

OX 8100
100 MHz-ANALOG/DIGITAL
OSCILLOSCOPE

User's Manual

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1. GENERAL INSTRUCTIONS

You have just purchased a 100 MHz oscilloscope; we congratulate you on your choice of this high quality product.

This apparatus complies with safety standard EN 61010-1, 1993 + A2, 1995 single insulation, dealing with electronic measurement instruments. Please read these instructions carefully and respect the usage precautions, in order to obtain the best use from it.

Failure to respect warnings and / or usage instructions may damage the apparatus and / or its components and may be dangerous to the user.

1.1. Safety precautions

1.1.1. Before use

- This instrument was designed for use indoors in an environment with a degree of pollution 2 at an elevation of less than 2000 m, a temperature between 0°C and 40°C, and a relative humidity of 80 % up to 31°C.

- It can be used for measurements on 300 V category II installation.

- Definition of installation categories (see publication IEC 664-1):

CAT I : CAT I circuits are protected by devices limiting transient overvoltages to a low level.

Example: protected electronic circuits

CAT II : CAT II circuits are power supply circuits for domestic or digital devices that may include transient overvoltages with an average value.

Example: power supply for household appliances and portable tools.

CAT III : CAT III circuits are power supply circuits for power equipment that may include large transient overvoltages.

Example: power supply for industrial machines or equipment

CAT IV : CAT IV circuits may include very high transient overvoltages.

Example: energy arrivals

- Check that your electricity distribution network is within the range 94 to 264 V.



The replacement fuse must be identical to the original fuse. It is located inside the apparatus in a housing on the cathode ray tube support part.

- Earth all metallic parts that are accessible to touch (including the working table).
- You are advised to use the accessories delivered with the instrument or proposed as options. Check that they are in perfect working condition before use.
- Plug the cable into a socket fitted with an earth connection.

1.1.2. During use

- Select vertical sensitivity and timebase ranges adapted to the measurement.



Never touch an unused terminal when the apparatus is connected to measurement circuits.

1.1.3. Symbols



Refer to the user's manual.
Incorrect use may result in damage
to the device or its components.



Risk of electric shock



Ground

1.1.4. Instructions

- **Before opening the apparatus**, always disconnect it from the mains power supply and measurement circuits, and make sure that you are not charged with static electricity which could damage internal components.
- Any repair, maintenance or adjustment of the oscilloscope when it is **powered** may only be done by qualified personnel, after reading the instructions in this manual.
- A "**qualified person**" is a person who is familiar with the installation, construction and use and the dangers present. He is authorized to switch the installation and equipment on and off in accordance with the safety rules.
- Take care not to obstruct ventilation holes when using the apparatus.



Some internal capacitors may retain a dangerous potential, even after the apparatus has been switched off.

1.2. Guarantee

This oscilloscope is guaranteed against any material defect or manufacturing vice in accordance with the general conditions of sale.

During the guarantee period (2 years), the apparatus may only be repaired by the manufacturer, and the manufacturer will be free to decide to repair or replace all or part of the apparatus. The guarantee conditions state that the manufacturer will pay for return transport.

The guarantee is not applicable in the following cases:

1. any improper use of the equipment or if it is used in association with incompatible equipment;
2. modification of the equipment without explicit authorization by the manufacturer's technical departments;
3. work done by a person not approved by the manufacturer;
4. adaptation to a specific application not included in the definition of the equipment or by the operating instructions;
5. a shock, drop or flooding.

1.3. Maintenance and metrological verification

Return your instrument to your distributor for any work to be done within or outside the guarantee.

1.4. Servicing

Clean the instrument with a wet cloth and soap. Never use abrasive products or solvents.

2. DESCRIPTION OF THE INSTRUMENT

2.1. Operating modes

This oscilloscope is a combined, 2-channel analog/digital instrument. To meet the most exacting user requirements it combines the advantages of the 2 operating modes.

Analog

- Display of signals in real time from 0 to 100 MHz
- "READ-OUT", cursors and automatic measurement
- Dual timebase

Digital

- Storage of signals from 0 to 100 MHz
- Post-acquisition analysis
- Observation of very slow signals without any loss of light (200 s/div.)
- Pre-triggering
- Expansion, compression
- Capture of unique phenomena (SINGLE SHOT mode)

2.2. Performance

Analog

- 2 100 MHz channels up to 2 mV/div.
- High input dynamics: 2 mV to 5 V/div.
- Triggering up to 180 MHz
- Dual resynchronisable timebase

Analog / Digital

- Automatic configuration (AUTOSET)
- Display of text in analog and digital modes
- Measurements by cursors and automatic
- Instrument fully programmable (language - SCPI)
- Interfaces : RS232, CENTRONICS (single output connector at the back)
- Bandwidth at -3 dB in digital mode: 100 MHz

Digital

- Sampling
 - SINGLE SHOT mode: 100 MS/s on one channel
 - REFRESH mode: 20 GS/s Equivalent time sampling (ETS)
- Acquisition size: selectable from 1 k, 8 k or 16 k
- Screen copy (Plotter, Printer)

2.3. Ergonomy









- The controls are grouped into functional blocks.
- The functions that are active are displayed by means of indicator lights (LED on the right-hand side of the front panel).
- The parameters are displayed on the screen (vertical sensitivity, timebase...) as well as a number of help messages to provide effective guidance to the user.
- The various menus, UTILITY (48), ENV (22), MEAS (44), CURS (45), VISU (41), SAVE (40) and MATH (39) are displayed on the screen and those keys which are active - under the screen - are indicated by the symbol: \wedge .
- The last configuration of the front panel is stored and automatically restored when the instrument is reconnected to the power supply.

3. GETTING STARTED



Respect the safety instructions indicated in Chapter 1.

- Position the rotary controls as indicated in the table below:

Position of knobs						
Mark (4)	Marks (6) (8) (10)	Mark (12)	Mark (15)	Mark (17)		
INTENSITY 	POSITION POSITION POSITION 	HOLDOFF 	LEVEL 	VAR 	BdT	
Mark (1)	Marks (37) (32)					
FOCUS 	VAR VAR CH1  CH2 					

- Press the POWER key (49): the last memorised configuration of the front panel is restored.
- Validate the AUTO key (18).
- Adjust brightness (4) and the thickness of the traces (1).
- Apply the signal to be displayed to channel CH1 or CH2.
- Press on the AUTOSET key (3) .



Adjust the brightness of the trace according to ambient lighting. Excessive brightness can damage the tube, particularly when there is no sweeping in process (spot stationary).

3.1. AUTOSET

- AUTOSET automatically carries out the following searches:
active channel, vertical sensitivity, horizontal deflection coefficient, level, trigger slope.
- AUTOSET automatically puts the oscilloscope into the following configuration:
synchro PTP, AC coupling of the connected channel, horizontal magnitude x 1, DC coupling of the trigger source.
- AUTOSET does not affect :
POSITION (H and V), VAR, DELAY, INTENSITY.

Signal not detected

The full configuration of the instrument is restored and a : "No signal found" message is temporarily displayed in zone 8 of figure 2.



Vertical adjustment is not set. You should ensure that position (6) and (10) rotary controls are correctly centred.

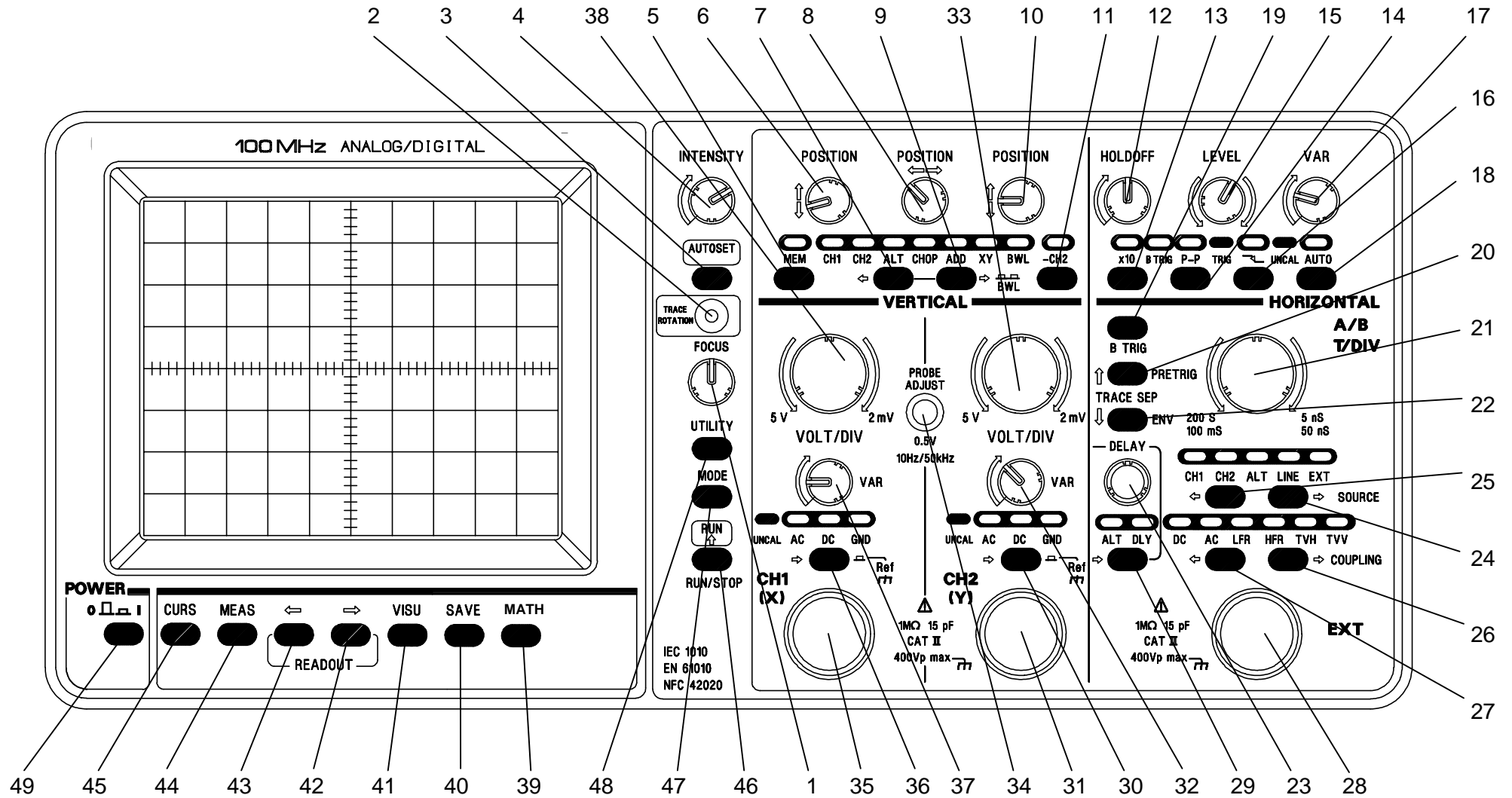



Figure 1 : Front

DESCRIPTION OF REFERENCES

1 -	FOCUS	• focus adjustment
2 -	TRACE ROTATION	• adjustment of the horizontal trace alignment
3 -	AUTOSET	• activation of the AUTOSET function
4 -	INTENSITY	• adjustment of the trace brightness
5 -	MEM	• activation of analog or digital modes
6 -	POSITION	• adjustment of the vertical position of CH1 trace
7 -	MODE ⇐	• left / right scroll of vertical modes
8 -	POSITION	• adjustment of the horizontal position of the traces
9 -	MODE ⇒	• right/left scroll of vertical modes
10 -	POSITION	• adjustment of the vertical position of CH2 trace
11 -	-CH2	• inversion of CH2
12 -	HOLDOFF	• adjustment of HOLDOFF time
13 -	x 10	• expansion by 10 of the sweep coefficient
14 -	P-P	• activation of peak-to-peak trigger mode
15 -	LEVEL	• adjustment of trigger level
16 -		• activation of positive  or negative  trigger slope
17 -	VAR	• continuous adjustment of sweep coefficient of timebase A
18 -	AUTO	• activation of AUTO or TRIGGERED sweep mode
19 -	B TRIG	• activation of B timebase resynchronised
20 -	↑ PRETRIG	• in analog mode: separation of trace B from bottom to top • in numeric mode: positioning of the TRIGGER in the recording
21 -	T/DIV	• selection of the sweep coefficient of timebase A or B
22 -	↓ ENV	• in analog mode: separation of trace B from top to bottom • in digital mode: selection of ENV or GLITCH mode
23 -	DELAY	• adjustment trigger delay of timebase B
24 -	SOURCE ⇒	• left/right scroll of trigger sources
25 -	SOURCE ⇐	• right/left scroll of trigger sources
26 -	COUPLING ⇒	• left/right scroll of trigger filters
27 -	COUPLING ⇐	• right/left scroll of trigger filters
28 -	EXT	• external trigger input
29 -	ALT DLY	• selection of alternate sweep modes A, B (ALT) or delayed B (DLY)
30 -	REF	• selection of CH2 input coupling or the measurement reference
31 -	CH2	• CH2 input
32 -	VAR	• continuous adjustment of the vertical sensitivity of CH2
33 -	VOLT/DIV	• selection of vertical sensitivity for CH2
34 -	PROBE ADJUST	• calibrator output
35 -	CH1	• CH1 input
36 -	REF	• selection of CH1 coupling or the measurement reference
37 -	VAR	• continuous adjustment of the vertical sensitivity of CH1
38 -	VOLT/DIV	• selection of vertical sensitivity for CH1
39 -	MATH	• digital mode: activation of mathematical function
40 -	SAVE	• digital mode: activation of saving of CH1 or CH2
41 -	VISU	• digital mode: access to the VISU menu
42 -	READOUT ⇒	• displacement of the horizontal/vertical cursors (or the trace in digital mode)
43 -	READOUT ⇐	• displacement of the horizontal/vertical cursors (or the trace in digital mode)
44 -	MEAS	• activation of the MEASURE menu
45 -	CURS	• activation of the CURSORS menu
46 -	RUN	• digital mode: initiate or stop acquisition
47 -	MODE	• activation of the MODE menu
48 -	UTILITY	• activation of the UTILITY menu
49 -	POWER	• ON/OFF button

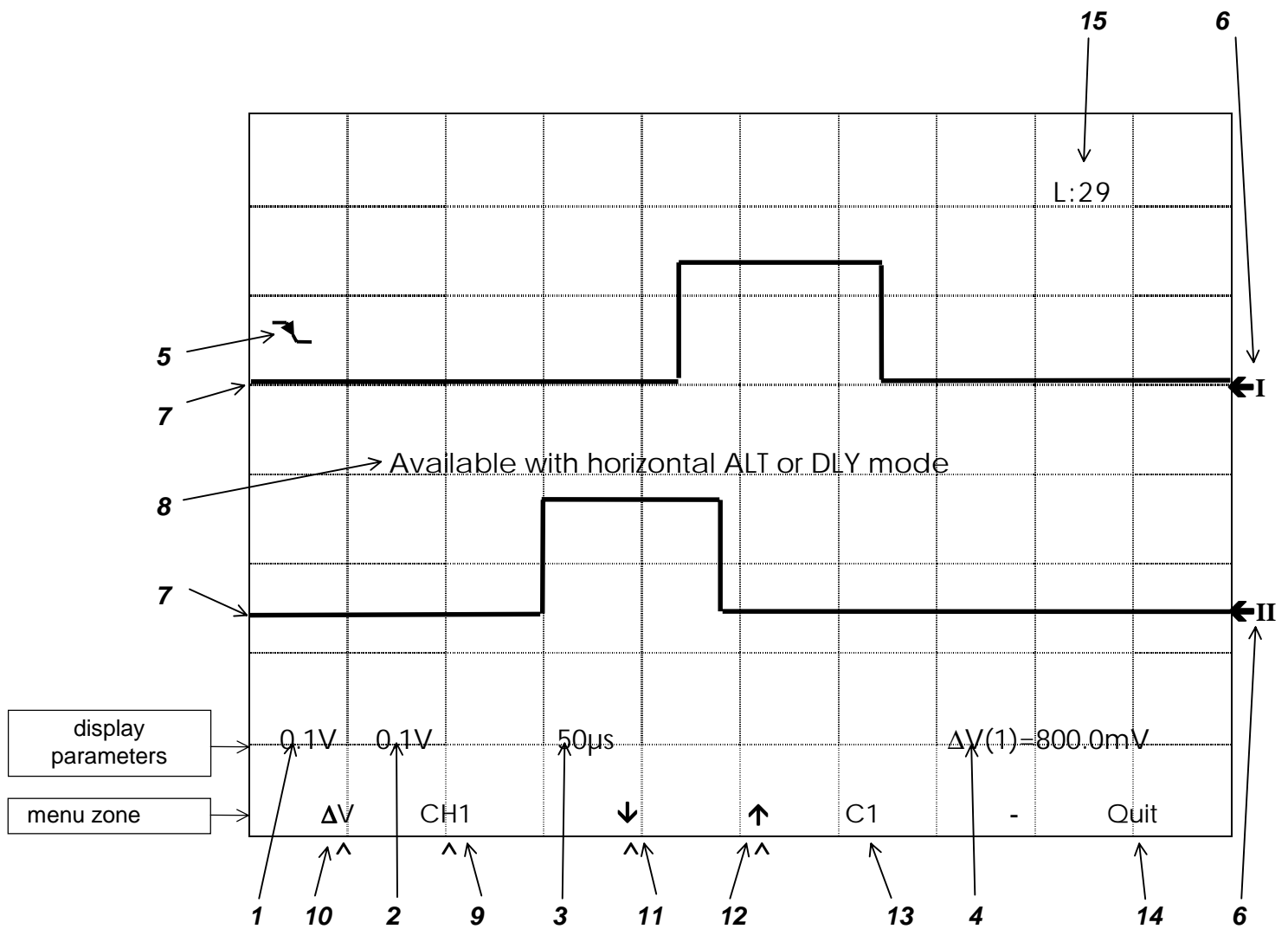


Figure 2: Visualisation of a screen in analog mode

- Zone 1 -** Vertical sensitivity CH1
- Zone 2 -** Vertical sensitivity CH2
- Zone 3 -** Timebase coefficient
- Zone 4 -** Automatic or manual measurement result for the channel selected 1 or 2
- Zone 5 -** Vertical position indicator of the TRIGGER level and the trigger slope (positive ; negative)
- Zone 6 -** Vertical position indicators of the reference of each channel
- Zone 7 -** Traces
- Zone 8 -** Display of temporary messages
- Zone 9 -** Selection of the measurement reference : CH1 or CH2
- Zone 10 -** Selection of the measurement voltage
- Zone 11 -** Displacement of the active cursor: towards the bottom
- Zone 12 -** Displacement of the active cursor: towards the top
- Zone 13 -** Selection of the active cursor C1, C2 (or C3 for phase measurement)
- Zone 14 -** Quit the menu
- Zone 15 -** Display of the line number or the raster in TV mode

4. FUNCTIONAL DESCRIPTION

4.1. Operating modes

Pressing once on the MEM key (5) toggles between the modes: analog or digital) (If the MEM indicator is on, this signifies that digital mode is selected).

4.1.1. Analog mode [MEM key (5)] - MEM indicator off

Example of screen: see figure 2.

Signals

Signals are displayed in real time according to vertical and horizontal mode parameters.

Text

Pressing simultaneously on the READOUT keys (42) and (43) allows the user to blank out or display the text.

Display parameters

- Current information
The current parameters of the front panel (vertical and horizontal) are displayed in zones 1, 2, and 3 [CH1 sensitivity (5 V/div. to 2 mV/div.), CH2 sensitivity (5 V/div. to 2 mV/div.), timebases A and B (100 ms/div. at 50 ns/div. (5 ns/div. in mode x10)].
- Result of measurement
When a measurement - by the cursor or automatic - is activated, the result is displayed in zone 4. For further details, see paragraph 4.11. Measurements.
- TV Line
In TV mode, the line number selected is displayed in zone 15.
- Menus
The menus are displayed for a short while at the bottom of the screen in place of the display parameters line which moves upwards; the display parameters line returns to its place at the bottom of the screen as soon as the menus are cancelled (see list of menus in ATTACHMENT 1 to 4).
- Temporary messages
In certain cases; help messages are temporarily displayed in zone 8 (for approximately 2 seconds):
 - * Display of the programme version (UTILITY menu),
 - * Display of error messages (see list of temporary messages in ATTACHMENT 5).
- Cursors
Two cursors (3 for phase measurement) horizontal or vertical can be displayed according to the type of measurement (CURS menu).

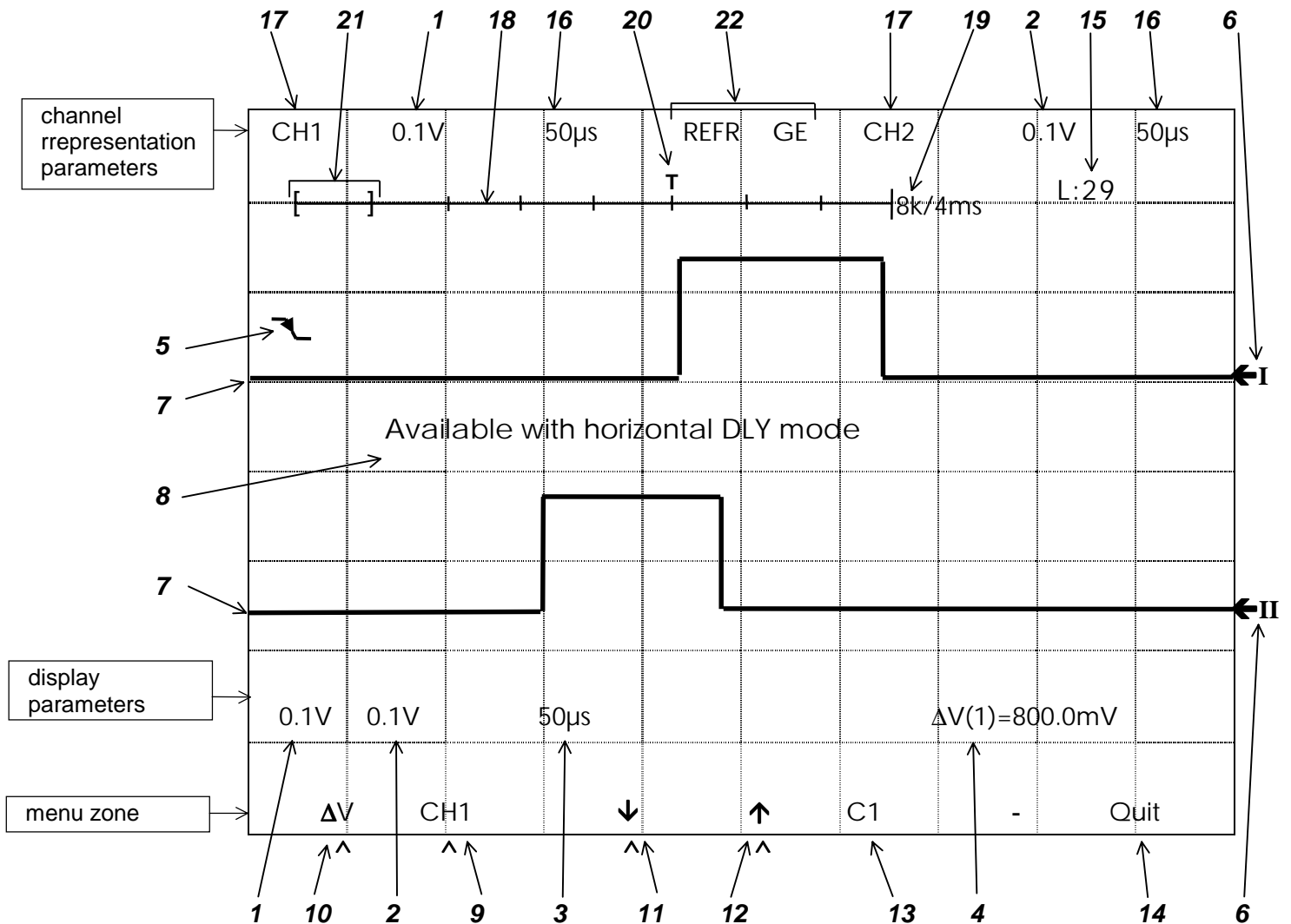


Figure 3 : Visualisation of a screen in digital mode

- Zone 1** - Vertical sensitivity CH1
- Zone 2** - Vertical sensitivity CH2
- Zone 3** - Acquisition timebase coefficient
- Zone 4** - Result of automatic or manual measurement of the channel selected, 1 or 2.
- Zone 5** - Indicator of the vertical position of the TRIGGER level and slope (positive ↗; negative ↘)
- Zone 6** - Indicators of the vertical position of the mass level of each channel
- Zone 7** - Traces
- Zone 8** - Display of temporary messages (the traces are then inhibited)
- Zone 9** - Selection of the measurement reference: CH1 or CH2
- Zone 10** - Selection of the measurement voltage
- Zone 11** - Displacement of the active cursor to the bottom or displacement of the traces from right to left, if the cursor menu is inactive
- Zone 12** - Displacement of the active cursor to the top or displacement of the traces from left to right, if the cursor menu is inactive
- Zone 13** - Selection of the active cursor, C1, C2 (or C3 for phase measurement)
- Zone 14** - Quit the menu
- Zone 15** - Display of the line number or the raster in TV mode
- Zone 16** - Channel representation timebase
- Zone 17** - Channels displayed
- Zone 18** - Bargraph (zone displayed in the acquisition memory)
- Zone 19** - Bargraph: size of recording in kbytes or seconds
- Zone 20** - Bargraph: position of the trigger in the memory
- Zone 21** - Bargraph: portion of memory displayed
- Zone 22** - Indication of the mode of acquisition

4.1.2. Digital mode [MEM key (5)] - MEM indicator on

Example of screen: see figure 3.

Signals

One or two digitised signals can be displayed according to the status of the vertical mode (CH1, CH2, ALT, CHOP, ADD, XY).

Text

Pressing simultaneously on the two READOUT keys (42) and (43) permits the user to blank out or display the text (as in analog mode).

The screen comprises 2 lines of text or 3 if a menu is selected:

Channel representation parameters

This line comprises scale information (vertical sensitivity and timebase) for digital signals as well as the current acquisition mode.



During acquisition, digital signal scale information follows the evolution of the current parameters of the front panel which are displayed on the lower part of the screen.

Once acquisition has finished, the sensitivity of the digital signals is frozen; the timebases vary according to the width of the window (paragraph 4.9.2.2.). In all cases, scale information of digital signals are true to the waveforms recorded and displayed.

Acquisition parameters

- Current information

The current parameters of the front panel (vertical and horizontal) are displayed in zones 1, 2, and 3 (CH1 sensitivity (5 V/div. to 2 mV/div.), CH2 sensitivity (5 V/div. to 2 mV/div.), timebases A and B (200 s/div. to 5 ns/div.).

- Screen/memory bargraph

It represents the storage memory. The part between square brackets indicates the part of the memory displayed on the screen, adjustable as regards width and position (see paragraphs 4.9.2.2. and 4.9.2.3.). The letter "T" represents the position of the trigger point in the acquisition memory (see paragraph 4.9.1.2. Pre-trigger). This point corresponds to:

- trigger of the analog timebase A in normal mode,
- trigger of the analog timebase B in DELAY mode.

The size of acquisition memory is indicated in zone 19 (in kbytes 1 k, 8 k, 16 k, or in seconds). The horizontal position of the trigger point in the memory is indicated by the symbol T (zone 20).

- Result of measurement

When a measurement is activated (by cursors or automatically), the result is displayed in zone 4. The measurement takes the parameters of the channel digitised as the reference (for further details, see paragraph 4.10. Measurements).

- Menus, temporary messages and cursors

Same as in analog mode (see paragraph 4.1.1. Analog mode).

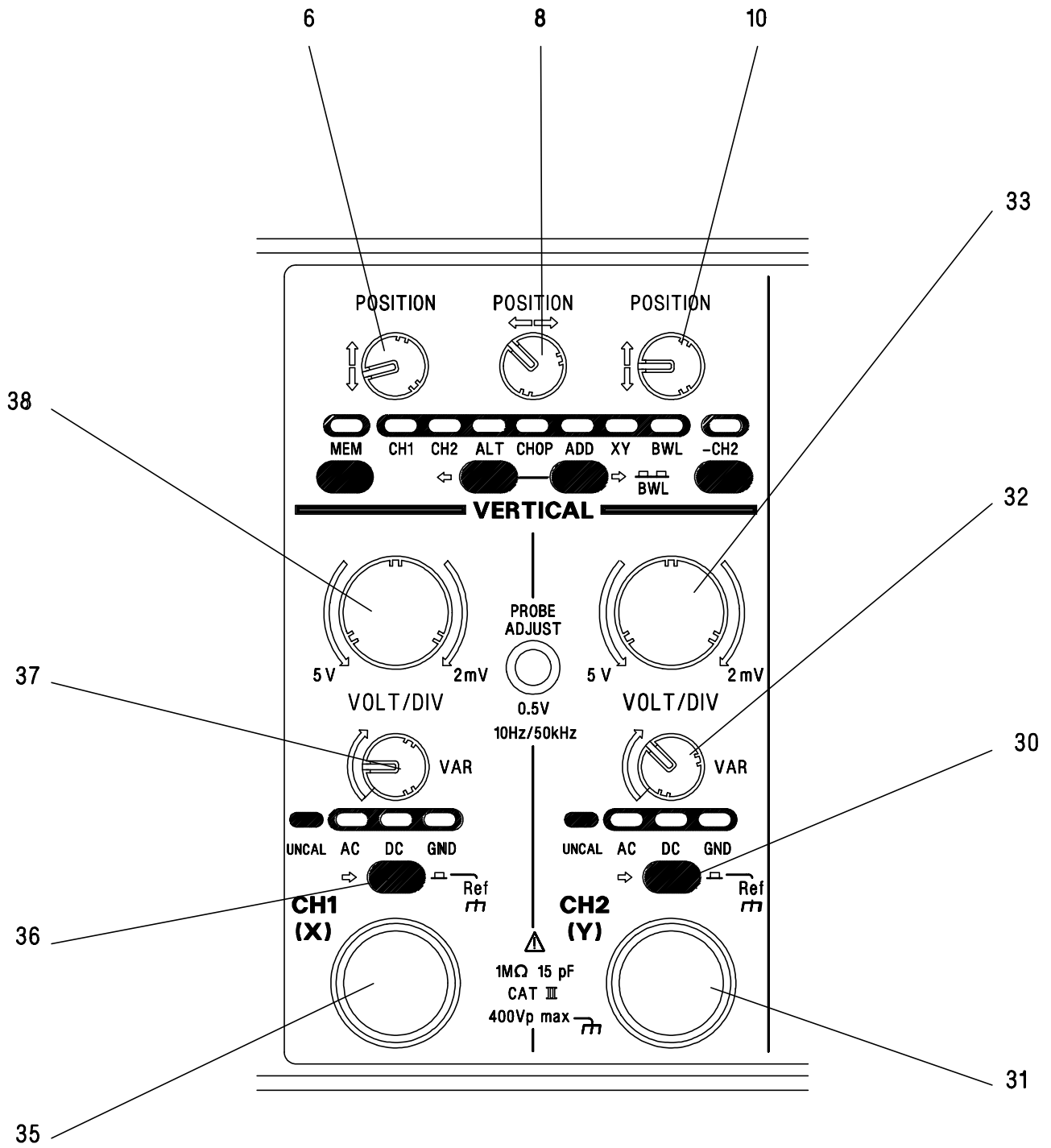
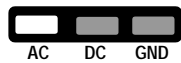


Figure 4

4.2. Vertical channels

- (6) - (10) **POSITION** - Vertical centring of the traces.
The 0 V references are indicated by the symbols **◀I** or **◀II** to the right of the screen. These references move with the potentiometers (6) and (10).
- (8) **POSITION** - Horizontal centring of the traces.
This command acts simultaneously on CH1 and CH2, in analog mode only.
- (33) - (38) **VOLT/DIV** - Vertical sensitivity : 11 positions (2 mV to 5 V/div.).
- (32) - (37) **VAR** - Continuous adjustment of vertical sensitivity. When the knob is locked in the left-hand position, the corresponding UNCAL indicator light is out.
- (30) - (36) **AC - DC - GND**

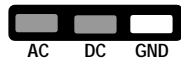
Short press: Input coupling



Visualisation of the A.C. component (deletion of the DC component).



Visualisation of the full signal (0 to 100 MHz).
Continuous coupling.



Coupling of the channel to earth (without short-circuiting the input signal). Enables accurate positioning of the trace on the screen using the POSITION controls
In this case, the reference symbol 0 V and trace are merged in AUTO sweep.

Button pressed down: Visualisation of the 0 V reference: (36) for CH1 or (30) for CH2. Allows the 0 V reference to be located easily; this can be modified vertically with the potentiometers (6) and (10).



Also enables the reference channel for measurements to be selected (without using the CURS menu).

- (31) - (35) **CH1 and CH2** - Input of signals to be observed on BNC sockets.

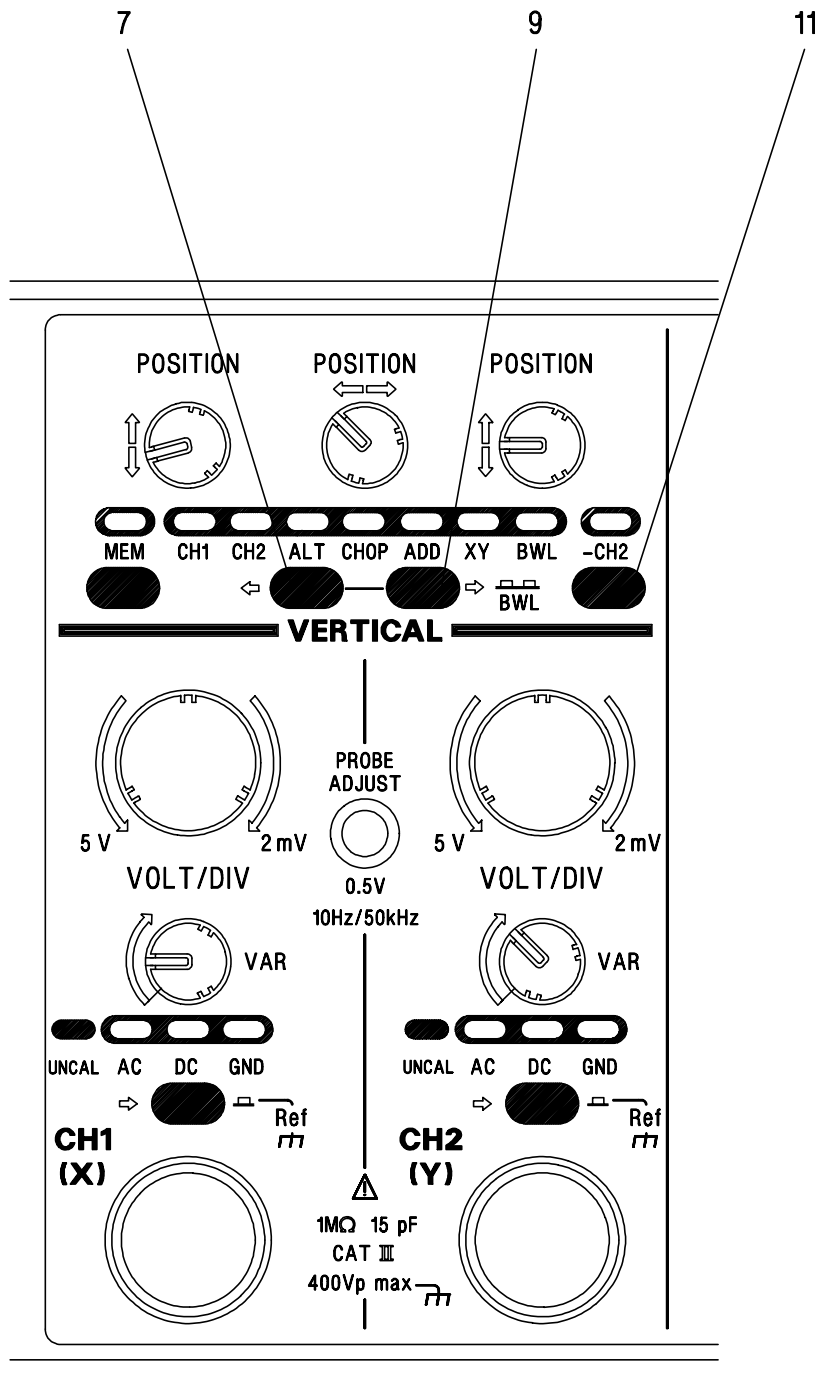


Figure 5

4.3. Display modes

(7) - (9) **CH1 - CH2 - ALT - CHOP - ADD - XY - BWL**

Selection by the ← (7) or → (9) key:



Display of CH1 only.



Display of CH2 only.



Display of CH1 and CH2 in alternate. mode.



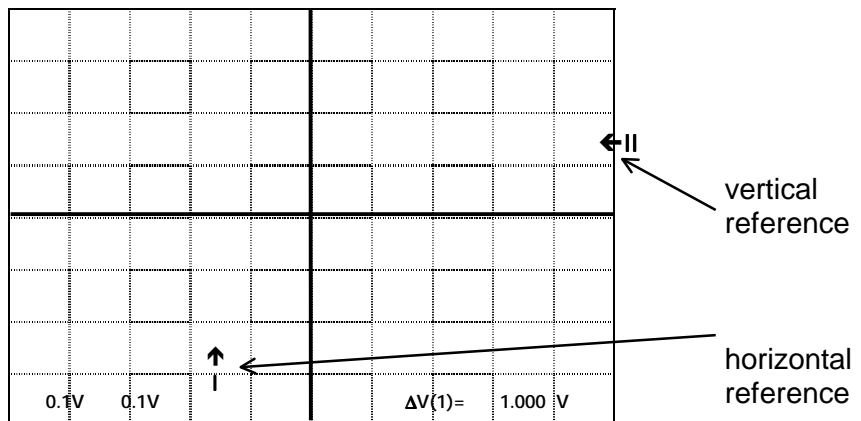
Display of CH1 and CH2 in chopper mode; during one sweep the channel passes from CH1 to CH2 at the chopper frequency (500 kHz approximately).



Display of the sum of CH1 and CH2 ; the difference of CH1- CH2 is displayed if inversion of CH2 is active.



Display of CH1 and CH2 as orthogonal co-ordinates (CH1 as X, CH2 as Y). The timebase is inoperative and vertical centring is carried out using the control (10):



Select the BWL function by pressing simultaneously on keys ← (7) and → (9) :



Bandwidth reduced to 20 MHz for CH1 and CH2 simultaneously in analog mode.



In the above example, CH1 is displayed and the bandwidth limiter (BWL) is active.

The BWL function allows the thickness of the trace to be reduced when masses are long or when the input connection is not suitably shielded.

If the required bandwidth is 100 MHz, deactivate the BWL function by pressing simultaneously on (7) and (9).

The automatic function in AUTOSET is inhibited.



In digital mode, the BWL is not active, the corresponding LED is out.

(11) **-CH2**



Inversion of CH2, by pressing key (11).

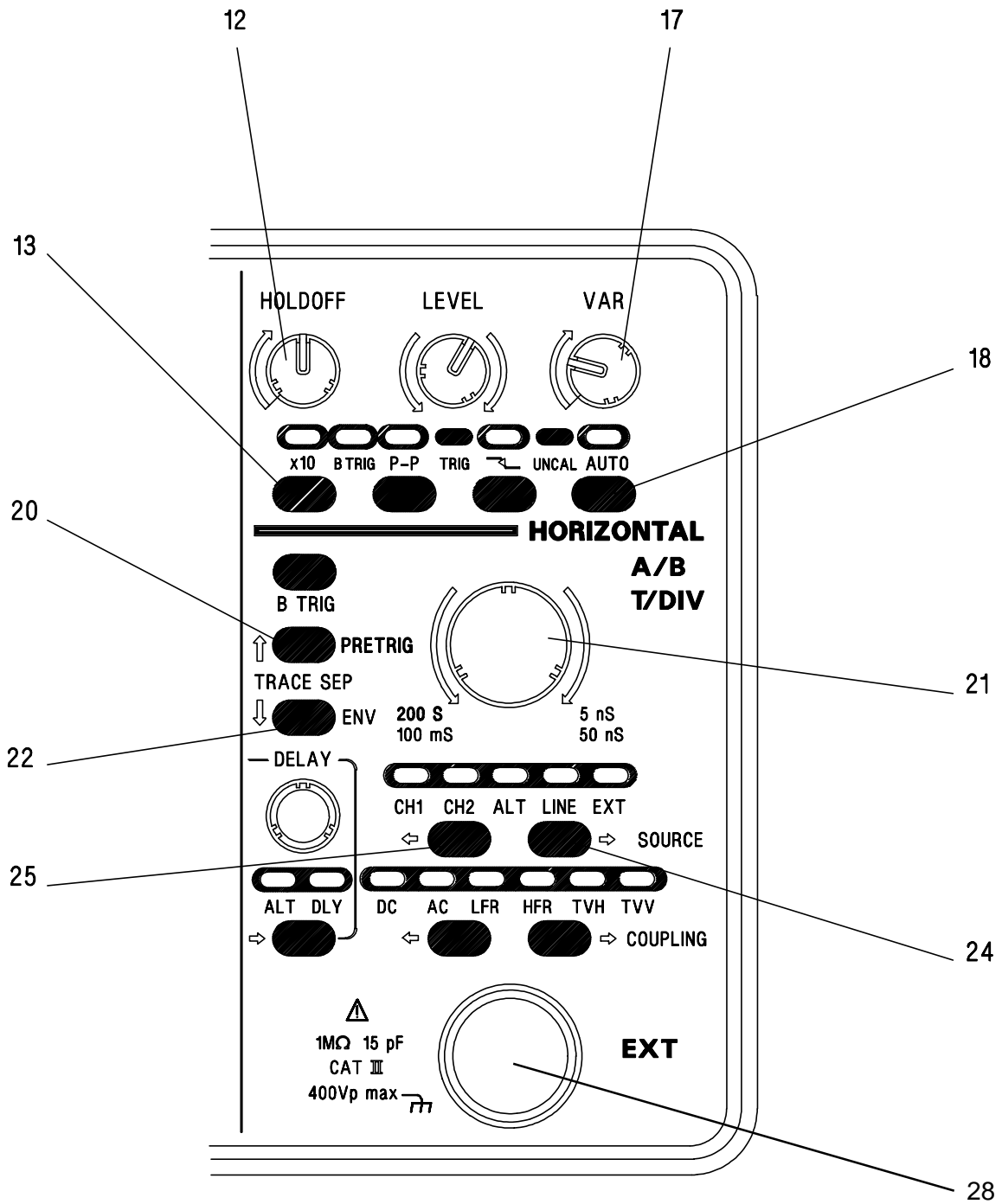


Figure 6

4.4. Timebase

- (21) **A/B T/DIV** - Sweep coefficient
 - 20 positions (50 ns to 100 ms/div.) for the two timebases A and B
 - 33 positions (5 ns to 200 s/div.) in digital mode

The timebase switch (21) has two functions:

- management of the speed of timebase A
- management of the speed of timebase B in ALT mode or in the DELAY function

(See paragraph 4.9.2.2. Width of the window).

- (17) **VAR** - Continuous adjustment of the sweep coefficient of timebase A
 When the knob is locked in the left-hand position, the UNCAL indicator is out.
- (12) **HOLDOFF** - Continuous adjustment of the minimum time between two successive sweeps. This control, active in both digital and analog modes, enables the holdoff of ill-timed triggering (multiple trigger conditions in the same period of the signal observed). In normal use the knob is locked in the left-hand position (click).
- (13) **x10** - Horizontal magnitude(x 10). This function is not active in XY analog mode (indicator out) or in any digital display modes (temporary message).
- (20)-(22) **TRACE SEP** - Separation of the traces in dual timebase mode (active in the ALT position of the DELAY function).

4.5. Trigger

- (24)-(25) **SOURCE** - Select by pressing on the → (24) or ← (25) keys:
 The same source serves for the synchronisation of timebases A and B.



Synchronisation by CH1.



Synchronisation by CH2.



Trigger source defined according to the display mode:

Display mode	Trigger channel
CH1	CH1
CH2	CH2
ALT (digital mode)	channel 1 synchronised with CH1 channel 2 synchronised with CH2
ALT (analog mode)	CH1
CHOP	CH1
ADD	CH1
- CH2	CH2



Synchronisation by the frequency of the mains supply. The trigger point can be adjusted using the LEVEL control. The trigger source coupling command is inoperative (LEDs coupling source off)



Synchronisation by the external source connected to the plug BNC EXT (28).

- (18) **AUTO** - Automatic trigger of the timebase. Traces visible even in the absence of a trigger event.

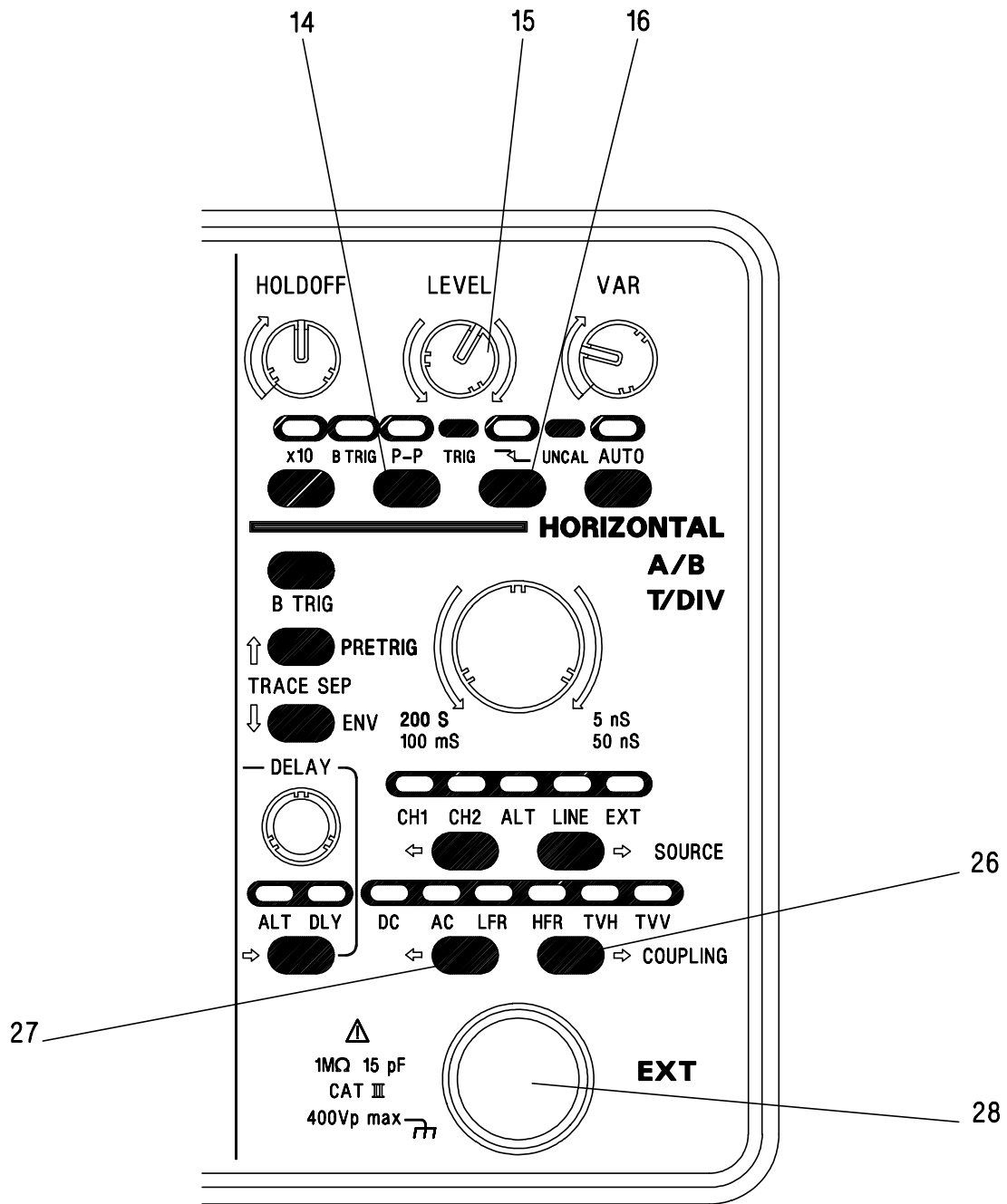









Figure 7

- (15) **LEVEL** - Adjustment of the trigger level
 The vertical position of the trigger point is displayed on the screen in real time by means of the symbols  or  (\triangle or ∇) depending on whether the trigger slope is negative or positive.
 The TRIG indicator lights up when a trigger event is detected.


- (16) **Trigger slope** 
 Indicator lights up : trigger on the negative slope.
 Indicator off: trigger on the positive slope.

 ***This function is inactive in XY analog mode (indicator out).***

 or  Symbol on the screen indicating an positive trigger slope
 or  Symbol on the screen indicating a negative trigger slope.
 This symbol is displayed in zone 5 of figures 2 and 3.

- (28) **EXT** - Input of the external synchronisation signal by the BNC socket (See Chapter 6. SPECIFICATIONS).

- (26) (27) **COUPLING** - Coupling of the trigger source

 ***Possible filtering only affects the trigger channel and not the display.***
Using \triangle or ∇ symbols means that the displayed TRIGGER level might be different from the visualised TRIGGER point.

Select by pressing on the \rightarrow (26) or \leftarrow (27) key:



D.C. coupling (0 to 180 MHz).



A.C. coupling (10 Hz to 180 MHz).



Rejection of source signal frequencies < 10 kHz (facilitates observation of signals with a D.C. component).




Rejection of source signal frequencies > 10 kHz (facilitates the observation of signals with high-frequency noise).



Trigger on the synchronisation pulse of the line selected from the TV menu [see Attachment I UTILITY Menu (TV)]. Sweep coefficient recommended for the examination of a TV line: 0.5 μ s at 20 μ s/div.



Trigger on the synchronisation pulse of the raster selected from the TV menu

 ***This function is inactive in XY analog mode (indicators out).***

- (14) **P - P** - Peak-to-peak trigger
 The trigger reference (accurate adjustment by LEVEL) is automatically between the low and the high peaks of the sinewave chosen, which guarantees the trigger irrespective of the amplitude or the D.C. component of the source signal (80% of the peak-to-peak amplitude of the sinewave for $f = 100$ Hz).

 ***This function is inactive in XY analog mode (indicators out).***

Utilisation of the P-P trigger is not recommended for very low frequency signals or short pulse signals.

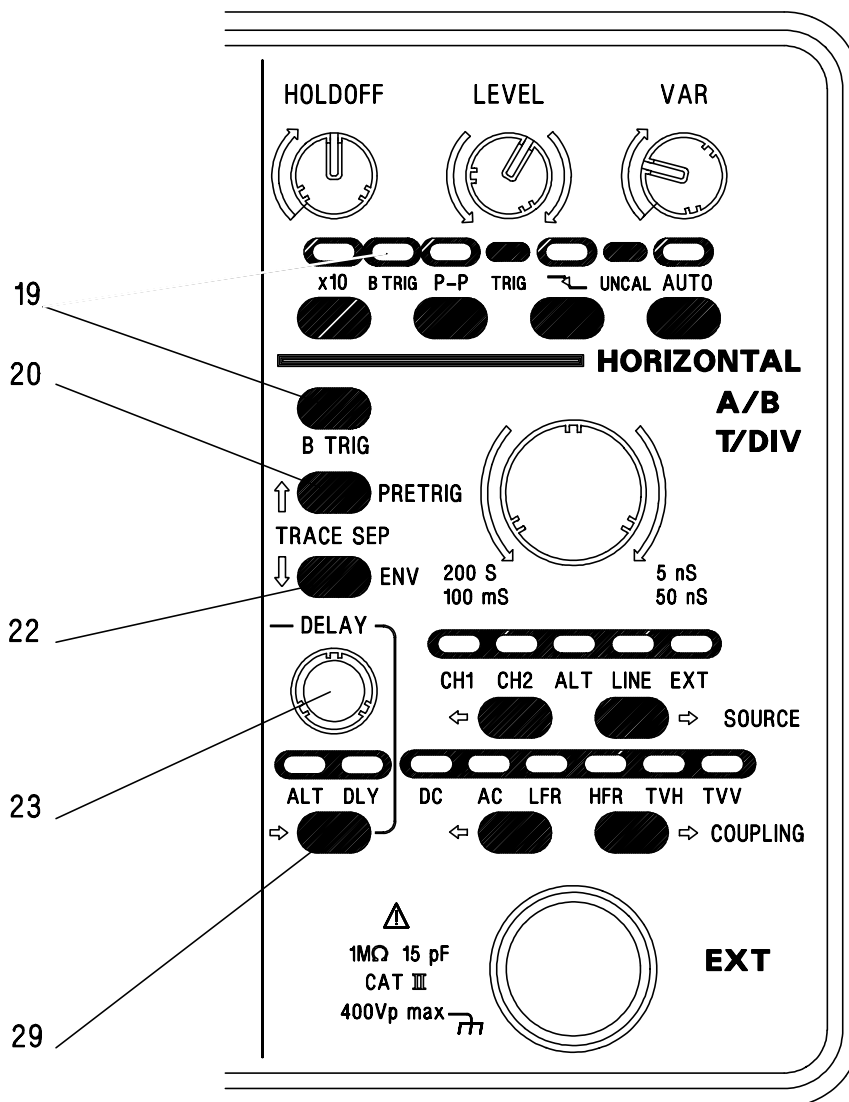


Figure 8

4.6. Trigger delay (DELAY) - Timebase B

This mode permits a portion of the signal to be examined in detail (at high sweep speed) after the trigger event chosen. The DELAY command (23) enables continuous adjustment of the delay (1 to 9 div.).

(29) **DELAY**- Select by pressing on button (29) :



Normal mode:

The sweep starts immediately (trigger event at the far left of the trace in analog mode).



Alternate mode ALT (not accessible in digital mode) :

2 traces are obtained for each of the vertical channels: the first corresponding to the sweep of the principal timebase A, with an overintensified zone corresponding to timebase B delayed by the value of the DELAY.

The second trace is displaced beneath the first. It has a duration defined by the sweep coefficient of timebase B. It can be displaced by using the TRACE SEP keys (20) - (22). In ALT or CHOP display modes, 4 traces are obtained:

- | | |
|--------------------|--------------------|
| 1 : CH1 timebase A | 2 : CH1 timebase B |
| 3 : CH2 timebase A | 4 : CH2 timebase B |

Delay: To alter the delay, use the ten-turn DELAY knob (23).

AC vertical position of the trace: in the region of -1 to -5 div. Use the 2 TRACE SEP knobs (20) - (22) immediately above the DELAY button. The upper key (20) reduces the vertical position, the lower key (22) increases it.



DLY delayed mode:

Only timebase B sweep is displayed

In digital mode (MEM on), it enables the extension of PRE and POST TRIG possibilities.



Before validating ALT or DLY modes, the user must choose sweep coefficient A with timebase button A/B T/DIV (21).



Sweep coefficients:

The A/B T/DIV button (21) is used to choose speed A in normal mode or timebase B in ALT or DLY mode. Speed B may not be lower than speed A.

(19) **B TRIG** - Select by pressing on key (19) :

Resynchronisation of timebase B. Active in timebase B ALT or DLY modes.



"RUN AFTER DELAY" Mode (indicator off) :

Sweep B is triggered automatically once the DELAY time has ended.



"TRIG AFTER DELAY" Mode (indicator on):

Sweep B is triggered by the same trigger as sweep A once the DELAY time has ended.

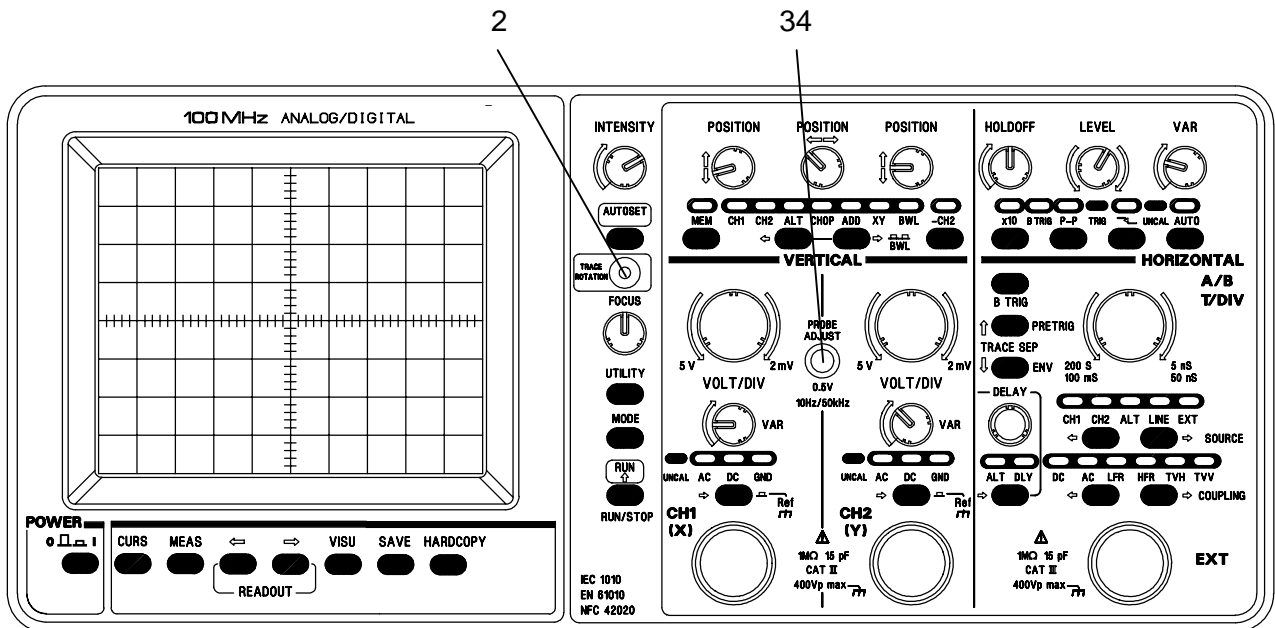


Figure 9

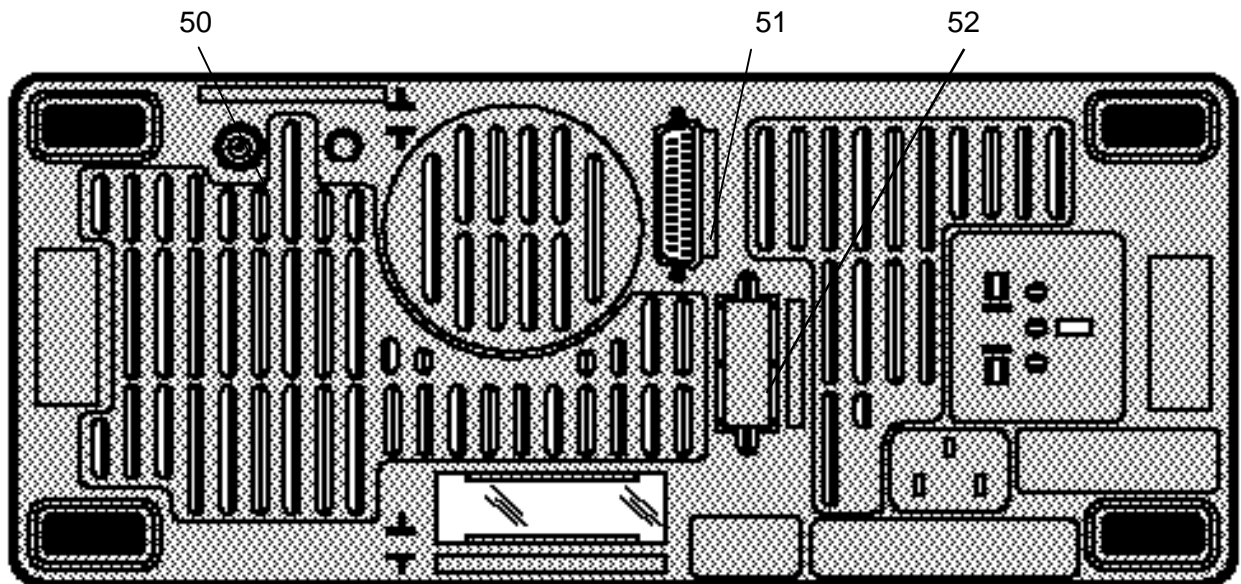


Figure 10

4.7. Other functions

- (34) **PROBE ADJUST** - Output of a rectangular signal (0.5 V c. to c. 10 Hz/50 kHz)
This signal is used for the compensation of measurement probes or for the verification of the vertical amplifiers and the timebase (see paragraph 5.1. Visualisation of the calibration signal).



The frequency of the calibrator is defined by sweep speed A. It varies from 10 Hz to 50 kHz so that each period covers 5 horizontal divisions from 20 ms/div. to 0.1 ms/div. The 1 kHz frequency corresponds to 0.2 ms/div.

This signal enables low and high frequency compensation to be made for probes. The reference plateau is the upper half of the peak.

- (2) **TRACE ROTATION** - Adjustment of the horizontal trace alignment in relation to the horizontal axes (this adjustment is done using a screw-driver).
- (50) **Z MODULATION** - Entry via the BNC socket at the back (figure 10), of a TTL signal controlling the switching off of the spot (0 V level → trace on, upper level 5 V ← trace off). In addition, this entry enables a time reference signal to be used (marker).
- (51) **INTERFACE - RS232 or CENTRONICS**: single output connector at the back.
- (52) **GPIB INTERFACE** (optional - ref. HA 1341): output connector location.

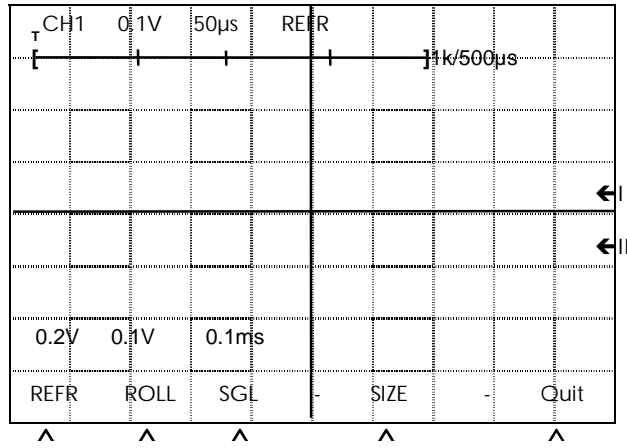


Figure 11 : MODE

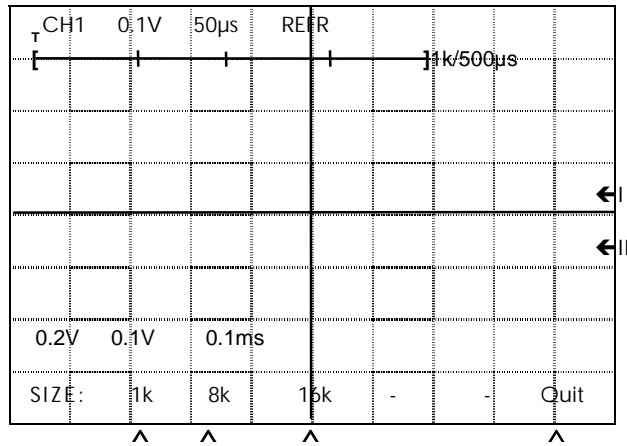


Figure 12 : SIZE

4.8. Display of parameters (READOUT)

Pressing simultaneously on the two READOUT keys (42) and (43) blanks out or displays text on the screen.



In analog mode, the writing of text has priority over the sweep of the signal. If a number of periods are displayed (> 20), the signal may occasionally be wiped out while the text is being written. Deletion of the text brings the full signal back.

4.9. Digital memory (See representation of the front (figure 1) and the screen in digital mode (figure 3).)

The CURS menu can be accessed directly with key 45 (*)

-	MEAS	-	44 (*)
-	VISU	-	41
-	SAVE	-	40
-	MODE	-	47
-	ENV	-	22

(*) also valid in analog mode

4.9.1. Management of acquisition

4.9.1.1. MODE Modes (key 47) - See figure 11.

SINGLE mode (SGL) : SINGLE SHOT acquisition (5 ns to 200 s/div.) :

- from (*) 2 μ s/div. to 5 ns/div.: the number of points displayed depends on the sweep coefficient chosen
- from (*) 2 μ s/div. to 200 s/div: the number of points displayed is constant (1000 pts)

(*) 1 μ s/div., if only one channel is selected.

REFRESH Mode (REFR) : Permanent acquisition (5 ns to 200 s/div.).

ROLL Mode (ROLL) : Acquisition with rolling of the trace from right to left (100 ms/div. to 200 s/div.).

Selection of the acquisition mode

Press once on the MODE key (47) to bring up the following menu:



Modification of an acquisition parameter cancels and reruns acquisition.

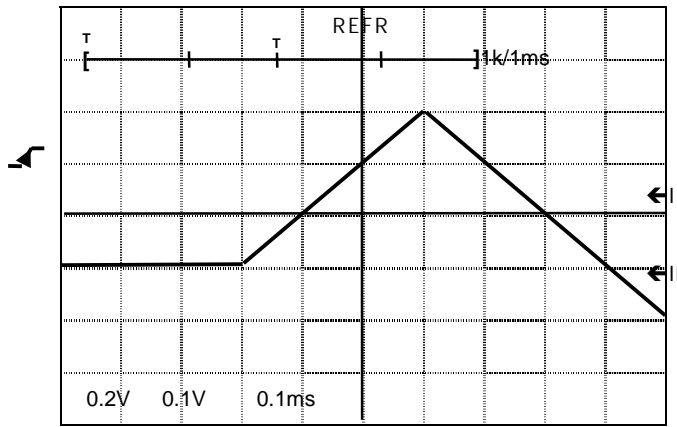
Then by pressing on key:

45,		REFR mode
44,	-	ROLL
43,	-	SGL
41,	-	acquisition size SIZE.

By pressing on key 41, the SIZE sub-menu appears (figure 12) :



By pressing on key	44,	size of	1k is selected,
-	43,	-	8 k
-	42,	-	16 k



**Figure 13 : PRETRIG Mode
ACQ Depth 1k Pretrig 500 bytes**

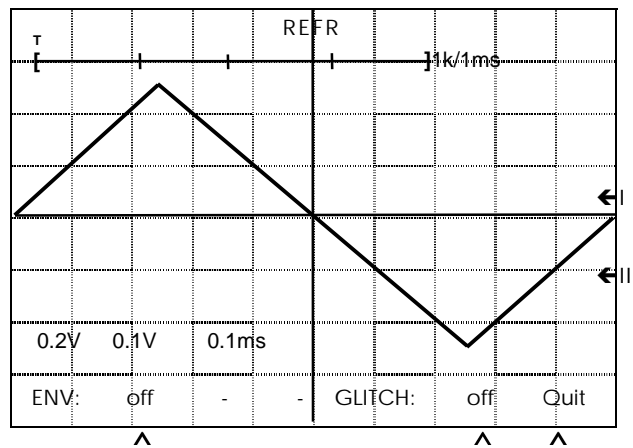


Figure 14 : Envelope Mode "OFF"

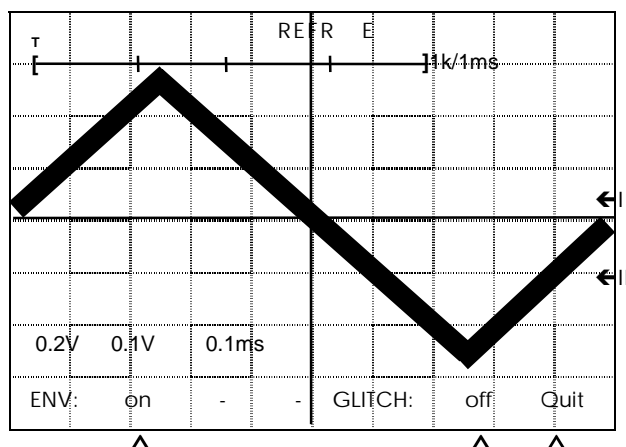


Figure 14 b: Envelope Mode "ON"

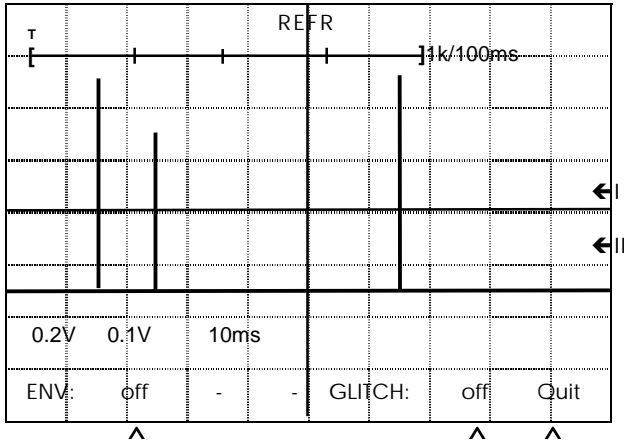


Figure 15 : Acquisition of a comb without capture of glitch.

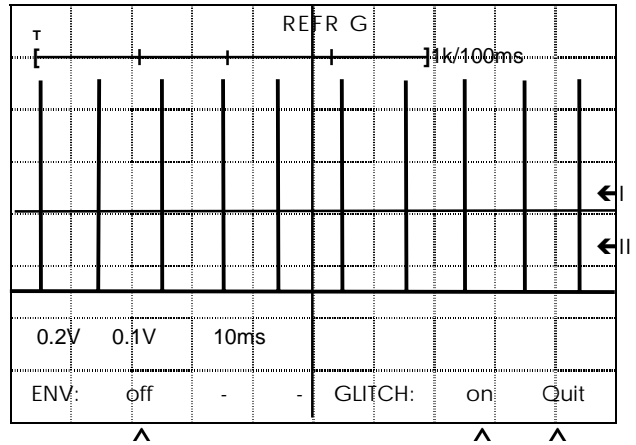


Figure 16 : Acquisition of a comb with capture of glitch

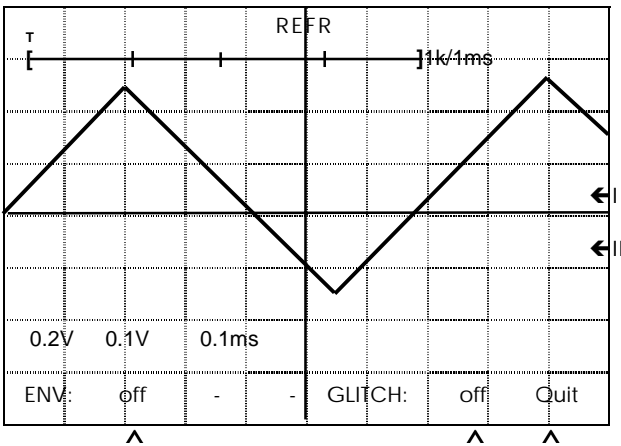


Figure 17 : Acquisition of an under-sampled signal without capture of glitch (false representation)

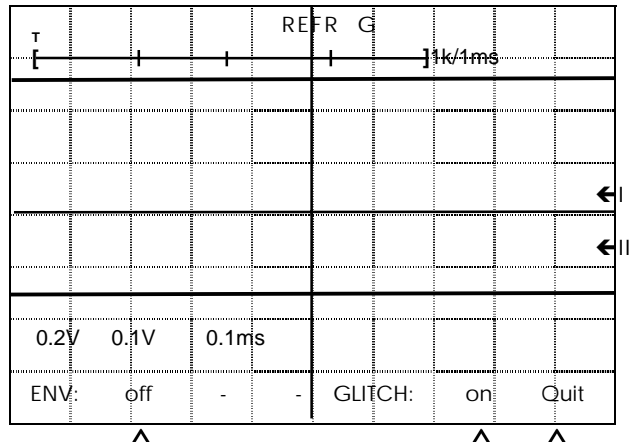


Figure 18 : Acquisition of an under-sampled signal with capture of glitch

4.9.1.4. Glitch capture mode

Glitch capture mode allows glitch to be captured for aduration of ≥ 20 ns over the full 5 μ s/div. to 200 s/div span.

Selecting of glitch capture mode

- Press on the ENV key (22); the following menu appears at the bottom of the screen:

ENV: off EADJ: off GLITCH: off Quit
45 44 43 42 41 40 39

- Press on key (40) to validate or invalidate glitch capture mode. Quit the menu by pressing key (39) Quit. A "G" appears on the line of text above:

CH1 0.5V 10ms REFR G CH2 10mV 50 μ s

4.9.1.5. Enhanced Analog Dot Join (EADJ) Mode

- Press on key ENV (22). The following main menu appears at the bottom of the screen:

ENV: off EADJ: on GLITCH: on Quit
45 44 43 42 41 40 39

- The selection of the EADJ mode (42) forces the configuration of the ENV off mode and of the GLITCH on mode.
- Quit the menu by pressing on the key QUIT (39).

Application 1: acquisition of a comb

Signal

- period 10 ms
- pulse width 10 μ s

Timebase 10 ms/div.

Sampling time 100 μ s/div.

Sampling time is greater than the pulse width; without glitch capture mode, pulses are missing from the recording or are poorly quantified as regards amplitude (figure 15). With glitch capture mode, all pulses are represented (figure 16).

Application 2: detection of false representation

Signal

- frequency 1 MHz
- period 1 μ s

Timebase 100 μ s/div.

Sampling time 1 μ s/div.

When the signal is under-sampled, recordings obtained may be incorrect (figure 17). Glitch capture mode records the minima and maxima between each sample: in this case, maximum and minimum peaks are obtained, confirming the false representations (figure 18). It is also possible to detect false representations by comparing the signals displayed in analog mode and in digital mode, using the MEM key (5) (see paragraph 4.1. Operating modes).



Modification of this parameter while acquisition is under way cancels acquisition and reruns it.

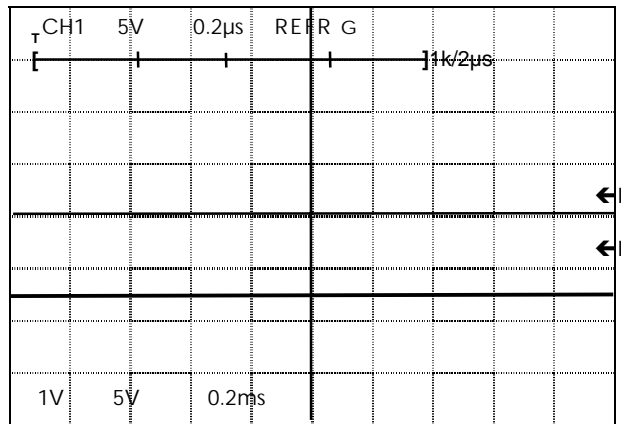


Figure 19: Before acquisition

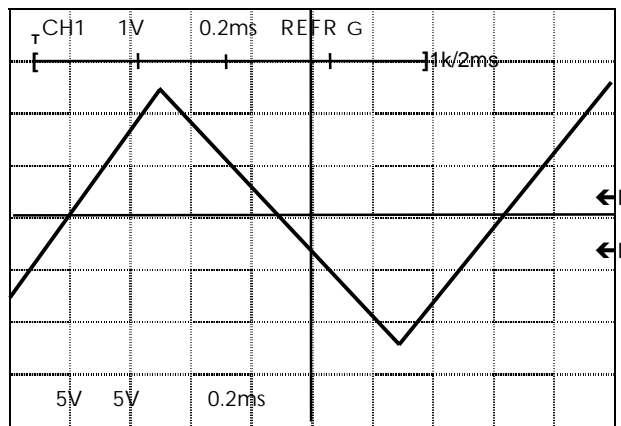


Figure 20: After acquisition

4.9.1.6. Running and stopping acquisition

Running (RUN)

Acquisition is run by pressing on RUN/STOP (46). The RUN indicator comes on and the parameters specific to signals (sensitivity and timebase) take on the current values (those displayed on the lower part of the screen).



If ROLL mode is configured, acquisition will only be run for timebase speeds slower than or equal to 100 ms/div. For faster speeds, an error message is temporarily displayed on the screen: "Set Time Base > 50 ms (ROLL)".

Stop (STOP)

If acquisition is in progress (RUN indicator on) one press on RUN/STOP (46) immediately stops the acquisition in process. The RUN indicator goes out and sensitivity specific to the signals recorded is frozen.



If no trigger has occurred between running and stopping of acquisition, the signals are not refreshed (except in continuous ROLL mode).



Any modification of the timebase, acquisition mode, envelope mode, glitch capture mode or vertical mode will cause the acquisition in process to be abandoned and it will be rerun with the new parameters.

Figures 19 and 20 can be obtained by carrying out the following sequence:

1. Oscilloscope in digital mode:
2. Select vertical CH1 mode, then REFRESH and GLITCH CAPTURE.
3. Set current acquisition values as follows (figure 19) :
 - sensitivity CH1, 1 V/div.
 - sensitivity CH2, 5 V/div.
 - sweep coefficient 0.2 ms/div.
4. Run acquisition by pressing on the RUN/STOP key (46).
5. Stop acquisition by pressing again on the RUN/STOP key .
6. Set the current acquisition values as follows (figure 20) :
 - sensitivity CH1, 5 V/div.
 - sensitivity CH2, 5 V/div.
 - sweep coefficient 0.2 ms/div.

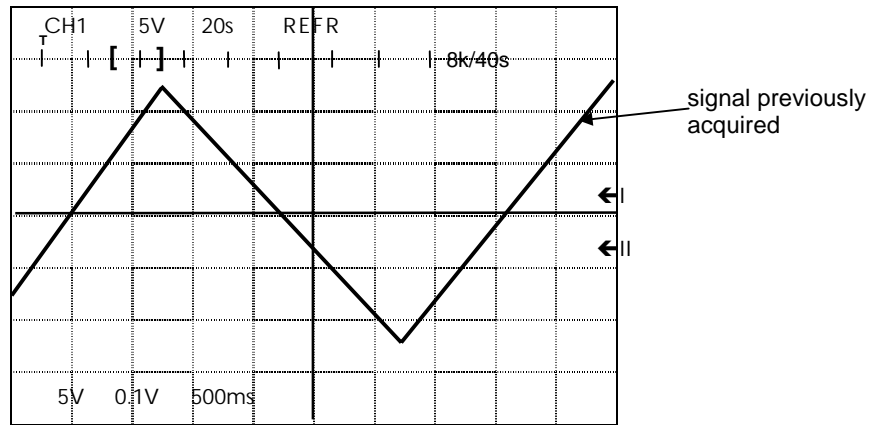


Figure 21: Setting the acquisition; purging the bargraph

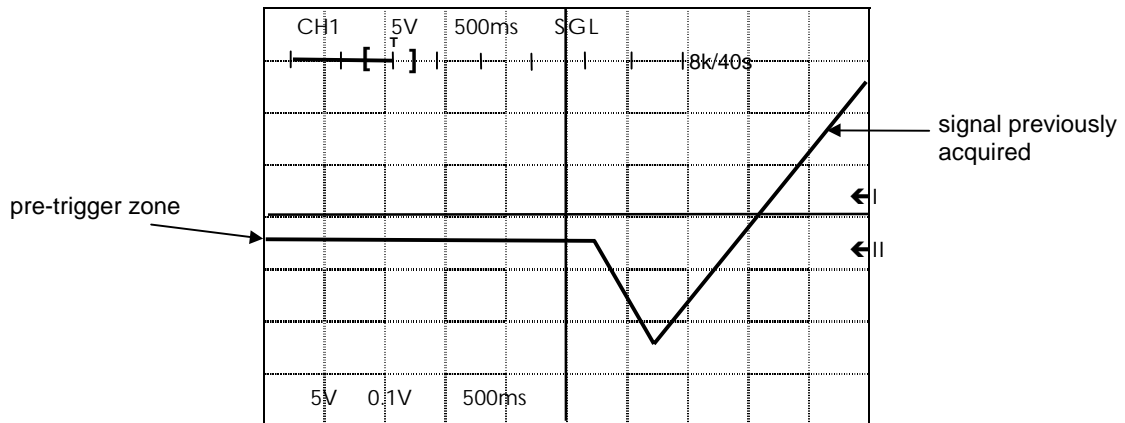


Figure 22: Trigger; updating of pre-trigger and visualisation of post-trigger acquisition point by point

4.9.1.7. Display update of signals

There are several possible cases:

- SINGLE or REFRESH mode and timebase of 50 ms/div. to 5 ns/div.:
the signal is refreshed as soon as acquisition is finished. In the case of SINGLE mode, a single acquisition takes place and the RUN indicator turns off, indicating that the instrument is idle.



For slow speeds, it may take a long time to acquire the signal to carry out a full sweep (acquisition time depends on the size of memory selected 1, 8 or 16 k).

- SINGLE or REFRESH mode and timebase of 200 s/div. to 100 ms/div.: since acquisition may be very long, its progression must be monitored. For this reason, the bargraph is purged at the start of acquisition and only the square brackets delimiting the memory and the screen remain (figure 21).
- As soon as triggering occurs:
 - the pre-trigger zone - if different from zero - is instantly refreshed on the bargraph.
Then, the horizontal line of the bargraph indicates the progression of acquisition until the memory is full (figure 22).
 - on the screen, only that part of the pre-trigger zone included in the display window is refreshed.
Then, the waveform is refreshed point by point (from left to right) to the edges of the screen.

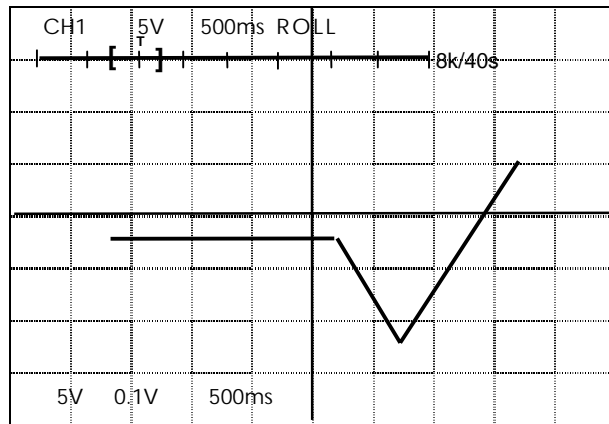


Figure 23: Incomplete recording (pre and post trigger)

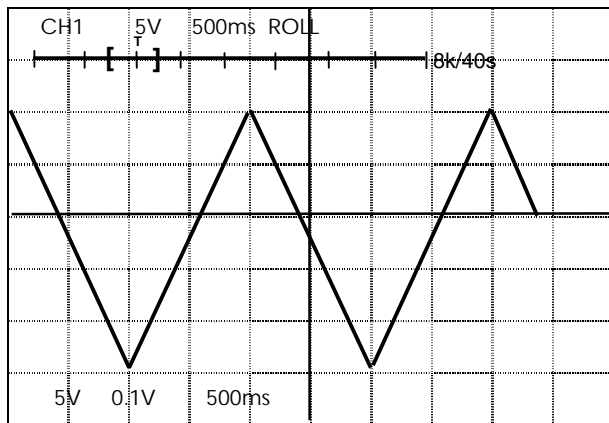


Figure 24: Incomplete recording in ROLL mode

ROLL Mode

Run: the screen is purged, then the trace scrolls from right to left. The screen width is configured to 1,000 points and its origin is unchanged.

- Discontinued ROLL mode:

It stops as soon as acquisition has been completed or as soon as the user decides to stop it (press on RUN/STOP).

In both cases, the signal is refreshed according to the position of the window and the trigger point.



Acquisition may be incomplete:

- ***Pre-trigger: trigger may occur before the pre-trigger zone is acquired.***
- ***Post-trigger :the user may stop acquisition before it is complete.***

The zones not filled in are purged (value 0) and are not visible on the screen (figure 23).

- Continuous ROLL mode:

Acquisition can only be stopped by pressing on RUN/STOP. The trace is then refreshed by taking the last samples acquired according to the position of the window.



If acquisition is stopped before the memory is completely filled, the purged zones are at 0 and therefore are invisible on the screen (figure 24).

4.9.2. Visualisation of digitised signals

4.9.2.1. Vertical position

Vertical position is active in digital mode, including for a memorised signal (except for acquisition); the POSITION potentiometers (6) - (10) adjust CH1 and CH2 traces, respectively.



The zero volt reference is permanently represented on the right of the screen.

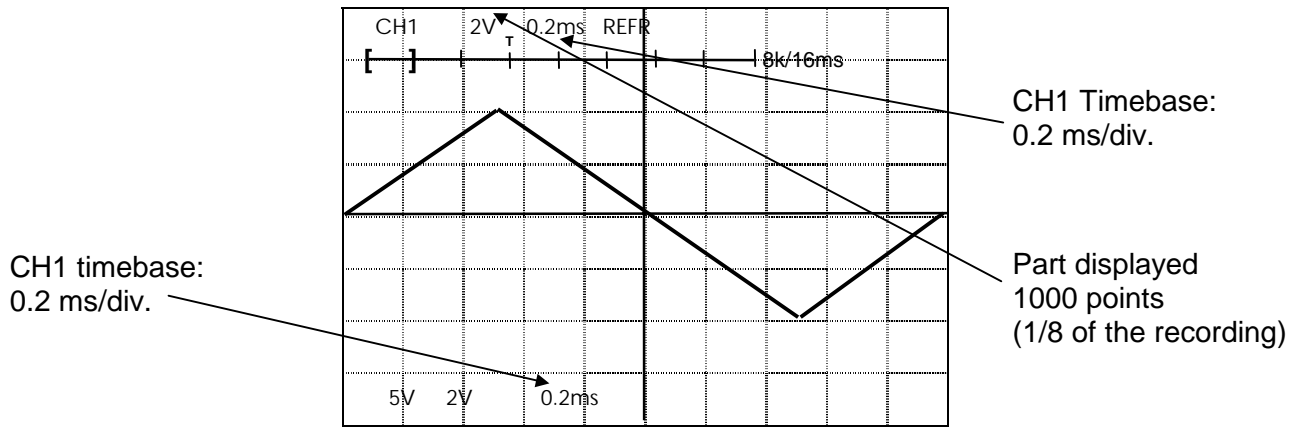


Figure 25 : After acquisition

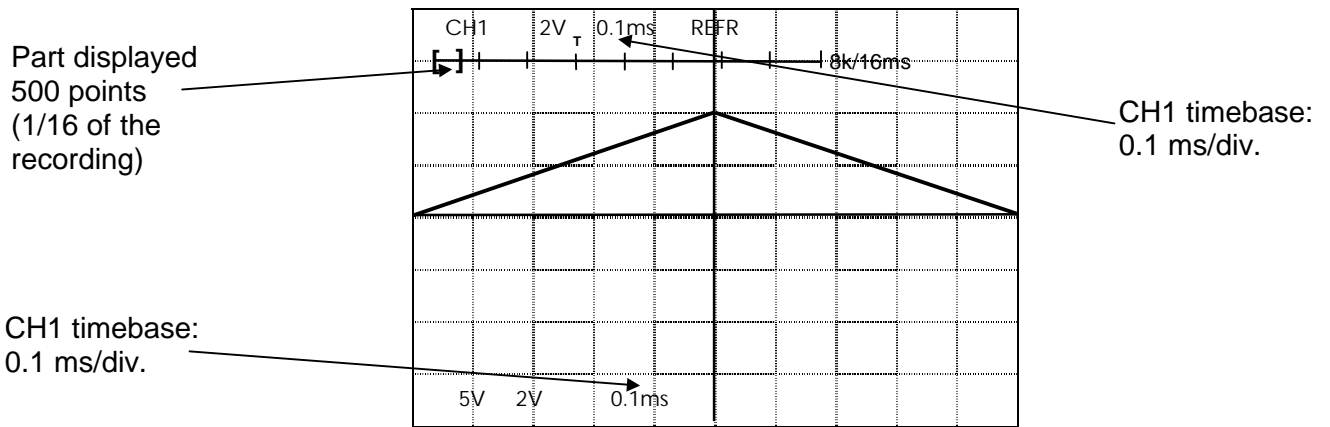


Figure 26 : Expansion of 1 timebase position

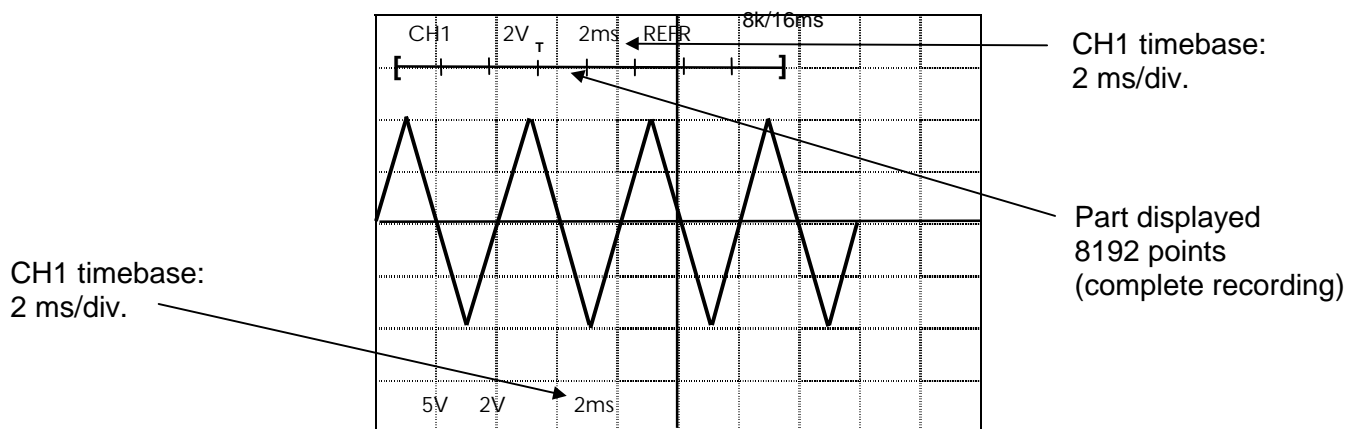


Figure 27 : Compression of 4 timebase positions

4.9.2.2. Width of the window

The "window" is the part of the acquisition represented on the screen. The window is symbolised by the part between square brackets in the bargraph (figures 25 to 27).

Expansion and compression can only be done when acquisition is stopped ("RUN/STOP" LED off).

Expansion One turn of the switch (21) to the right allows the trace(s) displayed to be expanded by one timebase position; the window gradually reduces.

Compression One turn of the switch (21) to the left allows the trace(s) displayed to be compressed, according to the table below. Therefore, the full memory can be represented on the screen in all cases,.

Expansion or compression is carried out from the left-hand edge of the screen.

Size of acquisition (SIZE)	Compression
1 k	no compression
8 k	by 1 to 8
16 k	by 1 to 16



When acquisition is run, the window is configured to 1,000 points and the timebase of the signal being acquired takes the value of the current timebase (displayed at the bottom).

4.9.2.3. Displacement of the window

The screen signal observation window can be displaced over the size of the acquisition, in both directions, using keys (42) and (43).

4.9.3. Mathematical function

Press on the MATH key (39). The following main menu appears :

Off	Exec	Rect	Log	FFT	Print	Quit
^	^	^	^	^	^	^
45	44	43	42	41	40	39

Select the windowing (43)

Press successively on the key (43), the following windows scroll through the menu :

- Rect : rectangular window
- Hann : Hanning window
- Hamm : Hamming window
- Blck : Blackman window

Select the vertical scale (42)

Press successively on the key (42), two possibilities are available :

- Log : logarithmic scale in dB/div. : 0 dB is assigned to a signal which RMS value is 1 div. in the time domain record.
- Lin : linear scale : 20%/div. The 100% value is attributed to the fundamental

Calculating FFT (44)

Press the key (44).



The calculation lasts at least 4 seconds.

During the calculation, the message "Performing FFT" is displayed.
At the end of the calculation, the cursor is automatically positioned to the frequency of the fundamental.

Select the measurement cursors (45)

Pressing on the key (45) validate or inhibit the measurement by cursor :
level measurement as per selected scale (Lin ; Log)
frequency measurement : unity (in Hz/div.) = 5 / sweep coefficient



When the measurement by cursors is selected, the cursors can be moved using the keys (45) and (46). The cursor is represented by a cross (x) which is linked to the waveform. The cursor position (frequency, level) is displayed in area 22 of the screen (refer to figure 3). In "HARM" mode, the selected harmonic line is displayed too (F: for the fundamental, Hn: for the harmonic of n line).



Selection of the shifting mode of the measurement cursor (41)

Press successively on the key (41), two possibilities are available :

- FFT : signal analysis according to FFT mode. Continuous shifting of cursor.
- HARM : searching the characteristics of the signal harmonics.
The cursor is moving from harmonics to harmonics.

Calculating the Fast FOURIER Transform (FFT)

The FFT is used to calculate the discrete representation of a signal in the frequency domain from its discrete representation in the time domain.

Use FFT in the following applications :

- measuring harmonic content and distortion of a signal ;
- impulse response analyses ;
- identify noise sources in digital logic circuits.

Description

FFT is computed based on the following equation :

$$X(k) = \frac{1}{N} * \sum_{n=-\frac{N}{2}}^{\frac{N}{2}-1} x(n) * \exp\left(-j \frac{2\pi nk}{N}\right) \text{ when } k \in [0 \text{ N-1}]$$

with: $x(n)$: a sample in the time domain
 $X(k)$: a sample in the frequency domain
 N : FFT length
 n : index in the time domain
 k : index in the frequency domain

The resulting waveform is a display of the magnitude (Volt or dB) of the various frequencies the waveform contains. DC component is suppressed by software.

FFT waveform

FFT waveform consists in two symmetric parts ; only the positive values of frequency are displayed.

Calculation method

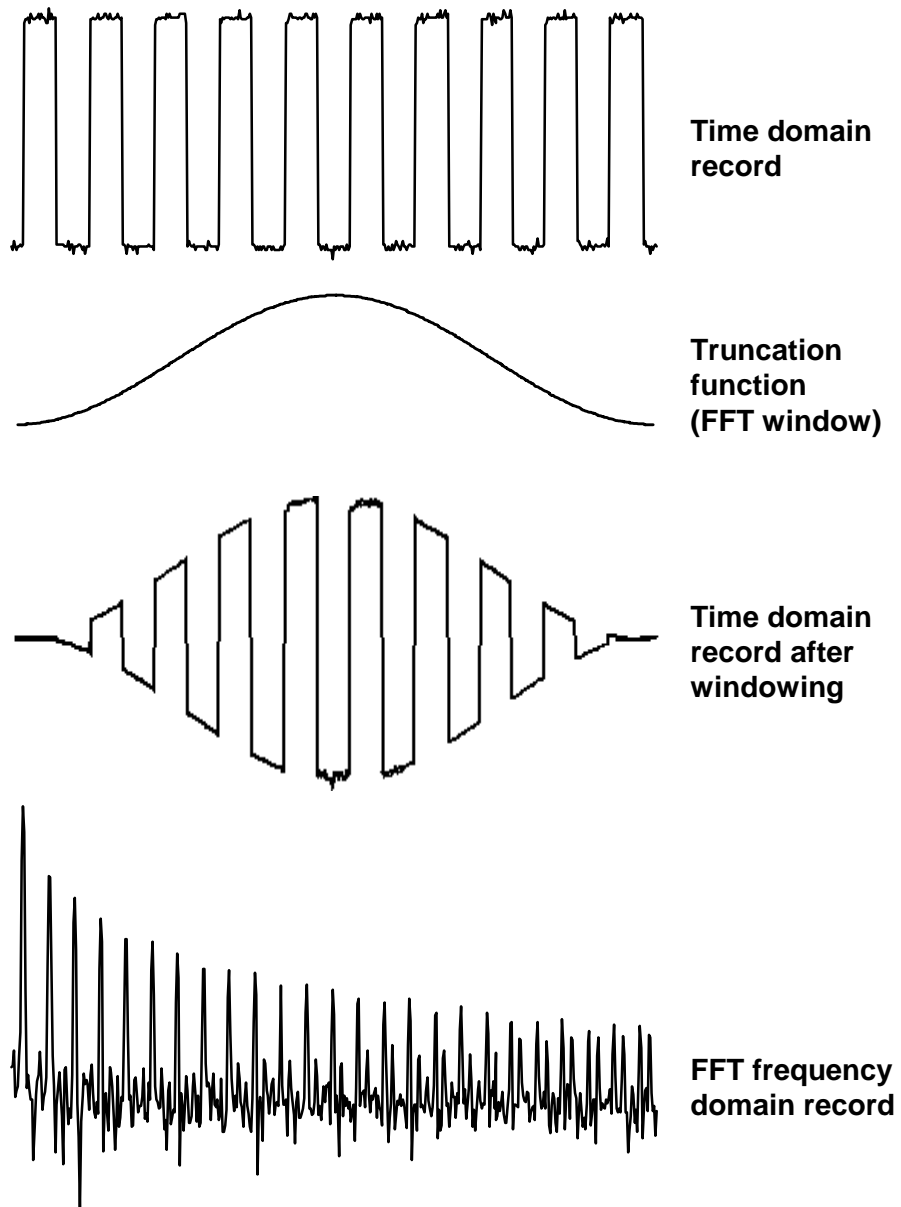
FFT length is 1024 samples.

The visualised 1000 samples are expanded in a 1024/1000 ratio.

Windowing

The FFT windowing acts like a pass-band filter.

Selecting a window is essential to resolve the frequencies and to measure the amplitude accurately.



Fixed length of the time domain record means a sinc/x convolution in the frequency domain.

The side-lobe characteristics of the sinc/x frequency function result in a difference in discrete and continuous Fourier Transform results.

To reduce leakage, it is necessary to use a time domain truncation function: the window.

There are 4 possibilities :

Window type	Main lobe width	Highest side lobe (compared to the main lobe)
Rectangular window	- 13 dB	$4\pi/N$
Hanning window	- 32 dB	$8\pi/N$
Hamming window	- 43 dB	$8\pi/N$
Blackman window	- 94 dB	$12\pi/N$

Undersampling on the time domain record

If the sampling frequency is not adapted ((twice the highest component of the signal to measure), the high frequency components are under-sampled and appear on the FFT waveform (fold back).

To start the analysis, choose a timebase displaying 10 and 20 periods of the signal to analyse.

A change of this timebase involves a variation of the displayed FFT frequency width.

4.10. Measurements

With this oscilloscope measurements can be taken using the cursors or by means of 17 automatic measurements. Results are displayed on the lower, right-hand part of the screen. In some cases, the results cannot be displayed. In this event, an error message replaces the results.

These cases are as follows:

CH1 - CH2 - ADD Measurement of the phase cannot be carried out if the vertical mode is configured on CH1, CH2, ADD.
In this case, the measurement displays CH1, CH2, ADD, respectively.

XY The type of measurement chosen is incompatible with XY vertical mode (temporal and phase measurement or automatic measurement in analog mode).

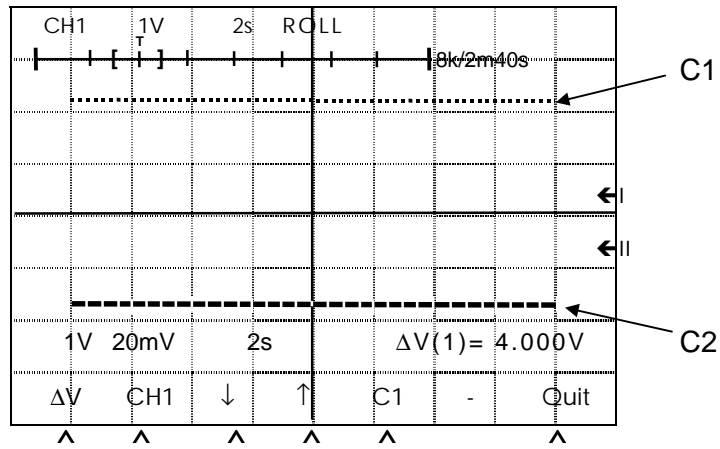


Figure 28: Measurement using cursors (CURS)

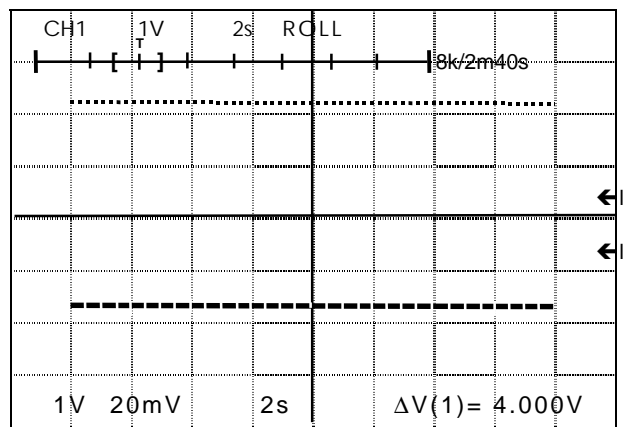


Figure 29: Measurement of voltage using cursors

4.10.1. Measurement using cursors (CURS)

Press on the CURS key (45). A menu specific to the cursors appears at the bottom of the screen (see figure 28).



Selecting the type of measurement

Key (45) enables the user to scroll through the type of measurement :

- | | |
|------------|--|
| Off | no cursors |
| ΔV | measurement of voltage (in XY mode, the cursors are vertical if the reference is CH1 and horizontal if the reference is CH2) |
| Δt | measurement of time (cursors vertical, measurement impossible in XY mode) |
| F | measurement of frequency (same remarks as in Δt) |
| φ | measurement of phase (in this mode, three cursors are available) |

Selecting the reference

Key (44) enables the user to choose the measurement reference:

- CH1
- CH2

The reference designates the input channel (CH1 or CH2). The voltage measurements then refer to the sensitivity of the channel chosen.



Note *To select the CH1 reference, the user should hold down key(36)
To select the CH2 reference, the user should hold down key(30)*

Displacement

Keys (42) and (43) enable the cursor selected in one direction or the other, either vertically or horizontally, according to the type of measurement and the display mode selected.

The displacement direction is indicated on the menu by arrows.

Selecting the cursor

The VISU key (41) is used to select C1, C2 or C3 (in the case of phase measurement).

The cursor selected is displayed as a continuous line and it can be displaced using keys (42) and (43).

Result of measurements

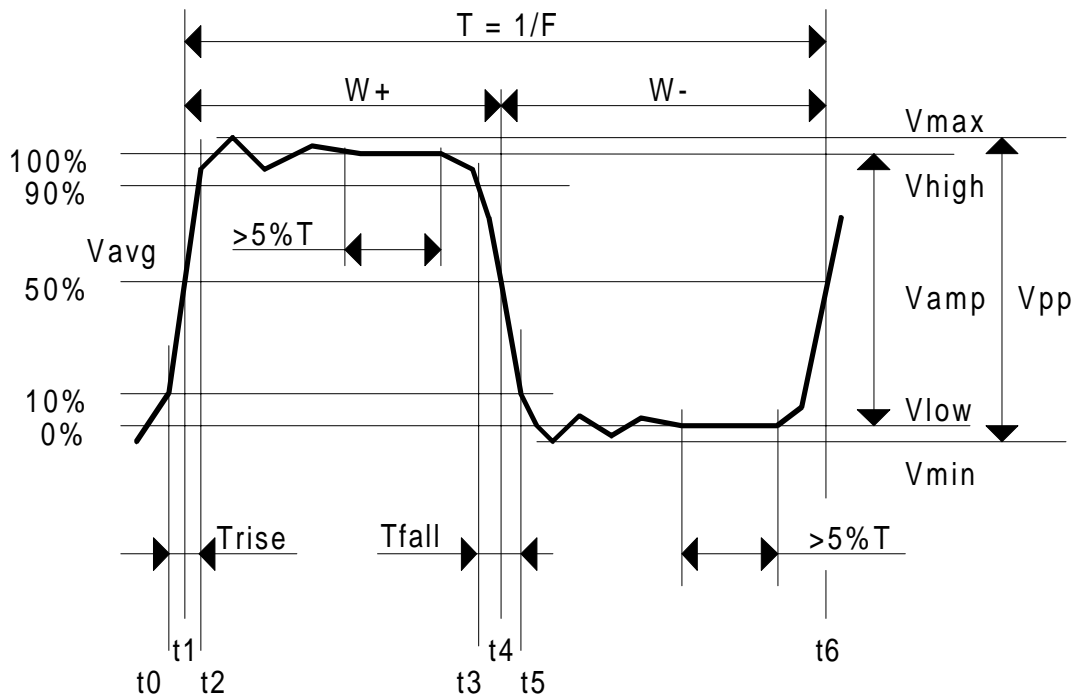
The result is displayed in the cursor menu and is updated according to the type of measurement of the reference and the position of the cursors.

When the menu is invalidated (Quit), the result of the measurement and the cursors are still displayed. The type of measurement and reference channel (figure 29) are indicated.

To cancel the measurement, call up the CURS menu, choose "off" with key (45), then exit using key (39) (Quit).

Clearing the menu

Press on the Quit key (39) on the cursors menu.



- $V_{pp} = V_{max} - V_{min}$
- $V_{rms} = \left[\frac{1}{n} \sum_{i=0}^{i=n} (y_i - y_{GND})^2 \right]^{1/2}$
- $V_{avg} = \frac{1}{n} \sum_{i=0}^{i=n} (y_i - y_{GND})$
- $t_r = (t_2 - t_0)$
- $t_f = (t_5 - t_3)$
- $W_+ = t_4 - t_1$
- $W_- = t_6 - t_4$
- $DC_+ = (W_+ / T) \times 100$
- $DC_- = (W_- / T) \times 100$
- ϕ = Measurement of phase shift of the signal of channel 2 onto the signal of channel 1.

The values displayed are averaged out using an averaging power algorithm according to the following formula:

$$\text{new value displayed} = (\text{old value displayed} \times 15 + \text{value measured}) / 16$$

When the value measured is more than 5 % from the value displayed, the device is reinitialised.

Figure 30 : Definition of automatic measurements

4.10.2. Automatic measurements (MEAS)

4.10.2.1. Definitions (figure 30)

17 automatic measurements are available:

Vpp	peak-to-peak voltage
Vrms	rms voltage
Vavg	average voltage
F	frequency
T	time
tr	risetime
tf	falltime
W+	positive pulse width (at 50 % of Vamp)
W-	negative pulse width (at 50 % of Vamp)
DC+	duty cycle $W+ / T \times 100$
DC-	duty cycle $W- / T \times 100$
Vmax	maximum peak voltage
Vmin	minimum peak voltage
Vh	established high voltage
Vlow	established low voltage
Vamp	amplitude
ϕ	phase

4.10.2.2. Measurement conditions

Measurement is carried out on the part displayed on the screen by taking the reference CH1 or CH2. Any modification of the signal displayed immediately updates the measurement (width and displacement of the window, interpolation, new acquisition, change in vertical mode).

Automatic measurements require a screen signal time of at least one and a half. If not, a "failed" message is displayed in place of the results. Measurement accuracy is optimum for 2 periods of time displayed on the screen.

If several periods are displayed, the measurement refers to the first one on the left-hand side of the screen.

Vh corresponds to the voltage of the most frequent points above the 50 % level. Vlow corresponds to the voltage of the most frequent points below the 50 % level.

Choosing the reference

- Press on the CURS key (45). A special menu appears, as follows:



- Press on the key under CH1 or CH2 (44) to scroll through the references, then on key (39) to clear the menu.

4.10.2.3. Running measurement

Press on the MEAS key (44). The following menu appears:



The MORE key (39) is used to access other automatic measurements.



To run a measurement, press on the corresponding key: the menu disappears and the measurement result is displayed on the lower, right-hand side of the screen.

To stop measurements, press on the MEAS key (44) then on "off" (45). The menu and measurement results disappear.



- **Running an automatic measurement in analog mode or switching the oscilloscope over to analog mode when an automatic measurement is in process, forces acquisition in REFRESH mode**

The following message may appear:

- **If you attempt to stop acquisition in analog mode, the message: "Measuring ... Press MEAS off then STOP" appears on the screen momentarily; cancel measurement, which will automatically stop acquisition.**

- **Results of special measurement:**

- **"failed" :** **measurement impossible**
- **no display:** **at timebase speeds of between 200 s/div and 100 ms/div, the result of the measurement is only displayed at the end of acquisition (only the measurement type and reference are displayed when acquisition is run). In REFRESH mode, the result is then purged at the start of each acquisition cycle.**

4.11. Screen copy (HARDCOPY)

Two parameters can be configured:

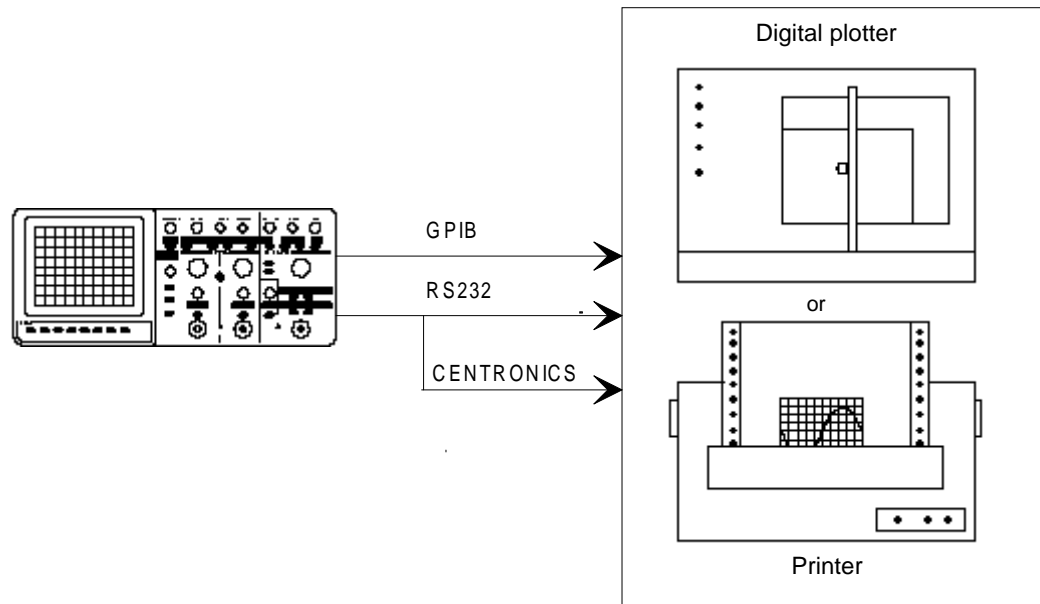
- The format of data generated:

HPGL	HPGL peripherals (e.g. digital plotter)
IBM Pr	Quadruple density matrix printers (e.g. IBM Proprinter XL24)
ESC P2	Epson InkJet printers (e.g.: Stylus 800+)
HP-DJT	DeskJet (PCL language)
HP-LJT	LaserJet

- The interface used to transfer the data when a screen copy is being executed :

RS232	Serial port (*)
CENTRO	Centronics (*)
GPIB	GPIB bus (if HA 1341 option present)

(*) The same SUB-D 25 pin output (at the back of the oscilloscope) is used for the RS232 and CENTRONICS interfaces (use an RS232 or CENTRONICS lead as required).



4.11.1. Configuration of printing

Press on the UTILITY key (48). The following menu appears:

Vers	RS232	XGPIB	TV	HCPY	Reset	Quit
^	^	^	^	^	^	^
45	44	43	42	41	40	39

To configure printing parameters, call up the HCPY sub-menu by pressing on key (41) under the HCPY heading.

The following menu appears:

HPGL	RS232	GratN	StatN	Scr1	Print	Quit
^	^	^	^	^	^	^
45	44	43	42	41	40	39

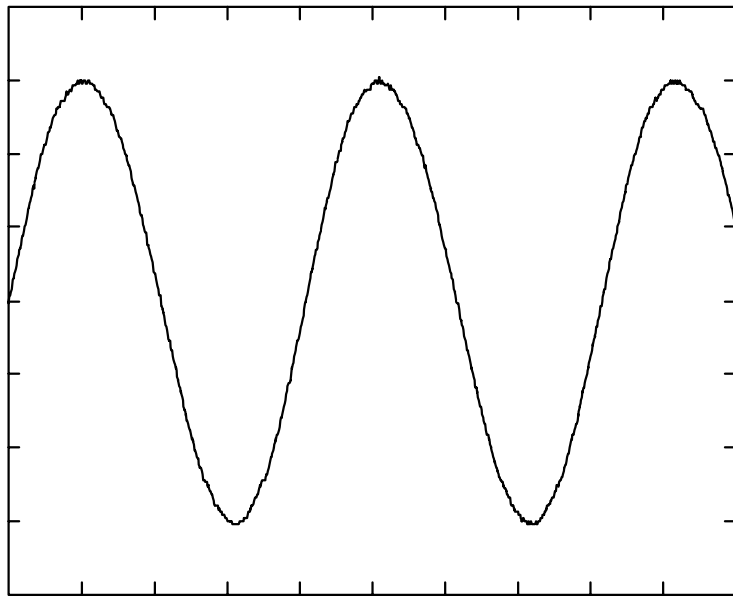
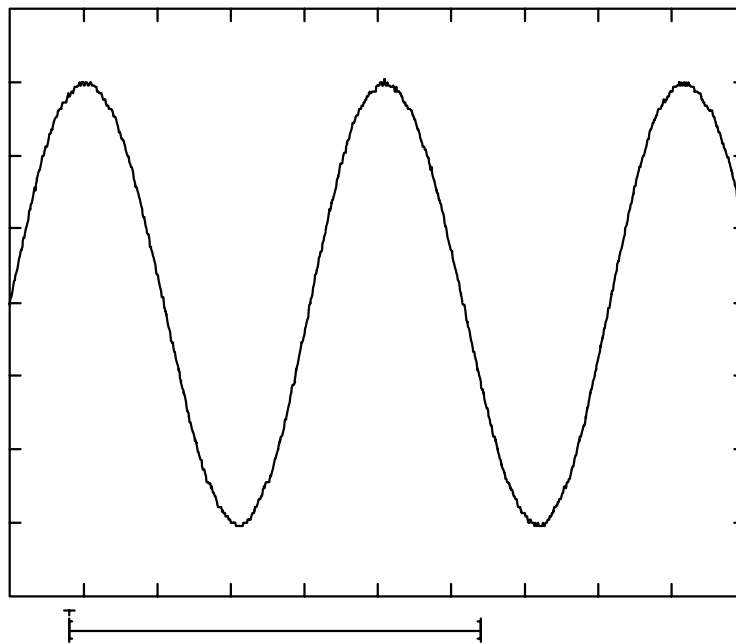


Figure 31: Screen copy without graticule



CH1 COUPLING	: AC	TRIGGER SOURCE	: CH1
CH2 COUPLING	: AC	COUPLING	: DC
TIME BASE MODE	: AUTO	SLOPE	: +
DELAY MODE	: NORM	MODE	: NORM
CH2 INVERT	: OFF	LEVEL	: 40.0mDiv

Figure 32: Screen copy with printing of status

Selecting data format

The following 4 possibilities can be obtained by pressing on key (45):

HPGL	HPGL peripherals (e.g.: digital plotting)
IBM Pr	Quadruple density matrix printers (e.g.: IBM Proprinter XL24)
ESC P2	Epson ink-jet printers (e.g.: Stylus 800+)
HP-LJT	LaserJet printer
HP-DJT	DeskJet printer (PCL language)

Selecting the communications interface for the data to be printed

The following are obtained successively by pressing on key (44) :

RS232	Serial port
GPIB	GPIB bus (if HA 1341 option present)
CENTRO	Centronics



If the RS232 or GPIB (on option) interface is selected to make a screen copy, the parameters used (speed, parity, length, stop bit, RS232 protocol and GPIB address) are those configured in the UTILITY/RS232 or UTILITY/GPIB menu. Check that the configuration adopted corresponds to that of the peripheral connected to your instrument.

Selecting of the interface used during a screen copy (UTILITY/HCPY menu is independent of that configured in the UTILITY menu which defines the programming interface by remote selection.

Selecting Printing of the Graticule (figure 31)

By pressing on key (43), the graticule option is validated (GratY) or invalidated (GratN).

When the option is validated the graticule is reproduced on the screen copy.

Selecting Printing of the Status (figure 32)

By pressing on key (42), printing of the status option is validated (StatY) or invalidated (StatN).

When it is validated; the complete configuration of the instrument is printed under the screen copy.

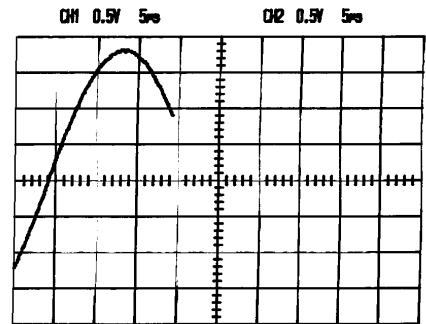
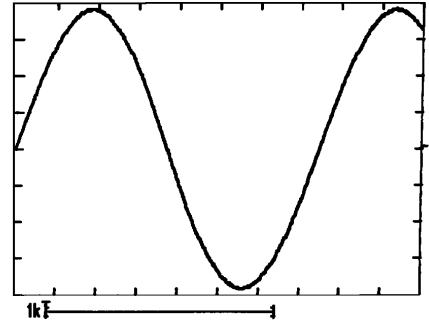
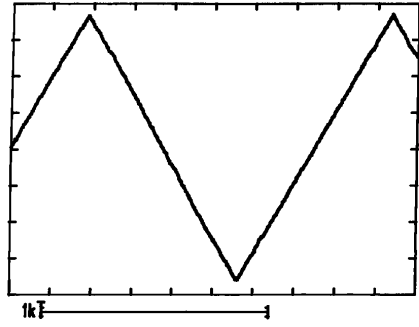


Figure 33: Splitting the sheet into quarters

Selection of the Splitting the sheet into quarters option (figure 33)

This option can only be accessed with a HPGL digital plotter (choice HPGL in the UTILITY/HCPY menu). If another choice is made (IBM Pro or ESC P2 or HP-DJT or HP-LJT), the sheet splitting option is invalidated.

By pressing on key (41), printing of a full sheet (Scr1) or on a 1/4 sheet (Scr4) is validated. Thus only 1/4 of the sheet can be used; the quarter (1, 2, 3 or 4) will be chosen when the screen copy is initiated.

4.11.2. Initiating / stopping a screen copy

A press on Print / Abort (40) key initiates or stops the screen copy. A message is displayed in the middle of the screen while data is being transferred :

"Plotting screen... "
or
"Printing screen... "

according to whether the type of format is HPGL or not (IBM-Pro or ESC P2 or HP-LJT, HP-DJT).

Ensure that the link, printing and interface are properly configured (paragraphs 4.11.1. to 4.12.2. inclusive) and that a suitable cable and connectors have been used.

Special case: When the Splitting the sheet option is validated (see paragraph 4.11.1. Configuration of printing), the screen copy will be run in 2 stages:

Display of the following text (at the bottom of the screen):

1 ^	2 ^	3 ^	4 ^	-	-	Quit ^
45	44	43	42	41	40	39

You should then choose the quadrant of the sheet, bearing in mind that the quadrants are arranged as follows:

1	2
3	4

Exiting the menu

Press on Quit (39)

4.11.3. Configuration of SCPI communications interfaces

Remote selection of the programming interface (RS232 or GPIB) may be independent from that used for the screen copy (RS232 or GPIB or CENTRONICS). To validate it, press on the UTILITY key (48).

The following menu appears:

Vers ^	RS232 ^	GPIB ^	TV ^	HCPY ^	Reset ^	Quit ^
45	44	43	42	41	40	39

To select and configure the interface, call up the RS232 or GPIB sub-menu by pressing on key (44) or (43).

4.11.3.1.RS232C interface

Connectors: see ATTACHMENT 6.

The following sub-menu appears:

-	9600	No	Ln8	StP1	Xon	Quit
	^	^	^	^	^	^
45	44	43	42	41	40	39

Selecting the transmission speed

Press on key (44), the following speeds can be scrolled through on the menu:
75, 110, 150, 300, 600, 1200, 2400, 4800, 9600, 19200

Selecting the parity

Press on key (43), the following types of parity can be scrolled through on the menu:

No : no parity
Even : even parity
Odd : odd parity

Selecting the length

Press on key (42), the following lengths can be scrolled through on the menu:

Ln8 : Length 8 bits
Ln7 : Length 7 bits

Selecting the number of stop bits

Press on key (41), the following numbers of stop bits can be scrolled through on the menu:

Stp 1 : 1 stop bit
Stp 2 : 2 stop bits

Selecting the protocol

Press on key (40), the following protocols can be scrolled through on the menu:

Xon : Xon/Xoff Protocol
RTS : RTS/CTS Protocol

Principle of the Xon/Xoff protocol

When the instrument receives an Xoff on the receive line (pin 3 of the SUB D 25-pin connector), it stops transmitting. It only resumes transmitting when it receives an Xon on the receive line (pin 3 of the SUB D 25-pin connector). The peripheral connected to the instrument thus controls the flow of data out of the instrument.

When the instrument detects that its buffer (128 bytes) is more than 75 % full, it sends an Xoff character on its send line (pin 2 of the SUB D 25-pin connector). As soon as the buffer is empty (< 25%), it sends an Xon character on its send line (pin 2 of the SUB D 25-pin connector). The instrument thus controls the flow of data into the instrument.

Advantages: simple to manager, very widespread, a three-wire cable is sufficient (send, receive, earth).

Principle of the RTS protocol

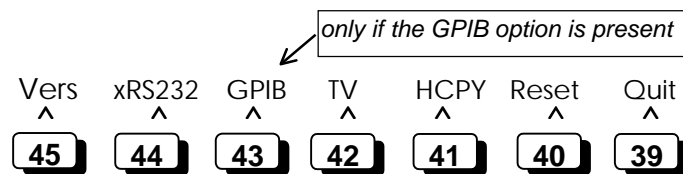
When the instrument detects a low level on its CTS line (pin 5 of the SUB D 25-pin connector), it stops sending. It only resumes sending when this line switches to a high level. The peripheral connected to the instrument thus controls the flow of data out of the instrument.

When the instrument detects that its buffer (128 bytes) is more than 75% full, it positions its RTS line (pin 2 of the SUB D 25-pin connector) at a low level. As soon as the buffer is empty (< 25 %), it repositions this RTS line at a high level. The instrument thus controls the flow of data into the instrument.

Validation of the RS232 configuration

Press on Quit (39) to validate the RS232 interface configuration and exit from the RS232 menu.

The validated RS232 interface is marked with a cross in the UTILITY menu:



When the GPIB option is not present, the RS232 is permanently validated: xRS232.

4.11.3.2. GPIB interface (on option)

Press on key (43) and the following sub-menu will appear:



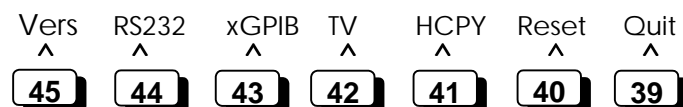
Selecting the address

The address is displayed on the left of the menu. Its value can be decreased by pressing on Dec (42) and increased by pressing on Inc (41).

Validating the GPIB interface

Press on Quit (39) to validate the GPIB interface configuration and quit the GPIB menu.

Quitting the GPIB menu validates this interface, marked with a cross in the UTILITY menu:



To exit the UTILITY menu, press again on Quit (39).

4.12. Miscellaneous

4.12.1. Display of the software version

Press on the UTILITY key (48), the following menu appears:



Then press on the Vers key (45), the following message will appear temporarily:

"--- oscilloscope manufacturer Vx.x-dd/mm/yy"

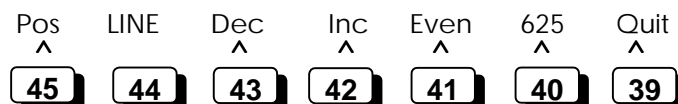
4.12.2. TV trigger menu

The following TV menu can be selected from the UTILITY menu:

Press on the UTILITY key (48), the following menu appears:



Then, press on TV (42), the following sub-menu appears:



By pressing on (45), positive or negative video can be selected (Pos, Neg).
(41), the even or odd frame (Even,Odd) can be selected.
(42), the no. of the line displayed (incrementation) (Inc) can be selected.
(43), - (decrementation) (Dec) can be selected.
(40), the norm 525 or 625 lines can be selected.
(39), quit the menu.

5. APPLICATIONS

5.1. Visualisation of the calibration signal

- Connect the PROBE output (34) to CH1 input (35) by using a 1/1 or 1/10 measurement probe.
- Select the following functions:
 - CH1 sensitivity (38) : 0.1 V/div. (1/1); 10 mV/div. (1/10)
 - Sweep speed (21) : 0.2 ms/div.
 - Trigger source (24) or (25) : CH1
 - Trigger mode (18) : AUTO
- If necessary, adjust vertically using the POSITION (6) control and stabilise the trace using the potentiometer LEVEL (15).
- Adjust the low-frequency compensation of the probe so that the impulse plateau is horizontal.

See figures 34 and 35, p. 54.

Sweep speed 50 ns/div.:

- Adjust the high-frequency compensation of the probe so that the edge and beginning of the plateau are as rectangular as possible.



To effect the compensation, please refer to the instructions enclosed with the probe.

5.2. Measurement of amplitude and frequency

- Connect the PROBE output (34) to the CH1 input (35) by using a 1/1 or 1/10 measurement probe.
- Configure the oscilloscope in digital mode [press on key (5)]: the MEM indicator is on.
- Configure REFRESH mode [press on the MODE key (47)] and select REFR mode (45).
- Run acquisition [press on the RUN/STOP key (46)]: the RUN indicator is on.
- Adjust CH1 sensitivity to 20 mV/div. (if a 1/10 probe) and the timebase to 1 ms/div.

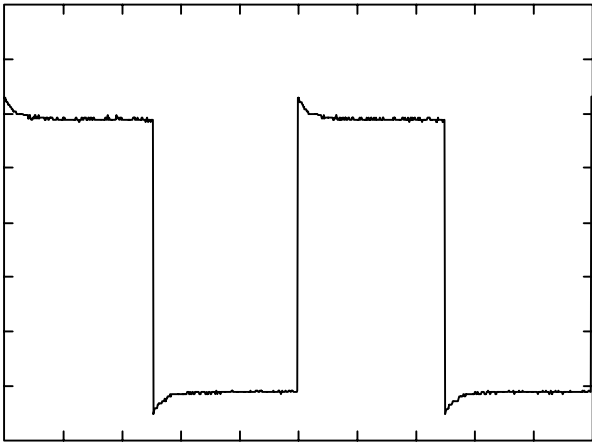


Figure 34: Probe incorrectly compensated in low frequency

Figure 35 : Low frequency compensation correct

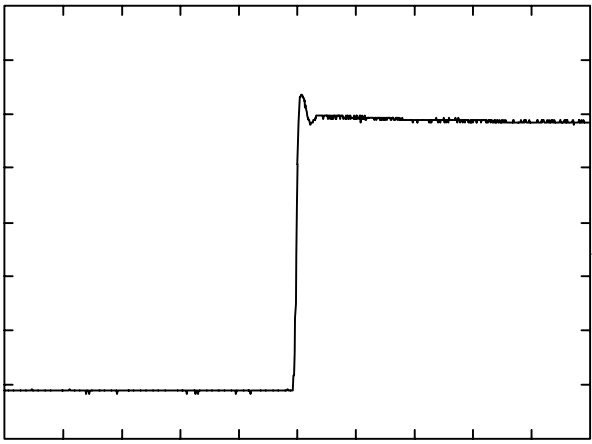
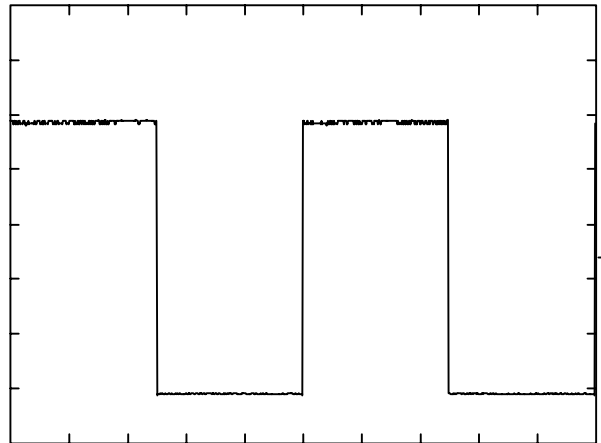
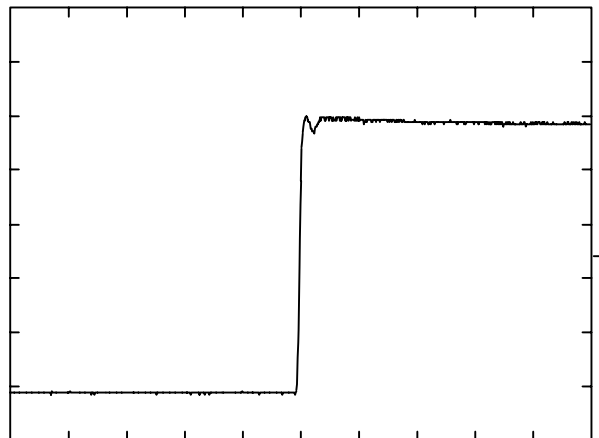


Figure 36 : Probe incorrectly compensated in high frequency

Figure 37 : High frequency compensation correct



- Run automatic amplitude measurement (figure 38, page 56) :
 - press on the MEAS key (44) ;
 - press twice under MORE (39) to display the menu with the amplitude measurement, Vamp.
 - press under Vamp (41).

The following result is displayed in zone 4 of the screen (figure 2) :

Vamp(1)= 500.0mV (with a 1/1 probe)
 ou
 Vamp(1)= 50.00mV (with a 1/10 probe)

- Run automatic frequency measurement:

- press on the MEAS key (44) ;
- press under F (41).

The following result is displayed in zone 4 of the screen (figure 2) :

F(1)= 1.000kHz

5.3. Phase shift measurement

First of all, we will acquire two shifted signals. The first step described below consists of acquiring two artificially shifted signals by using a single generator. If you have two shifted signals, this preliminary step is not necessary.

5.3.1. First step: Acquisition of 2 shifted signals

For this, inject a 1 kHz signal onto CH1 input.

- Configure the oscilloscope in digital mode (5): the MEM indicator is on.
- Configure REFRESH mode (press on the MODE key (47) then select REFR mode.
- Run acquisition [press on the RUN/STOP key (46)]: the RUN indicator is on.
- Press on the AUTOSSET key (3): the signal appears on the screen.
- Adjust the frequency of the signal to have a period over 6 divisions (this enables simple calculations to be made: $60^\circ/\text{div.}$).
- Stop acquisition: the signal is stored.

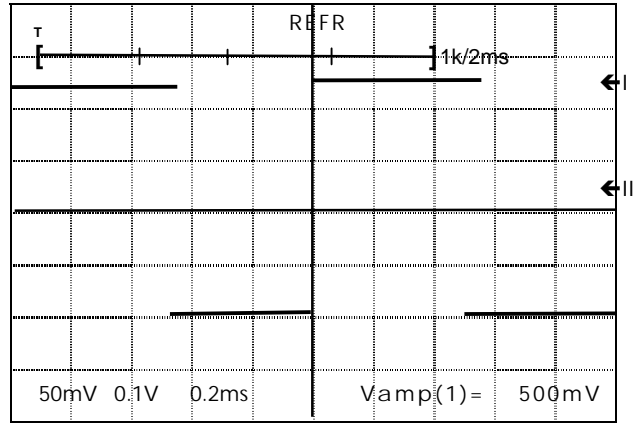


Figure 38 : Acquisition of the calibration signal and automatic measurement of amplitude

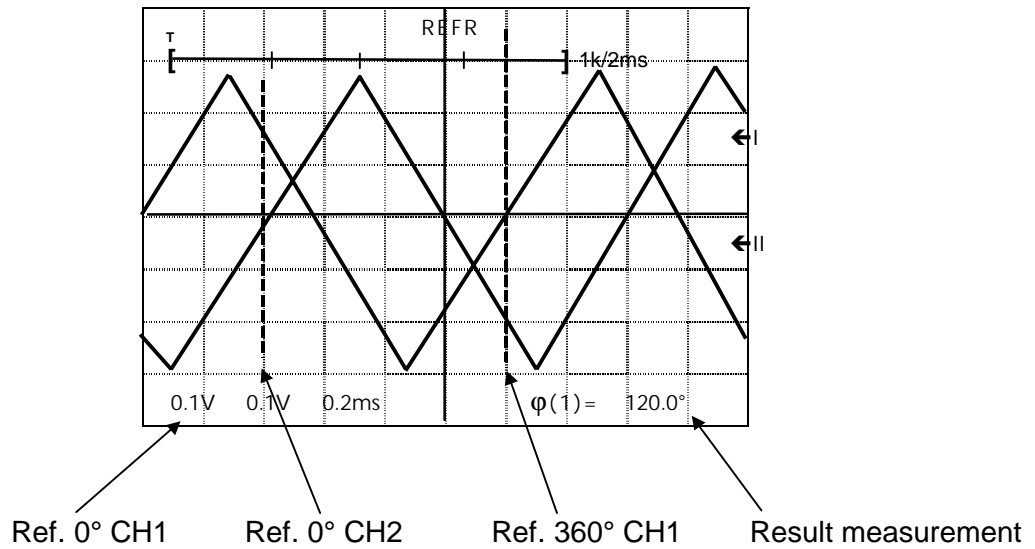


Figure 39 : Measurement of phase shift by cursors

- Save the acquisition:
 - Call up the SAVE menu [SAVE key (40)]. The following menu appears:



- Press on key (44) under CH1: CH1 becomes SCH1 on the menu and on the top line: acquisition has been saved.
- Quit the SAVE menu [press on key (39)].

We are now going to acquire the same signal on channel 2, but artificially shifted by the trigger delay:

- Inject this same signal to the CH2 input.
- Configure the vertical mode on CHOP key (7) or (9) and the synchronisation source on CH2 key (24) or (25).
- Run acquisition by configuring the same sensitivity as on CH1: the traces should superimpose perfectly (adjust vertical centring of CH2 (10) if necessary).
- Configure the delayed timebase on DLY (29): there is X-shift on channel 2.
- Use DELAY (23) to adjust the phase shift to 2 divisions (120°).
- Stop acquisition.

We have now acquired 2 shifted signals.

5.3.2. Second step: Measurement of the phase shift

Using the cursors (figure 39) :

- Call up the CURS menu (45).
- Select phase measurement phase, φ using key (45).
- Frame the CH1 signal time (ref. 0° CH1, ref. 360° CH1):
 - choose (ref. 0° CH1): the cursor is then displayed as a continuous line;
 - move it using the arrow keys ← (43) and → (42) ;
 - choose (ref. 360° CH1): the cursor is then displayed as a continuous line;
 - move it using the arrow keys ← (43) and → (42).
- Place (ref. 0° CH2) on the cross-over point of the rising edge of CH2 with the horizontal axis:
 - choose (ref. 0° CH2): the cursor is then displayed as a continuous line.
 - move it using the arrow keys ← (43) and → (42);
 - the phase shift value is then displayed on the bottom, right-hand side of the screen.

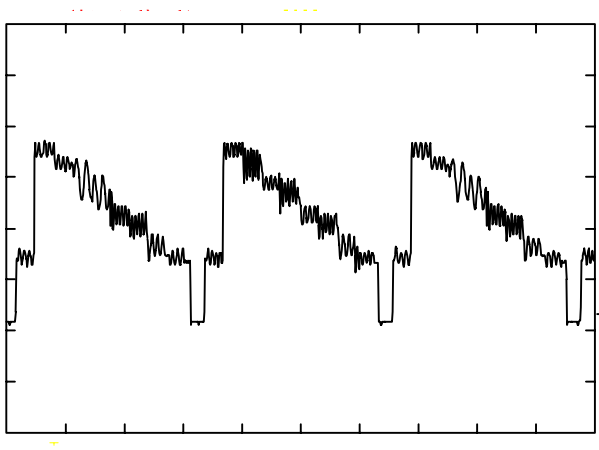


Figure 40: Video signal

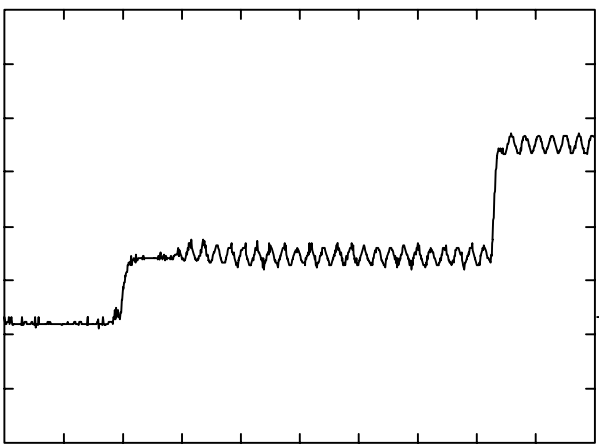


Figure 41: Detailed examination (Burst)

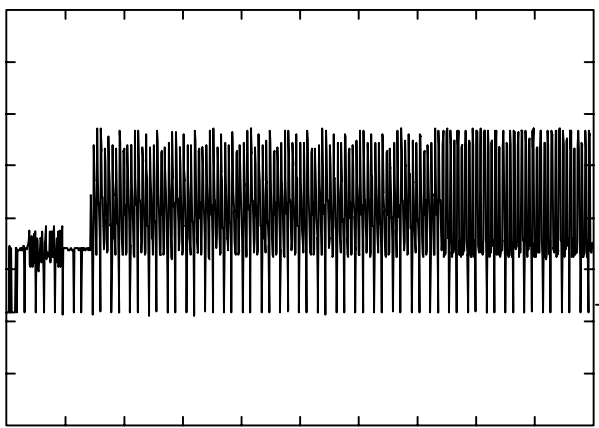


Figure 42: TV frame

5.4. Visualisation of a video signal

This example is to illustrate the TV synchronisation functions (H and V) and trigger delay (DELAY).

Examination of a TV signal (figure 38)

- Inject a composite video TV signal presenting the following characteristics on CH1:
 - positive modulation,
 - vertical bands in scales of grey.
- Configure the oscilloscope in digital mode [press on key (5)]: the MEM indicator is on.
- Configure REFRESH mode [press on the MODE key (47) and select REFR mode.
- Run acquisition [press on the RUN/STOP key (46)]: the RUN indicator is on.
- Optimise timebase speed in order to observe several complete TV lines (20 $\mu\text{s}/\text{div.}$).
- Configure the coupling on TVH [key (26) or (27)]: synchronisation is carried out on the line synchronisation pulse and the line selected (LINE N°) is displayed.
- Automatic measurement of the time [press on MEAS (44), then select T] indicates: T (1) = 64.00 μs .

Detailed examination of the BURST (figure 39)

- Select DELAY mode (29), then use the potentiometer adjustment (23) to displace the acquired part of the signal.
- Reduce the speed of the timebase to 1 $\mu\text{s}/\text{div.}$ The burst now appears in detail without any loss of light (sweep speed is constant in digital mode).

Examination of a TV frame (figure 40)

- Select the TVV coupling [key (26) or (27)], choose even or odd frame from the menu.
- Configure the timebase speed to 1 ms/div.
- Cancel the trigger delay by pressing on key (29) (S and DLY off).

The image observed corresponds to the first 10 milliseconds of the TV frame. The synchronisation train is perfectly visible at the start of the screen.

6. SPECIFICATIONS

Only the values affected by tolerances or limits constitute guaranteed values (after half an hour's warming up. Values without tolerances are given for information.

6.1. Vertical deflection

CH1 - CH2	Specifications	Comments
Bandwidth at - 3dB in BWL	> 100 MHz ≈ 20 MHz	
Risetime	< 3.5 ns	
Vertical deflection coefficients (sensitivity)	Ratings: 2 mV/div. to 5 V/div. ± 3%	11 positions sequences 1-2-5
Variable vertical deflection coefficients	Multiplication of the V/div. rating by 1 to 2.5 (reduction of the amplitude of the signal displayed)	Calibrated control: control in left-hand position, indicator on Non calibrated position indicator on
Max. input voltage.	Protection : ± 420 V (DC + AC peak at 1 kHz)	
Limit level / frequency	DC at 3 MHz 300 V _{eff} from 3 MHz to 100 MHz : - 20 dB/decade	
Focused trace thickness	< 2 mm	
Chop frequency (CHOP)	500 kHz approx.	
Input coupling	DC : 0 to 100 MHz AC : 10 Hz to 100 MHz GND : reference 0 V	
Input impedance	1 MΩ ± 1 % // 15 pF	
Response in rectangular signals	Overflow < 5 % Aberration at 10 mV/div. : • on the plateau < 1 mm • before the edge < 2 mm	1 kHz to 1 MHz 1 MHz (T _m < 100 ps)
Crosstalk	36 dB ideal	up to 100 MHz same sensitivity on CH1 and CH2, 6 div.
Display	CH1 : CH1 only CH2 : CH2 only ALT : CH1 then CH2 alternately CHOP : CH1 and CH2 chopped ADD : CH1 + CH2 or CH1 - CH2 XY : CH1 on X and CH2 on Y	

6.2. Horizontal deflection (timebase)

CH1-CH2	Specifications	Comments
Sweep coefficient	Ratings 50 ns to 100 ms/div. $\pm 3\%$	20 positions sequences 1-2-5
Variable coefficient (A only)	Division of rating ms/div. 1 to 2.5 (horizontal contraction of signal)	Calibrated position: control in left-hand position, indicator off Non-calibrated position: indicator on
Expansion x 10	Accuracy: $\pm 5\%$	5 ns/div. can be obtained
Sweep holdoff time (holdoff)	Variable 1 to 10	
XY Mode	Channel X on CH1 Channel Y on CH2	DC Coupling: 0 Hz to 4 MHz AC Coupling: 10 Hz to 4 MHz DC Coupling: 0 Hz to 100 MHz AC Coupling: 10 Hz to 100 MHz
	Phase shift $< 1.5^\circ$ to 100 kHz	

6.3. Triggering system

	Specifications	Comments
Sources	<i>Sensitivity in normal mode - Trigger from 0 to 180 MHz</i>	
CH1 or CH2	0.5 div. to 1 kHz 1 div. to 100 MHz 2 div. to 160 MHz	
ALT		Source according to display mode: CH1 triggers CH1 CH2 triggers CH2 ALT triggers CH1 then CH2 CHOP triggers CH1 ADD triggers CH1 -CH2 triggers CH2
LINE		
EXT	100 mVeff 10 Hz to 50 MHz 200 mVeff 50 to 100 MHz	protection ± 420 V (DC + AC peak $f < 1$ kHz)
Filters (coupling)	<i>Bandwidth:</i>	
	AC 10 Hz to 180 MHz	
	DC 0 Hz to 180 MHz	
	LFR (rejection) 10 kHz to 180 MHz	
	HFR (rejection) 0 Hz to 10 kHz	
	TVH synchronisation of video signal on top lines	Rising edge: positive video Falling edge: negative video
	TVV synchronisation of video signal on top frames	Rising edge: positive video Falling edge: negative video
Horizontal mode	AUTO Normal	
Slope	Falling edge Rising edge	
Level	<i>Adjustment range:</i> P-P: between the min. and max. of the signal Normal: ± 12 divisions	

6.4. Digital memory

Acquisition	Specifications	Comments
Sampling frequency max.	100 MS/s on a channel in SINGLE SHOT mode 50 MS/s for 2 channels simultaneously in SINGLE mode 20 GS/s in ETS mode	
Vertical resolution	8 bits (256 levels)	
Horizontal resolution	8 bits (256 levels)	
Accuracy of vertical channels	3% for the complete chain	
Memory capacity	2 memory buffers of 1, 8 or 16 k	
Bandwidth	> 100 MHz	
Risetime	< 3.5 ns	
Saving of signals recorded		See SAVE menu
Acquisition modes		ENVELOPE Mode : available in REFRESH (repetitive signals). GLITCH Mode: capture of events > 20 ns from 200 s to 5 µs/div.
	ROLL	100 ms at 200 s/div. (continuous scroll: PRETRIG infinite - see special case § 4.9.1.2.)
	REFRESH	5 ns at 200 s/div.
	SINGLE	5 ns at 200 s/div. (SINGLE SHOT)
Pre-trigger	In increments of 1 k or 250 bytes according to the size of memory selected: (see table Page 29 : Positioning of the TRIGGER)	
	0, 250, 500, 750, 1 (points)	if memory size is 1 k
	0, 1, 2, 3, 4, 5, 6, 7, 8 (k points)	if memory size is 8 k
	0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16 (k points)	if memory size is 16 k

Visualisation

- READOUT in analog and digital mode (can be switched)
- Selecting of channels according to vertical mode
- Analysis of signals Vertical position (during and after acquisition)
Expansion, displacement (bargraph), compression

Measurements

Measurements are available in analog and digital mode.

- using a cursor : voltage, time, frequency and phase
selection of the reference channel for the measurement (CH1 or CH2)
- automatic : 17 measurements are available:

Vpp	peak-to-peak voltage
Vavg	average voltage
T	time
tf	falltime(90% to 10%)
W-	negative pulse width < 0 (to 50%)
DC-	duty cycle W-/T
Vh	high voltage
Vamp	amplitude
Vrms	rlms voltage
F	frequency
tr	risetime (10% to 90%)
W+	positive pulse width > 0 (to 50%)
DC+	duty cycle W-/T
Vmax	maximum voltage
Vmin	minimum voltage
Vlow	low voltage
φ	phase



Automatic measurements are calculated from digitised signals; this part of acquisition must cover at least one and a half periods (4 edges), except for Vrms and Vavg (if less than one and a half periods, the calculation is carried out on the 1000 points of the screen).

Relative accuracy of automatic measurements

1. Measurement of amplitude

$$* P = 3\% + 8 / \text{Amplitude (in div.)} \quad \text{for 8 div. : } P = 4\%$$

2. Measurement of time

$$2.1 \quad t/\text{div.} \geq 5 \mu\text{s}/\text{div.} \quad P = 0.01\% + 2 * [t/\text{div.} (\mu\text{s})] / [T_{\text{measured}} (\mu\text{s})]$$

$$2.2 \quad t/\text{div.} < 5 \mu\text{s}/\text{div.} \quad P = 0.01\% + 5 / [T_{\text{measured}} (\mu\text{s})]$$

3. Measurement of frequency

$$3.1 \quad t/\text{div.} \geq 5 \mu\text{s}/\text{div.} \quad P = 0.01\% + 2 * [t/\text{div.} (\mu\text{s})] * [F_{\text{measured}} (\text{MHz})]$$

$$3.2 \quad t/\text{div.} < 5 \mu\text{s}/\text{div.} \quad P = 0.01\% + 5 * [F_{\text{measured}} (\text{MHz})]$$

Screen copy

Support media

Format

HPGL	HPGL peripherals(e.g.: digital plotter)
IBM Pr	Quadruple density matrix printers (e.g. IBM Proprinter XL24)
ESC P2	Epson ink-jet printers (e.g.: Stylus 800+)
HP-DJT	DeskJet printer
HP-LJT	LaserJet printer

Interfaces

RS232	Serial port (SUB-D connector at the back of the oscilloscope)
Centro	CENTRONICS (SUB-D connector at the back of the oscilloscope)
GPIB	GPIB bus (HA 1341option)

Possibilities

- printing the graticule
- printing the status
- printing the text
- printing on a 1/4 of the sheet (HPGL digital plotter only)

Communications interfaces

Utilisation

Screen copy or remote programming (SCPI language)

RS232

- speed 50, 75, 110, 150, 300, 600, 1200, 2400, 4800, 9600, 19200
- parity no, even, odd
- length 7 or 8
- stop bit 1 or 2
- protocol Xon/Xoff or RTS/CTS

GPIB (HA 1341 option) :

- address 0 to 30

6.5. Miscellaneous

Calibration signal

Form	rectangular
Amplitude	- 0.5 V \pm 1 % CAT I
Frequency	10 Hz to 50 kHz

Modulation Z

Input	BNC at the back
Sensitivity	TTL level
Input resistance	10 k Ω
Maximum frequency	20 MHz
Maximum voltage	\pm 50 VDC CAT I

6.6. General characteristics

Cathode ray tube

Type	rectangular with 13 cm diagonal internal graticule
Graticule	8 vertical divisions with 5 subdivisions 10 horizontal divisions with 5 subdivisions 1 division = 1 cm
Screen	phosphor with average GY persistence
Trace	adjustment of trace rotation adjustment of focusing adjustment of intensity of brightness
Total acceleration voltage	15,5 kV

Power supply

Mains: automatic selection 94 to 264 Veff, 45 Hz to 440 Hz, CAT II
Removable mains power cord
Winder with plug holder at the back of the instrument
Consumption : < 70 W

Electromagnetic compatibility

Emission in conformity with EN 61326-1 class A
Immunity in conformity with EN 61326-1

Safety

In conformity with EN 61010-1 (1993) [NFC 42-020 (1993)]

Environment

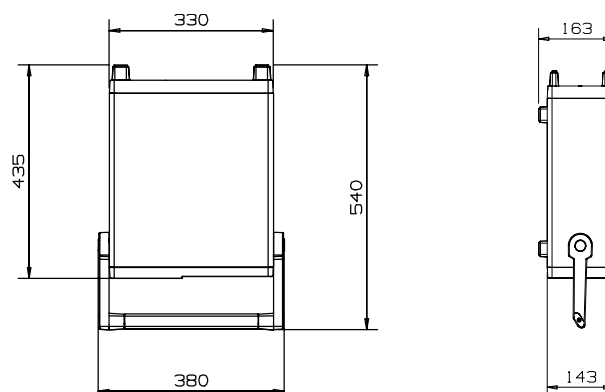
Utilisation	indoors	
Altitude	< 2 000 m	
Reference temperature	+ 18 °C	to + 28 °C
Utilisation temperature	+ 10 °C	to + 40 °C
Operating temperature	0 °C	to + 40 °C
Storage temperature	- 20 °C	to + 70 °C
Relative humidity	< 80 % HR	up to 31 °C

Mechanical characteristics

Stackable instrument, the handle being used as a stand

Weight: ≈ 5,5 kg

Dimensions :



When packed

Dimensions : 550 x 460 x 280 mm

Weight: ≈ 7 kg

7. SUPPLIES AND OPTIONS

7.1. Accessories

7.1.1. Provided with the instrument

- User's manual 906121621
- Programming instructions 906121478
- Power cable AG0416
- Spare ceramic fuse T 2.5 A / 5x20 / 250 V
located at the back of the instrument in a receptacle
on the cathode ray tube stand AT0090
- 2 1/10, 200 MHz attenuator probes HX0004

7.1.2. Provided as options

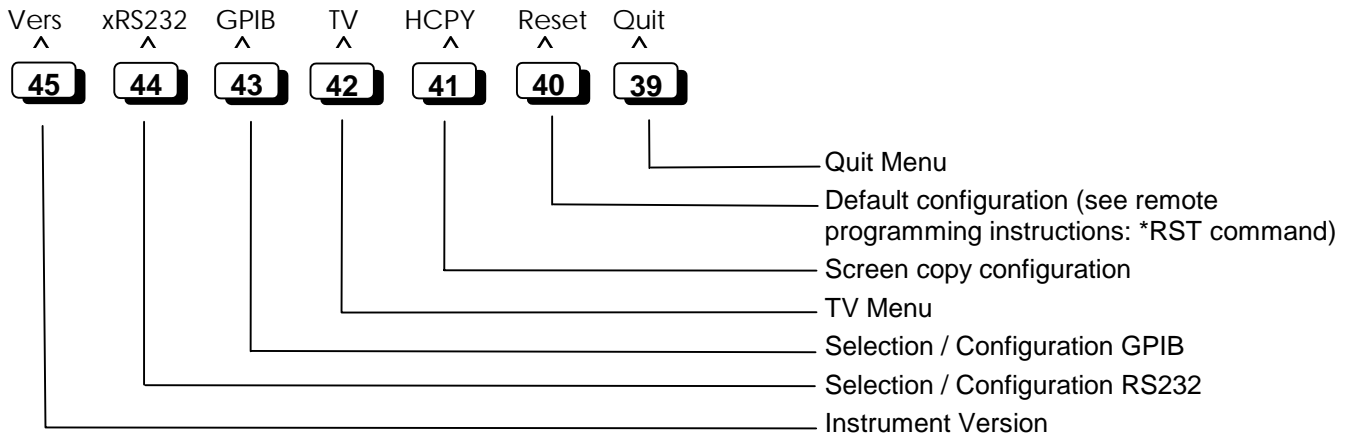
- 9 pin male / 25 pin female adapter AS0204
- BNC male banana adapter /
2 female banana adapters EP7043
- BNC T 1 male / 2 female PA3285
- 50 Ω BNC cableway terminator PA4119-50
- 1/100, 200 MHz, 2 kV probe HA1317
- 15 MHz differential probe MX9003
- 1/1, 35 MHz and 1/10, 150 MHz attenuator probe HX0003
- 1/10, 400 MHz attenuator probe HA1323
- RS232 serial cable, 25-pin male / 9-pin female X00397A00A
- BNC/BNC 50 Ω cable PA2249-C48
- 100 A current clamp for oscilloscope AM0030N
- 600 A current clamp for oscilloscope AM0031N
- GPIB lead, length 1 m AG0368
- GPIB interface card HA1341
- PC transfer software SX-METRO 3.0
- Labwindows and Labview Drivers (VISA standard) available
on the NATIONAL INSTRUMENTS site (www.natinst.com)
- Compact printer HA1327
- HPGL A3 / A4 plotter TX7131
- Carrying bag AE0189

7.2. Options

- Rack assembly kit (4U - 19") RK0008
- A version of this oscilloscope exists with the
GPIB HA1341 option fitted as standard.

ATTACHMENT 1 UTILITY Menu

General menu called up with the UTILITY key



The symbol "x" before RS232 or GPIB designates the interface selected.

The heading "vers": indicates the version of the instrument

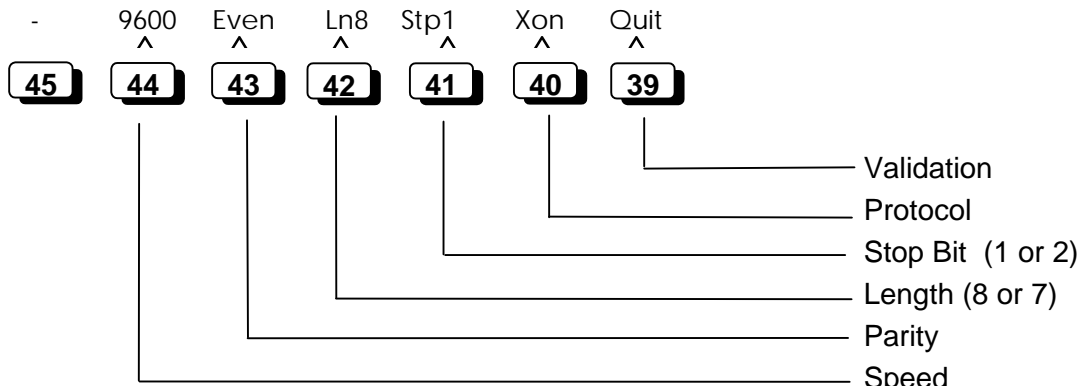
Effect: Temporary display of the following text:

"--- oscilloscope manufacturer --- Vx.x--dd/mm/yy"

Heading "RS232 : Configuration of the RS232 link

Effect: Display of the configuration menu

All the possible values are listed in order:

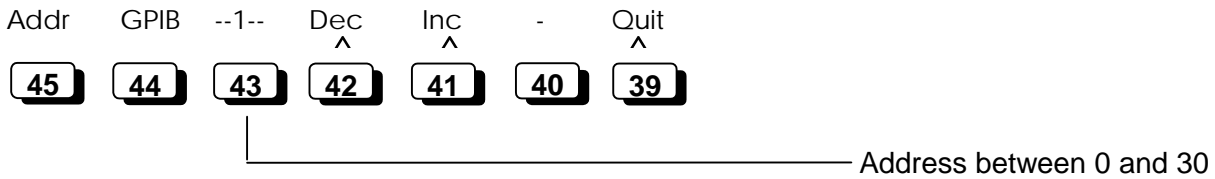


Other values possible, listed in ascending order:

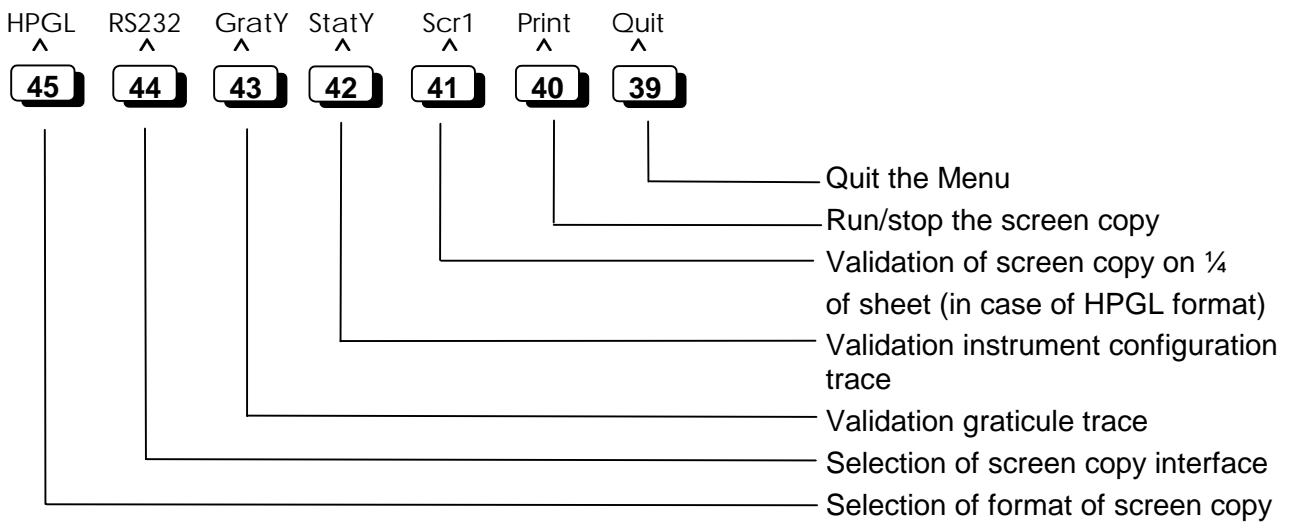
-	50	Odd	Ln7	Stp2	RTS	Quit
	75	No				
	110					
	150					
	300					
	600					
	1200					
	2400					
	4800					
	9600					
	19200					

Heading " GPIB" (on option): Configuration of the GPIB interface

Effect: Display of the configuration menu:



Heading "HCPY": Configuration of screen copy

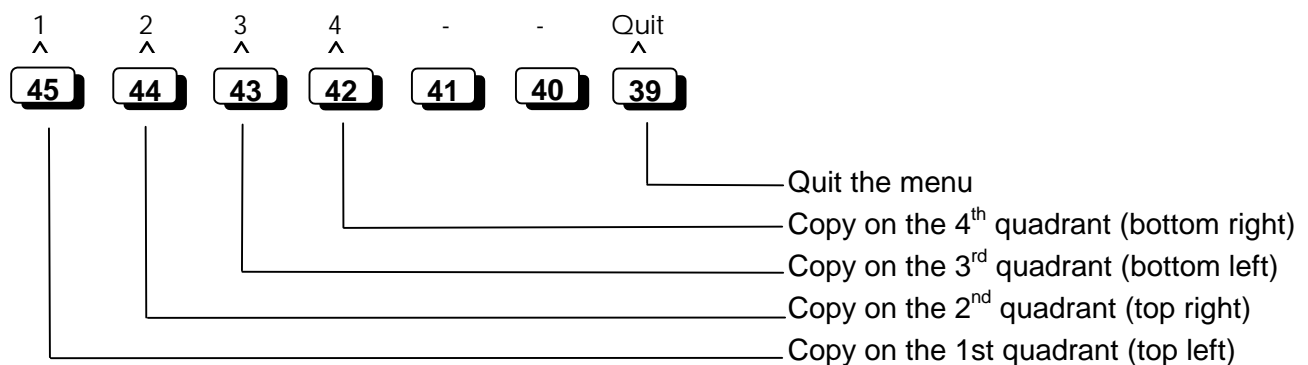


Other selections possible:

IBM Pr Centro GratN StatN Scr4 Abort Quit
 ESC P2 GPIB
 HP-DJT
 HP-LJT

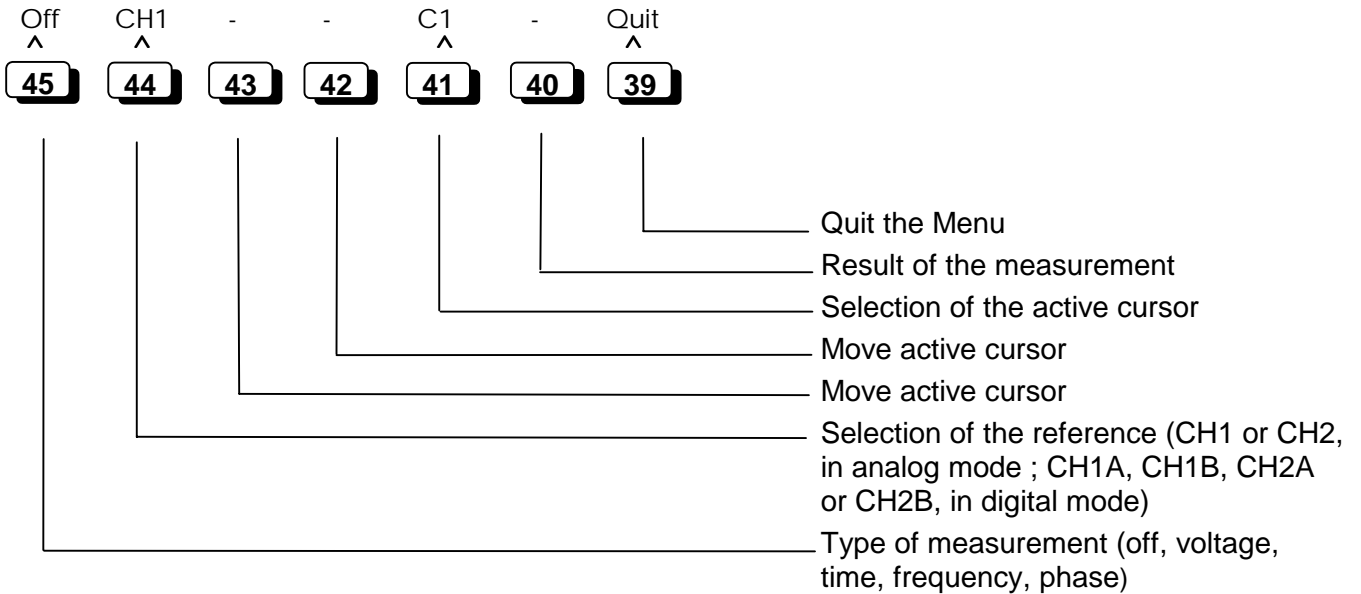
General menu called up using the PRINT key: Management of screen copies on 1/4 of the sheet

This menu only appears if the "Scr4" option has been validated in the UTILITY/HCPY sub-menu.



ATTACHMENT 2 CURS and MEAS Menus

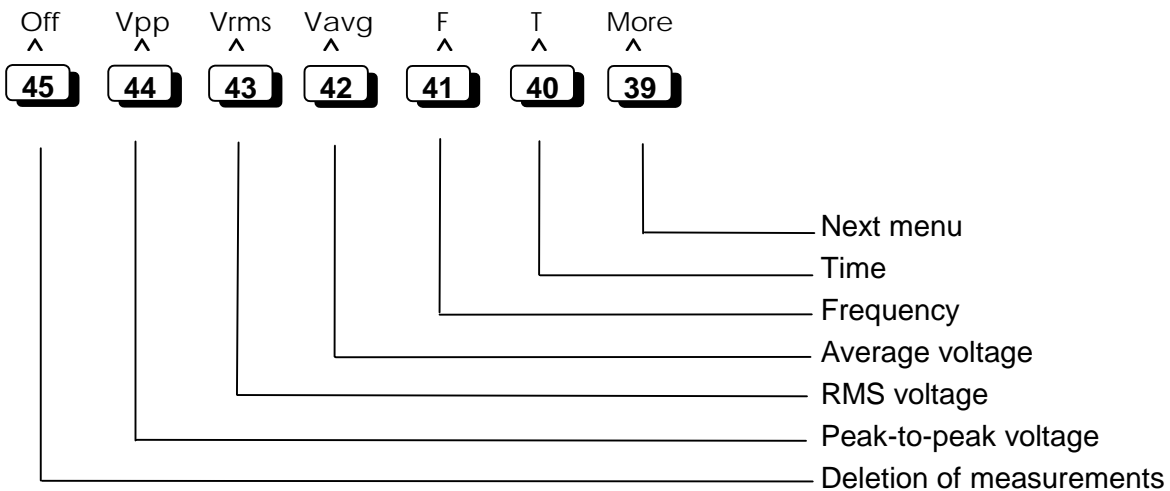
General menu called up with the CURS key: Management of the cursors



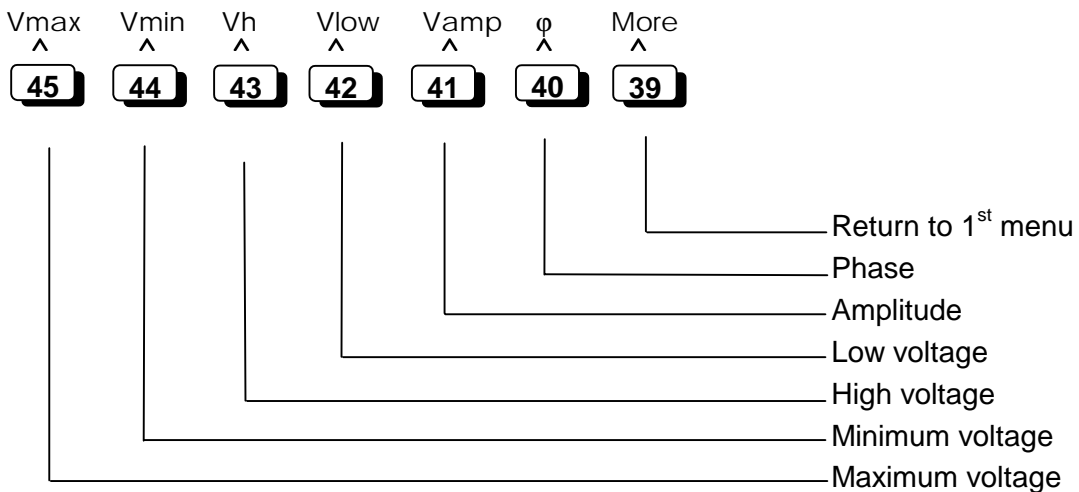
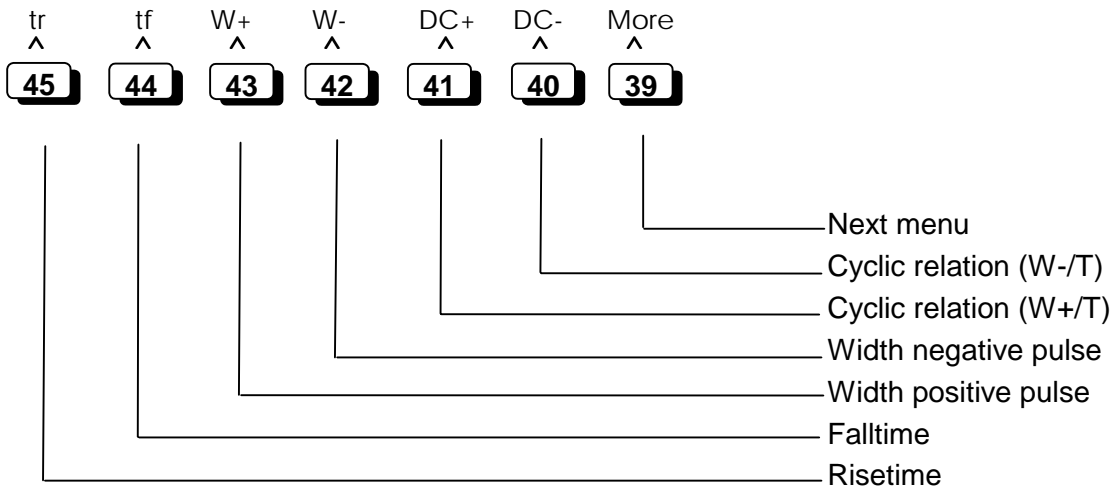
Other possible configurations:

ΔV	CH2	↓	↑	C2	800.0mV	Quit
Δt		←	→			
F						
φ						

General menu called up with the MEAS key: Management of automatic measurements

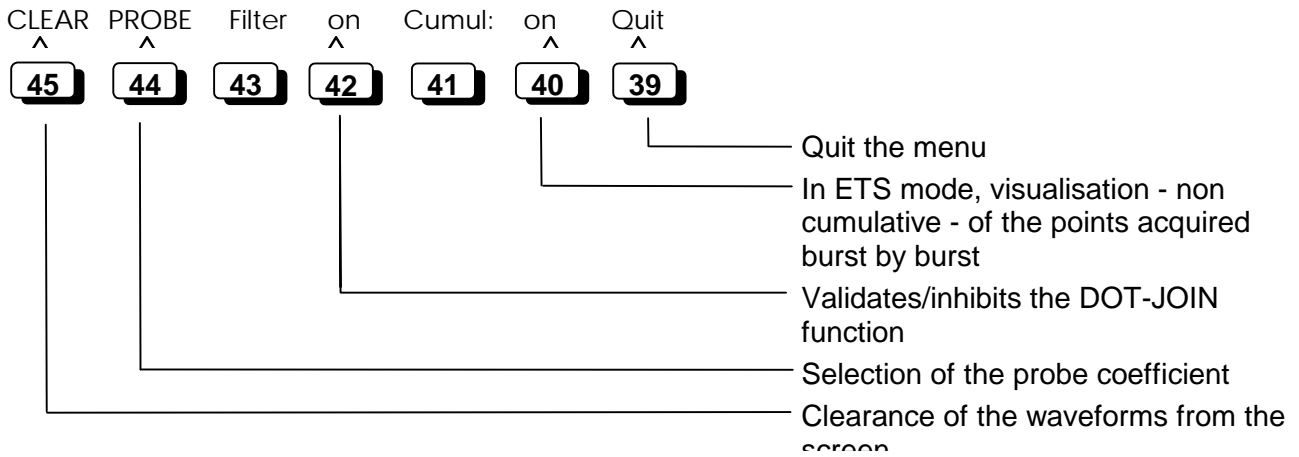


General menu called up with the MEAS key: Management of automatic measurements (contd)



ATTACHMENT 3 VISU and SAVE Menus

General menu called up with the VISU key: Management of visualisation of traces in digital mode and probe coefficients



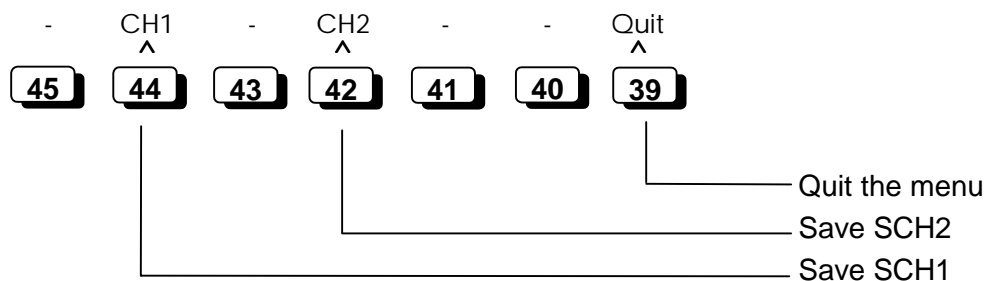
Selecting the probe coefficient PROBE

Press the PROBE key (40) and the following menu appears:



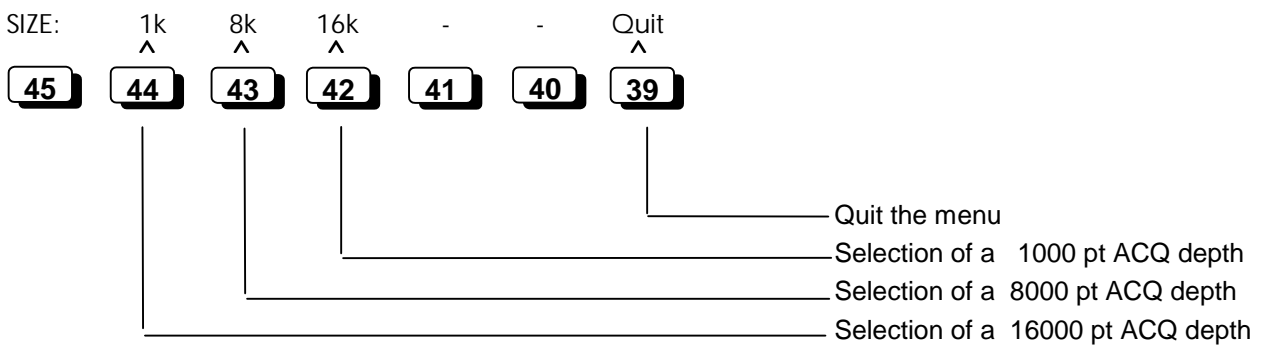
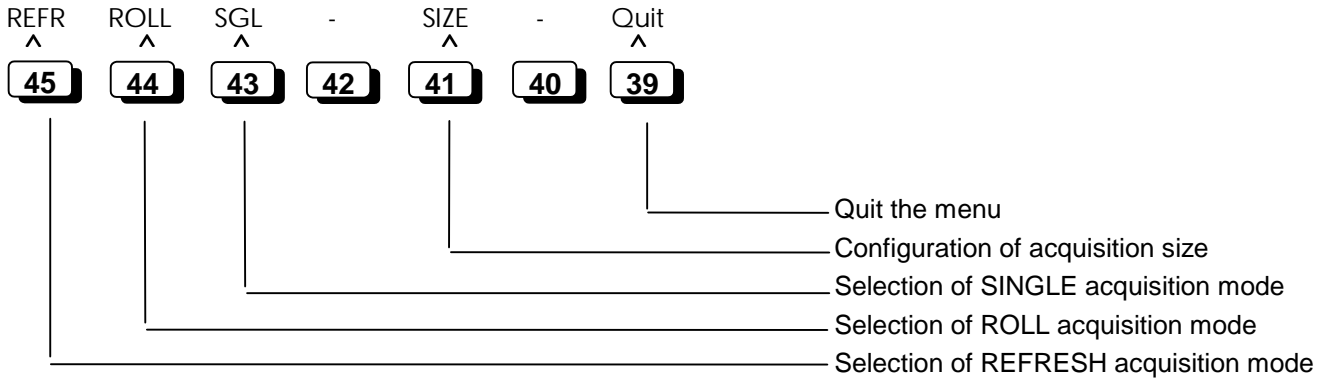
Pressing on one of the keys **44** **41** selects the probe coefficient (x 1, x 10, x 100) attributed to the corresponding channel.

General menu called up with the SAVE key: Saving the digitised signals

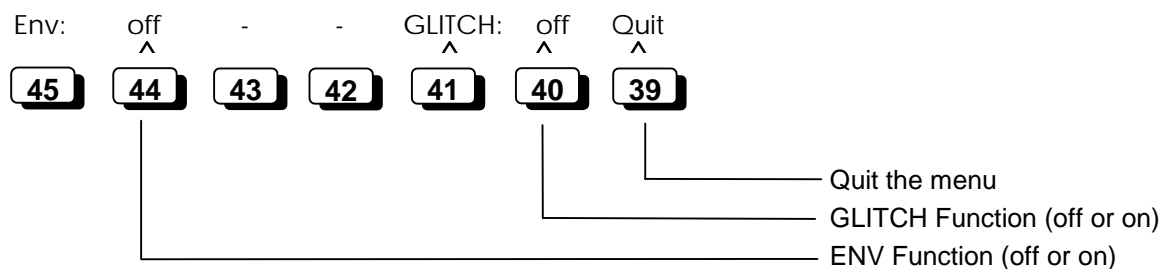


ATTACHMENT 4 MODE and ENV Menus

General menu called up with the MODE key: Acquisition mode and memory size sub-menu function



General menu called up with the ENV key: Envelope and Glitch Capture modes



ATTACHMENT 5

List of temporary messages

Version

"--- oscilloscope manufacturer--- Vx.x-- dd/mm/yy"

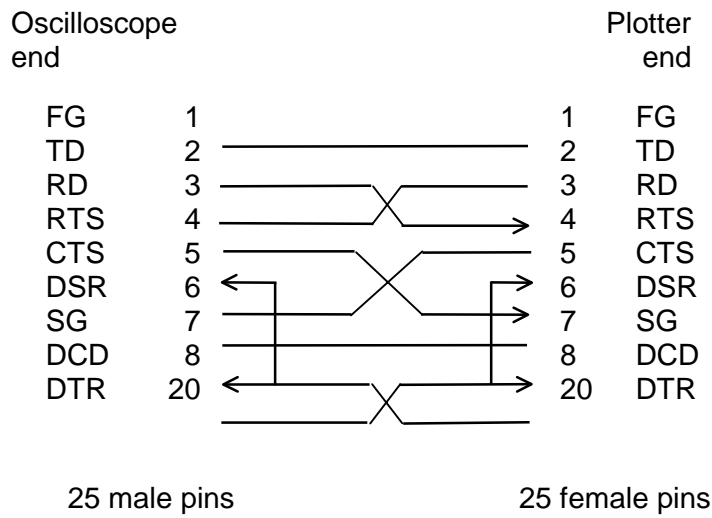
Help messages

- **Signal not found during an AUTOSET :**
" No signal found "
- **Screen copy in process:**
Plotter : "Plotting screen ... Press HARDCOPY to abort"
- **Run acquisition in ROLL mode with a timebase < 100 ms/div. :**
" Set time base > 50 ms (ROLL) ... "
- **AUTOSET running:**
" Autoset running ... "
- **Screen copy in process:**
Printer: "Printing screen ..."
- **Call-up of a function not available with TV mode:**
" Not available with TV mode "
- **Management of save function when acquisition running:**
" Acquisition running ... Press RUN/STOP "
- **Call-up of a function only available in digital mode:**
" Available with digital mode ... Press MEM "
- **Saving of waveforms:**
" Saving waveform "
- **Running of an automatic measurement in analog mode on a saved channel:**
" Channel saved ... Press SAVE then MEAS "

- **Stop acquisition in analog mode and automatic measurements in process:**
" Measuring ... Press MEAS off then STOP "
- **Running of acquisition with channel(s) saved:**
" Channel(s) saved ... Press SAVE then RUN "
- **Receive error on serial link:**
" DUART receive error "
- **Call-up of a function available in horizontal ALT mode:**
" Available with horizontal ALT mode "
- **Call up of a function available in horizontal ALT or DLY mode:**
" Available with horizontal ALT or DLY mode "
- **Call-up of a function not available with vertical XY mode:**
" Not available with analog XY mode "
- **Call-up of a function not available with synchro source LINE:**
" Not available with trigger source LINE "
- **Call-up of a function only available with analog mode :**
" Available with analog mode "
- **Call-up of a function not available for this timebase value:**
" Available for this timebase value "
- **Printer or plotter not ready:**
" Printer (*or plotter*) not ready "
- **Call-up of a function not available with SINGLE mode:**
" Not available with SGL mode "
- **Call-up of a function not available with the instrument configuration:**
" Not available with EADJ mode "

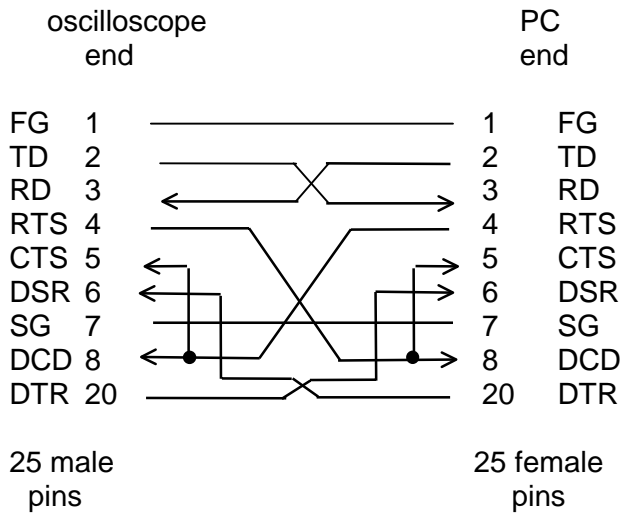
ATTACHMENT 6
RS232C link cable
between oscilloscope and plotter

Complete cable : 25 pins
(RTS Protocol)

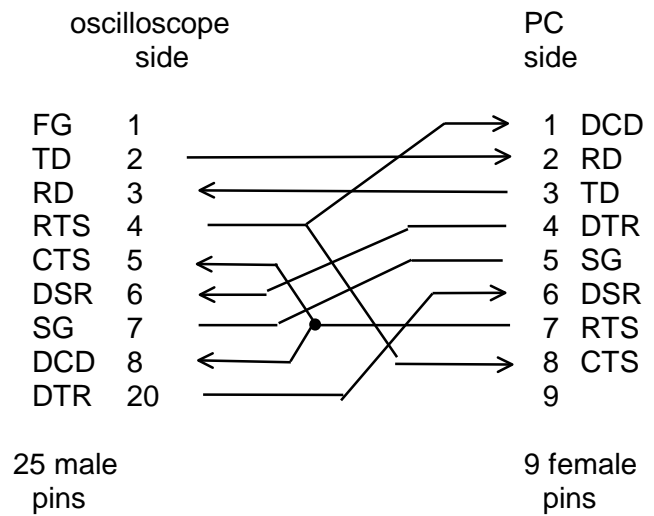


ANNEXE 7 RS232C link cable between oscilloscope and PC

Complete cable: 25 pins
(XON/OFF or RTS Protocol) null modem



Complete cable: 25/9 pins
(XON/OFF or RTS Protocol)



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