



# 'ScopeMaster' multi-function portable oscilloscope

**R S stock numbers SM610 216-334  
SM620 216-340  
SM630 816-805**

## Introduction

The SM610 ScopeMaster comprises a 20MHz two channel digital storage oscilloscope and a digital multimeter.

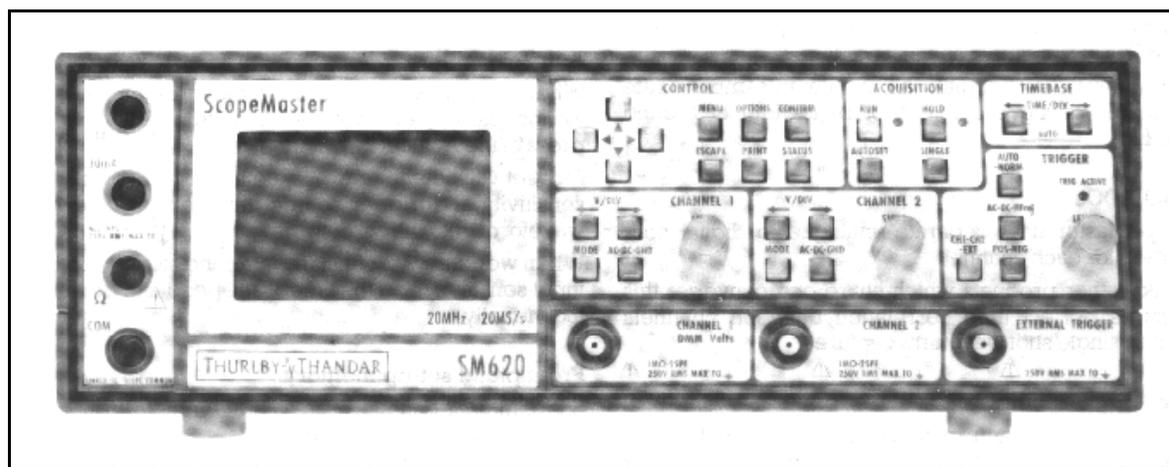
The SM620 model also comprises a data-logger, a serial data analyser and a 20MHz timer-counter.

The SM630 incorporates all these features plus true rms ac measurements, and a switchable backlight display.

## Features

Feature	RS stock no. 216-334 Model SM610	RS stock no. 216-340 Model SM620	RS stock no. 816-805 Model SM630
<b>2 channel 20MHz DSO</b>	●	●	●
20MS/s max. sampling	☐	☐	☐
10 waveform memories	☐	☐	☐
20 set-up memories	☐	☐	☐
Waveform averaging	☐	☐	☐
Waveform printout		☐	☐
Waveform dump to PC		☐	☐
<b>3000 count DMM</b>	●	●	●
dcV, acV, W, dcA, acA	☐	☐	☐
Manual or auto-ranging	☐	☐	☐
Bargraph analogue display	☐	☐	☐
Continuity and diode test	☐	☐	☐
Ax + B function	☐	☐	☐
<b>1000 reading data-logger</b>		●	●

Feature	RS stock no. 216-334 Model SM610	RS stock no. 216-340 Model SM620	RS stock no. 816-805 Model SM630
Timed or triggered readings		☐	☐
Data-logger printout		☐	☐
Data-logger dump to PC		☐	☐
<b>20MHz timer-counter</b>		●	●
8 digit display		☐	☐
Crystal accuracy 0.001%		☐	☐
Period and rpm modes		☐	☐
Totalise and timer modes		☐	☐
Reading output to PC	☐	☐	☐
<b>Serial data analyser</b>		●	●
RS232, RS423, RS422		☐	☐
Display in ASCII and HEX		☐	☐
Scrolling activity window		☐	☐
1024 character memory		☐	☐
Multiple character trigger		☐	☐
Analyser memory printout		☐	☐
<b>General</b>			
Compact and lightweight	☐	☐	☐
Battery operation up to 10hrs	☐	☐	☐
Disposable or rechargeable	☐	☐	☐
Full safety sockets	☐	☐	☐
Isolated RS232 interface		☐	☐
ARC Compatible		☐	☐
Display Backlight			☐
True rms ac measurement			☐



**Safety**

Because portable instruments may be used without earth grounding, they must conform to the more rigorous safety standards of IEC Class II.

ScopeMaster achieves this by the use of full safety sockets not just on the DMM but on the oscilloscope as well. All BNC sockets are fully insulated and all other connectors are electrically isolated.

**On screen help**

Wherever any possibility of uncertainty exists, on-screen help is available.

```

WAVEFORM AVERAGING
Use INC AND DEC
KEY TO SELECT
AVERAGING OVER
2, 4, 8, 16, 32 OR 64
SAMPLES BEFORE
DISPLAY IS UPDATED
(OFF = 1 SAMPLE).

```

Help is context sensitive. One press of the Help button gives information relevant to the function being accessed.

**Digital storage oscilloscope****Features**

- 2 channels, 20MHz bandwidth and 5mV/div sensitivity
- 20MS/s max. sampling, dual ADCs for time correlation
- 50ns/div to 200s/div timebase range, roll mode display
- Variable pre-trigger capture, waveform averaging
- 10 waveform memories, 20 set-up memories
- Autoset button for instant display of new signals
- Waveform printout, via RS-232.

**Bandwidth and sampling speed**

ScopeMaster has a bandwidth of 20MHz for repetitive signals using an equivalent sampling rate of up to 400MS/s.

For non-repetitive signals the maximum sampling rate is 20MS/s giving a single shot bandwidth of around 4MHz.

**Dual ADCs**

ScopeMaster uses separate analogue to digital converters for each channel.

Unlike other products which share one converter, this ensures perfect time correlation between channels during single shot waveform capture.

**Pre-trigger facility**

Only a DSO can capture the waveform prior to the trigger event. ScopeMaster has variable pre-trigger allowing various combinations of the pre and post trigger waveform to be captured.

**Slow waveform capture**

The extended timebase range of ScopeMaster (from 50ns down to 200 seconds per division) enables a very wide range of signals to be displayed and stored.

Roll mode turns the display into an electronic chart recorder enabling very slowly varying events to be observed (up to 20 minutes record length.)

**Memory function**

Up to ten waveforms can be stored in non-volatile memory and then recalled to the screen whenever required.

This enables reference waveforms to be stored for comparison purposes, or data to be recorded in the field and analysed later.

**Individual channel freeze**

A 'mode' button for each channel enables the display from one channel to be frozen whilst continuing to update the display from the other channel.

**Waveform averaging**

When trying to observe signals within noisy environments waveform averaging can be selected.

Between 2 and 64 acquisitions can be averaged giving up to an eight fold improvement in viewed signal to noise ratio.

**Instant on screen status display**

When changing any of the oscilloscope parameters an on-screen display of that parameter appears automatically.

One press of the Status button shows the whole oscilloscope set-up at a glance.

```

CH1 =      2V  ☐
CH2 =      5mV AC
TR1 = CH1   TR2 = MEM09
TIME/DIV =  50ns
PRE-TRIG = 03 DIV
TRIG = CH1 HFREJ POS
MODE = AUTO

```

**Autoset facility**

When starting with a new or unknown signal, all of the 'scope parameters can be set automatically by one press of the Autoset key.

Autoset will set the appropriate timebase speed, input sensitivity and trigger source thus getting a viewable waveform onto the screen.

When working with constantly varying signals, both the input sensitivity and the timebase speed can be autoset individually.

**Front panel set-up memory**

ScopeMaster can store up to 20 complete front panel set-ups in non-volatile memory.

This means that the parameters used to make specific tests (along with reference waveforms) can be remembered and recalled whenever needed.

**Waveform printout**

Waveforms can be sent to a printer or plotter complete with annotation showing the oscilloscope set-up parameters.

Alternatively waveform data can be dumped to a PC for storage or analysis.

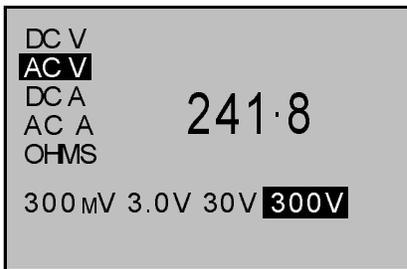
**Precision digital multimeter**

ScopeMaster includes a full digital multimeter with a 3000 count digital display and a fast-update analogue bar graph.

Current measurement up to 3 Amps dc and ac is included.

Voltage measurements are made using the CH1 oscilloscope input for extra convenience. The attenuation error of  $\times 10$  probes is automatically corrected by a user accessible compensation constant.

Resistance and current measurements are made using conventional multimeter leads in 4mm sockets for maximum flexibility. Resistances can be resolved down to  $0.1\Omega$  and currents measured up to 3 Amps.



**Automatic or manual ranging**

The DMM function can be set to auto-ranging mode by a single press of the Autoset button. A press of the range button returns immediately to manual range control.

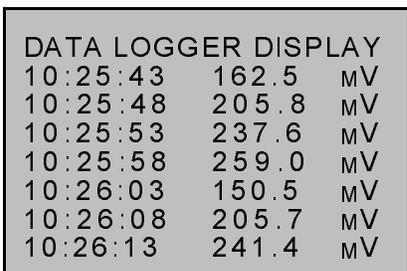
**Linear scaling with offset**

DMM readings can be scaled and offset using the Ax + B function. This powerful feature allows direct transducer signals and 4-20mA current loops to be displayed in terms of the original analogue parameter.

**Data logger**

ScopeMaster's DMM can be linked to a full 1000 reading data logger.

Multimeter readings can be stored at timed intervals from 4 per second up to one every 3 hours or can be triggered from an external signal.



Logger readings are held in non-volatile memory so that they are not lost when the power is turned off. Readings can be recalled to the screen or dumped to a printer.

**Printer/Plotter output**

ScopeMaster can be connected to a printer or plotter for the output of waveforms, data-logger results and data memory lists. Connection is made using the isolated RS232 serial interface.

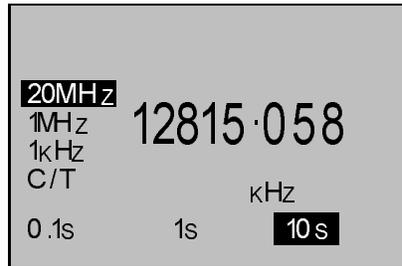
**Data transfer to a PC**

The RS232 serial interface enables ScopeMaster to be linked to a personal computer for data transfer.

**Counter-timer**

ScopeMaster can offer not just frequency measurements but full counter-timer facilities. The unit provides full accuracy and resolution.

Using a crystal controlled timebase and up to an 8 digit display length the accuracy is better than 0.001%.

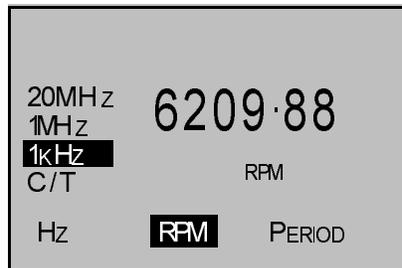


Selectable gate time gives a choice of update rate and the use of reciprocal frequency measurement at low frequencies provides resolution down to 0.001 Hz.

**Period and rpm measurement**

ScopeMaster can measure in terms of period as well as frequency. This provides very high resolution for low frequency measurement. Reciprocal calculation enables the result to be shown as frequency if preferred.

For rotating machines, frequency can also be displayed in terms of rpm.



**Totalise and timed interval function**

ScopeMaster can count pulses up to 99999999. In timer mode intervals up to 27 hours can be resolved to 0.1 seconds.

**Serial data analyser**

One of the most common problems that engineers come across when working with computer based systems is faults with serial links such as RS232.

A breakout box can show the state of the lines but cannot show whether the correct data is being sent.

ScopeMaster can interpret the data from most asynchronous serial links such as RS232, RS423 and RS422.

The data analyser interprets the serial data in terms of

## A17806

The analyser display comprises three sections. The format section enables the baud rate and word format (data length, start/stop bits and parity) to be set.

The activity section displays a scrolling list of the last 20 characters independently of the memory.

TUVWXYZ0123456789 c <sub>R</sub> L <sub>F</sub> A			
CURS	HEX	ASC	TYPE
0972	39	9	
0973	0D	CR	CNTRL
0974	0A	LF	CNTRL
0975	41	A	
19200,8,NP,1 STOPPED			

The data buffer section can store up to 1024 characters in non-volatile memory. The buffer display shows the data in both Hex and ASCII formats along with the character type (data or control) and the buffer location. Alternatively the contents can be dumped to a computer or a printer.

The storing of data can be started or stopped manually or can be controlled by a trigger word sequence.

A sequence of up to 3 characters can be defined which will trigger the data acquisition with both pre and post trigger data being stored.

## Unit specifications

### Oscilloscope

#### Vertical

Bandwidth:	dc to 20MHz, except 10mV/div (15MHz) and 5mV/div (10MHz).
Sensitivity:	5mV/div to 10V/div in 11 ranges; calibration accuracy $\pm(3\% + 1 \text{ pixel})$ .
Coupling:	Selectable ac/dc/GND; ac coupling -3dB at 10Hz.
Resolution:	15 points per division (6-bit A/D converter).
I/P impedance:	1M $\Omega$ /25pF.
Max. input	350V (dc + ac pk) between scope input and common; 250Vdc/250Vrms with respect to ground.
Modes:	Trace 1 = Channel 1, Channel 1 + Trace 2, any memory, HOLD or OFF. Trace 2 = Channel 2, Channel 2 inverted, any memory, HOLD, or OFF.
Trace Offset:	$\pm 75\%$ of screen.

#### Horizontal (Timebase)

Sweep times:	50ns/div to 200s/div in a 1-2-5 sequence (32 ranges).
Single shot:	1 $\mu$ s/div to (2 $\mu$ s/div dual trace) to 200s/div, see timebase modes.
Repetitive:	50ns/div to 500ns/div, see Timebase Modes.
Record length:	128 points per channel; 20 points per division.
Accuracy:	$+ (0.1\% + 1 \text{ pixel})$ ; $\pm (3\% + 1 \text{ pixel})$ in repetitive sampling mode.
Auto-ranging:	Pressing both timebase buttons simultaneously sets the timebase to give approx. 3 triggers per screen

### Trigger

Source:	Channel 1, Channel 2 or external.
Coupling:	ac, dc, or HF reject filter (-3dB at 7kHz); ac coupling only on external.
Sensitivity:	0.5div CH1/CH2 dc to 10MHz; typically 1.5V pk-pk external.
Slope:	+ve or -ve.
Mode:	In AUTO mode the timebase free runs in the absence of a trigger signal (except in repetitive sampling mode).
I/P impedance:	1M $\Omega$ external.
Max. input:	350V (dc + ac pk) between trigger and common; 250Vdc/250Vrms with respect to ground.
Pre-trigger:	0, 1, 2 or 3 divisions of pre-trigger data can be selected.

### Timebase modes

Roll:	200s/div to 2s/div. Screen updated continuously from the right at the selected sweep rate.
Update:	1s/div and 500ms/div. Screen updated from left to right (overwritten) at the selected sweep rate.
Normal:	200ms/div to 1 $\mu$ s/div (2 $\mu$ s/div dual trace). Simultaneous data storage for each trace. Screen updated at end of sweep. Max. sample rate 20MS/s (10MS/s dual trace).
Alternate:	1 $\mu$ s/div, dual trace only. Data for each trace acquired sequentially at 20MS/s.
Repeat:	500ns/div to 50ns/div. Data is repetitively sampled to give high equivalent sample rates (up to 400MS/s).

### Acquisition modes

Run:	Initiates continuous updating of screen subject to trigger mode.
Hold:	Immediately freezes the display.
Single:	Initiates a single screen update.
Autoset:	Pressing AUTOSET finds the trigger source, and sets the timebase and input sensitivities to give a viewable display.
Average:	Average can be set between 2 and 64 in a binary sequence.

### Storage memory

Waveforms:	Non-volatile storage for 10 acquisitions; acquisitions can be stored from either channel and recalled to either trace.
Set-ups:	Non-volatile storage for 20 full set-ups.

### Waveform display

128  $\times$  64 pixels supertwist LCD with a 56  $\times$  38mm active viewing area (68mm diagonal). On-screen 6  $\times$  4 division half-intensity graticule with 0.2 division sub-markings. Contrast and viewing angle user-adjustable by control in case base. Switchable backlight on SM630.

**Frequency display**

Selectable 5 digit display of trigger frequency at bottom left of screen. 10Hz resolution, 999kHz max.

**Status display**

Pressing the STATUS key gives an on-screen summary of all timebase, trigger and channel settings.

**Probe calibrator output**

A 1 volt pk-pk, 1kHz signal can be generated for setting up the compensation of  $\times 10$  probes.

**Printer/Plotter output (SM620 and SM630 only)**

Waveforms can be sent to a dot-matrix (Epson or HP Deskjet / PCL compatible) or HPGL compatible plotter via the RS232 serial interface.

Waveform is printed along with annotation of 'scope set-up parameters.'

**Digital multimeter****dc and ac voltage**

Signal input: Via CH1 'scope input.  
 I/P impedance:  $1M\Omega$  direct or  $10M\Omega$  via 10:1 'scope probe.  
 Ranges: 300mV, 3.0V, 30V, 300V.  
 Accuracy:  $\pm(0.4\% + 2 \text{ digits})$  dc;  
 $\pm(0.5\% + 5 \text{ digits})$  ac 45Hz - 500Hz.  
 Max. input: 250Vdc/250Vrms between scope input and common or ground.

**Ohms**

Ranges: 200, 2k, 20k, 200k, 2M, 20M plus continuity test.  
 Accuracy:  $\pm(0.4\% + 2 \text{ digits})$  except 20M range  
 $\pm(2\% + 2 \text{ digits})$   
 Full scale volts: <2.5V.  
 O/C volts: <5V.  
 Max. Input: 250Vdc/250Vrms between ohms input and common or ground.

**dc and ac current**

Ranges: 30mA, 3A.  
 Accuracy:  $\pm(0.4\% + 2 \text{ digits})$  dc  
 $\pm(0.5\% + 5 \text{ digits})$  ac 45Hz - 500Hz.  
 True rms ac  $\pm(0.5\% + 20 \text{ digits})$   
 Protection: Both ranges protected by 3.15AT HBC fuse in common line.  
 Max. input: 250Vdc/250Vrms any input to ground.

**Display**

3000 counts, 10mm characters. Update rate 4/sec.

**DMM special features****Bar graph display:**

100 segment bipolar(dc) or unipolar (ac and ohms) bar-graph display on all ranges. Update rate 10/sec.

**Autoranging:**

Pressing AUTOSET sets the DMM into autorange mode.

**Linear scaling with offset (Ax + B):**

A can be set from 00.00 to 19.999 and B from 000.00 to 999.99.

**Continuity test**

In continuity test mode the reading rate is increased and a buzzer sounds for resistance <100ohms.

**'Closed-box' calibration:**

All ranges can be individually calibrated against a standard from the front panel.

A  $\times 10$  probe can be independently calibrated for use on the dc and ac voltage ranges.

**Data logger (SM620 and SM630 only)****Stored readings**

Stores readings from DMM. 1000 readings maximum.

**Reading storage control**

Triggered by external input or timed from internal clock. Internal clock period 0.25 seconds to 9999 seconds.

**Operation modes**

CLEAR, ON or HOLD. HOLD inhibits further data-logging without loss of data; ON restarts logging.

**Output formats**

Output to screen or to printer. Output to printer via RS232 port. Available formats:  
 Standard DMM display plus reading number;  
 List of reading numbers, value and range;  
 List of times, value and range;  
 List of reading numbers, time, value and range.

**Counter timer (SM620 and SM 630 only)****Functions**

Frequency, period, rpm, count and timer.

**20MHz range**

Range: dc to 20MHz.  
 Gate times: 0.1s, 1s, 10s.  
 Resolution: 2Hz to 200Hz, set by gate time.

**1MHz range**

Range: dc to 1MHz.  
 Gate times: 0.1s, 1s, 10s.  
 Resolution: 0.2Hz to 20Hz, set by gate time.

**1kHz range**

Range: dc to 1kHz.  
 Gate times: 0.1s or 1 period.  
 Resolution: Autoranged with frequency, from .001Hz to 1Hz across the range.

**rpm range**

Range: dc to 10,000rpm (166Hz).  
 Gate times: 0.1s or 1 period.  
 Resolution: 0.01 rpm.

**Period range**

Range: 1 to 10,000ms (dc to 1kHz).  
 Gate time: 0.1s or 1 period.  
 Resolution: .01ms.

## A17806

### Counter

Range: 0 to 10<sup>9</sup>.  
Frequency: dc to 1Mhz.  
Features: Run, hold, restart, and zero.

### Timer

Range: 10<sup>5</sup> seconds (27.77 hours).  
Resolution: 0.1s  
Features: Run, hold, restart, and zero.

### Common specifications

Display: 10mm characters. Up to 8 digits depending on range.  
Input: From CH 1, CH 2 or external trigger input as set by trigger source.  
Timebase: Crystal oscillator, 20MHz ± 10ppm, 18°C to 28°C.

### Serial data analyser (SM620 and SM630 only)

#### Data decoding

Can decode asynchronous data from RS232, RS423, and RS422 serial data links.  
Signal input: Oscilloscope CH1 via ×1 probe.  
Baud rate: 50 to 19,200 in 12 steps.  
Word formats: 7 or 8 bit data; 1 or 2 stop bits; parity odd, even or none.  
Polarity +ve or -ve.  
Data buffer: 1024 word data buffer.

#### Data display

20 characters are displayed in ASCII with automatic scrolling.  
4 characters in the buffer are shown in Hex and ASCII, together with the store location and character type. Locations in the buffer can be scrolled.

#### Triggering

Acquisition can be started or stopped manually. Alternatively a trigger condition of up to three consecutive characters can be defined.  
A pre-trigger delay of up to 9999 samples and a post-trigger delay of up to 999 samples can be set.

#### System data

##### Clock

A real-time clock is maintained whilst the instrument is powered up. Time and date are set on the SYSTEM SET-UP menu and used by the DMM data logger.

#### RS-232 Interface (SM620 and SM630 only)

9 way D-type for printer/plotter output and remote control; interface complies with the ARC (Addressable RS-232 Chain) standard

#### Non-volatile memory

Automatic non-volatile storage of current set-ups for all instrument sections and DMM data-logger results, plus 10 waveforms and 20 'scope set-ups.  
Data retention by lithium cell; typical life 5 years.  
Calibration constants for the DMM are held in permanent EEPROM.

### Help display

Context sensitive on-screen HELP messages are available in all instrument modes.

### Power requirements

#### Internal

Battery type: 6'C' size disposable or rechargeable cells.  
Battery life: Typically 10 hours from alkaline cells or 7 hours from Ni-Cad rechargeables.

**Note:** Operation of the display backlight reduces battery life by about 10% (SM630 only)

Charge current: Typically 200mA from approved ac adaptor with instrument off, ie. 12-14 hours to fully recharge.

Low battery: On screen indication.

#### External

dc output: 6V-14V max. from approved ac adaptor (optional accessory) or other dc source.  
Consumption: 3VA typical.

### Safety and input protection

The SM600 ScopeMaster range are Safety Class II instruments by IEC classification, designed and tested in general to comply with IEC 348 safety standards.

The instruments are designed for installation Category II measurement use to 250Vdc/250Vrms in a Pollution Degree 1 environment (non-condensing).

Channel 1, Channel 2, trigger and ohms inputs are protected to 250Vdc/250Vrms with respect to common; 30mA and 3A inputs are fuse protected.

All oscilloscope input use insulated BNC connectors and the multimeter section has 4mm safety sockets to ensure isolation of all inputs (including common) to 250Vdc/250Vrms between any terminal and earth ground (3kVrms test).

dc power and RS232 connections are isolated to 250Vdc/Vrms with respect to the measurement inputs by reinforced/double isolation (3kVrms test).

### General

Environmental operating range:  
+5°C to +40°C, 20% to 80% RH (non-condensing).  
Environmental storage range:  
-20°C to +60°C.  
Size: 260(W) × 88(H) × 250(D)mm, excluding handle and feet.  
Weight: 1.75kg (3.9lb) excluding batteries.

### Accessories

	RS stock no.
Safety probe	216-356
Mains adaptor/charger	203-451

### Calibration

A full calibration service is available, see your current RS Catalogue for further details.