PHILIPS

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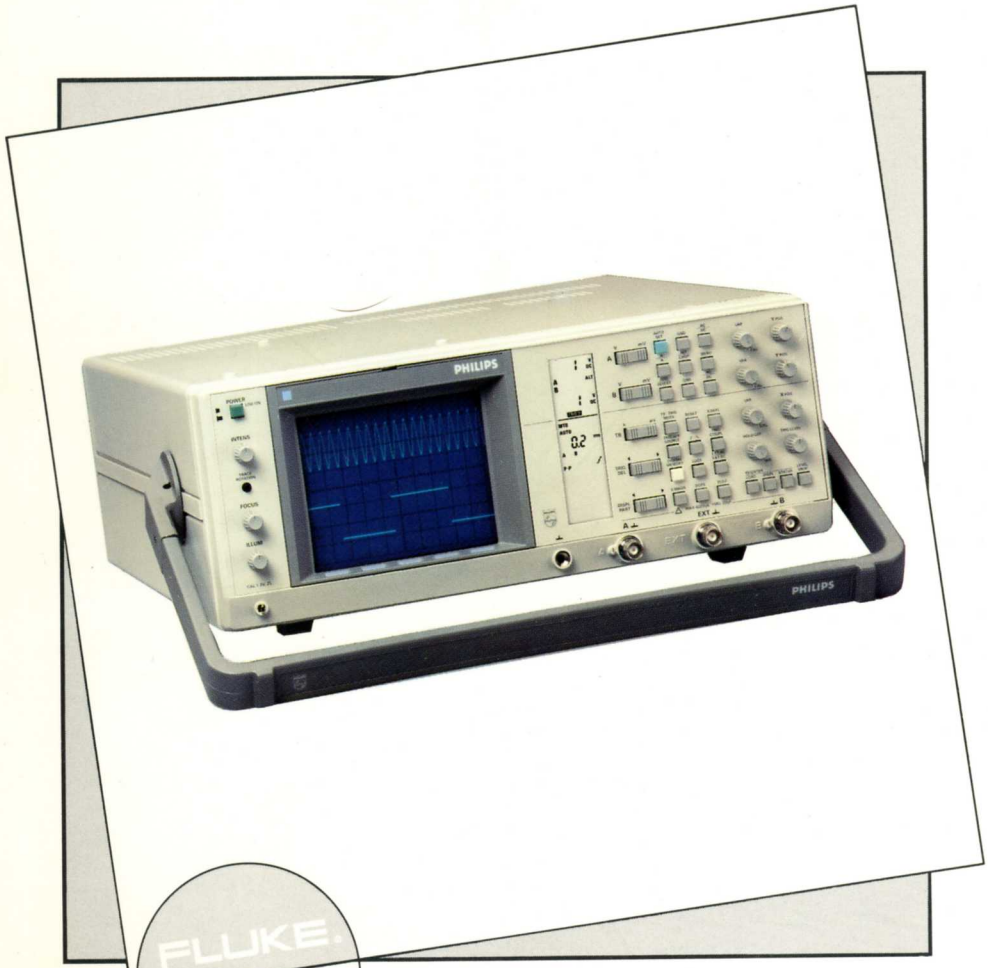
Digital Storage Oscilloscopes

PM3350A/52A/55/57/65A/67A/75/77

TEST & MEASUREMENT *CUSTOMER SUPPORT*



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Operation Guide

Digital Storage Oscilloscopes
PM3350A/52A/55/57/65A/67A/75/77

Operation Guide

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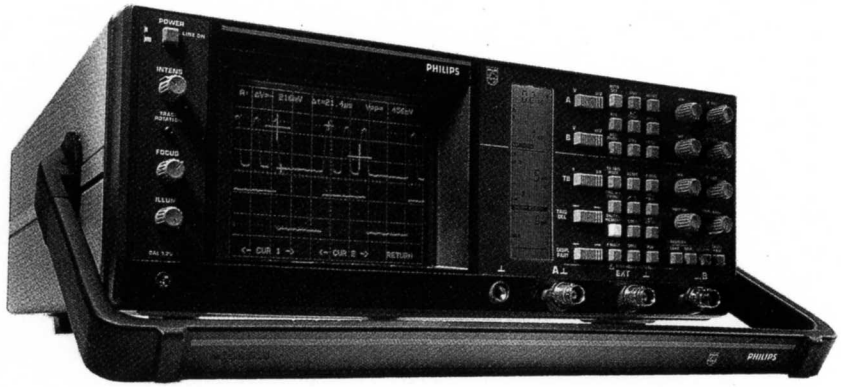

PHILIPS

IMPORTANT: **In correspondence concerning this instrument please quote the typenumber and serial number as given on the type plate on the rear of the instrument.**

NOTE: *The design of this instrument is subject to continuous development and improvement. Consequently, this instrument may incorporate minor changes in detail from the information contained in this manual.*

PRINTED IN THE NETHERLANDS

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SHIPMENT NOTE

The following parts should be included in the shipment:

- 1 OSCILLOSCOPE
- 2 BATTERIES
- 1 FRONT COVER
- 1 OPERATION GUIDE or
- 1 BEDIENUNGSANLEITUNG or
- 1 NOTICE D'UTILISATION
- 1 MAINS VOLTAGE CORD
- 2 PROBES
- 1 SPARE FUSE, 1.6 AT (located inside fuse holder)
- 1 REFERENCE MANUAL

INITIAL INSPECTION

Check the contents of the shipment for completeness and note whether any damage has occurred during transport. If the contents are incomplete, or there is damage, a claim should be filed with the carrier immediately, and the Philips/Fluke Sales or Service organisation should be notified in order to facilitate the repair or replacement of the instrument.

ACCESSORIES

- PROBE 1:1	PM8924/00
- PROBE 10:1	PM8926/59
- PROBE 100:1	PM8931/09
- FRONT COVER	PM8988
- BATTERIES (2 pcs)	ALKALINE PENLIGHT, TYPE: LR6

SERVICE REPLACEMENT PARTS

- 5322 480 30181	CRT CONTRAST FILTER
- 5322 459 20503	BEZEL
- 5322 321 21616	MAINS VOLTAGE CORD (EUROPEAN TYPE)
5322 321 10466	MAINS VOLTAGE CORD (USA TYPE)
5322 321 21617	MAINS VOLTAGE CORD (BRITISH TYPE)
5322 321 21618	MAINS VOLTAGE CORD (SWISS TYPE)
5322 321 21781	MAINS VOLTAGE CORD (AUSTRALEAN TYPE)
- 4822 253 30024	FUSE 1.6 AT

Thank you for purchasing this Philips oscilloscope. It has been designed and manufactured to the highest quality standards to give you many years of trouble free and accurate measurements.
The powerful measuring functions listed below have been combined with an easy logical operation to let you use the full power of this instrument each and every day.

Should you have any comments on how this product could be improved then please contact your local Fluke/Philips organisation.

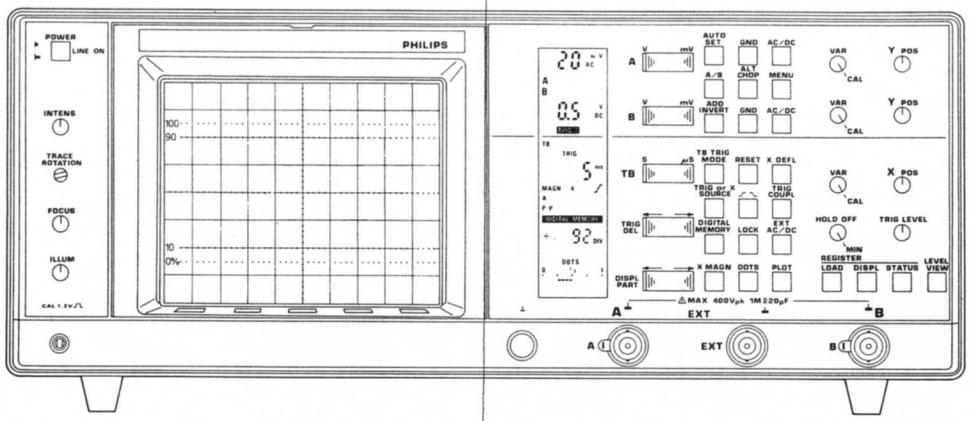
All information given in this manual concerns the oscilloscopes PM3350A/52A/55/57/65A/67A/75/77. If an action is to be taken, that is specific for one member of the above mentioned family, this will be clearly indicated.

Main Capabilities

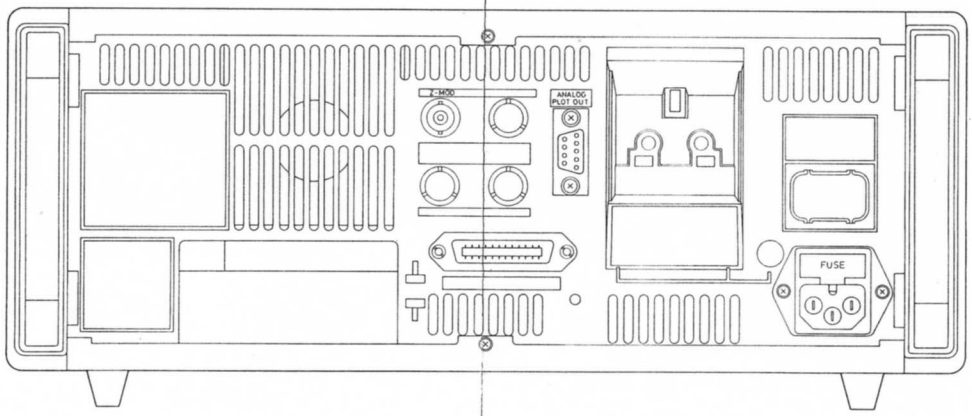
This Philips Digital Storage Oscilloscope (DSO) range consists of four members (and derivatives), each of which has the following easy-to-use features:

- 60 MHz analog oscilloscope for PM3350A and PM3355
  100 MHz analog oscilloscope for PM3365A and PM3375
- 100 Msamples/s single shot digital acquisition on both channels for PM3350A and PM3365A
  250 Msamples/s single shot digital acquisition on both channels for PM3355 and PM3375
- Auto Set for instant signal viewing in both analog and digital oscilloscope modes
- Cursors for time and amplitude measurements in digital oscilloscope mode
- Reference memories and non-volatile storage of all waveforms
- Optional interface facilities for remote control and hard copy output
- Storage of 64 front settings

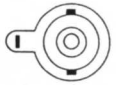
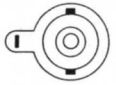
FRONT VIEW OF OSCILLOSCOPE



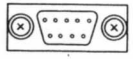
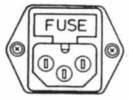
REAR VIEW OF OSCILLOSCOPE



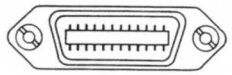
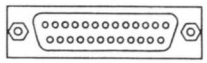
FRONT PANEL CONNECTORS

	CAL	Amplitude calibrated output socket
	⊥	Measuring earth (ground) socket (banana)
	A	BNC input socket for channel A with probe indication
	EXT	BNC input socket channel EXTERNAL
	B	BNC input socket for channel B with probe indication

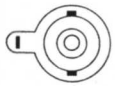
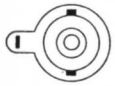
REAR PANEL CONNECTORS

	Z-MOD	BNC input socket for Z-modulation of the CRT trace.
	ANALOG PLOT OUT	Plot output socket to connect the oscilloscope to an analog XY plotter
	LINE IN	Mains (line) input socket including fuse holder.

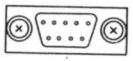
OPTIONAL REAR PANEL CONNECTORS

	IEEE BUS OPTION	Input/output socket to connect the oscilloscope to a IEEE 488/IEC 625 interface.
	OR	
	RS232 BUS OPTION	Input/output socket to connect the oscilloscope to an RS-232C/V24 interface.

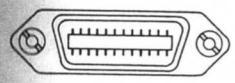
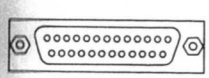
FRONT PANEL CONNECTORS

	CAL	Amplitude calibrated output socket
	⊥	Measuring earth (ground) socket (banana)
	A	BNC input socket for channel A with probe indication
	EXT	BNC input socket channel EXTERNAL
	B	BNC input socket for channel B with probe indication

REAR PANEL CONNECTORS

	Z-MOD	BNC input socket for Z-modulation of the CRT trace.
	ANALOG PLOT OUT	Plot output socket to connect the oscilloscope to an analog XY plotter
	LINE IN	Mains (line) input socket including fuse holder.

OPTIONAL REAR PANEL CONNECTORS

	IEEE BUS OPTION	Input/output socket to connect the oscilloscope to a IEEE 488/IEC 625 interface.
	OR	
	RS232 BUS OPTION	Input/output socket to connect the oscilloscope to an RS-232C/V24 interface.

1 OPERATORS SAFETY

ATTENTION: Read this page carefully before installation and use of the instrument.

1.1 INTRODUCTION

The instrument described in this manual is designed to be used by properly-trained personel only. Adjustment, maintenance and repair of the exposed equipment shall be carried out only by qualified personnel.

1.2 SAFETY PRECAUTIONS

For the correct and safe use of this instrument it is essential that both operating and servicing personnel follow generally-accepted safety procedures in addition to the safety precautions specified in this manual. Specific warning and caution statements, where they apply, will be found throughout the manual. Where necessary, the warning and caution statements and/or symbols are marked on the apparatus.

1.3 CAUTION AND WARNING STATEMENTS

CAUTION: Is used to indicate correct operating or maintenance procedures in order to prevent damage to or destruction of the equipment or other property.

WARNING: Calls attention to a potential danger that requires correct procedures or practices in order to prevent personal injury.

1.4 SYMBOLS

 Read the operating instructions.

 Protective earth (grounding) terminal (black)

1.5 IMPAIRED SAFETY-PROTECTION

Whenever it is likely that safety-protection has been impaired, the instrument must be made inoperative and be secured against any unintended operation. The matter should then be referred to qualified technicians. Safety protection is likely to be impaired if, for example, the instrument fails to perform the intended measurements or shows visible damage.

2 INSTALLATION INSTRUCTIONS

ATTENTION: You are strongly advised to read this chapter thoroughly before installing your oscilloscope.

2.1 SAFETY INSTRUCTIONS

2.1.1 EARTHING (GROUNDING)

Before any connection to the inputs is made, the instrument must be connected to protective earth (ground) via the three-core mains (line) cable. The mains (line) plug must be inserted only into a socket outlet provided with a protective earth (ground) contact. The protective action must not be negated by the use of an extension cord without protective conductor.

WARNING: Any interruption of the protective conductor inside or outside the instrument is likely to make the instrument dangerous. Intentional interruption is prohibited.

When an instrument is brought from a cold into a warm environment, condensation may cause a hazardous condition. Therefore, make sure that the earthing (grounding) requirements are strictly adhered to.

2.1.2 MAINS (LINE) VOLTAGE CORD AND FUSES

Different power cords are available for the various local mains (line) voltage outlets. The power cord version delivered is determined by the particular instrument version ordered.

NOTE: If the mains (line) plug has to be adapted to the local situation, such adaptation should be done only by a qualified technician.

This oscilloscope has a tapless switched-mode power supply that covers most nominal voltage ranges in use:
AC voltages from 100 V...240 V (r.m.s.).
This obviates the need to adapt to the local mains (line) voltage. The nominal mains (line) frequency range is 50 Hz...400 Hz.

WARNING: The instrument shall be disconnected from all voltage sources when renewing a fuse.

Mains (line) fuse rating: 1,6 AT delayed-action, 250 V
(for ordering code, see page i).

The mains (line) fuseholder is located on the rear panel in the mains (line) input socket. If the mains (line) fuse needs replacing, proceed as follows:
- disconnect the instrument from the mains (line).
- remove the cover of the fuseholder by means of a screwdriver.
- fit a new fuse of the correct rating and refit the cover of the fuseholder.

WARNING: Make sure that only fuses of the required current and voltage rating, and of the specified type, are used for renewal. The use of the repaired fuses, and/or short- circuiting of the fuseholder, is prohibited.

2.2 MEMORY BACK-UP

This instrument is provided with a built-in memory back-up circuit, if batteries are fitted.

NOTE: The batteries are not factory installed and must be fitted at delivery

Upon power down, only front settings are stored when in the analog mode of use, or the front settings and traces are stored when in the digital mode of use. The oscilloscope returns to these settings on power on.
This memory function works when the oscilloscope is switched off from the front panel or when the mains (line) supply is interrupted more then 20 ms.

The memory back-up batteries (2*LR6 Alkaline Penlight) placement and replacement must be carried out only by a qualified technician.

Replacing the batteries:

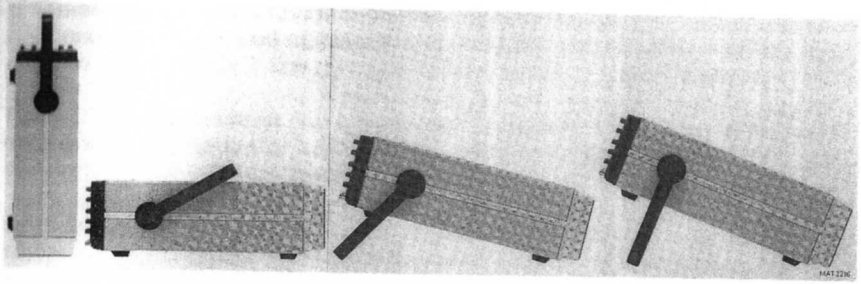
- The instrument must be disconnected from the mains (line).
- Remove the screw that holds the top cover at the rear of the instrument.
- Gently push the cover backwards until it can be lifted.
- Remove the cover by lifting it clear of the instrument. The memory battery back-up unit is now accessible. This unit is located on the instrument's rear panel.
- Ease off the clip that holds the memory back up unit to the chassis.
- Gently slide the battery holder out of the chassis.
- Install both batteries in their holders. The installation direction of the batteries is shown on the battery holder.

NOTE: When replacing the memory back-up unit, take care not to damage the wiring in the vicinity of the battery holder.

2.3 HANDLE ADJUSTMENT AND OPERATING POSITIONS

By pulling both handle ends outwards away from the instrument the handle can be rotated to allow the following instrument positions:

- vertically on its rear feet;
- horizontally on its bottom feet;
- in two sloping positions on the handle.



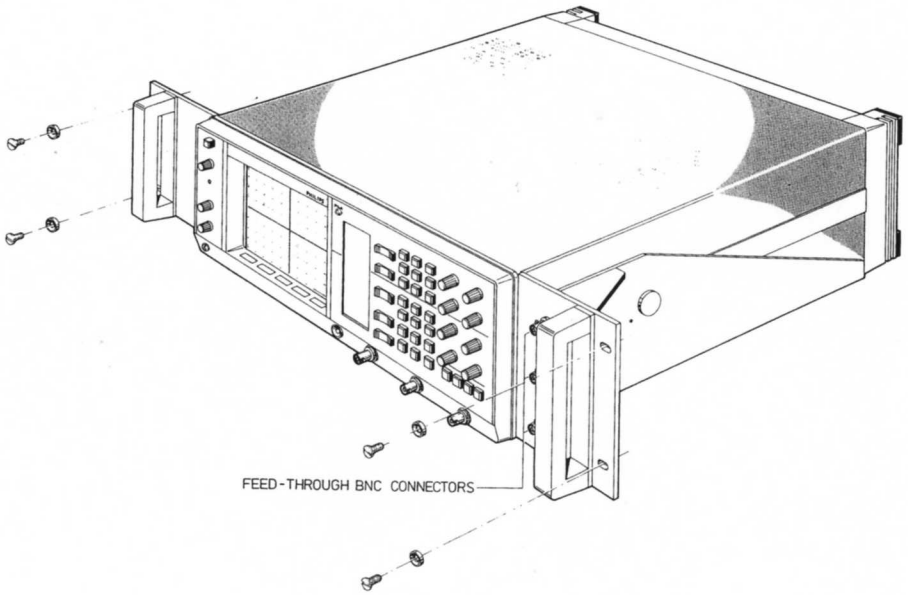
ATTENTION: Do not position the oscilloscope on any surface which radiates heat, or in direct sunlight.
Ensure that the ventilation holes at the rear and top are free from obstruction.

2.4 RACKMOUNT VERSION

The PM3352A/57/67A/77 are provided with a rackmount cabinet without handle. This offers the possibility to build the instrument into a standard 19 inch rack. Apart from the rackmount cabinet these instruments are identical to the PM3350A/55/65A/75 and are not described separately.

The above mentioned oscilloscopes are delivered with spacers and screws [4 *European (metric) type and 4 * American (standard) type].

ATTENTION: To maintain adequate instrument cooling, all ventilation holes of the cabinet above and behind must remain free of obstructions by at least 2 cm.



3 OPERATING INSTRUCTIONS

3.1 GETTING STARTED

- Connect the oscilloscope to the mains (line) voltage.
- Switch the oscilloscope on by means of the push-button POWER LINE ON.
- Adjust the TRACE ROTATION by means of a screwdriver so that the trace is parallel with the horizontal graticule lines.
- Connect a probe to input A of the oscilloscope.
- Connect the other end of the probe to the CAL output of the oscilloscope.
- Press the AUTO SET key.

The AUTO SET function will set automatically all relevant parameters of the oscilloscope (attenuator setting, time base setting and trigger source setting) for an optimum trace.

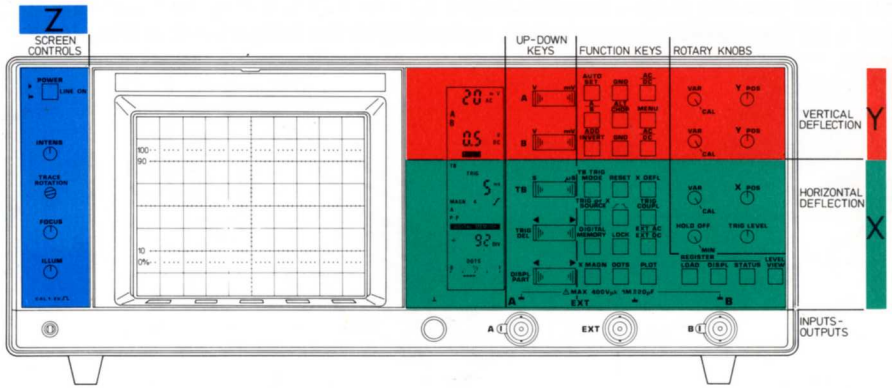
If the probe you use is an attenuator probe 10:1 or 100:1, it may be necessary to adjust it for the correct compensation, according to the instructions in the probe manual.

3.2 FRONTPANEL LAY OUT AND OPERATION

3.2.1 FRONTPANEL LAY OUT

The frontpanel is designed with optimum ergonomic and logical lay-out of the controls: from left to right and from top to bottom, like reading a book.
For ease of access to the oscilloscope the front panel is divided into seven main areas, which will be described in the following sections.

- Screen controls
- Viewing area (screen + LCD)
- Up-down keys
- Function keys
- Rotary knobs
- Softkeys
- Inputs and outputs



3.2.2 SCREEN CONTROLS

After switch-on with the POWER LINE ON push button, the screen controls can be adjusted for optimum illumination, trace and spot quality.

The trace and text intensity is set by the INTENS rotary knob, and a sharp display is obtained by the FOCUS rotary knob.

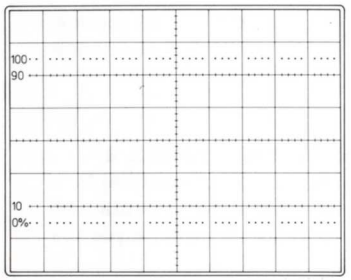
The screw driver control TRACE ROTATION is used to set a grounded trace parallel with the horizontal graticule lines.

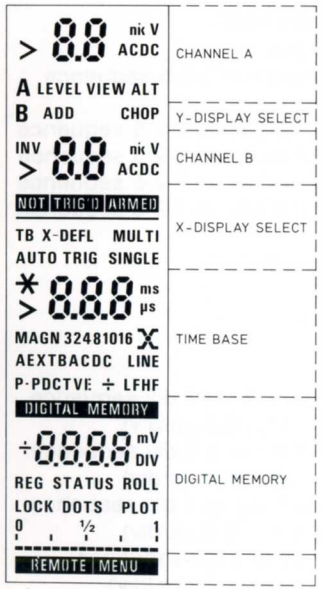
The graticule of the screen can be lit-up by the ILLUMINATION rotary knob, this can be used in dark environment or for making photographs.

3.2.3 VIEWING AREA

The viewing area consists of the screen of the Cathode Ray Tube (CRT) and a Liquid Crystal Display (LCD).

The CRT screen is divided in a 10 * 8 divisions area. Each division contains five sub-divisions. On the left side of the CRT screen four lines are marked with the values 100% 90% 10% and 0%. These marked lines can be used for percentage measurements or rise time measurements.





The LCD indicates all the selected active functions, settings and parameters.
Its layout is logically divided into areas according to the keys and knobs.

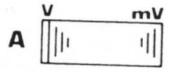
A flashing segment indicates a situation that requires your special attention, for example:

- an incorrect selection of knobs/keys controls,
- a VAR rotary knob in uncal position,
- the end of a UP-DOWN control range,
- a key has been operated during the PLOT action,
- the DISPL PART UP-DOWN key has been pressed in TB MAGN *1 mode.
- display of register only.

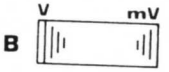
3.2.4 UP-DOWN KEYS

The UP-DOWN key selects the required setting out of the range of settings possible for that function.
They are used for the attenuator setting, the time base setting, the trigger delay setting and the display part setting.

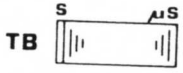
RANGES OF UP-DOWN KEYS



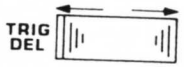
VERTICAL ATTENUATOR SETTING CHANNEL A
Selection of vertical attenuation of channel A
Analog: 2 mV/div ... 10 V/div in 1-2-5 sequence
Digital : 2 mV/div ... 10 V/div in 1-2-5 sequence



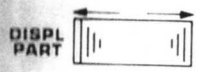
VERTICAL ATTENUATOR SETTING CHANNEL B
Selection of vertical attenuation of channel B
Analog: 2 mV/div ... 10 V/div in 1-2-5 sequence
Digital : 2 mV/div ... 10 V/div in 1-2-5 sequence



HORIZONTAL TIME-BASE SETTING
Selection of time-base speed
Analog: 0,5 s/div ... 50 ns/div in 1-2-5 sequence
Digital :
PM3350A: 50 s/div ... 0,5 µs/div in 1-2-5 sequence
PM3355 : 50 s/div ... 0,2 µs/div in 1-2-5 sequence
PM3365A: 50 s/div ... 20 ns/div in 1-2-5 sequence
PM3375 : 50 s/div ... 20 ns/div in 1-2-5 sequence



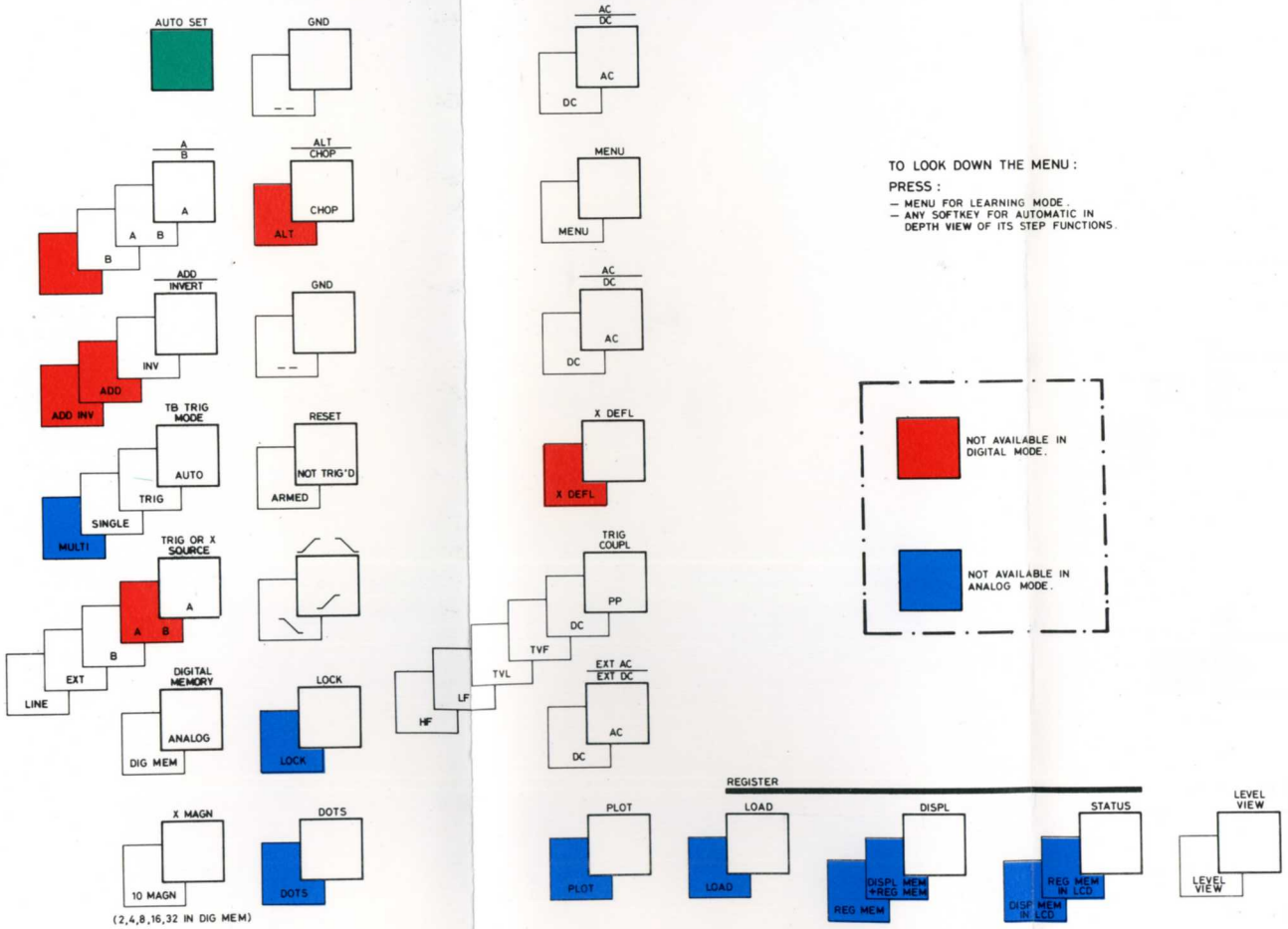
TRIGGER DELAY SETTING
Selection of trigger delay
Analog: not available
Digital :
PM3350A:-10 div ... +2500 div in 1 div sequence
(in TB = 50 s/div ... 0,5 µs/div)
PM3355 :-10 div ... +5000 div in 1 div sequence
(in TB = 50 s/div ... 0,2 µs/div)
PM3365A:-10 div ... +2500 div in 1 div sequence
(in TB = 50 s/div ... 0,5 µs/div)
0 div ,,, +20 div in 1 div sequence
(in TB = 0,2 µs/div ... 20 ns/div)
PM3375 :-10 div ... +5000 div in 1 div sequence
(in TB = 50 s/div ... 0,2 µs/div)
0 div ... +20 div in 1 div sequence
(in TB = 0,1 µs/div ... 20 ns/div)



DISPLAY PART SETTING
Selection of the displayed part of a magnified trace
Analog: not available
Digital : 1/16 ... 16/16 sequence depending on TB MAGNIFY value.

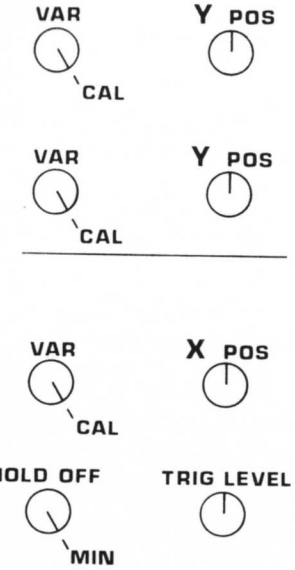
3.2.5 FUNCTION KEYS

This oscilloscope features the possibility to select several functions with a single key in sequential order. To obtain the correct function it is necessary to press the particular key repeatedly until the correct function is visible in the LCD. After the last function in line, the sequence starts again. An overview of the functions is given below. The positions of the keys in this picture are according their actual positions on the front panel of the oscilloscope.



3.2.6 ROTARY KNOBS

With the ROTARY knobs, continuously-variable adjustment of the function is obtained. ROTARY knobs are available for the functions:



Y POS
Vertical screen position channel A

VAR A
Variable attenuation channel A
(Is in CALibrated position when fully clockwise)

Y POS
Vertical screen position channel B

VAR B
Variable attenuation channel B
(Is in CALibrated position when fully clockwise)

X POS
Horizontal screen position time-base

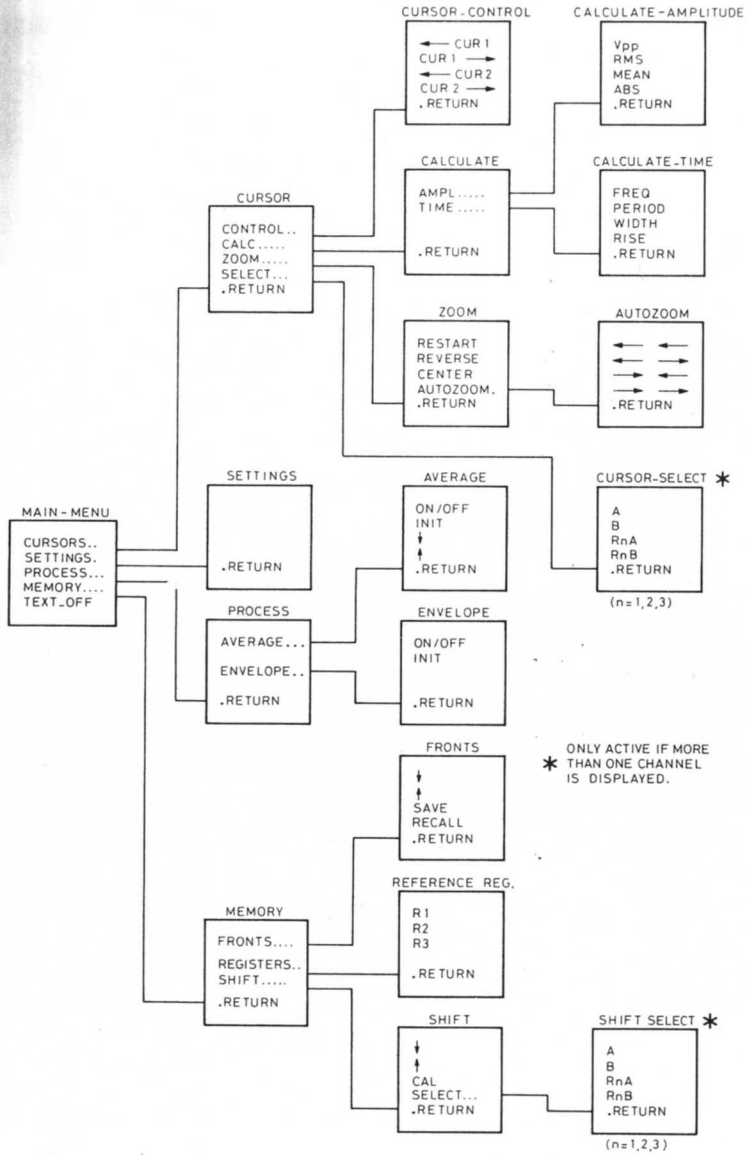
VAR
Variable time-base (not in DIGITAL MEMORY)
(Is is CALibrated position when fully clockwise)

TRIG LEVEL
Trigger level

HOLD OFF
Hold off time
(Is in normal position when fully clockwise,
i.e. minimum HOLD OFF)

3.2.7 SOFTKEYS

The five softkeys located below the CRT can be used for different functions in digital memory mode, e.g. AMPLITUDE CALCULATIONS, TIME CALCULATIONS, PROCESS MEASUREMENTS, choice of REGISTER MEMORY and the ZOOM facility. All calculation and manipulation facilities are activated via successive steps through the softkey menu structure. When the menu has been activated, the CRT screen contains two area's for text. The top text area shows all calculation information and channel settings and the bottom text area shows all functions assigned to the five softkeys.

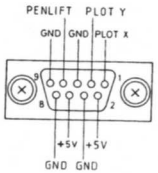


3.2.8 INPUTS AND OUTPUTS

The oscilloscope is equipped with several inputs and outputs to provide special functions and applications.
All standard and optional sockets are described below:

3.2.8.1 Standard

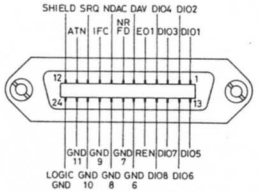
SOCKET	DESCRIPTION
A	BNC input socket for channel A. Probe range indicator identifies attenuation of probe connected and this is compensated for in the LCD display for vertical deflection. (only active with probes that are provided with range indicator).
B	BNC input socket for channel B. Probe range indicator identifies attenuation of probe connected and this is compensated for in the LCD display for vertical deflection. (only active with probes that are provided with range indicator).
EXT	BNC input socket; When EXT input is selected via the time-base the signal input is used for external triggering. When EXT input socket is selected via X DEFL, the horizontal deflection is determined by the signal applied to this socket.
CAL	Output socket providing a 1,2 V(p-p), 2 kHz approx. square-wave voltage. To be used for probe compensation or to calibrate the vertical deflection AMPL. control.
LINE IN	Input socket for mains supply: 100 V...240 V(ac), 45 Hz...440 Hz or 127 V...370 V(dc).
ANALOG PLOT OUT	Output socket providing the plot signals Y PLOT, X PLOT and PENLIFT. Penlift can be defined in "APPL" application preselect (see chapter 7). Sensitivity PLOT X and PLOT Y: 100 mV/div Penlift: open collector



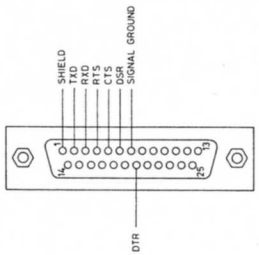
SOCKET	DESCRIPTION
Z-MOD	Input socket for Z-modulation of the CRT trace. The trace is blanked when this input is "high" (> +2,5 V). Input voltage range: 0 V... +12 V.

3.2.8.2 Optional

IEEE 488 BUS	Input/output connector to connect the oscilloscope to an IEEE 488/IEC 625 interface (24 pole micro-ribbon connector).



RS-232C BUS	Input/output connector to connect the oscilloscope to a RS-232 C/V 24 interface (25 pole male connector).



4 APPLICATIONS

4.1 USE AS AN ANALOG OSCILLOSCOPE

First ensure the oscilloscope is operating in the analog mode (DIGITAL MEMORY indication in LCD is off), otherwise press the DIGITAL MEMORY key.
By pressing the AUTO SET key, the oscilloscope will automatically set the main functions to a near optimal setting. Further adjustments and selections can then be made by operating the various keys and knobs.

To use the instrument as an analog oscilloscope three main functions need first to be defined:

- Vertical mode
- Horizontal mode
- Trigger mode

(These modes also exist when using the instrument as a digital storage oscilloscope, see Section 4.2.)

4.1.1. VERTICAL MODE

In vertical mode the following adjustments can be made:

- **Vertical display mode selection**
  by pressing the A/B key.

Select the channel you want to see A, B or A and B simultaneously. If the ADD function is in use, it is possible to switch off the channels A and B (see page 4.7).

- **Adjustment of the absolute zero level**
  by using the GND key and the Y POS rotary knob, the zero level can be positioned anywhere on the screen.

By pressing the GND key the input signal is interrupted and the input signal path is grounded. With the Y POS rotary knob the zero level can be adjusted to any level on the screen. By pressing the GND key once again the signal is once more connected to the input.

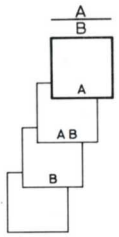
The zero level adjustment is neccesary for all DC measurements.

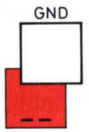
- **Channel coupling**
  by pressing the AC/DC key.

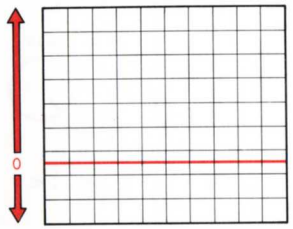
In AC position the DC component of the measuring signal is rejected.
In DC position the full bandwidth is available.

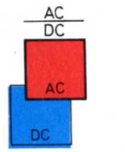
AC coupling is used when a small AC signal has to be measured that is superimposed on a large DC voltage.

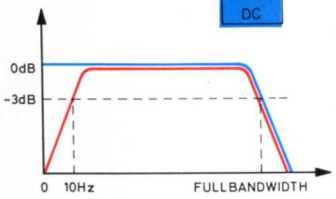
For example, noise measurements on power supply voltages.











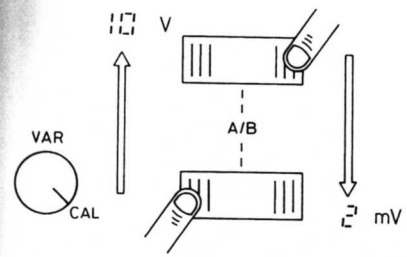
- **Vertical amplitude adjustment**
  by operating the V...mV UP-DOWN key for best setting.

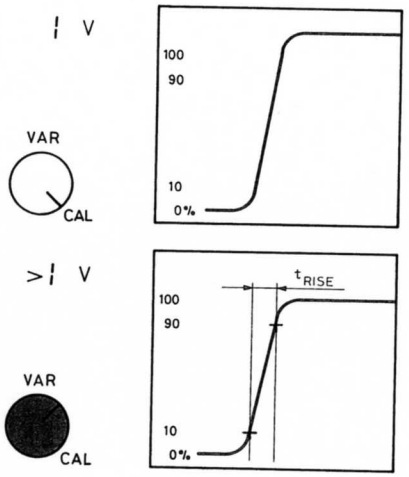
  The setting can be chosen out of a range from 2 mV up to 10 V per division in a fixed 1-2-5 sequence.

- Vertical variable attenuation
  by adjusting the VAR rotary knob.

The UNCAL position is used when the measurement is taken in percentages (UNCAL indication ">" flashes in the LCD). With the rotary knob the measured signal can be set to 100 %

For example rise-time measurements are made between 10 % and 90 % of a waveforms edge. If a measured square-wave signal has a peak-peak value of 6,2 divisions it can be attenuated to 5,0 divisions (=100%) by adjusting the VAR rotary knob. As 5 divisions is now 100 %, the 10 % and the 90 % levels and the time between these levels can easily be read from the screen.





- **Selection of ALTERNATED or CHOPPED display**
  by pressing the ALT/CHOP key

This selection is used if two signals are displayed.

In alternate mode, the CRT beam alternately traces one signal sweep and then the other. At low repetition rates this can be seen, so ALT is mainly used for high speed time-base settings (from around 0,1 ms/div and above).

In chop mode, the beam chops from one signal to the other at a fast switching frequency and is therefore suitable for low speed signals.
At high frequencies interference can occur between the switching signal and the measured signal, so take care when using the chop mode with high frequency signals.

- **Selection of ADD, NORMAL or INVERTED display**
  by pressing the ADD/INVERT key.

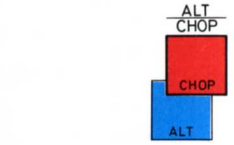
"INVERT" is active on channel B.

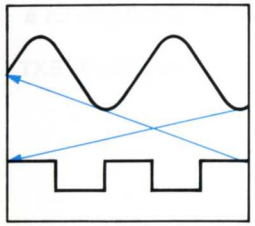
In the ADD mode, channel B is added to channel A (A + B).

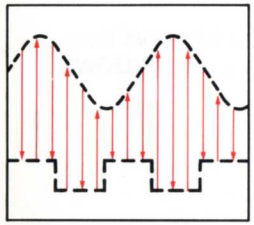
In the ADD INVERT mode, channel B is subtracted from channel A (A-B).

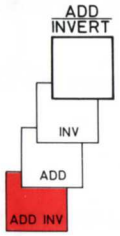
The differential mode (A-B) is useful for rejecting common-mode signals. By measuring in differential mode, the common-mode signal on one channel cancels out the common-mode signal on the other channel, leaving the actual signal visible on the display.

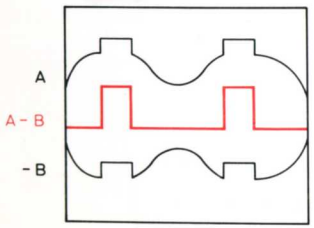
A practical application of the differential mode is to eliminate hum from a signal.











4.1.2. HORIZONTAL MODE

In horizontal mode the following selections can be made:

- **Selection of X deflection or horizontal time-base**
  by pressing the X DEFL key.

In the X deflection mode the oscilloscope shows one signal to be displayed as a function of another signal (X-Y graph).
The required X-axis signal is selected by the TRIG OR X SOURCE key (A, B, EXT or LINE).

The X-Y mode has a wide range of applications, for example:
- amplitude vs frequency of circuits and filters;
- output current vs input voltage of semiconductors;
- comparison of frequency or phase shift using Lissajous figures.

In horizontal time-base mode the display shows the measured signal vs time (Y-t graph). The time coefficient can be selected with the TB s...μs UP-DOWN key.

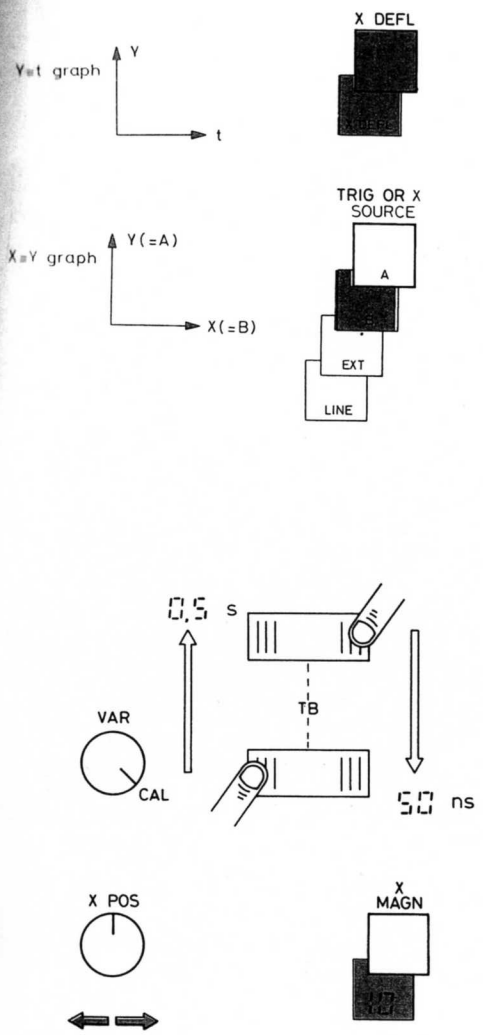
- **Selection of horizontal time scale**
  by using the TB s...μs UP-DOWN key,
  the VAR rotary knob, or
  the X MAGN key.

With the TB s...μs UP-DOWN key you can make a selection of the time-base speed in a 1-2-5 sequence.

With the rotary knob VAR you can make fine adjustments between the 1-2-5 steps.

With the X MAGN key you can expand the time-base 10 times.

By operating the X POS rotary knob the trace can be shifted across the screen in horizontal direction.



4.1.3. TRIGGER MODE

In trigger mode the following selections can be made:

- **Time-base trigger mode**
  by using the TB TRIG MODE key.

The time base can operate in three modes:

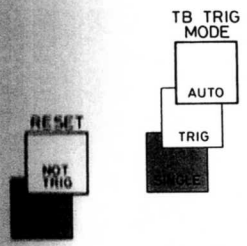
AUTO	the horizontal sweep normally starts when a trigger occurs. If no trigger is detected within 100 ms after the last sweep then a sweep start automatically occurs. This means a trace is always visible on the display.
TRIG	horizontal sweep will only start on a trigger pulse derived from the selected trigger source.
SINGLE	horizontal sweep runs only once after it is armed by the RESET key and the receipt of a trigger pulse derived from the selected trigger source.The mode is very useful to capture single events.

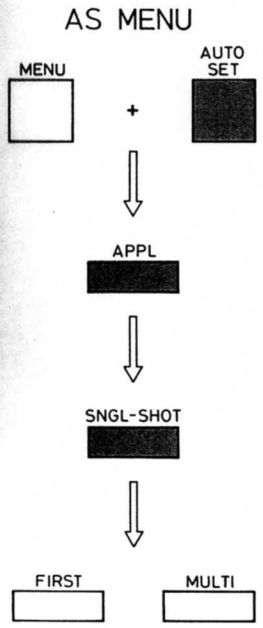
If the display mode is ALT (alternate), a special selection of single shot can be made in the application preselect menu (APPL),

- enter the APPL menu by pressing MENU and keep it pressed. Then press AUTO SET,
- select the CRT softkey APPL,
- select the CRT softkey SNGL_SHOT,
- select the CRT softkey FIRST or MULTI

FIRST =	single shot is always done on channel A (provided this channel is active).
MULTI =	single shot alternates between A, B and ADD (provided these functions are active).

Leave the application preselect menu again by pressing the AUTO SET key.
The chosen SNGL_SHOT setting remains selected after leaving the application preselect menu.





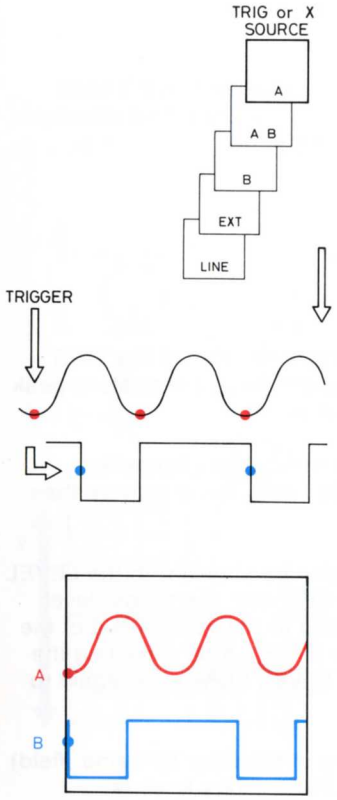
- **Trigger source selection**
  by pressing the TRIG OR X SOURCE key.

The trigger sources can be selected from:

A	channel A
A B	composite channel A and channel B
B	channel B
EXT	channel EXTERNAL
LINE	50 Hz or 60 Hz sine-wave derived from the line voltage.

In composite triggering (A B) the trigger source alternates between A and B, therefore this trigger mode is only possible in the alternated display mode. Notice that in this mode the displayed traces are NOT time related while the trigger pulses indicate different time moments. An example of composite triggering is shown on the next page.

Line triggering is used where signals have to be measured that are time related to the LINE frequency; e.g. measurements of hum.



- **Trigger level**
  by adjusting the TRIG LEVEL rotary knob.

For repetitive signals, a stable, jitter-free display will only be obtained if each time-base sweep is triggered at precisely the same point on the signal waveform. The trigger level is adjusted with the TRIG LEVEL rotary knob.

- **Trigger coupling**
  by the TRIG COUPL key.

Six modes can be selected for trigger coupling:

P-P — Peak-to-peak triggering gives automatic ranging of the TRIG LEVEL knob, the ranging being determined by the peak-to-peak value of the signal. DC signals are rejected.

DC — DC triggering; the full bandwidth of the trigger channel is available, while the level range of the rotary knob is more than ± 8 divisions.

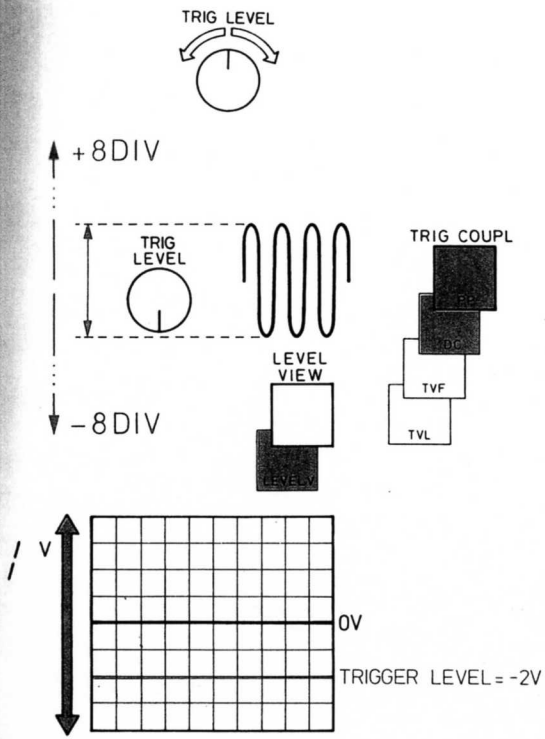
In this mode, the trigger level can also be shown with the LEVEL VIEW key. By pressing the LEVEL VIEW key, the trigger level will be shown as a DC voltage, related to the vertical mid of the oscilloscope screen (vertical mid = 0 volt). After adjusting the TRIG LEVEL rotary knob press the LEVEL VIEW knob again to return to the original screen.

TVF — TV frame triggering allows triggering at the slow TV frame (field) synchronisation pulses; the TRIG LEVEL rotary knob is inoperative.

TVL — TV line triggering allows triggering at the fast TV line synchronisation pulses; the TRIG LEVEL rotary knob is inoperative.

LF — In this mode the signal used for triggering is first passed through a low-pass filter with a cut-off frequency of 50 kHz. All components with high frequencies are rejected.

HF — In this mode the signal used for triggering is first passed through a high-pass filter with a cut-off frequency of 50 kHz. All components with low frequencies are rejected.



- **Trigger slope selection**
  by pressing the ⎍ key.

For triggering on a positive-going slope select ⎍, for triggering on a negative-going slope select ⎲.

If trigger coupling TVF or TFL is selected, LCD indicates + and - instead of ⎍ and ⎲.

+ = positive video,
– = negative video.

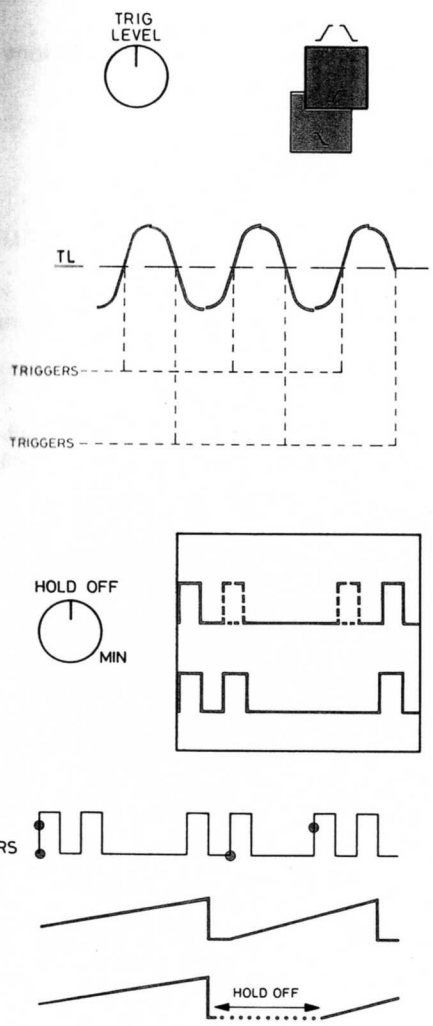
If horizontal mode X DEFL is selected, LCD indicates + and - instead of ⎍ and ⎲.

+ = signal not inverted,
– = signal inverted.

- **Hold-off time**
  by using the HOLD OFF rotary knob.

The HOLD OFF rotary knob is used to prevent "false" triggering and "double writing" when examining multiple pulse signals. After the horizontal sweep is completed triggering is inhibited for period of time set by the HOLD OFF knob. Adjustment of the HOLD OFF enables triggering to be synchronized on the same pulse in the pulse train and so gives a stable display.

For example, consider a double pulse repetitive input signal. The selected trigger signal sees the same condition on the second pulse as the first pulse, and so the time base sweep starts too soon. The double-writing effect is seen as an extended base-line on the upper trace.
Adjusting the hold-off time will inhibit the trigger unit until it sees the first pulse again.



4.2 USE AS A DIGITAL STORAGE OSCILLOSCOPE

To use the instrument as a digital storage oscilloscope three main functions should be defined:

- Vertical mode
- Horizontal mode
- Trigger mode

First ensure the oscilloscope is operating in the digital mode (DIGITAL MEMORY indication in LCD is on), if not then press the key DIGITAL MEMORY.

By pressing the AUTO SET key the oscilloscope will automatically set the main functions to the most convenient setting.

Further adjustments should be made by operating the keys. In DIGITAL MEMORY mode there are more functions available than in the analog mode. The use of the identical analog functions is described in Section 4.1 "Use as an Analog Oscilloscope".

The analog functions which are not available in DIGITAL MEMORY mode are: ADD, ALT/CHOP, X DEFL, COMP TRIG, X VAR.

In this section only the DIGITAL functions are described.

4.2.1. VERTICAL MODE

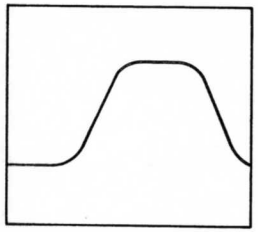
In vertical mode the following additional choices can be made:

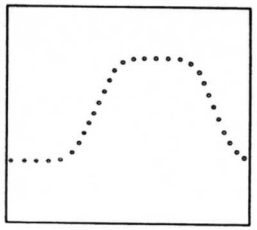
- **Dotted or joined display**
  by pressing the DOTS key.

In digital memory mode the traces are built-up by "dots" of samples. Selection of "dotted" or interpolated (dotjoined) display can be made.

In dotjoined mode the dots are interconnected by a line, so the display appears continuous.

In dotted mode every dot is displayed separately. The vertical resolution is 256 dot positions over 10 divisions, the horizontal display resolution is 1000 dot positions over 10 divisions when the expansion factor is x1.





- **Loading of register memory**
  by pressing the register LOAD key.

The oscilloscope has two types of memory:

- a display memory, which you see in normal operation,
- three register memories, which are used to store reference waveforms.

If you want to store a waveform in a register, first select destination register R1 or R2 or R3. This is done by operating the softkeys MEMORY and REGISTERS (see Section 4.3). When one of these registers is chosen, you only have to press the LOAD key to store the signal into this register. Provided the oscilloscope is equipped with a battery back-up, the waveforms in all registers are still stored after power down for recall at the next power up.

- **Display of register memory**
  by pressing the DISPLay key.

Pressing the DISPLay key once will show the contents of the display memory and the selected register memory (R1 or R2 or R3) together on the screen. Now the two signals can be compared with each other.

Pressing the DISPLay key a second time will show only the contents of the selected register memory (R1 or R2 or R3).

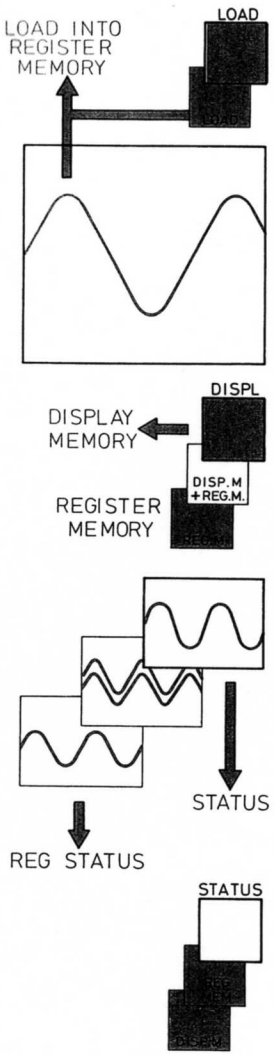
Pressing the DISPLay key a third time will result in displaying the contents of the display memory again.

NOTE Only one of the register memories can be displayed at the same time (with the display memory).

- **Status of register memory**
  by pressing the STATUS key.

Pressing the STATUS key once enables the LCD to show the full settings of the selected register memory (R1 or R2 or R3).

Pressing the STATUS key twice within one second, the LCD will show the complete settings of the display memory.



4.2.2. HORIZONTAL MODE

In horizontal mode the following selections can be made:

- **Selection of horizontal time scale**
  by the TB s...μs UP-DOWN key,
  the X MAGN key.

The adjacent figure shows the time-base ranges in relation to the sample rate and resolution. Only in SAMPLING mode repetitive signals are needed (see also page 4.26).

The digital time-base has three modes:

ROLL
50 s/div ... 1 s/div (PM3350A/55/65A/75)

In ROLL mode the screen build-up is from right to left.

RECURRENT
0,5 s/div ... 0,5 μs/div (PM3350A/65A)
0,5 s/div ... 0,2 μs/div (PM3355/75)
In RECURRENT mode the screen build-up is from left to right.

SAMPLING
0,2 μs/div ... 20 ns/div (PM3365A)
0,1 μs/div ... 20 ns/div (PM3375)

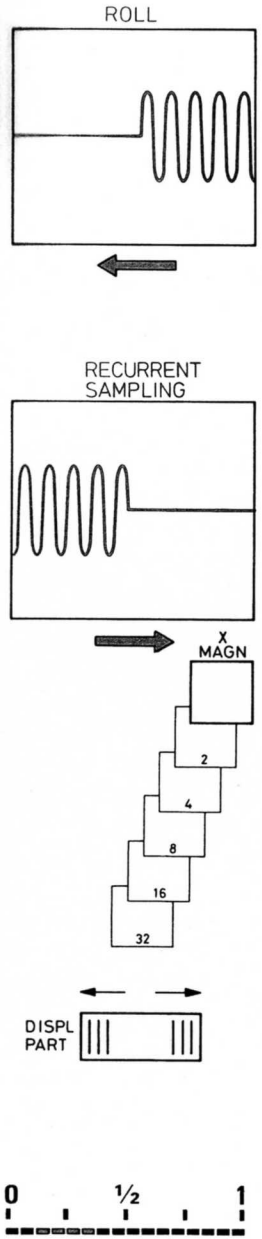
In SAMPLING mode repetitive signals are needed for a screen build-up from left to right.

NOTE The PM3350A/55 have no sampling mode !

By pressing the X MAGN key, a horizontal magnification of 2, 4, 8, 16, or 32 times can be obtained. Any part of interest in a magnified signal may be selected for display by the DISPL PART UP-DOWN key.

By operating the DISPL PART UP-DOWN key, the displayed waveform will scroll across the screen in the selected direction.

The LCD bar shows the actual position of the displayed part of the magnified signal in relationship to the memory length.



In the following part the already mentioned time-base modes will be explained:

ROLL MODE

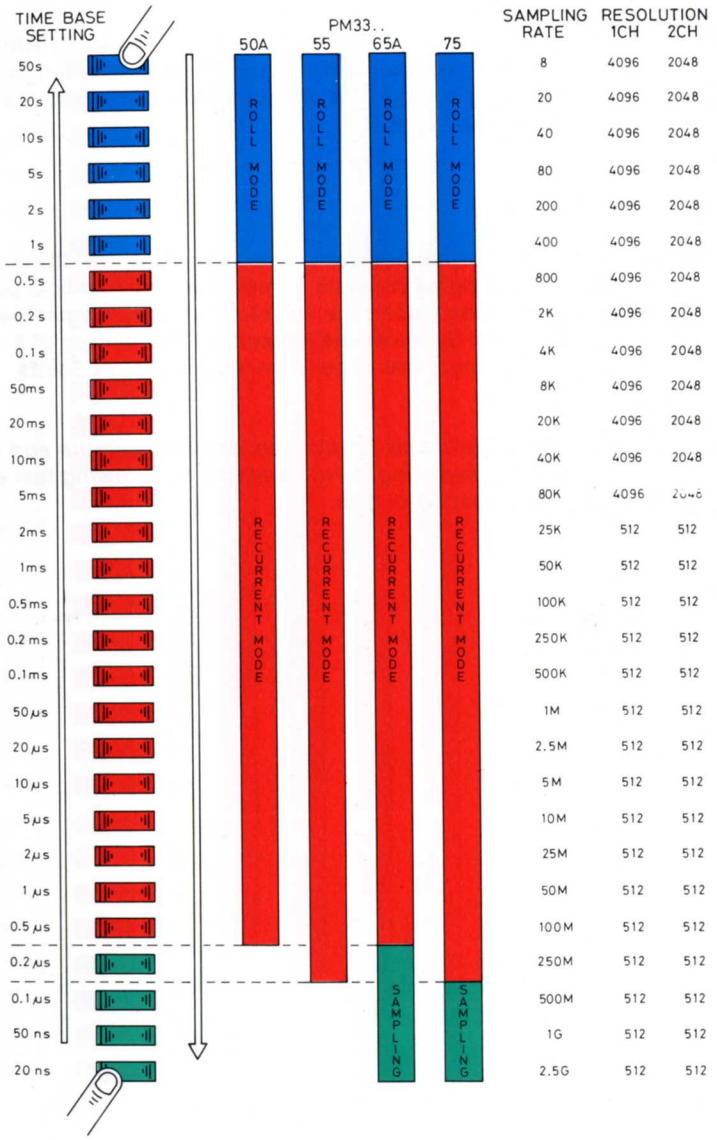
Lower frequency signals, such as reference voltage drift in an amplifier over periods of several hours, can now be captured and stored in the memory. The signal is built up point-by-point at the right-hand side of the screen and moves to the left. The ROLL segment on the LCD indicates that the ROLL mode is operative.
The ROLL mode is usually started with the release of the RESET knob, but is also started when changing the triggering or amplitude control.

The TRIGGER DELAY defines the amount of the stored signal in the memory before and after the trigger. As an example: In case a trigger delay of 0 is selected, the ROLL mode stops when the startpoint of the acquisition has reached the far left vertical graticule line (the extreme left of the CRT). Exactly one screen is filled this way. If a TRIGGER DELAY of -3 is selected, the ROLL mode stops when the startpoint of the acquisition has reached the fourth graticule line (related to the left of the CRT).

The following TRIGGER MODE conditions can be applied, selectable with the TB TRIG MODE button:

- AUTO — The stop condition of the ROLL mode in auto trigger is not the trigger level crossing point, but that point in time where the ROLL mode was first activated.
- TRIG — The stop condition is now defined by the actual trigger point, so trigger source, trigger coupling, slope and level become valid. After receiving the trigger pulse, the acquisition is then copied to the display memory.
- SINGLE — In this case the single shot acts identical to the TRIGger mode.
- MULTI — The principle of operation is also identical to the TRIGger mode. The first acquisition is copied to the selected register memory (R1 or R2 or R3), the second acquisition is copied to the display memory (R0), see also page 4-30. This mode is not selectable if one of the PROCESS functions (ENVELOPE or AVERAGE) is active (see page 4.40).

ATTENTION: Take note that the lower transition point of the bandwidth for TRIGger COUPLing P-P is limited to 20 Hz. So the peak-to-peak is not applicable for the ROLL mode. The trigger coupling should be set to DC.



SAMPLING RATE	RESOLUTION 1CH	2CH
8	4096	2048
20	4096	2048
40	4096	2048
80	4096	2048
200	4096	2048
400	4096	2048
800	4096	2048
2K	4096	2048
4K	4096	2048
8K	4096	2048
20K	4096	2048
40K	4096	2048
80K	4096	2048
25K	512	512
50K	512	512
100K	512	512
250K	512	512
500K	512	512
1M	512	512
2.5M	512	512
5M	512	512
10M	512	512
25M	512	512
50M	512	512
100M	512	512
250M	512	512
500M	512	512
1G	512	512
2.5G	512	512

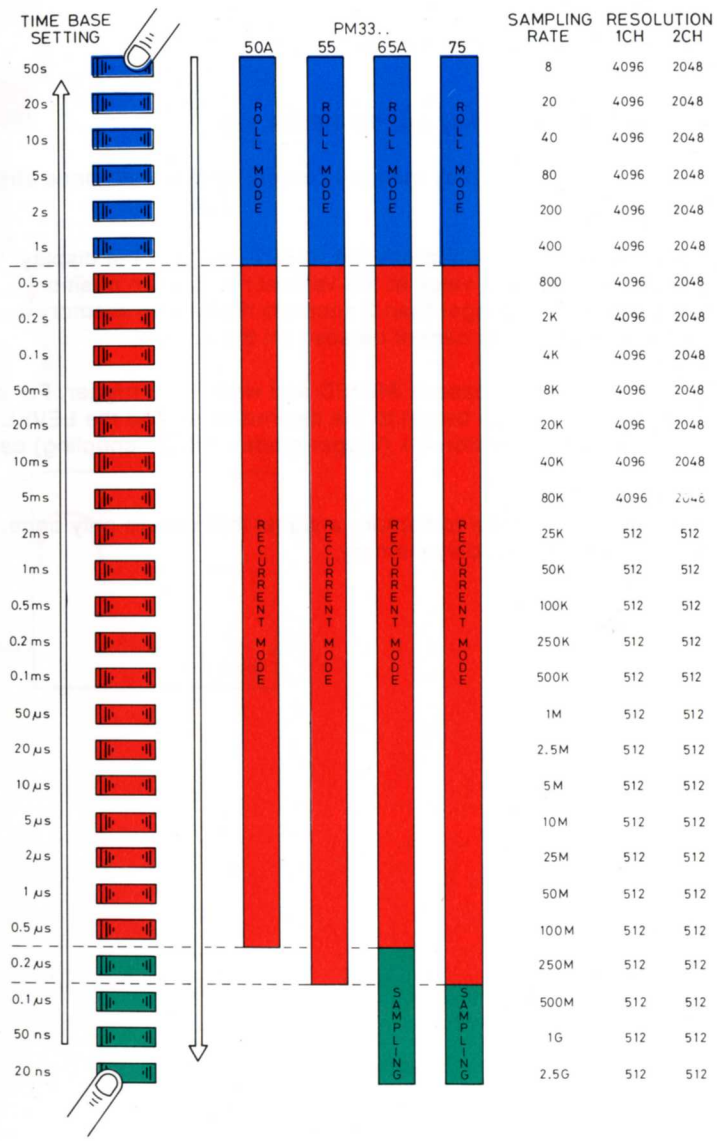
RECURRENT MODE

Signals with intermediate frequencies can be made visible in the RECURRENT mode. In this mode the signal is sampled at fixed time intervals, the length of which depends on the time-base setting. The sampled values are written in the display memory and displayed on screen.

SAMPLING (PM3365A/75 only)

Higher frequency signals can now be captured up to the full bandwidth of the oscilloscope, provided that the signal consists of repetitive and identical pulses. With sequential sampling, one point along the waveform is sampled per sweep until enough points are acquired by the display memory. The number of sweeps needed to capture a signal will therefore depend on the number of points required to fill the memory.

ATTENTION: Because of the fixed time relationship between sample and trigger point, sequential sampling is NOT suitable for showing fast edges of short widely-spaced pulses.



4.2.3. TRIGGER MODE

In DIGITAL trigger mode the following extra functions are available:

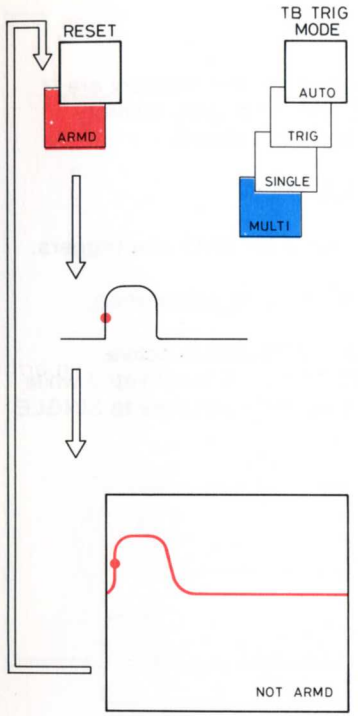
- **SINGLE SHOT**
  by pressing the TB TRIG MODE key and the RESET key.

In DIGITAL MEMORY mode the display memory content is refreshed once after a suitable trigger is received.

To clear the display memory contents press the RESET key, and the display memory contents are then set to a value at the vertical mid screen position. If the RESET key is pressed for longer than 2 seconds the display memory contents are set to the value 0 and cannot be seen on the screen.

After a RESET operation the time-base is ARMED and waits for a trigger. For a good trigger, the trigger level must be set to the desired value and the LEVEL VIEW function as described in Section 4.1 (trigger mode - trigger coupling) can be of help.

The single-shot mode is very useful to capture a signal that occurs only once. The signal is then stored in the display memory.



- **MULTIPLE SHOT**
  by pressing the TB TRIG MODE key and the RESET key.

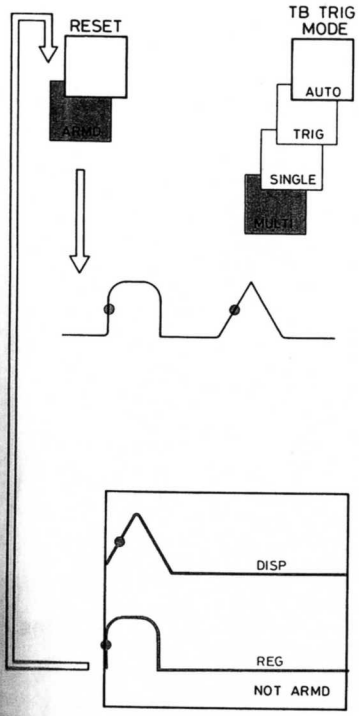
In DIGITAL MEMORY mode the contents of the selected register memory are refreshed ONCE after the FIRST trigger is received, and the display memory contents are refreshed ONCE after the SECOND trigger is received.

To CLEAR the contents of the memories , see SINGLE SHOT.

After a reset operation the time base is ARMED and waits for TWO new triggers.

NOTE: In this mode the content of the register memory is overwritten.

When one of the PROCESS functions (ENVELOPE or AVERAGE) is active, MULTIPLE SHOT mode is not available. If a PROCESS function is activated while in the MULTIPLE SHOT mode, the oscilloscope automatically switches to SINGLE SHOT mode.



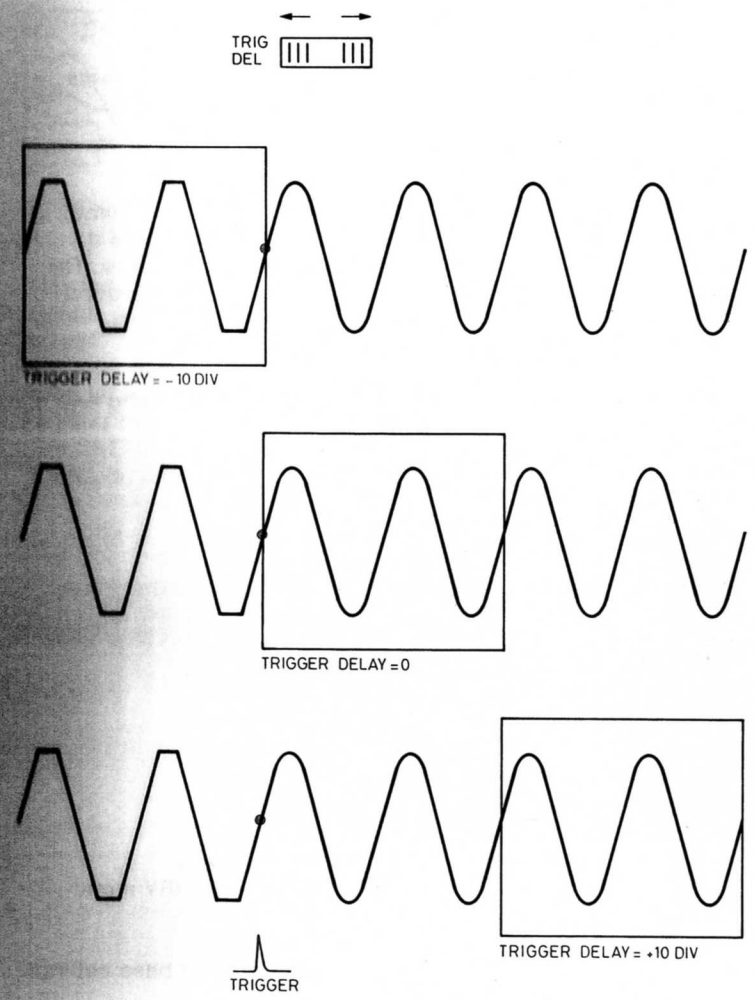
- **TRIGGER DELAY SETTING**
  by pressing the TRIG DEL UP-DOWN key.

The TRIGger DELay setting offers PRE- and POST triggering.

In PRE triggering you can look BEFORE the trigger point. For example, if trigger delay = -10 divisions, the trigger point is at the far RIGHT vertical graticule line. What you see is then the signal BEFORE the trigger point.
This mode enables observation of events leading up to the trigger; e.g. to pin-point the cause of a problem, for instance, a mains (line) transient.
The PM3350A/55/65A/75 all have a maximum PRE triggering of 10 divisions (max. TRIG DEL = -10 div.).

In trigger delay = 0 divisions the trigger point is at the LEFT vertical graticule line.

In POST triggering you can look AFTER the trigger point. For example, if trigger delay = +10 divisions, the trigger point is one full screen LEFT of the screen that you see.
This mode effectively stretches the memory capacity and is for example very useful when measuring a certain line in a TV pattern.
The PM3350A/65A have the disposal of a POST triggering of max. 2500 divisions (max. TRIG DEL = + 2500 div.). With the PM3355/75 the maximum POST triggering is 5000 divisions (max. TRIG DEL = + 5000 div.).



4.3 MENUS AND MEASUREMENTS

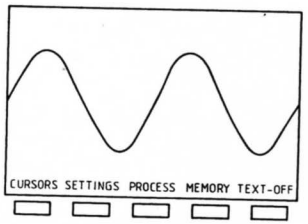
NOTE: The menus that are described here and the cursor measurements performed in this section are only available in DIGITAL MODE.

4.3.1 EXPLANATION OF MENU-STRUCTURES

The following text explains the function of each menu within the softkey menu structure. The softkey function RETURN can be found in many menus and if activated it will result in a return to the previous level in the menu structure. The CRT screen contains two areas for text, the top text area shows all calculation information and channel settings, the bottom text area shows all functions selections assigned to the five softkeys.

When in DIGITAL mode, the text on the CRT can be activated by pressing one of the five softkeys that are positioned under the CRT

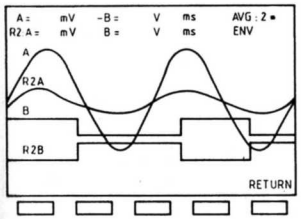
MAIN MENU



This menu is mainly used to activate the extensive CURSORS menu (see page 4-36), the PROCESS menu (see page 4-40) or the MEMORY menu (see page 4-43). Other possible selections are:

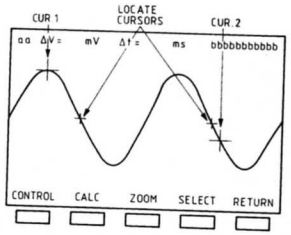
- SETTINGS. When active, this menu displays the vertical and time base settings relating to the displayed traces.

- TEXT-OFF. When this key is pressed, all text disappears from the screen. The text is placed on the screen again by pressing one of the five softkeys.



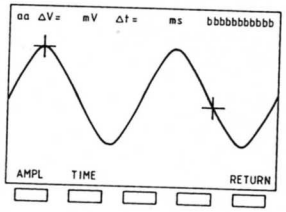
This menu shows all vertical and horizontal setting information of the active signals and the stored and displayed signals in the top text area of the CRT screen. The traces are marked A and B (for channel A and B in display memory), R1A and R1B (for channel A and B in register memory 1), R2A and R2B (for channel A and B in register memory 2) and R3A and R3B (for cannel A and B in register memory 3).
The SETTINGS menu can be very useful for making a hardcopy (photographs, printouts, plot-outs) of the screen traces, including the settings.

CURSOR menu



Once activated two cross-shaped MAIN CURSORS are positioned on the waveform. The trace on which the CURSORS operate can be selected in the SELECT menu. Via the CONTROL menu the two MAIN CURSORS can be separately positioned horizontally on the waveform. Positioning to the left and to the right is possible. CURsor 1 and CURsor 2 can not pass each other to avoid erroneous negative time. Depending on previous measurement selections either a horizontal dotted line or two so-called LOCATE cursors may also be visible. The dotted line serves as a ground reference point for certain AMPlitude measurements. The small LOCATE cursors are placed on the waveform inbetween the MAIN cursors. Their position is used to indicate exactly where on the waveform the selected automatic measurement is being calculated. The result of the cursor measurements are shown on the top text line.

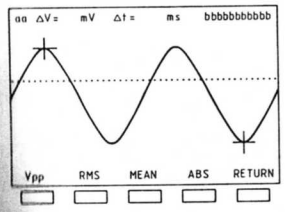
CALCULATE menu



A pre-selection of either AMPLitude or TIME measurements is made via this menu. The following explanation gives details of each measurement possibility.

CALCULATE-AMPLITUDE menu

This menu is entered from the CALCULATE menu by pressing the AMP-softkey

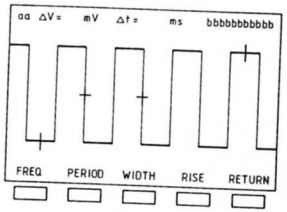


The following selections can be made:

- Vpp calculates the peak to peak value of the signal part between the MAIN CURSORS. The LOCATE CURSORS indicate the signal top and bottom the calculation is related. The calculation result is displayed in the right corner of the top text area of the CRT.
- RMS calculates the Root Mean Square value of the waveform between the MAIN cursors. This value is referenced to the dotted ground line. This line can be vertically positioned by grounding (GND key) the relevant channel and then adjusting (Y POS) the line to the desired vertical position. The calculation will start again when the GND is released.
- MEAN calculates the mean value of the waveform between the MAIN cursors. This value is referenced to the dotted ground line. This line can be positioned in the screen as explained under the RMS mode.
- ABSolute calculates the vertical voltage differences between the dotted ground line and MAIN Cursor 1 (C1 value) and MAIN Cursor 2 (C2 value). The results are displayed in the top text area of the CRT. The reference line can be positioned across the screen as explained under the RMS mode.

CALCULATE-TIME menu

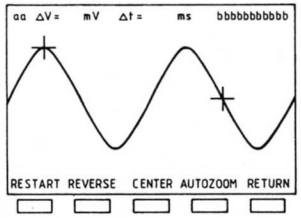
This menu is entered from the CALCULATE menu by pressing the TIME-softkey.



The following selections can be made:

- FREQuency calculates the signal frequency (indicated on the CRT with "f") provided that at least one signal period is present between the MAIN cursors. Only one cycle is used in the calculation, this is the nearest to the left cursor. The LOCATE cursors indicate the signal period over which the calculation is made.
- PERIOD calculates the duration of one signal period ("T") provided that at least one signal period is present between the MAIN cursors. Only one cycle is used in the calculation, this is the nearest to the left cursor. The LOCATE cursors indicate the signal period over which the calculation is made.
- WIDTH calculates the width of the first pulse ("t_w") seen from the left cursor provided that there is at least one pulse present between the MAIN cursors. The LOCATE cursors indicate the signal part over which the calculation is made. The pulse may be negative- or positive-going.
- RISE calculates the rise- or fall-time ("t_r") of the first signal slope seen from the left cursor provided that there is at least one slope between the MAIN cursors. The 100% level is taken to be the vertical value between the MAIN cursors. The LOCATE cursors indicate the part of the slope over which the calculation is made. The rise time is automatically calculated between the 10% and 90% level of the dV-amplitude or to the nearest sample to these points.

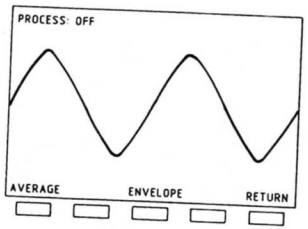
ZOOM menu



This menu is used to magnify a part of the signal while the sample resolution stays unchanged. This is only possible if the instrument is out of the LOCK mode because a new signal acquisition is necessary with adapted time-base and TRIG DELay setting. The possible softkey selections are:

- RESTART expands the part of the waveform between the MAIN cursors. This part can then be examined in more detail.
- REVERSE resets the instrument to the situation immediately before the RESTART command and then resamples the signal. This function is only available after use of the RESTART function.
- CENTER replaces the MAIN cursors horizontally to +2 div and -2 div of the screen centre after which the RESTART can be used again.
- AUTOZOOM accesses the menu where the cursors can be shifted both to the left, away from each other, towards each other or both to the right. When shifting the cursors an automatic RESTART is made when the time between the cursors is suitable for another time-base and/or TRIG DEL setting to be used.

PROCESS MENU



This menu is an intermediate menu to define which of the two processes, AVERAGE or ENVELOPE, is activated. The two processes can never be active at the same time !

De-activating a selected function can be done by:

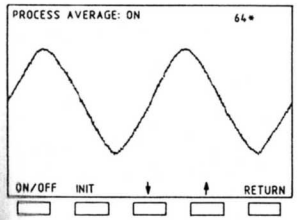
- switching-off the process in the sub-menu,
- switching-on the other process,
- performing an AUTOSET or SOFTSTART,
- switching-off and on the instrument.

The choosen AVERAGE or ENVELOPE function remains selected when leaving the PROCESS menu .

The functions AVERAGE and ENVELOPE are temporarely switched-off in the ROLL mode (for TIME/DIV positions slower than 0,5 s/div). This will be indicated by a message on the screen (see pages 4-41 and 4-42).

The ENVELOPE function is switched-off in case of re-definition of the reference register. This will be indicated by a message on the screen (see page 4-41).

PROCESS AVERAGE menu



With this function you can suppress noise without loosing bandwidth. Every dot is calculated after every sweep in the following way:

$$new = previous + \frac{measured - previous}{C}$$

In this formula "previous" is a sample on the same position of the previous sweep. "C" is the average-factor; the bigger C is, the slower the dot positions change. The following values for C can be selected: 2, 4, 8, 16, 32, 64, 128 or 256.

Once activated, AVERAGE is a continuous process until it is switched off. The process is started again when the INIT softkey is pressed or when the triggering or amplitude control is changed. In this case the display memory is cleared.

In SINGLE SHOT trigger mode the number of acquisitions is equal to the average factor C, in MULTIPLE SHOT trigger mode this number is twice.

In ROLL mode, AVERAGE is temporarely switched-off. This is indicated by the message:

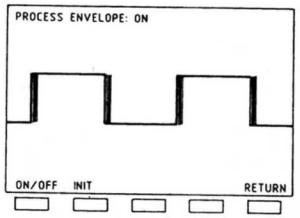
AVERAGE suspended because of ROLL mode

During AUTOZOOM, AVERAGE is also temporarely switched-off. This is then indicated by the message:

AVERAGE suspended because of AUTOZOOM

Activating or re-activating of the AVERAGE process can be done by using the ON/OFF softkey.

PROCESS ENVELOPE menu



This function stores alternating the minimum and the maximum of each sample position over the sweeps taken. The ENVELOPE is stored in the reference register (R1, R2 or R3) and default displayed together with the acquired signal (display memory R0).

Once activated, this is a continuous process until it is switched-off. The ENVELOPE process is started again when the INIT softkey is pressed or when the triggering or amplitude control is changed. In this case the display memory is cleared.

In ROLL mode, ENVELOPE is temporarely switched-off. This is indicated by the message:

ENVELOPE suspended because of ROLL mode

During AUTOZOOM, ENVELOPE is also temporarely switched-off. This is then indicated by the message:

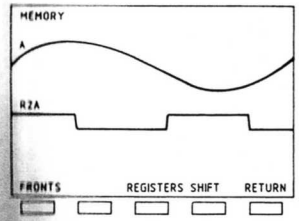
ENVELOPE suspended because of AUTOZOOM

Activating or re-activating of the ENVELOPE process can be done by using the ON/OFF softkey.

Redefining the reference register will stop the ENVELOPE process. This is indicated by the message:

ENVELOPE deactivated

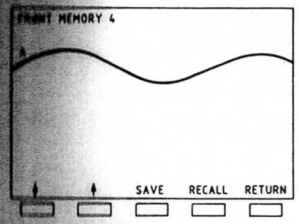
MEMORY menu



This menu is an intermediate menu, used to choose between the FRONTS menu, REGISTERS menu and SHIFT menu.

With the FRONTS menu it is possible to store up to 63 different settings of the front panel keys in the oscilloscope memory.
In the REGISTERS menu it is possible to choose between R1 or R2 or R3 for the active register memory, upon which operations can be performed.
The traces on the screen can be shifted with the SHIFT menu.

FRONTS menu

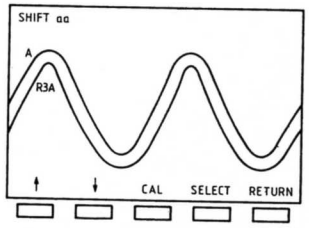


With this menu it is possible to store up to 63 (1 ... 63) different front panel key settings. When the oscilloscope is controlled via the optional IEEE-488 or RS-232C interface, 64 (0 ... 63) different front key settings can be stored (see Communication Interface Manual). The front panel key settings are still stored in the oscilloscope memory after power down for recall at the next power up (if backup batteries are fitted). One of the FRONT MEMORIES can be selected with the up-down softkeys. The actual front panel key setting can be stored in the selected FRONT MEMORY by pressing the SAVE softkey. If the selected FRONT MEMORY already contains a front panel key setting, this can be activated by pressing the RECALL softkey.

REGISTERS menu

In this menu one of the register memories R1 or R2 or R3 can be selected as the REFERENCE REGISTER MEMORY upon which operations can be performed. This can be done by pressing one of the softkeys R1, R2 or R3.

SHIFT menu



In this menu a displayed trace can be positioned UPwards or DOWNwards on the screen. If CAL is pressed the trace returns to its original position. The SELECT menu permits selection of the trace to be positioned. This menu is only active if more than one trace is visible on the screen. Correct positioning of trace A and B is only possible in LOCK mode, as this is a post acquisition facility. This can be useful for overlaying single shot signals where the normal position controls can not be used.

In the following sections will be described how to perform various measurements using the cursors (section 4.3.2) and the PROCESS functions (section 4.3.3).

4.3.2 PERFORMING AMPLITUDE MEASUREMENTS

NOTE : In the following sections the MAIN cursors are always printed in BLUE, the LOCATE cursors in RED

Vpp **Peak-to-peak voltage**

The Vpp amplitude measurement is calculated over the signal lying between the MAIN CURSORS. It is necessary to set the main cursors on the wanted trace, using the CURSOR-SELECT menu and on the required part of the signal, using the CURSOR-CONTROL menu.

By activating the Vpp calculation function, the oscilloscope will automatically measure the peak-to-peak voltage, and will show the measuring points by two small LOCATE CURSORS.

The measuring result is shown in the top text area. If the VAR rotary knob of the channel is in CAL position, the result will be displayed in Volts. If the VAR rotary knob is in UNCAL position, the result will be displayed in Divisions:

Vpp = ... mV, or Vpp = ... DIV

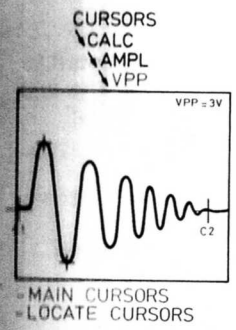
ABS **Absolute**

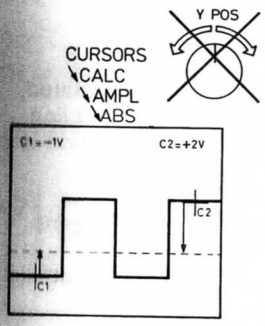
The ABS amplitude measurement will be calculated from the MAIN CURSORS related to the absolute zero level. This zero level is indicated as a horizontal dotted line and is related to the grounded Y position. The correct way to use this function is:

- activate the ABS function,
- ground the trace and adjust the zero level anywhere on the screen, by means of the Y POS rotary knob.
- press the GND key once again (the signal is now connected to the channel). **Do not** re-adjust the Y POS rotary knob anymore.

The measuring result is shown in the top text area. If the VAR rotary knob of the channel is in CAL position, the result will be displayed in Volts. If the VAR rotary knob is in UNCAL position, the result will be displayed in Divisions:

ABS: C1 = ... mV, C2 = ... mV, or C1 = .. DIV, C2 = .. DIV





RMS **Root mean square voltage**

The RMS measurement is calculated between the MAIN CURSORS and related to the absolute zero level. This zero level is indicated as a horizontal dotted line and is related to the grounded Y position. The correct way to use this function is:

- activate the RMS function,
- ground the trace and adjust the zero level anywhere on the screen by means of the Y POS rotary knob,
- press the GND key once again (the signal is now connected to the channel). **Do not** re-adjust the Y POS rotary knob anymore.

The measuring result is shown in the top text area.

If the VAR rotary knob of the channel is in CAL position, the result will be displayed in Volts. If the VAR rotary knob is in UNCAL position, the result will be displayed in Divisions:

RMS = ... mV, or RMS = ... DIV

MEAN **Mean voltage**

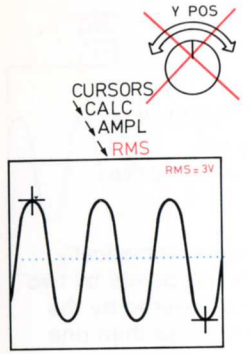
The MEAN measurement is calculated between the MAIN CURSORS and related to the absolute zero level. This zero level is indicated as a horizontal dotted line and is related to the grounded Y position. The correct way to use this function is:

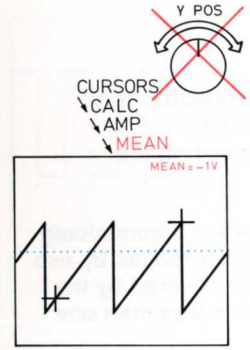
- activate the MEAN function,
- ground the trace and adjust the zero level anywhere on the screen by means of the Y POS rotary knob,
- press the GND key once again (the signal is now connected to the channel). **Do not** re-adjust the Y POS rotary knob anymore.

The measuring result is shown in the top text area.

If the VAR rotary knob of the channel is in CAL position, the result will be displayed in Volts. If the VAR rotary knob is in UNCAL position, the result will be displayed in Divisions:

MEAN = ... mV, or MEAN = ... DIV





4.3.3 PERFORMING TIME MEASUREMENTS

FREQ **Frequency**

The FREQ measurement is calculated between the MAIN CURSORS. It is necessary to set the main cursors on the wanted trace, using the CURSOR-SELECT menu, and on the required part of the signal using the CURSOR-CONTROL menu (see also Section 3.2.7).

By activating the FREQ calculation function the oscilloscope will automatically measure the period time of the signal and will show the measuring points by two small LOCATE CURSORS. Minimal one signal period should be covered by the MAIN CURSORS. If the distance between the MAIN CURSORS is less then one signal period, an error message is given.

The measuring result is shown in the right corner of the top text area.

FREQ : f = ... kHz

PERIOD **Period**

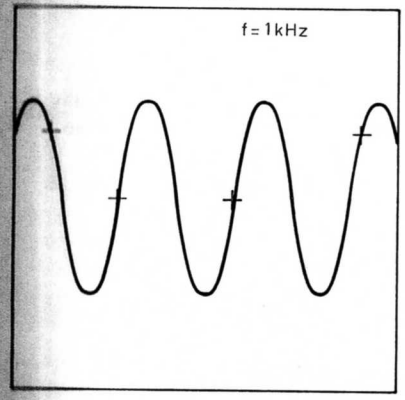
The PERIOD measurement is calculated between the MAIN CURSORS. It is necessary to set the main cursors on the wanted trace, using the CURSOR-SELECT menu, and on the required part of the signal using the CURSOR-CONTROL menu (see also Section 3.2.7).

By activating the PERIOD calculation function the oscilloscope will automatically measure the period time of the signal and will show the measuring points by two small LOCATE CURSORS. Minimal one signal period should be covered by the MAIN CURSORS. If the distance between the MAIN CURSORS is less then one signal period, an error message is displayed.

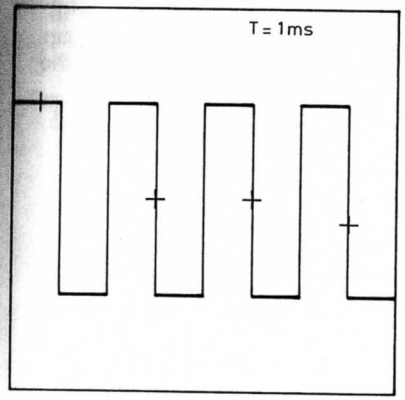
The measuring result is shown in the top text area.

PERIOD : T = ... s

CURSORS
↘ CALC
↘ TIME
↘ FREQ



CURSORS
↘ CALC
↘ TIME
↘ PERIOD



WIDTH **Pulse width**

The WIDTH measurement is calculated between the MAIN CURSORS. It is necessary to set the main cursors on the wanted trace, using the CURSOR-SELECT menu, and on the required part of the signal using the CURSOR-CONTROL menu (see also Section 3.2.7).

By activating the WIDTH calculation function the oscilloscope will automatically measure the pulse width of the first pulse seen from the left cursor. The pulse width is determined on the half peak-to-peak amplitude between the MAIN CURSORS. There must be at least one upgoing edge and one downgoing edge between the two MAIN CURSORS, otherwise an error message is given.
The measuring result is shown in the right corner of the top text area.

WIDTH : t_W = ... s

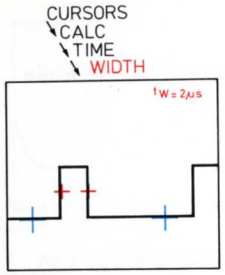
RISE **Rise-time**

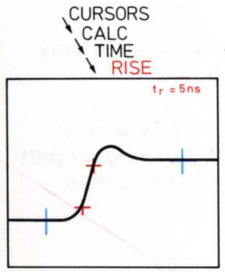
The RISE (or FALL) measurement is calculated between the MAIN CURSORS. It is necessary to set the main cursors on the wanted trace, using the CURSOR-SELECT menu, and on the required part of the signal using the CURSOR-CONTROL menu.

By activating the RISE calculation function, the oscilloscope will automatically measure the rise-time (or the fall-time, if the first signal edge is negative-going) of the first signal edge seen from the left cursor. The rise-time is determined on the nearest sample to the 10 % and the 90 % level of the amplitude between the MAIN CURSORS.

The measuring result is shown in the right corner of the top text area.

RISE : t_r = ... ns





4.3.4 ZOOM AND AUTO ZOOM FUNCTIONS

The ZOOM and AUTO ZOOM functions are used to magnify a part of signal while retaining full sample resolution over the selected part.

ZOOM

If part of the signal needs to be examined in more detail the ZOOM function can be used. The main cursors can be set on the wanted trace and on the signal part of interest, using the CURSOR SELECT menu and the CURSOR CONTROL menu.

Then by entering the ZOOM menu and activating the RESTART function, if within the limits of time base and delay range, a new acquisition will be made in the adapted time base setting and delay time. This means that the the selected part is resampled using full memory and at a higher sample rate and so higher resolution is used only on the part of interest.

The REVERSE function resamples at the previous settings (This function is only active after use of the RESTART function).

The CENTER function sets the MAIN CURSORS horizontally to +2 DIV and -2 DIV from the screen centre. This helps to continuously zoom in on the signal part of interest without having to return to the CURSOR CONTROL menu and then back to the ZOOM menu.

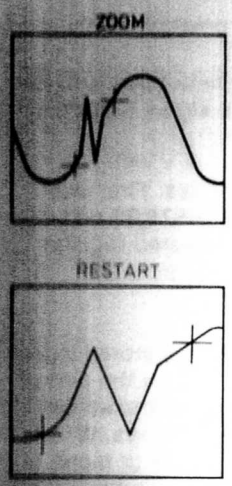
After CENTERing the MAIN CURSORS, a new RESTART can be made.

The limitations for the ZOOM function are given as error messages on the screen. The three possible error messages are:

NO RESTART, timebase limit reached
NO RESTART, trigger delay limit reached
NO RESTART, Δt between cursors too big

The ZOOM mode is not active if the signal memory is locked. When locked, the following error message is shown on the screen:

WARNING, oscilloscope is in lock mode

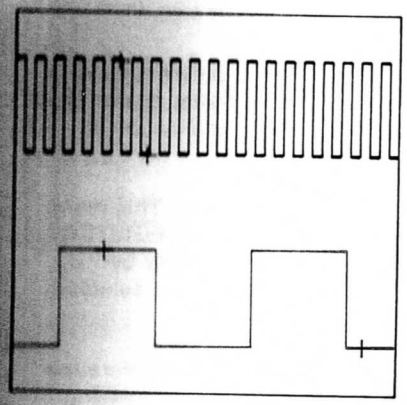


AUTO ZOOM

In this mode it is possible to simulate the operation of a delay time-base function by displaying a main time-base signal and a delayed time-base signal together on the screen.

The main time-base signal is stored in one of the register memories. First select one of the register memories by pressing the MEMORY and REGISTERS softkeys (see page 4-44). Now load the signal to be examined into the selected register memory and display this on the screen. Move the live signal away from the stored signal by use of the channel position control.

When AUTO ZOOM is activated, the MAIN CURSORS are set on the stored signal and the LOCATE CURSORS on the live signal. These cursors indicate the part of the signal that is displayed in more detail and can be shifted across the screen or the time-base can be expanded up or down by means of the softkeys. When the distance between the LOCATE CURSORS is less than 3 divisions or more than 9 divisions, then the time-base is automatically set to a more suitable setting (if possible). The result is that the live signal shows the adapted situation. This mode is not active if the signal memory is locked.

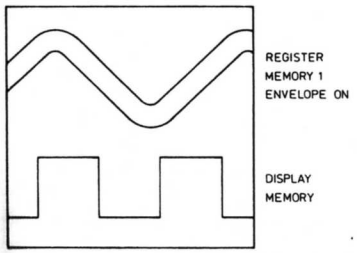


4.3.5 WAVEFORM COMPARISON

The register memories R1, R2 and R3 make it possible to store different waveforms in the oscilloscope memory. These signals remain stored after power down and can be displayed on screen whenever needed. A possible application is signal comparison.

First select one of the register memories with the REGISTERS menu. This menu is entered by pressing the MEMORY softkey and then pressing the REGISTERS softkey. Now load a reference signal into the selected register memory by pressing the LOAD key. In this way all three register memories can be selected and filled with reference signals.

Now a measured signal (R0) can be compared with one of the stored reference signals by displaying the signals on screen simultaneously. Signal processing functions (PROCESS menu) can be used on the live signal. The stored signals can be moved on the screen by using the SHIFT function.



5 PLOTTING AND PRINTING

5.1 INTRODUCTION

The oscilloscope has facilities to make a hard copy of the information on the CRT via a plotter or a printer. The plot out can consist of the recorded waveform(s), the belonging oscilloscope settings, the trace identification, cursors, results of measurements and a measuring graticule. Different options exist depending upon the version of the oscilloscope (indicated on type plate on rear panel).

- The standard or /00 version of the oscilloscope has no interface options installed. Consequently the plot out facilities are limited to analog plot out via an analog XY plotter.
- Version /40 has an IEEE-488 option installed. Plot out via a number of digital XY plotters (compatible with HPGL and PHILIPS GL) and via Epson FX-80 and compatible dot-matrix printers or HP Thinkjet (HP 2225) is possible if they are equipped with an IEEE-488 interface.
- Version /50 has an RS-232C option installed. Plot out via a number of digital XY plotters (compatible with HPGL and PHILIPS GL) and via Epson FX-80 and compatible dot-matrix printers or HP Thinkjet (HP 2225) is possible if they are equipped with a RS-232C interface.

Before you are able to plot or print a hard copy of the information on the CRT it is necessary to make some preparations:
- Oscilloscope and printer/plotter must be interconnected via a suitable cable.
- The oscilloscope and the printer/plotter must be set up to the correct interface parameters.

All set up actions are done under the APPLication preselect menu which can be entered by performing the following action: press the front panel key MENU and keep it pressed. Then press AUTO SET. After this the APPL softkey must be pressed. Selected parameters are visible in the top text area of the CRT.

The plot action is started by pressing the front panel PLOT key. Please note that during the plot action the signal acquisition stops and all softkeys are inactive. Plotting can be stopped by pressing the PLOT key again.

The following pages explain how to set up the IEEE-488 interface and the RS-232C interface for the analog plot out.. Also the features and limitations are discussed. In order to make a correct set up possible it is necessary to have an operator's manual available of the plotter/printer that is to be connected to the oscilloscope.

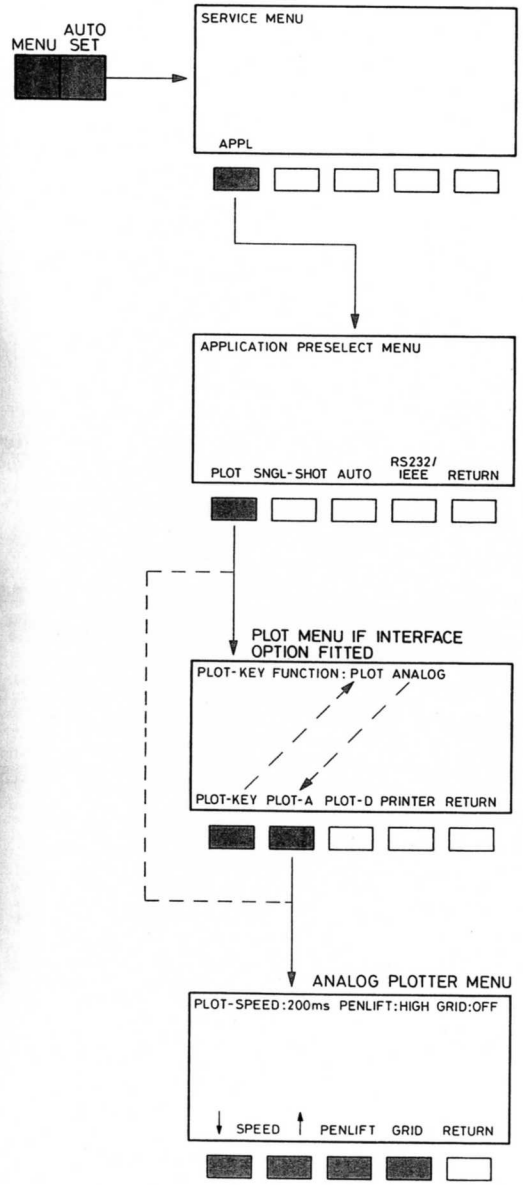
5.2 ANALOG PLOT OUT TO XY RECORDERS.

This mode is possible for all versions of all mentioned oscilloscopes. The things that can be plotted out are the waveform(s), the channel identification on the CRT and the measuring graticule. The analog plot out can be used to make a hard copy of the screen information including all mentioned facilities. The set up is done as follows (selections marked with # are plotter dependent. Refer the operator's manual of the plotter):

- Enter the service menu by pressing MENU and keep this key pressed. Now also press the AUTO SET key and * becomes visible in the LCD.
- Press softkey APPL to enter the applications select menu.
- Press softkey PLOT.
- If present, press softkey PLOT-KEY until "plot analog" appears in the top text area of the CRT. This has the result that the analog plot action is started if the front panel key PLOT is pressed. (When the instrument is not provided with an IEEE or RS-232 option. the PLOT-KEY softkey is not available.)
- Press softkey PLOT-A: this gives access to the set up menu for the analog plot mode. Via this menu the PLOTSPEED (#, range 20 ... 2000 ms/dot) for slow-rate limitations and the PENLIFT (#, pen on paper at high or low level) can be adapted to the plotter. Moreover with GRID on, a graticule is plotted.
- Press front panel key AUTO SET in order to leave the service menu.

The plot out information becomes available at the 9 pin D-connector. This connector is at the rear of the oscilloscope. The output signal consists of X and Y deflection signals of 1V (100 mV/div) and the penlift signal at TTL level. For interconnection between oscilloscope and XY recorder two cable types are available. Both are equipped with a 9 pin connector that fits in the analog plot out connector of the oscilloscope. The connector on the other end depends on the type that is ordered:

- The PM9076/01 type has 6 banana plugs: black = neutral (3x), red = Y-deflection, blue = X-deflection, green = pen lift.
- The PM9076/02 type has a 14 pole amphenol connector.



5.3 PLOT AND PRINT VIA IEEE-488 INTERFACE

This mode is only possible for the /40 version of the oscilloscope. All information on the screen will be plotted out or printed out: this includes the settings of the displayed traces. The set up is done as follows:

- Enter the service menu by pressing the MENU key and keep it pressed. Now also press the AUTO SET key and * becomes visible on the LCD.
- Press softkey APPL to enter the application preselect menu.
- Press softkey IEEE to enter the IEEE set up menu.
- Select the IEEE address with the ADDRESS softkey (0..30).
- Select the IEEE mode with the T/L softkey (TALKER/LISTENER, TALK ONLY or LISTEN ONLY).
- Press softkey RETURN.
- Press softkey PLOT.

From now on the set up procedure for digital plotter and printer is different; first the procedure for the digital XY plotter is explained:

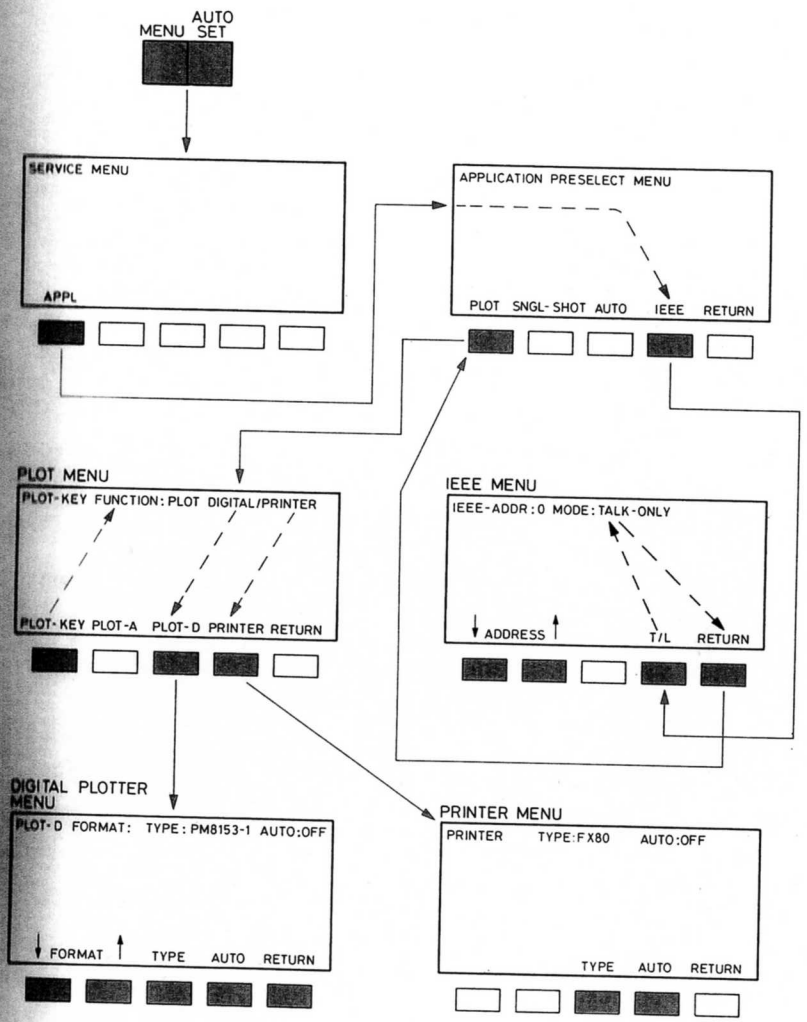
- Select "plot-digital" in the top text area with softkey PLOT-KEY. This has the result that the digital plot action is started if the front panel key PLOT is pressed.
- Press softkey PLOT-D to enter the digital plotter menu.
- Select the plotter type with softkey TYPE; the selected plotter is indicated in the top text area.
  These types are: PM8153/1, PM8153/6, PM8154 (limited plot-size!), PM8155, HP7475A (limited plot-size!), HP7550
- Select the format of the hard copy; can be choosen between 0,5x and 2x the screen size via softkey FORMAT.
- If you select AUTO:on, a hard copy is plotted after each single shot.
- Press front panel key AUTO SET once to return to normal oscilloscope use.

The procedure for the set up for the dot matrix printer is as follows:

- Select "printer" in the top text area with softkey PLOT-KEY. This has the result that the printer is started if the front panel key PLOT is pressed.
- Press softkey PRINTER to enter the printer menu.
- Select the printer type with softkey TYPE; the selected printer is indicated in the top text area of the CRT screen. It is possible to choose between FX80 and HP2225.
- If you select AUTO:on, a hard copy is printed after each single shot.
- Press front panel key AUTO SET once to exit the application preselect menu..

Philips offers three different cable types to connect the oscilloscope to the plotter or printer via the IEEE-488 bus:

- Type PM2295/05: cable length 0,5m.
- Type PM2295/10: cable length 1 m.
- Type PM2295/20: cable length 2 m.



5.4 PLOT AND PRINT VIA RS-232C INTERFACE

This mode is only possible for the /50 version of the oscilloscope. All information on the screen will be plotted out or printed out; this includes the settings of the displayed traces. The set up is done as follows (selections marked with # are plotter/printer dependent. Refer to the operator's manual of the plotter/printer):

- Enter the service menu by pressing the MENU key and keep it pressed. Now also press the AUTO SET key and * becomes visible on the LCD.
- Press softkey APPL to enter the application preselect menu.
- Press softkey RS232 to enter the RS-232C set up menu.
- Press softkey BAUDRATE and adjust the OUT-SPD (output speed) to the desired value (#).
- If a software protocol is used to control the communication with the plotter or printer, also set the INP_SPD (input speed) to the desired value (#).
- Press softkey RETURN.
- Press softkey DATA and adjust PARITY, STOP BIT and DATA BIT to the desired value (#).
- Press softkey RETURN twice.
- Press softkey PLOT to enter the PLOT menu.

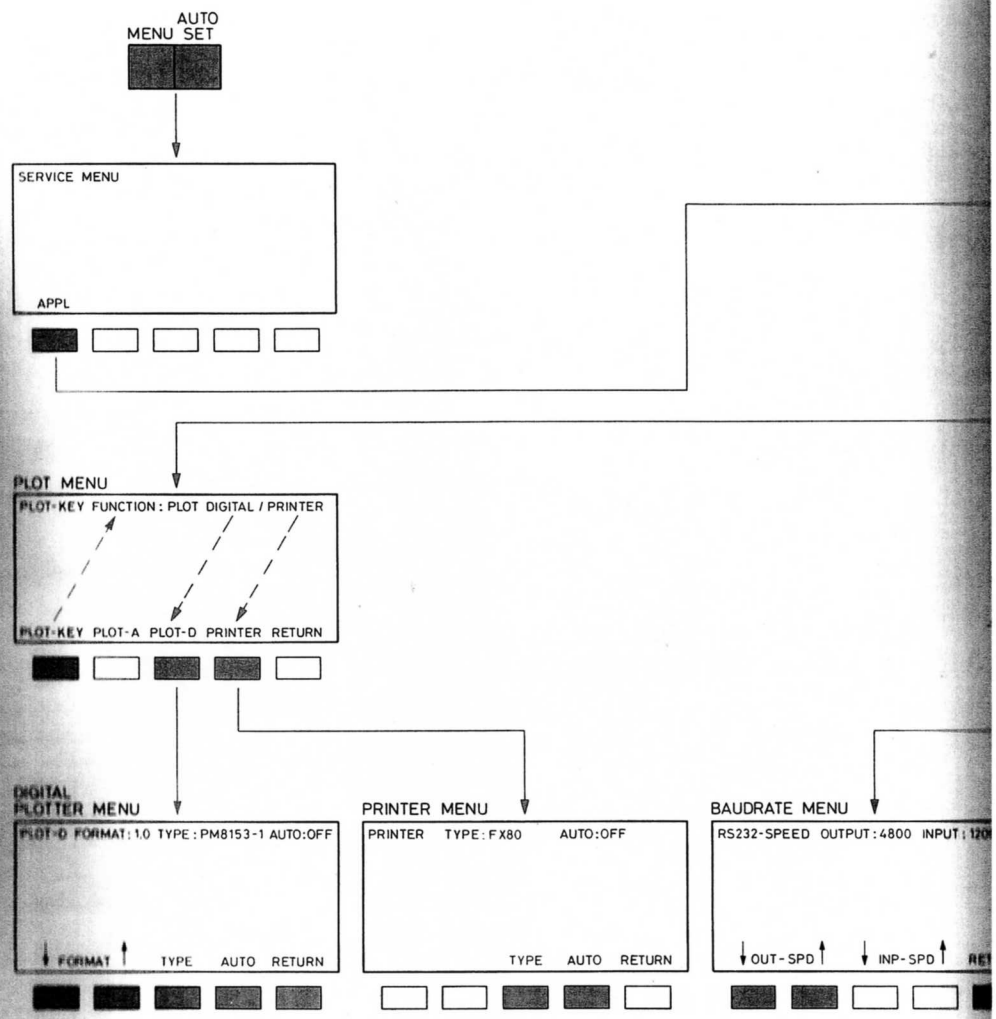
From now on the set up procedure for digital plotter and printer is different; first the procedure for digital XY plotter is explained:

- Select "plot-digital" in the top text area with softkey PLOT-KEY. This has the result that the digital plot action is started if the front panel key PLOT is pressed.
- Press softkey PLOT-D to enter the digital plotter menu.
- Select the plotter type with softkey TYPE; the selected plotter is indicated in the top text area. The types to be selected are: PM8153/1, PM8153/6, PM8154 (limited plotsize !), PM8155, HP7475A (limited plotsize !), HP7550.
- Select the format of the hard copy; can be chosen between 0,5x and 2x the screen size via softkey FORMAT.
- If you select AUTO:on, a hard copy is plotted after each single shot.
- Press front panel key AUTO SET to exit the application preselect menu..

The procedure for the set up for the dot matrix printer is as follows:

- Select "printer" in the top text area with softkey PLOT-KEY. This has the result that the printer is started, if the front panel key PLOT is pressed.
- Press softkey PRINTER to enter the printer menu.
- Select the printer type with softkey TYPE; the selected printer is indicated in the top text area of the CRT screen. It is possible to choose between FX80 and HP2225.
- If you select AUTO:on, a hard copy is plotted out after each single shot and re-arming.
- Press front panel key AUTO SET to return to normal oscilloscope use.

The diagrams on the page 5-8 show the necessary interconnections between the oscilloscope and plotter.



:32C INTERFACE

rsion of the oscilloscope. All information
ɜd out; this includes the settings of the
ollows (selections marked with # are
ɔerator's manual of the plotter/printer):

ɜ MENU key and keep it pressed. Now
ecomes visible on the LCD.
ation preselect menu.
32C set up menu.
ɪe OUT-SPD (output speed) to the

ɔl the communication with the plotter or
eed) to the desired value (#).

, STOP BIT and DATA BIT to the

menu.

ɪltal plotter and printer is different; first
ained:
with softkey PLOT-KEY. This has the
ɜd if the front panel key PLOT is

ɜl plotter menu.
E; the selected plotter is indicated in
ɜd are: PM8153/1, PM8153/6, PM8154
imited plotsize !), HP7550.
be chosen between 0,5x and 2x the

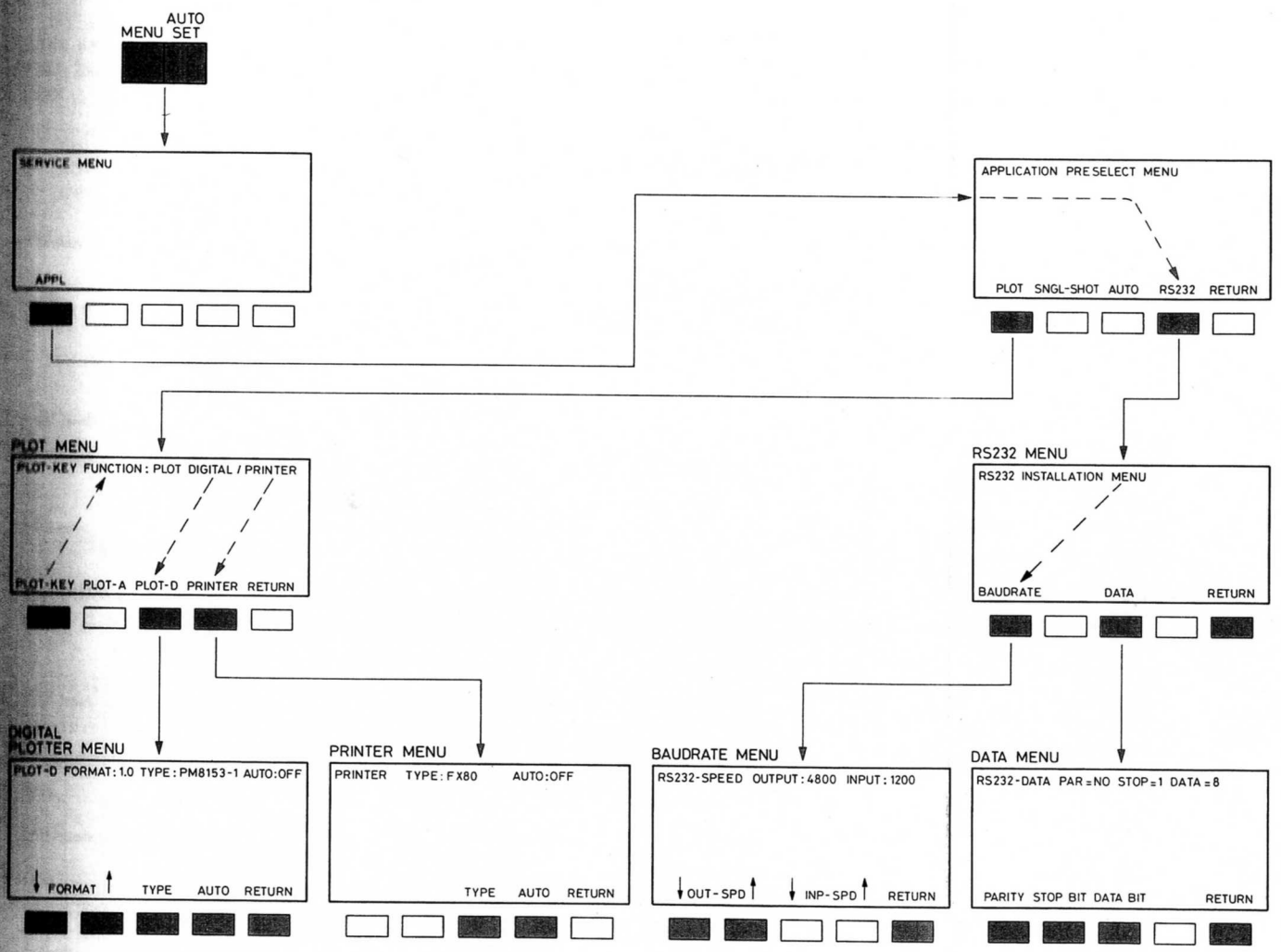
otted after each single shot.
the application preselect menu..

atrix printer is as follows:
softkey PLOT-KEY. This has the result
ɪel key PLOT is pressed.
ter menu.
; the selected printer is indicated in
possible to choose between FX80

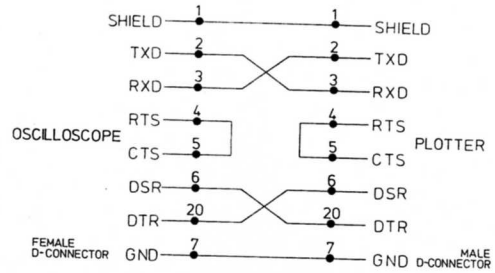
ɔtted out after each single shot and

n to normal oscilloscope use.

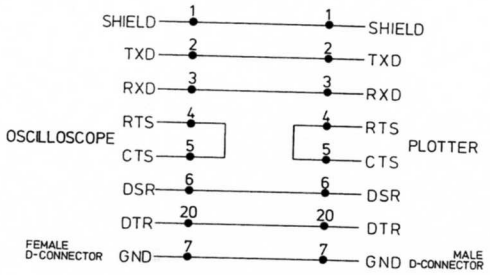
cessary interconnections between the



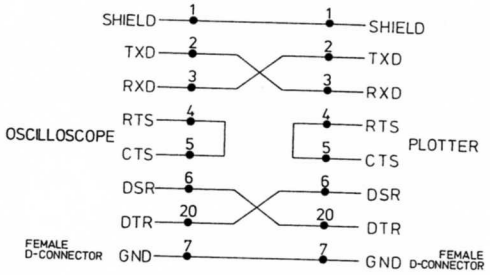
Cable configuration for the XY plotters PM8153-1, PM8153-6, PM8155, HP7475A, FX80 compatible dot matrix printers and HP-Thinkjet printer.



Cable configuration for the XY plotter PM8154.



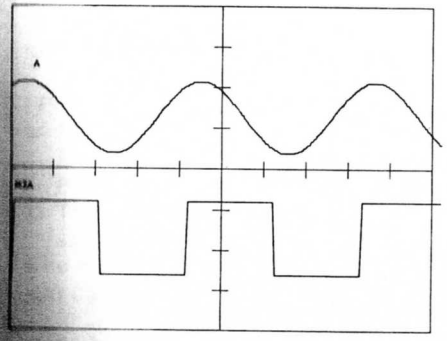
Cable configuration for the XY plotter HP7550.



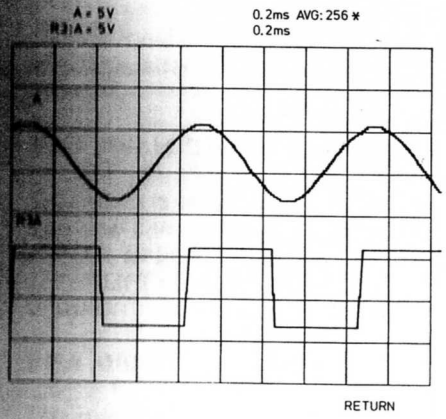
5.5 PLOTTING OR PRINTING RESULTS

This section shows examples of the three possible hard copy results, obtained with this oscilloscope. The three possibilities to make a hard copy of the screen are:

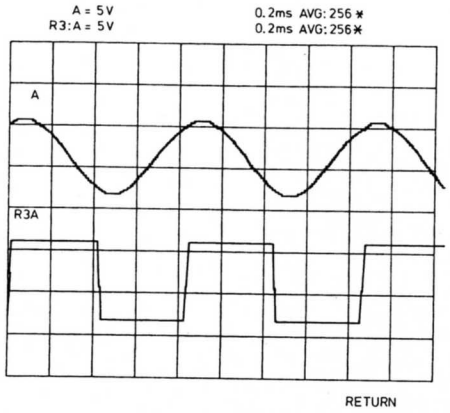
- plot-out by an analog plotter (X-Y recorder)
- plot-out by a digital plotter
- print-out by a printer.



***Example** plot-out by an analog plotter (X-Y recorder)*



***Example** plot-out by a digital plotter*



Print-out by a printer

6 APPLICATION PRESELECT MENU

6.1 INTRODUCTION

Within this menu a number of operating functions can be selected, that normally do not need to be altered frequently. These functions have relation with the SINGLE SHOT mode, TV triggering and adjustment of plotter/printer- and interface parameters. The APPLICATION PRESELECT menu is part of the SERVICE menu. (The other selections in the SERVICE menu are used for service and repair and are described in the Service Manual.)

Proceed as follows to enter the APPLICATION PRESELECT menu:
- Press MENU and keep it pressed. Now also press AUTO SET.
- Now the Service menu has been entered, the LCD should indicate "*".
- Press APPL, which is one of the CRT softkeys.
- The CRT should indicate "APPLICATION PRESELECT MENU" on the upper side of the screen.

The selections are made with the softkeys under the CRT. The selected functions are displayed in the top text line of the CRT.

6.2 SELECTION OF PLOTTER PARAMETERS (PLOT)

By pressing the PLOT softkey a menu is entered, in which the plotter- and printer parameters can be adjusted.
When an IEEE-488 or RS-232C interface option is installed, the PLOT menu first offers a selection between PLOT_A (analog plot), PLOT_D (digital plot) or PRINTER (selection with PLOT-KEY). If the oscilloscope comes without an interface, after pressing the PLOT key directly the ANALOG PLOT mode is entered.

6.2.1 ANALOG PLOT MODE (PLOT_ANALOG)

This menu is entered from the PLOT menu by pressing the PLOT_A softkey.
You now can define various parameters of the analog plot:
- PLOT SPEED: 20 ms...2000 ms in 20 or 100 steps sequence
- PENLIFT LEVEL: active high or active low
- GRID: plotting or not plotting a grid in the picture

6.2.2 DIGITAL PLOT MODE (PLOT_DIGITAL)

This menu is entered from the PLOT menu by pressing the PLOT_D softkey.
You now can define the plotter FORMAT, TYPE of plotter and AUTOplot mode:
- FORMAT: 0,5 * normal screen ... 2 * normal screen (in steps of 0,1).
- TYPE: PM8153/1, PM8153/6, PM8154, PM8155, HP7475A and HP7550
- AUTO: ON for a plot after each single-shot and re-arming
  OFF for a plot after pressing the PLOT key

6.2.3 PRINT

Selected by pressing PRINTER.
You now can define the AUTO MODE:
- AUTO: ON for a print after each single-shot and re-arming
  OFF for a print after pressing the PLOT key

6.3 SINGLE SHOT (SNGL_SHOT)

This menu can be selected from the APPLICATION PRESELECT menu by pressing the SNGL_SHOT softkey.
In analog single shot mode you can define the single shot sequence when the instrument is in alternated mode.
- FIRST: single shot is always done on channel A (provided it is active)
- MULTI: single shot is always done alternated between channel A, B and ADD (provided these are active)

6.4 TV TRIGGERING AFTER AUTOSET (AUTO)

With the AUTO softkey you enter the AUTOSET menu. In this menu it is possible to select the TV triggermode after an AUTOSET command.
Selection of TVF forces the trigger coupling in TVFrame mode after an AUTOSET. This in case that TVF or TVL was already active before the AUTOSET command. If there is no trigger found, after AUTOSET in TVF mode the oscilloscope jumps back to AUTO P-P.
If TVF/TVL is selected, the trigger coupling returns to the previous mode (TVFrame or TVLine) that was active before the AUTOSET command. If there is no trigger found after AUTOSET, the oscilloscope jumps back to AUTO P-P.

6.5 IEEE-488: OPTIONAL (IEEE)

This menu is selected by pressing the CRT softkey marked IEEE. (Only if IEEE option is present !). You can now define the IEEE MODE and IEEE ADDRESS:
- ADDRESS: between 0..30 (default address: 8)
- MODE: TALK_ONLY, LISTEN_ONLY and TALKER/LISTENER

6.6 RS-232C: OPTIONAL (RS232)

This menu is selected by pressing CRT softkey RS232. (Only if RS-232C option is present !) You can now define the RS-232C parameters:
- OUTPUT SPEED: between 75 ... 19200 bits/sec
- INPUT SPEED: between 75 ... 1200 bits/sec
- PARITY: EVEN, ODD or NONE
- STOP BIT: 1 or 2
- DATA BIT: 7 or 8

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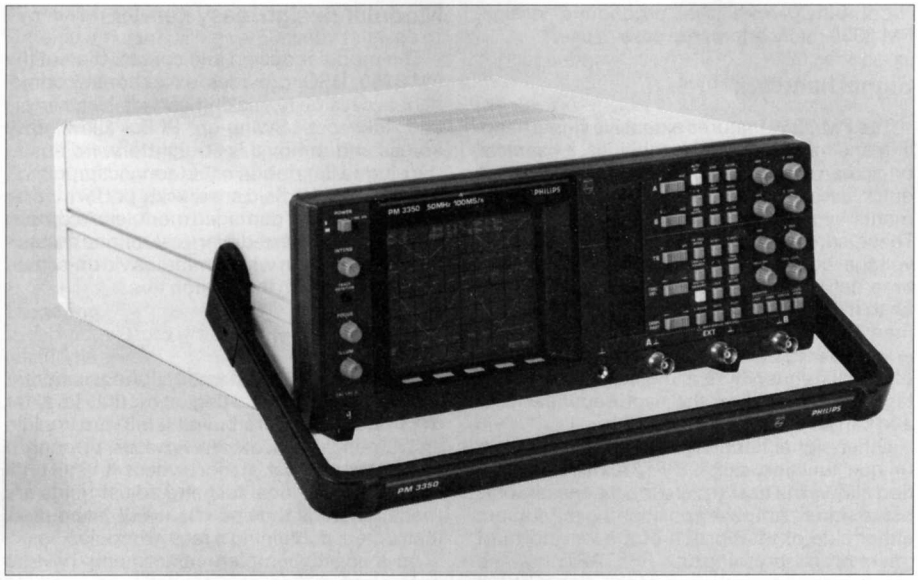
PM 3350

GPIB IEEE-488



PM 3350 100 MS/s advanced digital storage oscilloscope

- 100 MS/s sample rate on each channel
- Synchronous sampling on both channels
- 50MHz analog bandwidth
- Operates as an analog oscilloscope or as fast Digital Storage Scope
- Triggering up to 100MHz
- Autoset for instant on-screen trace display in both operating modes
- Cursors for measuring dV,dt and automatic rise/fall time, frequency and amplitudes.
- IEEE-488 or RS 232 interface options
- Analog and digital plot capabilities

Analog and digital

The PM 3350 is the answer to many DSO measurement requirements, offering a combination of the best of real-time and digital storage oscilloscope technology.

PM 3350 is designed as a high power digital storage scope for capture and analysis of single events and repetitive signals. It also has real-time capabilities that are needed or convenient in some applications.

The PM 3350 is not simply an analog scope with 'add-on' digital features but is a fully implemented DSO with real-time capability. The PM 3350 storage 'benchmark' is a very high maximum 100 MSamples/s sampling rate for each channel simultaneously. This very high sampling frequency offers the capability of storing fast signals with excellent resolution.

The maximum single event resolution is 10ns.

Analog shift register

PM 3350 uses a P2CCD (or profiled peristaltic charge coupled device), a solid state combination of a fast track-and-hold input circuit and an analog shift register. Momentary values of input signals in analog samples are captured with intervals as short as 10ns (100 Megasamples/second clock). After triggering these samples are presented to an accurate, successive approximation ADC at a much slower 100 kilosamples/second. Digitizing is thus internally a low frequency operation, giving high resolution, yet not sacrificing the very high data capture rate of 100 Megasamples/sec. This means that single shot events can be captured and displayed up to a capture bandwidth of over 20 MHz, such as in destructive testing or power device switching transients.

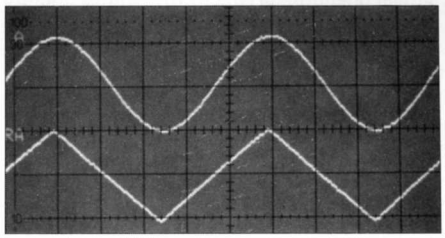
Indeed, the fast sample rate of the PM 3350 brings an unparalled break-through in DSO performance, in this price range.

Deep memory

At lower timebase speeds up to 5 ms/div signals are stored in a 4k x 8-bit memory. Data from the memory can be transferred to a second 4k x 8-bit memory by one keystroke, permitting separate storage of channels A and/or B.

This allows storage and display of reference waveforms while at the same time capturing and displaying live signals from the device under test.

Up to 4 traces may be stored en displayed at any one time.



Low frequency signal registration

As well as fast signal capture the PM 3350 has a 50 s/div. facility giving a visual lasting 8 minutes, allowing low frequency phenomena to be studied. The signal can be frozen at any time within a single button.

This feature is useful for study of chemical or biological reactions and responses for example, or for slow mechanical 'wear and tear' cycling. In fact the roll facility as it is known, is used in a simular way to a paper and pen recorder.

Triggering functions

The PM 3350 has a selection of powerful trigger capabilities, including Automatic, Manual and Single shot settings.

In addition the micro-computer control delivers built-in intelligence that completely eliminates operator adjustment in auto-triggering mode, making operation simpler and more accurate. TV line and frame for positive and negative video, alternate, auto P-P or DC, ext. and line trigger are all included in the triggering facilities, which has a wide 100MHz bandwidth.

Pretrigger and post trigger delay capabilities

A major advantage of a digital storage scope is its ability to precisely define the portion of the waveform to be captured before or after the trigger. The PM 3350 has a pre-trigger capability of up to 10 divisions. This means that events leading up to the trigger moment may be captured and viewed. For example in transient waveforms the whole of the leading edge may be recorded rather than just from the trigger moment on. Further for post-trigger, i.e. the time delay after the trigger point, the PM 3350 has a capability of up to 250 divisions.

That means that records of over 25 screens worth of information can be captured and displayed.

Low level signals

In mechanical application where very low level signals are usual, the 2mV/div. input allows direct input of, for example, a transducer, to the memory.

PM 3350

GPIB IEEE-488

X-Y displays

The analog mode can be used for the display of X-Y diagrams.

Filter curves, lissajous figures and other similar phenomena which are not time-related, but have other reference voltages can be displayed for further analysis.

IEEE-488 or RS 232 C Interface

Signal transfers between the PM 3350 and a controller are possible via IEEE-488 or RS 232 C interfaces, for data processing, digital plot and mass storage.

Documentation and hard copies

The PM 3350 provides the user with several options to document waveforms on hard copies.

Every PM 3350 comes with an analog output to drive an X-Y recorder. A pen lift control is also provided.

Digital plotters can be driven directly from the optional IEEE-488 or RS 232 ports.

The Philips PM 8155 and HPGL compatible plotters are supported by the PM 3350.

Furthermore, the RS 232 port is directly compatible with certain types of dot-matrix printers, such as the Epson FX 80 and compatibles.

Ergonomic Design

Much attention has been paid to the operator interface on the PM 3350. All the innovations on the Philips 60MHz and 100MHz oscilloscopes are utilized in the PM 3350, resulting in a front panel layout that is much clearer, simpler and easier to use that on conventional scopes. Significant and new features are:

- LCD panel for direct read-out.

The LCD panel right next to the screen gives a clear, at-a-glance alphanumeric read-out of settings eliminating the need to look at control positions set on a crowded textplate.

- Fast-action up/down controls.

Ranges and settings are entered by fast, fingertip-action controls.

- Menu-driven softkeys.

Functions such as time base and trigger settings are softkeyed, with a step-through function sequence. Selected functions are clearly indicated at all times on the LCD panel.

- Logical panel layout.

Variable settings like Y-pos, and X-pos, trigger levels and hold-off are grouped together on the right of the front panel and display settings are grouped on the left of the CRT.

The result is a clear panel layout that simplifies and speeds operation.

Autoset

This function, accessed by a single button, allows instant setting of all scope parameters for any input signal, eliminating time-consuming manual range finding and fine adjustment.

AUTOSET operates in the Digital Storage mode, as well as when operating in the Real Time mode.

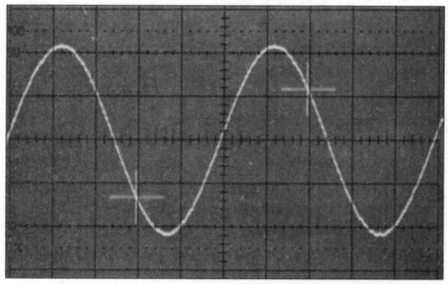
Combined with the ergonomic design, PM 3350 really offers true ease of use.

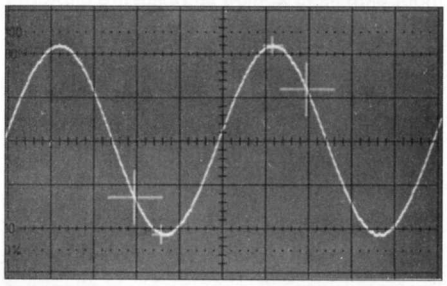
Signal handling

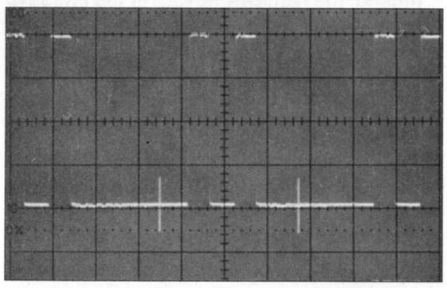
The PM 3350 features extensive signal handling and measurement capabilities. It has clear on-screen softkey menu structures that permit quick access to a wide variety of measurements by means of two independent cursors. These cursors allow the usual dV (difference voltage between cursors) and dt (difference time between cursors) to be performed, and further extend the range of automatic measurement facilities.

In addition, the cursors offer measurements of signal frequency, rise and fall times and voltage peak-to-peak of the captured waveform and can be performed live.

Other signal handling capabilities include a unique function called 'RESTART'. This function allows the user to zero in on a specific part of the signal, simply by positioning the cursors either side of the portion of the waveform of interest and pressing the RESTART key. The result is the reacquisition of the signal at full resolution (not just expansion which yields no further signal information), with a digital delay and timebase calculated from the position of the cursors. To complement the signal handling there is a further signal expansion possibility up to a factor 32.







Modular design, easy service

The modular design and construction of the PM 3350 DSO provides exceptional component accessibility, making service fast, simple and low-cost. Swing-up PCBs allow easy access and removal is straightforward due to the plug-in flat ribbon cable connections.

Repairs in the field are quickly performed by simply replacing damaged modules. A complete, built-in software-driven test routine assures correct operation within minutes via on-screen test displays with instruction text.

Automatic testing

The modular construction brings another benefit – thorough testing, at module level for the first time, before building into a complete instrument. Each module passes through a computerized test station where it is given a complete functional test and adjustments are made. There is thus no chance of a complete instrument containing a faulty module.

As a check, complete instruments have to pass a test routine, an extended burn-in period and then, a final series of test. Thus, through such a rigorous test procedure, last minute defects are eliminated ensuring a long, trouble-free service life for the instrument.

Specifications

Analog mode

Vertical
Display modes YA, YB, -YB, YA+YB, YA-YB

Frequency response
DC ... >50MHz - 3dB (20mV/div ... 10V/div)
DC ... >35MHz - 3dB (2mV/div ... 10mV/div)
In AC mode, lower - 3dB point is <10Hz

Risetime
<7nS (20mV/div ... 10V/div)
<10nS (2mV/div ... 10mV/div)
Max. pulse aberrations <1.5sub. div. peak-to-peak (input pulse 5 div. risetime 1ns)

Deflection co-efficient
2mV/div ... 10V/div in steps of 1,2,5 sequence
Error limit 3%
Continuous control between steps with '>' flashing in LCD as warning symbol for uncal. amplitude setting

Input impedance
1 Mohm + 2% // 20pF + 2pF
Max. rated input voltage 400V (DC + AC peak)

Dynamic range
>±24 div. at 10MHz
>±8 div. at 50MHz
CMRR 100 : 1 at 1MHz

Horizontal
Display modes
Timebase, or XY displays using YA and/or YB (Vertical) and YA, YB or Ext (Horizontal)

PM 3350

GPIB IEEE-488

Timebase (TB)
Time co-efficient 0.5s/div - 50ns/div in steps of 1,2,5 sequence
Expansion: x10
Fastest sweep speed is 5 ns/div.
Error limit 3%
Error limit total incl. x10 magn. 4%
Continuous control between steps with '>' flasing in LCD as warning symbol for uncal. sweep setting.
Hold-off continuously adjustable up to 10x min. value.

Triggering
Trig. modes: Auto (free run), Non Auto Triggered, Single
Trig. source: A, B, Composite (A,B), Ext. (DC or AC), Line LCD indicates 'Not triggered', 'Triggered' or 'Armed' status
Trig. coupling: Auto Peak-to-peak (P-P), DC, TVL, TVF

Trig. sensitivity

	Int.	Ext.
10MHz	0,5 div	50mV
50MHz	1 div	150mV
100MHz	3 div	500mV
TVF/TVL	0.7 div sync.	70mV sync.
Level range	+/– 8 div.	+/– 800 mV

Slope positive, or negative, TVF or TVL pos. (+) or neg. (–).
X-deflection
Deflection co-efficient:
via channel A or B 2mV/div ... 10V/div
via Ext. input 100mV/div
Freq. response DC ... 2MHz
Error limit 5%
Phase shift <3 (at 100KHz)
Ext. input 1MOhm + 2%//20pF + 2 pF
Max. input voltage 400V (DC + AC peak)

Digital mode

All specifications as analog mode except where stated

Vertical
Resolution 8 bits.
Display modes YA, YB, -YB
Frequency response
DC ... >20MHz - 3dB (2mV/div ... 10V/div)

Horizontal
Display modes Recurrent, Single shot, Multiple shot (up to 2) and Roll (stopped by trigger).

Timebase
Recurrent, single shot,
multiple shot 0.5 s/div - 0.5 /us/div
Roll 50s/div - 1s/div
Error limit ± 0.2% up to memory

Horizontal resolution
Single channel acquisition: per channel
5ms/div ... 50s/div; 4096 samples
0.5/us/div ... 2ms/div; 512 samples
Dual channel acquisition: per channel
5ms/div ... 50s/div; 2048 samples
0.5/us/div ... 2ms/div; 512 samples

Signal acquisition

Sampling	0.5/us/div ... 50s/div
Maximum sampling Rate	up to 100Msamples/s, synchronously for both channels
Trigger delay	–10 ... +250 divisions, adjustable
Display expansion	x1 ... x32 horizontal

Memory

Registers	2
Depth of acquistion register	4096 words
Vertical resolution	8 bits

Cursors

Horizontal resolution	in single channel mode 1 : 4096 in dual channel mode 1 : 2048
At 2 ms/div ... 0.5us/div	1 : 512
Vertical resolution	1 : 256
Read out resolution	3 digits
Voltage cursors	error limit ± 2% (ambient temperature 15 ... 35°C)
Time cursors	error limit ± 0.2%
Calculation functions	peak to peak value rise or fall time frequency dt dV 1/dt

Analog output for X-Y recorders

Output level	1V/full memory ± 2%
Penlift	TTL compatible
Plot time per sample	20ms ... 2000ms
Connector	DIN 9 pin female
Functions	Memory dump, register selectable
Output sequence	Channel A first

IEEE 488

Bus driver	E2 (Three state)

Interface function repertoire
SH 1, AH 1, T5, L3, SR1, RL2, PP0, DT1, DC1, C0

RS 232

Handshake	Software XON/XOFF Hardware DSR/DTR and CTS/DTR
Baud rate	Transmit 75 ... 19,200 Receive 75 ... 1,200
Stop bits	1 or 2
Parity	odd, even or no
Character length	7 or 8

Digital plot capabilities

Language	HPGL or Philips protocol depending on plotter type selected
Plotter select	Philips PM 8153/1, PM 8153/6, PM 8154, PM 8155 HP 7450, HP 7475 A
Pen select	Pen 1 for Ch A Pen 2 for Ch B Pen 3 for Register Ch A Pen 4 for Register Ch B Pen 5 for graticule and alphanumerics
Plot area	Software selectable 0.5 ... 2.0 x 8 cm x 10 cm

Dot matrix printer capabilities
Compatible with Epson FX 80 or compatible dot matrix printers.

Drawing area	10 x 10 cm

Miscellaneous

Display	CRT with 8 x 10 cm viewing area P31 phosphor 16kV acceleration voltage Parallax-free graticule with continuously variable illumination

Separate LCD for display for menus, settings, status indications etc.
LCD is constantly illuminated by backlighting.
Autoset selects proper channel(s), sets vertical defection, timebase speeds and triggering for easy-to-read display of input signals

Power supply

Line voltage range	100V...240VAC + or ±10%
Line frequencies	50Hz ... 400Hz ±10%
Power consumption	70W

Mechanical data

Dimension	387×455×147× (W×L×H)
Weight	approx. 9.5kg

Environmental data

Temperature	
rated range of use	10°C ... 40°C
Limited range of operation	0°C ... 40°C
Storage	–40°C ... +75°C
Altitude	
operating	4,500m (15,000ft)
transport	12,000m (40,000ft)
EMI	Meets requirements of MIL-STD-461 Class B, VDE 6871 and VDE 0875 Grenzwertklasse B

Ordering information

Standard model	PM 3350
Rackmountable model	PM 3352
Option 40	Incl. IEEE-488 interface PM 8957
Option 50	Incl. RS 232 interface PM 8958

Both interface options include digital plot-out with HPGL and Philips protocols.

Power and power cord options:

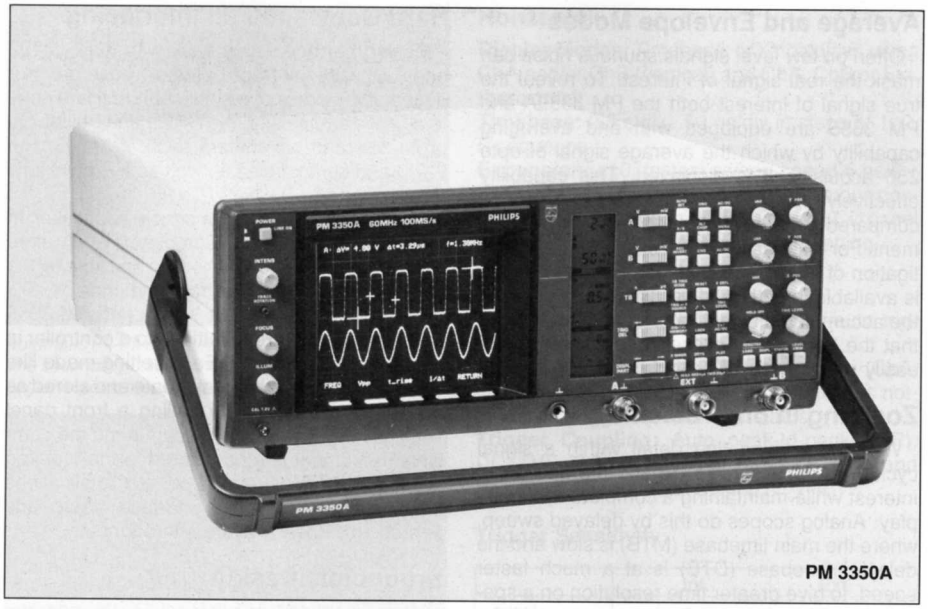
Option 003	Standard North America 120V/15A, 60Hz
Option 001	Universal Euro 220V/16A, 50Hz
Option 004	U.K. 240V/13A, 50Hz
Option 005	Switzerland 220V/10A, 50Hz
Option 008	Australia 240V/10A, 50Hz

PM 3350A & PM 3355

GPIB
IEEE-488

RS-232

NEW



PM 3350A

PM 3350A & PM 3355 Digital Storage Oscilloscopes

- Sample rates of 100 MS/s or 250 MS/s on each channel
- Synchronous sampling on both channels
- 60 MHz analog bandwidth with 100 MHz triggering on both models
- Operate as an analog oscilloscope or as fast digital storage oscilloscope
- 64 Front Setting Memories
- 12k Reference memory stores up to 6 reference traces
- AUTOSET for instant on-screen trace display in both operating modes
- Advanced cursors for automatic measurements of voltage and time parameters
- Average and Envelope display modes
- Dual Timebase Referencing with Autozoom

Analog and Digital

The PM 3350A and PM 3355 are the answer to many DSO measurement requirements, offering a combination of the best of real-time and digital storage oscilloscope technology. Both models contain high power digital storage scope capabilities for capture and analysis of single events and repetitive signals. For those applications where real-time oscilloscopes are needed or convenient full 60 MHz analog oscilloscope facilities are available.

These products are not simply analog scopes with "add-on" digital features but have fully implemented DSOs with real-time capabilities. The PM 3355 storage sampling rate "benchmark" is a very high maximum 250 Msamples/s for each channel simultaneously. This very high sampling frequency allows storage of fast signals with excellent resolution. Maximum single event resolution is just 4 ns.

Analog Shift Register

Both the PM 3350A and PM 3355 use a P²CCD (or Profiled Peristaltic Charge Coupled Device), a solid state combination of a fast track-and-hold input circuit and an analog shift register. Momentary values of input signals in analog samples are captured with intervals as short as 4 ns (250 Msamples/s clock). After triggering these samples are presented to an accurate, successive approximation ADC at a much slower 100 ksamples/s. Digitizing is thus internally a low frequency operation, giving high resolution, yet not sacrificing the very high data capture rate of upto 250 Msamples/s. This ensures single shot events are captured and displayed to a bandwidth of over 25 MHz, with 10 sample points per period. Indeed, the fast sampling rate of PM 3350A and PM 3355 bring an unparalleled breakthrough in DSO performance in this price range.

Deep Memory

At lower timebase, signals measured at speeds up to 5 ms/div are stored in a 4 kbytes x 8-bit memory. Data from the memory can be transferred to one of the three reference memories which are each 4 kbytes x 8-bit memory. This allows storage and display of reference waveforms while at the same time, capturing and displaying live signals from the device under test. In addition to the 2 input channel traces another 6 reference traces may be stored and up to 4 traces may be displayed at any one time.

Simultaneous Sampling

Unlike many DSOs in the PM 3350A's or PM3355's class, the maximum sample rate is maintained even when both channels are in use. It's essential that sample rate is not reduced in two channel acquisition, because sample rate determines the effective single shot bandwidth, and this is one of the critical specifications for a DSO. The PM 3355 offers full 250 MS/s on both channels simultaneously, which also means no time errors are caused by sample multiplexing in capture from channel to channel. Furthermore, the resolution is maintained at a very high 4 ns.

Extending single shot applications further, the PM 3350A and PM 3355 incorporate a multishot capability. The second reference memory effectively doubles single shot memory depth, by first capturing a single shot in the acquisition memory (which itself can be as long as 4 k words). Then it is dumped into one of the reference memory (again a deep 4 k). The scope re-arms and takes the next once-off signal, so capturing 2 events. These signals may be close in time (within 50 ms) or may be many hours apart. Combined with the high sample rate, this flexibility is a great help in tracking down elusive intermittent faults.

Low Frequency Signal Registration

As well as fast signal capture both models have a 50s/div facility giving a visual display lasting 8 minutes, allowing low frequency phenomena to be studied. The signal can be frozen at any time by pressing a single button. This is useful for study of chemical or biological reactions and responses, or for slow mechanical "wear and tear" cycling. In fact the roll facility, as it is known, is used in a similar way to a paper and pen recorder.

Triggering Functions

The PM 3350A and PM 3355 have a wide selection of powerful trigger capabilities, including Automatic, Manual and Single shot settings. In addition, microcomputer control supplies a built-in intelligence that completely eliminates operator adjustment in auto-triggering mode, making operation simpler and more accurate. TV line and frame for positive and negative video, alternate, auto P-P or DC, ext. and line trigger as well as LF and HF reject filters on the PM 3355 are all

included in the triggering facilities. With a trigger bandwidth of 100 MHz stable triggering is assured on even the fastest signals.

Pretrigger and Posttrigger Delay Capabilities

A major advantage of a digital storage scope is its ability to define precisely the portion of the waveform to be captured before or after the trigger. Both models have a pre-trigger capability of up to 10 divisions, allowing events leading up to the trigger moment to be captured and viewed. For example in transient waveforms, the whole of the leading edge may be recorded rather than just from the trigger moment on. Furthermore, the PM 3355 has a capability of posttrigger (i.e. the time delay after the trigger point) for up to 5000 divisions (2500 for the PM3350A) so that records of over 500 screen widths of information can be captured and displayed. This effectively stretches the memory depth of these instruments as any occurence within this large delay range can be accurately examined.

Autoset plus User Settings

Accessed by a single button, the Autoset function allows instant setting of all scope parameters for any input signal, eliminating time-consuming manual range finding and fine adjustment. AUTOSET operates in the Digital Storage mode, as well as when operating in the Real Time analog mode.

For production and service applications, where the same setting needs to be accurately duplicated from time to time, both the PM 3350A and PM 3355 have 64 front panel settings. Each setting can be loaded or called from the front panel or from the IEEE 488 or RS 232C interface.

Advanced Cursors

Analysis of captured signals couldn't be easier than with the PM 3350A or PM 3355. Independent control allows positioning of the two cursors to perform measurements on exactly the part of the waveform of interest. With signal tracing cross-hair cursors, parallax errors and the inconvenience of manual measurements are eliminated. No calculations are needed; signal voltages and time differences are read directly from the crisp, clear display and all important pulse characteristics including signal frequency, period, pulse width and rise and fall times are automatically calculated. Amplitude can be measured as peak-peak, RMS, mean and absolute voltage referenced to signal ground.

This advanced performance is easily accessed, through intuitive softkey menus, and simply executed in most cases with a single push of a button. Remote control allows access to distributed computing power; the scope will itself analyze trace data for a frequency measurement and return the result.

Average and Envelope Modes

Often on low level signals spurious noise can mask the real signal of interest. To reveal the true signal of interest both the PM 3350A and PM 3355 are equipped with and averaging capability by which the average signal of upto 256 acquisitions is displayed. This capability effectively reduces the noise level by a factor 16 compared with a single acquisition measurement. For the measurement of jitter or the investigation of unstable signals the Envelope mode is available in both models. This mode displays the accumulated signal over a period of time so that the boundaries of the input signal can be easily measured.

Zooming in on Problems

When examining fine detail within a signal cycle it is necessary to expand the section of interest while maintaining a complete cycle display. Analog scopes do this by delayed sweep, where the main timebase (MTB) is slow and the delayed timebase (DTB) is at a much faster speed, to give greater time resolution on a specific part of the signal. To see any part of the wave in detail and not just a portion from the trigger point on, the second timebase sweep is delayed by a user-specified time interval relative to the MTB. At the same time reference of the detailed part to its position in the cycle is displayed on the MTB waveform by an intensified zone.

In the PM 3350A or PM 3355, a similar function is available with the AUTOZOOM feature. A waveform is stored in the reference memory and displayed on screen, and acquisition takes place over a portion of the waveform, defined by cursors positioned by the user on the reference. If the cursors are moved towards each other, the acquisition timebase is automatically increased or 'zoomed' and so resolution and sample rate are higher only in the area between the cursors. For examination of any point, both cursors can be tracked together left and right across the screen over the reference trace, delaying acquisition to that point. This delayed timebase referencing makes signal capture and analysis fast, efficient and simple.

Low Level Signals

In mechanical applications where very low level signals are normal, the 2 mV/div facility allows direct input to the memory from, for example, a transducer.

X-Y displays

The analog mode enables the display of X-Y diagrams. Filter curves, lissajous figures and other similar phenomena which are not time-related, but have other reference voltages, can then be displayed for further analysis.

Hard Copy and Full Interfacing

Making hard copies is easy with the RS 232 and IEEE-488 interface options. These are produced at the press of a single button. Hard copy to digital plotters using the HPGL and Philips GL protocols, and on printers such as the Epson FX80 and compatibles as well as HP Thinkjet® are supported.

The interfaces also allow simple application in systems environments. Complete system control of all main scope functions is possible by the use of simple programming commands.

In addition both the PM 3350A and PM 3355 can dump their current settings to a controller in a packed binary format. Each setting made like this can be reloaded at a later date and stored as a front panel setting. By calling a front panel setting with a single control command the complete instrument is reconfigured to the required setting. In ATE or remote service applications this drastically reduces interface traffic and appreciably speeds system throughput.

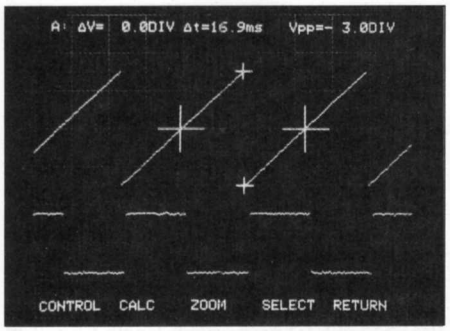
Ergonomic Design

Much attention has been paid to the operator interface on these products. All the innovations on the Philips 60 MHz and 100 MHz oscilloscopes are utilized, resulting in a front panel layout that is much clearer, simpler and easier to use than on conventional scopes. Significant and new features are:

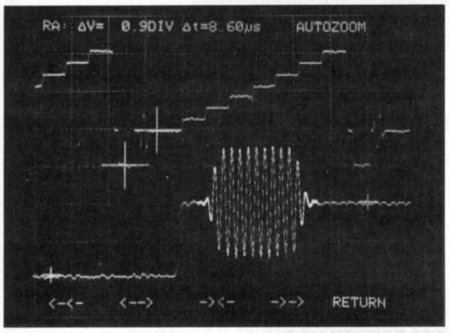
- LCD panel for direct read-out. The LCD panel is directly alongside the screen and gives a clear, at-a-glance alphanumeric read-out of settings, eliminating the need to look at control positions set on a crowded front panel.
- Fast-action up/down controls. Ranges and settings are entered by fast, fingertip-action controls.
- Menu-driven softkeys. Functions such as timebase and trigger settings are softkeyed, with a step-through function sequence. Selected functions are clearly indicated at all times on the LCD panelo
- Logical panel layout. Variable settings like Y-pos. and X-pos., trigger levels and hold-off are grouped together on the right of the front panel; display settings are grouped on the left of the CRT. The result is a clear panel layout that simplifies and speeds operation.

Modular design, easy service

The modular design and construction of the PM 3350 and PM 3355 DSOs provides exceptional component accessibility, making service fast, simple and low-cost. Swing-up PCBs allow easy access and removal is straightforward, due to the plug-in flat ribbon cable connections. Repairs in the field are quickly performed by simply replacing damaged modules. A complete, built-in software-driven test routine assures correct operation within minutes via on-screen test displays with instruction text.



Automatic Pk-Pk measurement between main cursors. The secondary cursors indicate where the positive and negative peak measurement is made.



Delay Time Referencing enables a burst within a video signal to be examined while still displaying the complete signal. This is directly equivalent to the delayed timebase function on an analog oscilloscope

Specifications

Technical Specifications

Unless stated all specifications refer to both PM 3350A and PM 3355.

Analog Mode

Vertical
Display Modes: ChA, ChB, -ChB, ChA+ChB, ChA-ChB (ALTernate or CHOPped)
Frequency Response:
DC...>60 MHz, -3 dB (20 mV/div...10 V/div)
DC...>35 MHz, -3 dB (2 mV/div...10 mV/div)
AC, lower -3 dB point is <10 Hz
Risetime:
<5.8 ns (20 mV/div...10 V/div)
<10 ns (2 mV/div...10 mV/div)
Deflection coefficient: 2 mV/div...10 V/div in 1, 2, 5 sequence
Error Limit: ±3% continuous control between steps with ">" flashing on LCD panel as warning symbol for uncalibrated setting
Input Impedance: 1 MΩ ±2% //20 pF ±2 pF
Max. Input Voltage: 400 V (DC + AC peak)
Dynamic Range: >24 div at 10 MHz, >8 div at 60 MHz
CMRR: 100:1 at 1 MHz

Horizontal

Display Modes: Timebase, or XY displays using ChA and/or ChB (vertical) and ChA, ChB or Ext. (horizontal)
Timebase: 0.5 s/div...50 ns/div in steps of 1, 2, 5 sequence
Expansion: x10, fastest sweep speed 5 ns/div
Error Limit: ±3%, in x10; ±4%. Continuous control between steps with ">" flashing on LCD panel as warning symbol for uncalibrated setting

Triggering

Trigger Modes: Auto (free run), non-auto triggered, single sweep
Trigger Sources: ChA, ChB, composite (ChA, ChB), Ext. (DC or AC), Line. LCD indicates not-triggered, triggered or armed status
Trigger Coupling: Auto peak-to-peak (P-P), DC, TVF, TVL. PM 3355 also has LF reject and HF reject (filter point at 50 kHz)

Trigger Sensitivity:

	Int.	Ext.
10 MHz	0.5 div	50 mV
50 MHz	1.0 div	150 mV
100 MHz	3.0 div	500 mV
TVF/TVL	0.7 div sync	70 mV sync
Level range	±8 div	±800 mV

Slope: Positive or negative, TVF or TVL positive or negative video

X-Deflection

Deflection coefficient:
Via ChA or ChB: 2μmV/div...10μV/div
Via Ext input: 100 mV/div
Frequency Response: DC to 2 MHz
Error Limit: ±5%
Phase Shift: <3± (at 100 kHz)
Ext. Input Impedance: 1 MΩ ±2%//20 pF ±2 pF
Max. Input Voltage: 400 V (DC + AC peak)

Digital Mode

All specifications as analog part unless otherwise stated

Vertical
Resolution: 8-bit
Display Modes: ChA, ChB, -ChB. Average and envelope possible in all three modes.
Frequency Response:
PM 3350A DC...>20 MHz, -3 dB (2 mV/div... 10 V/div)
PM 3355 DC...>20 MHz, -3 dB (2 mV/div... 10 mV/div)
DC...>35 MHz, -3 dB (20 mV/div... 10 V/div)

Horizontal
Acquisition modes: Recurrent, single shot, multiple shot (up to 2), autozoom
Timebase
Single Shot, Multiple Shot:
PM 3350A 0.5 s/div... 0.5 μs/div
PM 3355 0.5 s/div...0.2 μs/div
Roll: 50 s/div...1 s/div
Timing Accuracy: ±0.1%
Display Expansion: x1...x32

Horizontal Resolution

Single Channel:
PM 3350A/55: 50 s/div...5 ms/div; 4096 samples/acquisition
PM 3350A: 2 ms/div...0.5 μs/div; 512 samples/acquisition
PM 3355: 2 ms/div...0.2 μs/div; 512 samples/acquisition
Dual Channel:
PM 3350A/55: 50 s/div...5 ms/div; 2048 samples/acquisition
PM 3350A: 2 ms/div...0.5 μs/div; 512 samples/acquisition
PM 3355: 2 ms/div...0.2 μs/div; 512 samples/acquisition

Signal Acquisition

Maximum Sample Rate:
PM 3350A: 100 MS/s, synchronously for both channels
PM 3355: 250 MS/s, synchronously for both channels
Trigger Delay:
PM 3350A 10 div. pretrigger to 2500 div. posttrigger
PM 3355 10 div. pretrigger to 5000 div. posttrigger
Display Expansion: x1...x32 horizontal

Memory

Number of Storage Memories: 4
No of Traces Stored in Each Memory: up to 2
Depth of Acquisition Memory: 4096 words
Depth of Reference Memory: 4096 words in each of 3 memories
Vertical Memory Resolution: 8-bit
Display Modes: Ch A, Ch B (from acquisition memory), Reg A, Reg B (from one of the three reference memories), in any combination

Acquisition Processing

Average: Continuous when activated. Selectable at 2, 4, 8, 16, 32, 64, 128, 256 times. Each shot contains the number of acquisitions equal to the average factor selected.
Envelope: Continuous when activated. Works on an incremental basis.

Cursors

Horizontal Resolution
Single channel; 1:4096 over 10 divisions
Dual channel; 1:2048
2 ms/div...0.2 μs/div; 1:512 (1:1024 in dot join)
Vertical Resolution: 1:256 over 10 divisions
Read Out Resolution: 3 digits amplitude and time

PM 3350A & PM 3355

Calculation Functions: dV, Vpk-pk, Vrms, Vmean, Vabs, dt, Freq, Period, Pulse Width, Rise/Fall time

Analog Output for XY recorders

Output level: 1V/full memory ± 3%
Penlift: TTL level selectable 0 or 1
Plot Time/Sample: 20 ms ... 2000 ms selectable
Connector: 9 pin D type, male/female
Function: Memory dump, acquisition or reference memory selectable

Interface Options

IEEE-488 (Option /40n)
Bus Driver: E2 (three state)
Function Available: SH1, AH1, T5, L3, SR1, RL2, PP0, DT1, DC1, C0

RS 232C (Option /50n)
Handshake: Software XON/XOFF, hardware DSR/DTR and CTS/RTS
Baudrate: Transmit 75...19200, Receive 75...1200
Stop Bits: 1 or 2
Parity: Odd, even or none
Character Length: 7 or 8 bits

Digital Plot Output (with option /40n or /50n)
Language: HPGL or Philips GL dependent on plotter type selected
Plotter Select: Philips PM 8153/1, PM 8153/6, PM 8154, PM 8155 HP7450, HP7475A
Pen Select: Pen 1 for ChA
Pen 2 for ChB
Pen 3 for Register A
Pen 4 for Register B
Pen 5 for graticule and alphanumerics
Plot Area: Softkey selectable

Dot Matrix Printer Output (with option /40n or /50n)
Screen Dump: Compatible with Epson FX80 and HP Thinkjet® graphics protocol or compatibles
Drawing Area: 10 cm x 10 cm

General Specifications

Miscellaneous

Display

Screen: CRT with 8 x 10 cm viewing area; P31 phosphor, 16 kV acceleration voltage. Softkey display area on CRT for selection of menu choices.
Graticule: Parallax-free with continuously variable illumination.
LCD Display: Separate constantly backlit LCD for display of status information, settings etc.
Autoset: Selects correct channels, vertical deflection, timebase speed and triggering for easy to read display of input signals

Power Supply

Line Voltage Range: 100 V...240 V AC ±10%
Line Frequencies: 50 Hz...400 Hz ±10%
Power Consumption: PM 3350A 70 W, PM 3355 80 W

Mechanical Data

Width: 387 mm (15.2 in) incl. handle, 350 mm (13.8 in) excl. handle
Length:
531 mm (20.9 in) incl. handle and knobs
518 mm (20.4 in) incl. handle, excl. knobs
456 mm (17.9 in) excl. handle, incl. knobs
434 mm (17.1 in) excl. handle and knobs
Height: 146.5 mm (5.8 in) incl. feet, 134.5 mm (5.3 in) excl. feet
Weight: Approx 9.5 kg (20.9 lbs) excl. accessories

Environmental Data

Meets requirements of MIL-T-28800 C, Class 5, Style D
Temperature
Rated Range of Use: +10°C...+40°C
Operating Range: 0°C...+40°C
Storage: -40°C...+75°C
Altitude
Operating: 4500 m (15000 ft)
Transport: 12000 m (40000 ft)
Vibration: Frequency 5...55 Hz, 15 minutes along each of the 3 axes, with a maximum acceleration of 3 g. Resonance dwell of 10 minutes at each frequency where resonance occurs, or at 33 Hz when no resonance found
Shock: Operating and non operating: Max acceleration 30 g, 1/2 sine, 11 ms duration, 6 shocks on each axis, 3 shocks on each face giving a total of 18 shocks
Bench Handling: MIL-STD-810 method 516,procedure V
Safety: Meets requirements of IEC 348 class 1, VDE 0411, UL 1244, CSA 556B
Included with the instrument: Operating manual, blue contrast CRT filter, 2 x 10:1 passive probes with scale factor readout

Ordering Information

Models

PM 3350A/00n 100 Ms/s, 60 MHz DSO
PM 3352A/00n 100 Ms/s, 60 MHz DSO, rackmounted
PM 3355/00n 250 Ms/s, 60 MHz DSO
PM 3357/00n 250 Ms/s, 60 MHz DSO, rackmounted
Note:n specifies power cord required

Options

When ordering, select on of the standard model numbers listed above and add configuration number listed below as suffix:
PM 335./40n IEEE-488 (GPIB) interface
PM 335./50n RS 232 interface

Accessories

Passive Probes

PM 8922/501 1:1 or 10:1 probe, cable length 1.5 m (5 ft)
PM 8924/001 1:1 probe, cable length 1.5 m (5 ft)
PM 8924/201 1:1 probe, cable length 2.5 m (8 ft)
PM 8926/591 10:1 probe with readout, cable length 1.5 m (5 ft)
PM 8926/291 10:1 probe with readout, cable length 2.5 m (5 ft)
PM 8931/091 20 MΩ 100:1 probe with readout
Active Probes
PM 8917/00n Video line selector
PM 8940/09n High voltage isolation amplifier with readout
PM 8943/00n 650 MHz FET probe
PM 9355/09n AC current probe with readout

Other Accessories

PM 9051/001 BNC to 4 mm banana adapter
PM 9381/001 Oscilloscope camera
PM 8902/001 12 V dc power convertor
PM 8991/041 Oscilloscope trolley
PM 8999/001 Oscilloscope stand
PM 8992/651 Accessory pouch
PM 8957A/001 Retrofittable IEEE-488 (GPIB) interface
PM 8958A/001 Retrofittable RS 232 C interface
PM 8988/001 Protective front panel cover
PM 9076/011 Analog plot cable to Amphenol connector
PM 9076/021 Analog plot cable to banana plug
PM 2195/09 Probe Switch 400 MHz
PM 2122 50 Ω coaxial switch
PM 223x Instrument Drivers Software
PM 2240 TestTeam Software
PM 2260 Oscilloscope Signal Processing Software

For full details of all accessories, see page 44