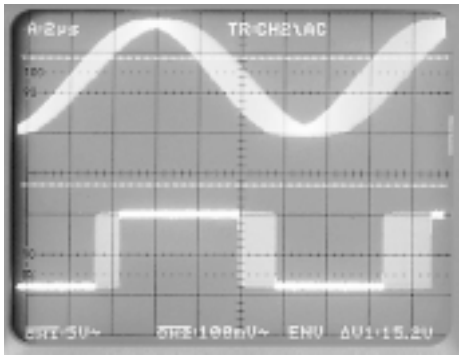
The instrument may be **remotely controlled** by any **personal computer** via its **built in serial interface** in all relevant functions. A suitable software program is supplied with the scope on delivery.

Operation

Like all members of the new series of **HAMEG** oscilloscopes the two devices combine a wide range of useful functions with an easy to use operator interface. In spite of the numerous functions the front panel is clearly designed. The logically designed layout and the proven functionality of the keys and knobs make additional menu keys avoidable. To reduce the number of front panel keys, some allow a second function that can be activated by pressing and holding (approx. 2 sec). This only applies to infrequently used functions. Even inexperienced oscilloscope users will soon become familiar with these instruments.



Screen photo of a composite video signal. Burst displayed via 2nd timebase (triggered).



Screen photo of a signals in envelope mode.

The easiest way to display signals of low complexity is the use of the **Autoset** function. The scope's logic circuitry performs all relevant parameter settings automatically for the best readout of the signal on the screen. Of course, any parameter may be modified manually if desired. The set up parameters and the result of the selected measurement function are clearly displayed on the screen. Another feature is the **storage capability** for **nine complete parameter settings**, which may be **stored** and **recalled** randomly by pushing the relevant front panel key. It includes beam intensity and cursor parameters settings.

The **cursor functions** enable the user to analyze a signal while watching the **numeric readout** for the **voltage difference**, **time difference**, or **frequency** values. The two cursors can be manually controlled at two rates. This ensures a high positioning accuracy.

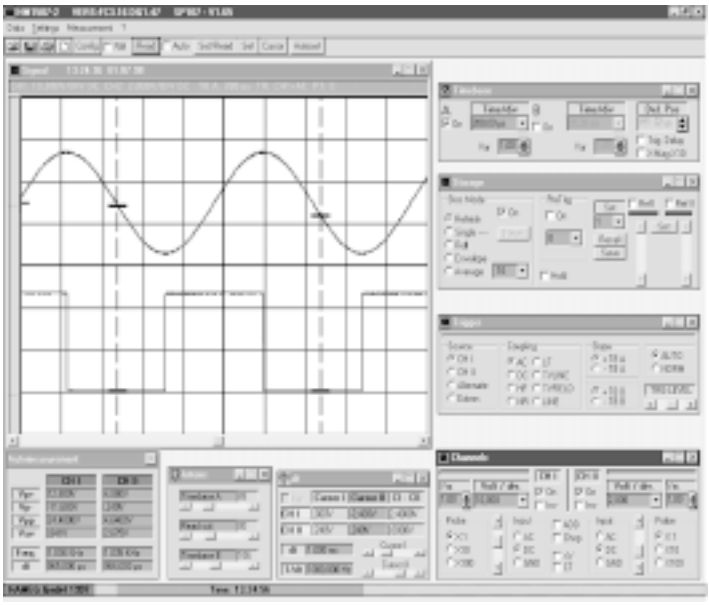
Applications

The screen photo shows a composite video signal with burst. The two time bases of the **HM1507** are operating in the mixed mode. Since the burst is asynchronous to other components of the **TV signal**, for the correct display of the signal a second trigger circuit is required. This is a feature of both oscilloscope types; the **HM407** uses the **trigger after delay** feature to display the burst whereas the **HM1507** can display the **signal and** the **burst** (with the 2nd time base) concurrently in **two curves**.

When signals are displayed in the envelope mode, the influence of jitter effects and amplitude changes can be demonstrated significantly. The scope builds the envelope curve by storing the minimum and maximum values over a number of consecutive sampling periods. For ease of operation the envelope curve can be stored in one of the reference memories and be displayed in combination with a currently measured signal. This eases the evaluation when comparison is required.

Software

The instrument functions can be controlled by a PC via the built in **RS232** Interface. Disks with programming examples, a listing of the oscilloscope commands and the program **SP107** for Windows **3.x**, **95** and **NT4.0** are part of the delivery. The **SP107** virtual instrument program enables the **PC** to **control** and **receive** instrument settings in analog and digital mode. Additionally in digital mode, signal data can be received for **archiving** (disk), **documentation** (printer) and **exportation** (table calculation) purposes. The data transfer can be started manually, or automatically (time interval / single event) controlled.



The 150 MHz (200MS/s) Analog-/Digital-Oscilloscope HM1507-2

Autoset

Auto Cursor

Readout / Cursor

Save / Recall

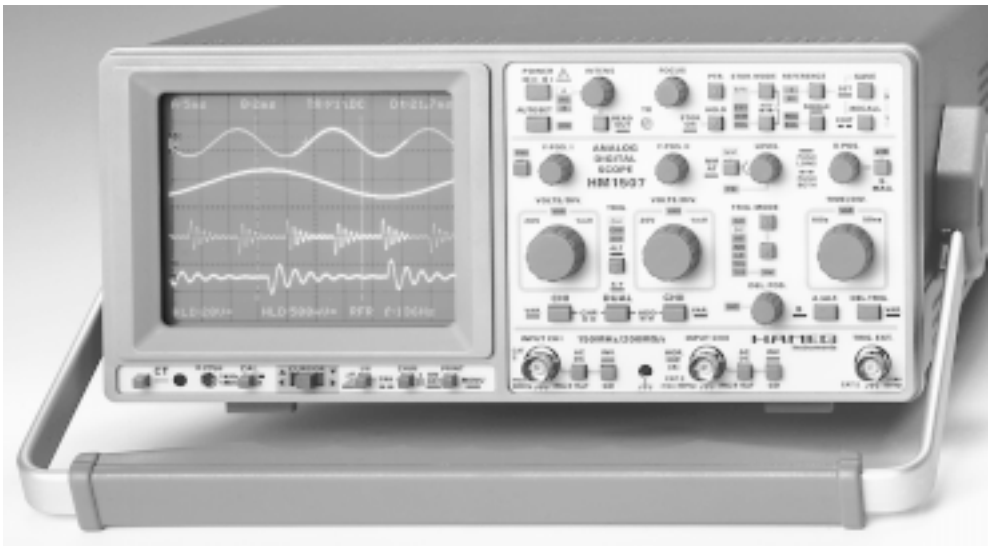
2 Reference Memories

Dual Time Base

Component Tester

1kHz/1MHz Calibrator

RS232 Interface



Analog:

- **2 x DC to 150MHz, 2 x 1mV-50V/div**
- **Timebase A with Trig. DC to 250MHz**
- **Timebase B with 2nd Trig. to 250MHz**
- **Trig. DC to 250MHz, TV Sync. Separator**
- **1kHz/1MHz Calibrator, CRT with 14kV**

Digital:

- **Refresh, Single, Roll-, Envelope-, Average-,XY-Mode**
- **Max.Sampling Rate 200MS/s, Storage 2x2048x8 bit**
- **Time Base A: 100s - 50ns/div., B: 20ms - 50ns/div.**
- **Pre Trigger 25-50-75-100%, Post Trigger 25-50-75%**
- **Screen Refresh 180/s, Dot Join (linear)**

Specifications

Vertical Deflection

Operating modes: Channel I or II separate both Channels (alternated or chopped)
Chopper frequency: approx. 0.5MHz)
Sum or **Difference:** from CH I and CH II
Invert: CH I and CH II
XY-Mode: via channel I (Y) and channel II(X)
Frequency range: **DC** to **150MHz** (-3dB)
Risetime: <2.3ns
Overshoot: ≤1%
Deflection coefficient: 14 calibrated positions from **1mV/div** to **20V/div** in 1-2-5 sequence, variable 2.5:1 to min. **50V/div**.
Accuracy in calibrated positions
1mV/div – 2mV/div: ±5% (DC-10MHz (-3dB))
5mV/div – 20V/div: ±3%
Input impedance: 1MΩ II 15pF
Input coupling: DC-AC-GD (ground)
Input voltage: max. 400V (DC + peak AC)
Delay line: approx. **70ns**

Triggering

Automatic (peak to peak): 20Hz-250MHz (≥0.5div.)
Normal with level control: DC-250MHz (≥0.5div.)
Indicator for trigger action: LED
Slope: positive or negative
Sources: Channel I or II, line and external
ALT. Triggering: CH I/CH II (≥ 0.8div.)
Coupling: **AC** (10 – 250MHz)
DC (0 – 250MHz)
HF (50kHz – 250MHz)
LF (0 – 1.5kHz)
NR (Noise reject)0 - 50MHz (≥ 0.8div.)
Triggering time base B: normal with level control and slope selection (0 – 250 MHz)
External: ≥0.3V_{pp} (0 – 250MHz)
Active TV Sync. Separator: field & line, + / –

Horizontal Deflection

Analog Time Base:
Accuracy in calibr. position 3%; 1-2-5 sequence
A: **0.5s** – **50ns/div**.
B: **20ms** – **50ns/div**.
Operating modes: **A** or **B**, alternate **A**/**B**
Variable: 2.5:1 up to 1.25s/div.
X-MAG. x10 (±5%) max. 5ns/div.
Holdoff time: variable to approx. 10:1
Bandwidth X-amplifier: 0 – 3MHz (-3dB)
X-Y phase shift: <3° below 220kHz
Digital Time Base:
Accuracy: 3%; 1-2-5 sequence
A: **100s** – **0.5µs/div**.
B: **20ms** – **0.5µs/div**.
Operating modes: **A** or **B**, alternate **A**/**B**
X-MAG. x10 (±5%): **50ns/div**.
Bandwidth X-Amplifier: 0 – 20MHz (-3dB)
X-Y phase shift: <3° below 20MHz
Input X-amplifier: via Channel II
Sensitivity: see CH II

Digital Storage

Operating modes: Refresh, Roll, Single, XY Average (2 to 512 waveforms), Envelope
Dot Join function: automatically
Acquisition (real time)
8 bit flash A/D max. **200MS/s**
Display refresh rate: max. 180/s
Memory & display: 2k x 8bit per channel
Reference memory: 2 waveforms 2k x 8bit
Saved in: (EEPROM).
Resolution (samples/div.): **X** 200/div.
Y 25 /div.
XY 25 x 25/div.
Pre-/Post Trigger: 25,50,75,100, -25,-50,-75%

Operation / Control

Manual: front panel switches
Auto Set: signal related automatic parameter selection
Save & Recall: 9 user defined parameter settings

Readout & Cursor (analog/digital)

Display of parameter settings and other functions on the screen. Triggerpoint indication. Cursor measurement of ΔU, Δt or 1/Δt (frequency), separate or in tracking mode.
Readout intensity: separately adjustable.

Interface

PC remote control: built in RS232 interface
Option: HO79-6 Multifunction-Interface IEEE-Bus, RS232, and Centronics
Output formats(HO79-6): PCL, Post Script HPGL, EPSON

Component Tester

Test voltage: max. 7V_{rms} (o/c).
Test current: max. 7mA_{rms} (s/c)
Test frequency: approx.50Hz
One test lead is grounded (Safety Earth)

General Information

CRT: D14-375GY, 8x10cm internal graticule
Acceleration voltage: approx. 14kV
Trace rotation: adjustable on front panel
Calibrator: 0.2V ±1%, ≈ 1kHz/1MHz (tr <4ns)
Line voltage: 100-240V AC ±10%, 50/60Hz
Power consumption: approx. 42 Watt at 50Hz
Min./Max. ambient temperature: 0°C...+40°C
Protective system: Safety class I (IEC1010-1)
Weight: approx. 5.6kg (12.4lbs)
Color: techno-brown
Cabinet: **W** 285, **H** 125, **D** 380 mm
Lockable tilt handle

Subject to change without notice 04/99

Accessories supplied:
Operators Manual, 4 Disks, Line Cord, 2 Probes 10:1