OX 8042 / OX 8062
ANALOG / DIGITAL
DIFFERENTIAL OSCILLOSCOPE

User's Manual

9061214576 - Ed. 1 - 04/99

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1. GENERAL INSTRUCTIONS

You have just purchased an analog/digital differential 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 installations 300 V category III and 600 V, CAT II (inputs) and 253 V, CAT II (power supply).

- 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

- Depending on the position of the fuse on the main board, this instrument may be powered by a 110 VAC or 230 VAC ± 10 % network. Before connecting up the instrument, check that the fuse position matches the rated voltage of your distribution network. To do this, remove the top cover from the oscilloscope.

> ⚠ ***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 manufac-turer, 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

The operating modes of this instrument - analogue or digital - and the measurement modes - normal or differential - will satisfy even the most demanding users in both the electrotechnical and electronics fields.

This oscilloscope has a specific control for each channel (CH1/CH2) for selecting the measurement mode: normal or differential.

2.1. Measurement modes

Normal

* The oscilloscope inputs behave as in a traditional oscilloscope.
* Inputs CH1+ and CH2+ are active.
* Inputs CH1- and CH2- are inhibited internally, but the impedance as seen from the input remains constant.

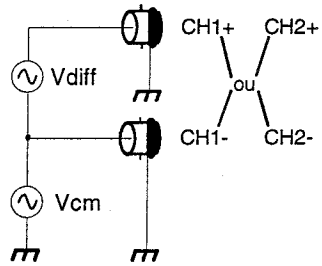
Differential

* Inputs CH1 and CH2 operate in differential measurement mode.
* The signal displays corresponds to the difference between the signals present on inputs CH 1+ and CH1- (and/or CH2+ and CH2-).

☞ ***The voltage common to the 2 inputs (CH1+, CH1-) or (CH2+, CH2-) is called the common mode voltage Vcm.***

* The max. peak common mode voltage authorized depends on the calibre used:

  - 20 V for sensitivities from 10 mV to 0.5 V
  - 200 V for sensitivities from 1 V to 5 V
  - 600 V for sensitivities from 10 V to 200 V/div.



☞ ***The representation of the signal on the screen may be erroneous when the max. common mode voltage authorized for the calibre selected is exceeded.***

2.2. Operating modes

By pressing the DIGITAL/ANALOG key (41) you can operate the oscilloscope in analogue or digital mode:

Analogue

* Display in real time of signals from 0 to 20 MHz (*OX 8042*)
  0 to 30 MHz (*OX 8062*)
* Automatic "READOUT", cursors and measurements
* Time base equipped with a trigger delay
* AUTOSET
* *OX 8042*: mono-accelerator tube, acceleration voltage 2 kV
  OX 8062: post-deflection accelerator tube, total acceleration voltage 14 kV
* 253 V CAT II power supply
* Inputs 300 V CAT III, 600 V CAT II
* High input dynamic ranging from 10 mV to 200 V/div.
* Trigger circuit bandwidth > 60 MHz

Digital

* Acquisition, processing, display and recording of the signals in the frequency band:
  - 0 to 40 MHz (*OX 8042*)
  - 0 to 60 MHz (*OX 8062*)
* Max. sampling frequency :
  - SINGLE-SWEEP mode: 100 MS/s on one channel; 50 MS/s on two channels
  - REFRESH mode: 20 GS/s Equivalent Time Sampling (ETS)
* Adjustable memory depth of 1, 8 or 16 kbytes (see MODE menu, SIZE)
* Pre-triggering
* Automatic measurements
* Capture of unique phenomena (SINGLE-SWEEP mode)
* GLITCH capture
* AUTOSET
* Expansion, compression
* Observation of very slow signals without light loss (200 s/div.)
* Analysis after acquisition
* Saving of signals in FLASH memory
* Filter (EADJ): - rendering of digital signal displayed close to analogue
  - suppression of representation "aliases" due to subsampling
* Software saved in FLASH memory can be updated via the RS232C serial link
* Front microcontroller in FLASH memory
* Screen copy on plotter or printer
* Instrument fully programmable with SCPI language
* LABWINDOWS and LABVIEW drivers available on the NATIONAL INSTRUMENTS site
* Specially-adapted PC transfer software (SX-METRO)
* RS232C and CENTRONICS interfaces available on the single SUB-D25 output connector at the back of the oscilloscope. The switch from RS232C to CENTRONICS is performed by software [see UTILITY menu, HARDCOPY (HCPY)].

The normal and differential operating modes can be used in both analogue and digital mode.

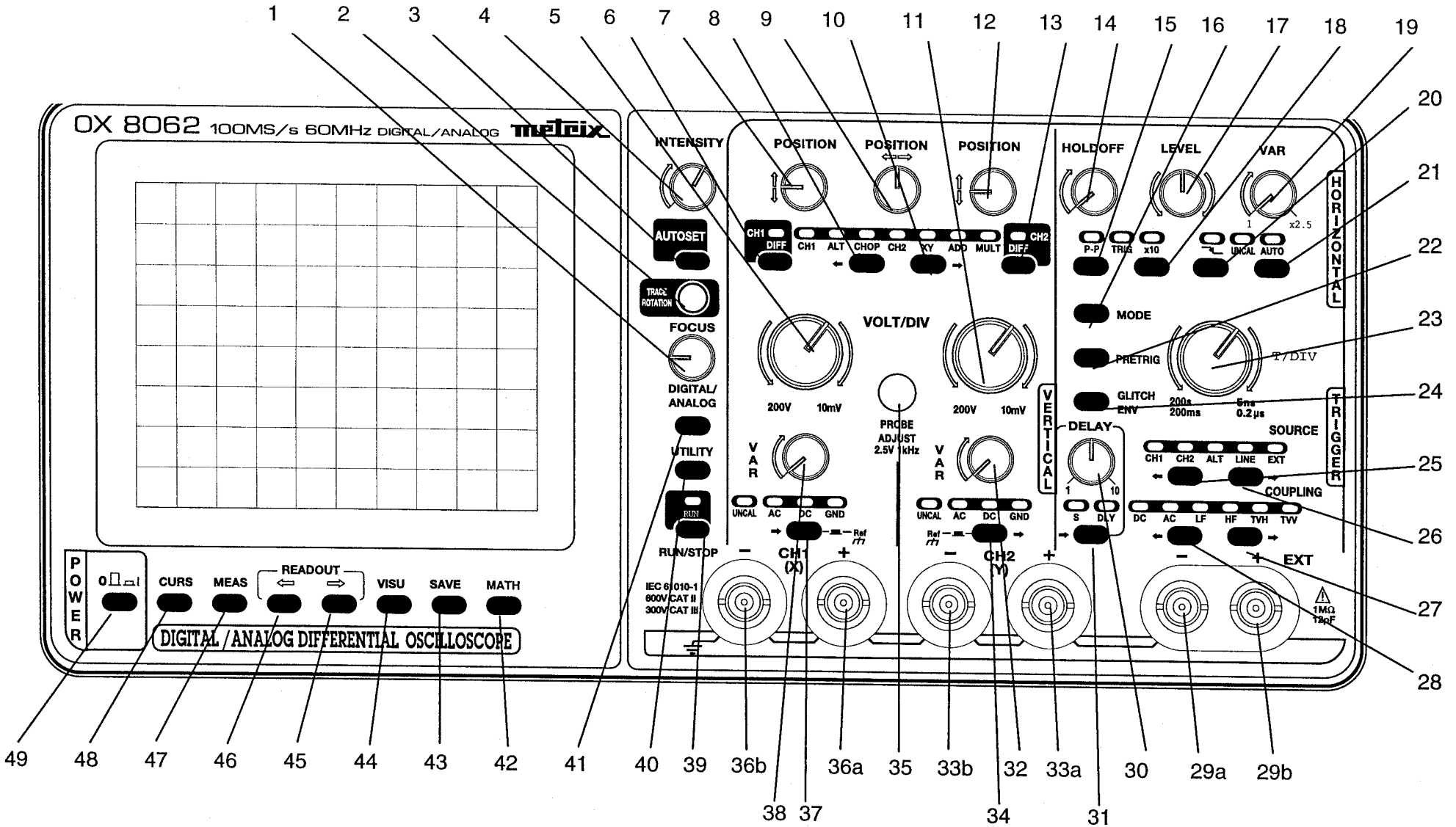


Figure 1 : Front face

3. FRONT DESCRIPTION

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 -	**VOLT/DIV**	• selection of the vertical sensitivity for CH1
6 -	**CH1 DIFF**	• switching to normal or differential operating mode of CH1 channel
7 -	**POSITION ⇧⇩**	• adjustment of the vertical position of CH1
8 -	**MODE ⇦**	• left/right scroll of vertical modes
9 -	**POSITION ⇦⇨**	• adjustment of the horizontal position of CH1 or CH2
10 -	**MODE ⇨**	• right/left scroll of vertical modes
11 -	**VOLT/DIV**	• selection of the vertical sensitivity for CH2
12 -	**POSITION ⇧⇩**	• adjustment of the vertical position of CH2
13 -	**CH2 DIFF**	• switching to normal or differential operating mode of CH2 channel
14 -	**HOLDOFF**	• adjustment of HOLDOFF time
15 -	**P-P**	• activation of peak-to-peak trigger mode
16 -	**MODE**	• activation of MODE menu (acquisition mode)
17 -	**LEVEL**	• adjustment of trigger level
18 -	**x 10**	• expansion by 10 of the sweep coefficient
19 -	**VAR**	• continuous adjustment of time base sweep coefficient
20 -		• activation of positive  or negative  trigger slope
21 -	**AUTO**	• activation of AUTO or TRIGGERED sweep mode
22 -	**PRETRIG**	• in digital mode : positionning of the TRIGGER in the recording
23 -	**T/DIV**	• selection of the sweep coefficient of timebase
24 -	**GLITCH ENV**	• selection of GLITCH, ENVELOPPE or EADJ modes
25 -	**SOURCE ⇦**	• to the left scroll of trigger sources
26 -	**SOURCE ⇨**	• to the right scroll of trigger sources
27 -	**COUPLING ⇨**	• to the right scroll of trigger filters

28 -	**COUPLING ⇦**	• to the left scroll of trigger filters
29a -	**EXT -**	• BNC- of external synchronisation input
29b -	**EXT +**	• BNC+ of external synchronisation input
30 -	**DELAY**	• adjustment trigger delay of timebase
31 -	**S / DLY**	• selection of SEARCH or delayed (DLY) sweep modes
32 -	**VAR**	• continuous adjustment of CH2 vertical sensitivity
33a -	**CH2 +**	• BNC+ of CH2 channel
33b -	**CH2 -**	• BNC- of CH2 channel
34 -	**REF**	• selection of CH2 input coupling or the measurement reference
35 -	**PROBE ADJUST**	• probe calibrator output
36a -	**CH1 +**	• BNC+ of CH1 channel
36b -	**CH1 -**	• BNC- of CH1 channel
37 -	**REF**	• selection of CH1 input coupling or the measurement reference
38 -	**VAR**	• continuous adjustment of sweep coefficient of timebase
39 -	**RUN / STOP**	• digital mode : acquisition run or stop
40 -	**UTILITY**	• acitivation of UTILITY menu (utilities)
41 -	**DIGITAL/ANALOG**	• selection of operating mode : digital or analogue
42 -	**MATH**	• digital mode : activation of MATH menu
43 -	**SAVE**	• digital mode : activation of CH1 or CH2 channel saving
44 -	**VISU**	• digital mode : activation of VISU menu (visualisation)
45 -	**READOUT ⇨**	• displacement of the horizontal/vertical cursors (or the trace in digital mode)
46 -	**READOUT ⇦**	• displacement of the horizontal/vertical cursors (or the trace in digital mode)
47 -	**MEAS**	• activation of MEASUREMENTS menu (automatic measurements)
48 -	**CURS**	• activation of CURSORS menu
49 -	**POWER**	• ON/OFF button

4. GETTING STARTED

> ***Respect the safety instructions indicated in Chapter 1.***

- Position the rotary controls as indicated in figure 1.
- Press the POWER key (49): the last memorised configuration of the front panel is restored.
- Validate the AUTO key (21).
- Adjust :
  - the brightness with the INTENSITY potentiometer (3),
  - the thickness of thetraces with the FOCUS potentiometer (1),
  - the horizontalness of the traces with the potentiometer to be reached through the TRACE ROTATION hole (2).
- 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).***

- Apply the signal to be displayed to channel CH1 or CH2.
- Press on the AUTOSET key (3).
- When using a 1/10 probe, use the PROBE ADJUST signal (35) (2.5 V, 1 kHz) to adjust the probe compensation (refer to § 4. APPLICATIONS).

4.1. AUTOSET

- AUTOSET automatically carries out the following searches:

  active channel, vertical sensitivity, horizontal deflection coefficient, trigger slope, trigger source.

- 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 area 8 of figure 2.

> ***Vertical adjustment is not set. You should ensure that position (7) and (12) rotary controls are correctly centred.***

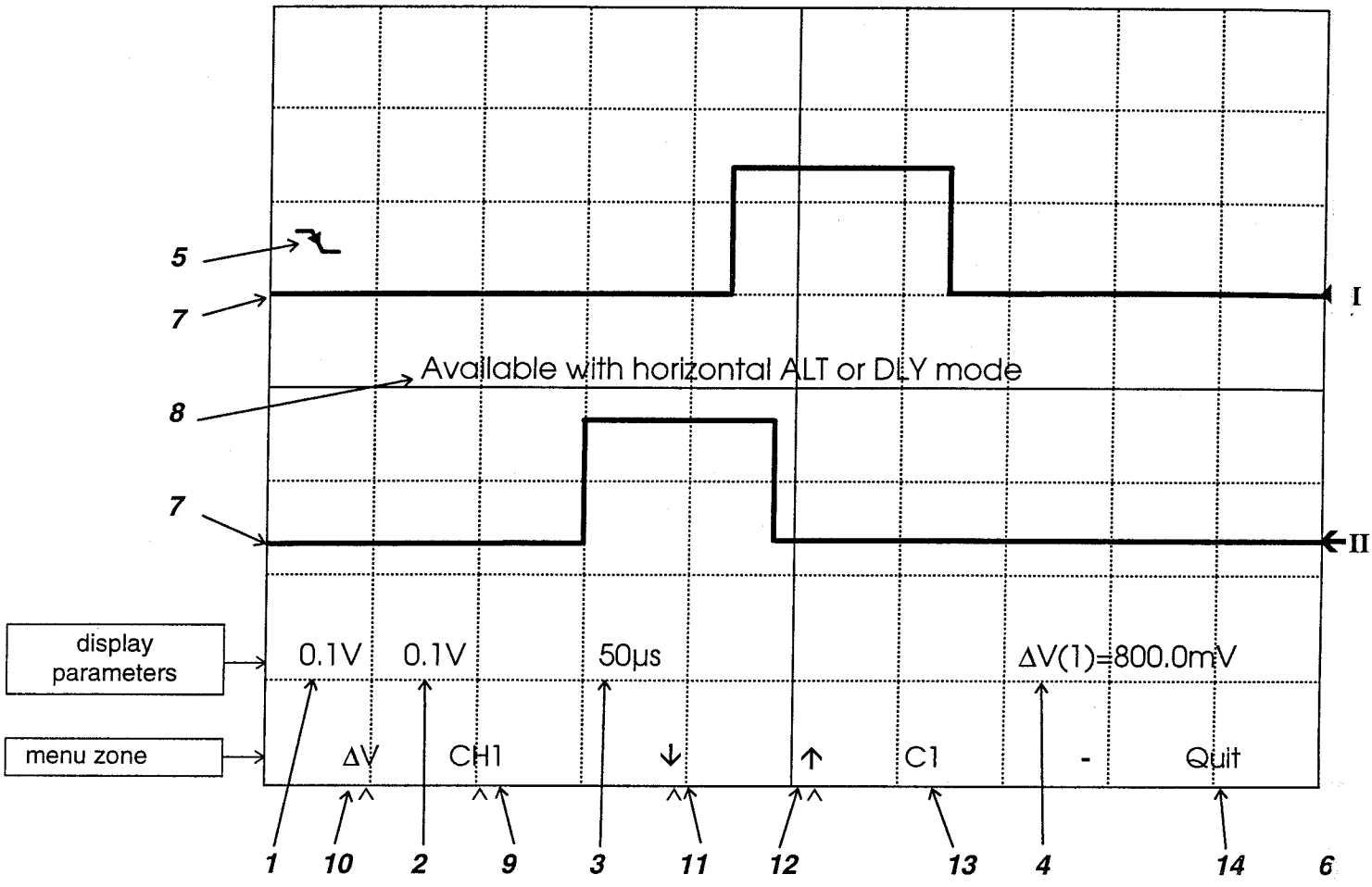


Figure 2: Visualisation of a screen in analog mode

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

☞ ***"^" symbole displayed on the screen signifies that the corresponding keys are active. They enable either to select a function or to scroll through a menu.***

5. FUNCTIONAL DESCRIPTION

5.1. Operating modes

Pressing once on the DIGITAL/ANALOG key (41) toggles between the modes: analog or digital.

5.1.1. Analog mode

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 areas 1, 2, and 3 [CH1 sensitivity (5 V/div. to 2 mV/div.), CH2 sensitivity (5 V/div. to 2 mV/div.)]
  OX 8042 : timebase (200 ms/div. to 0.5 µs/div. (50 ns/div. in expansion x10)
  OX 8062 : timebase (200 ms/div. to 0.2 µs/div. (20 ns/div. in expansion x10)

- *Result of measurement*
  When a measurement - by the cursor or automatic - is activated, the result is displayed in area 4. For further details, see paragraph 5.9. Measurements.

- *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.

- *Temporary messages*
  In certain cases; help messages are temporarily displayed in area 8 (for approximately 2 seconds):

  * Display of the programme version (UTILITY menu),
  * Display of error messages (see list of temporary messages in ATTACHMENT 1).

- *Cursors*
  Two cursors horizontal or vertical (3 for phase measurement) can be displayed according to the type of measurement (CURS menu).

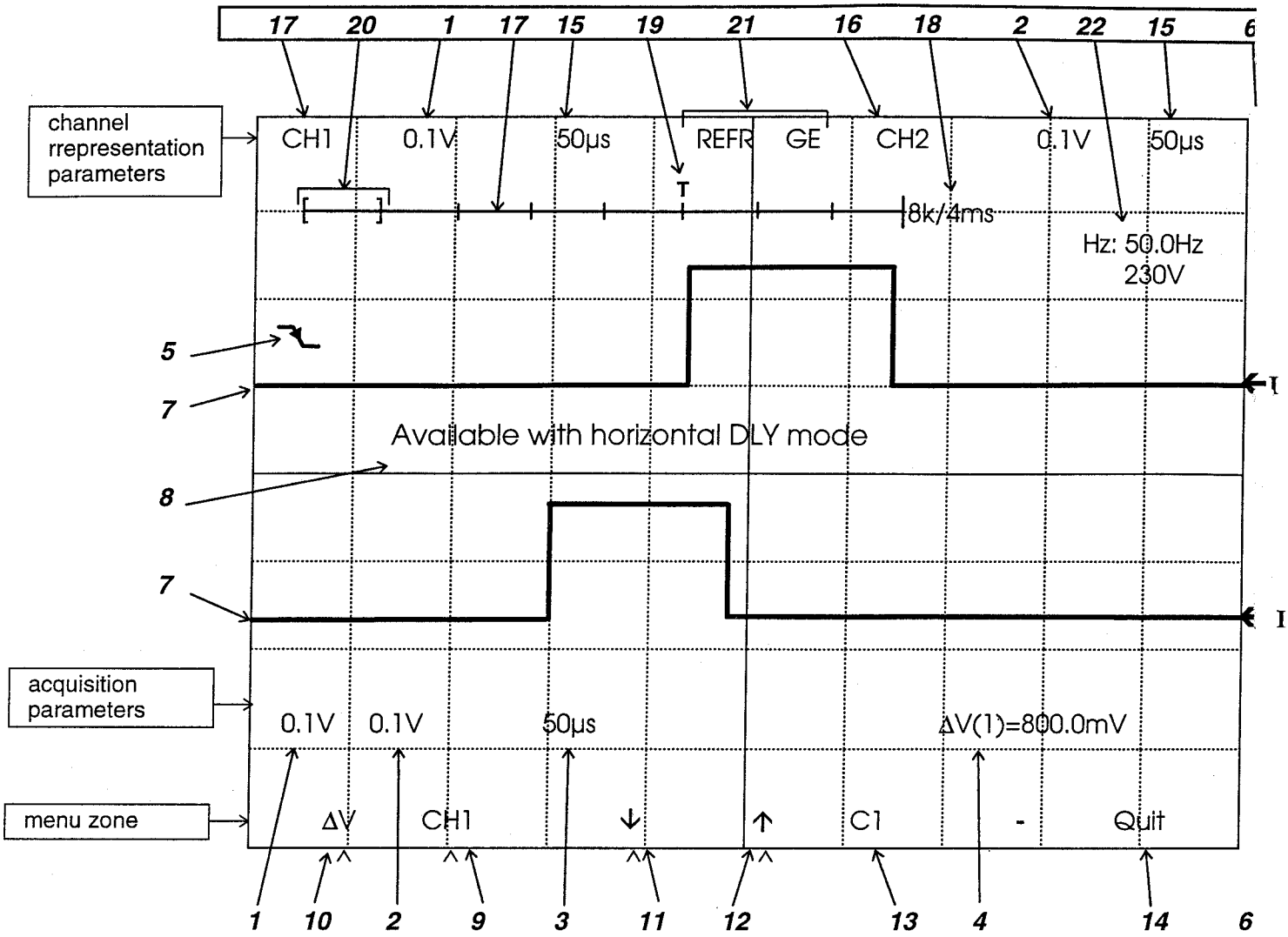


Figure 3 : Visualisation of a screen in digital mode

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

5.1.2. Digital mode

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 (45) and (46) 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. 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 areas 1, 2, and 3 (CH1sensitivity (5 V/div. to 2 mV/div.), CH2 sensitivity (5 V/div. to 2 mV/div.), timebase (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 5.8.2.2. and 5.8.2.3.). The letter "T" (area 19) represents the position of the trigger point in the acquisition memory (see paragraph 5.8.1.3. Pre-trigger). This point corresponds to trigger of the analog timebase in normal mode.
  The size of acquisition memory is indicated in area 19 (in kbytes 1 k, 8 k, 16 k, or in seconds).

- *Result of measurement*
  When a measurement is activated (using cursors or automatically), the result is displayed in area 4. The measurement takes the parameters of the channel digitised as the reference (for further details, see paragraph 5.9. Measurements).

- *Menus, temporary messages and cursors*
  Same as in analog mode (see paragraph 5.1.1. Analog mode).

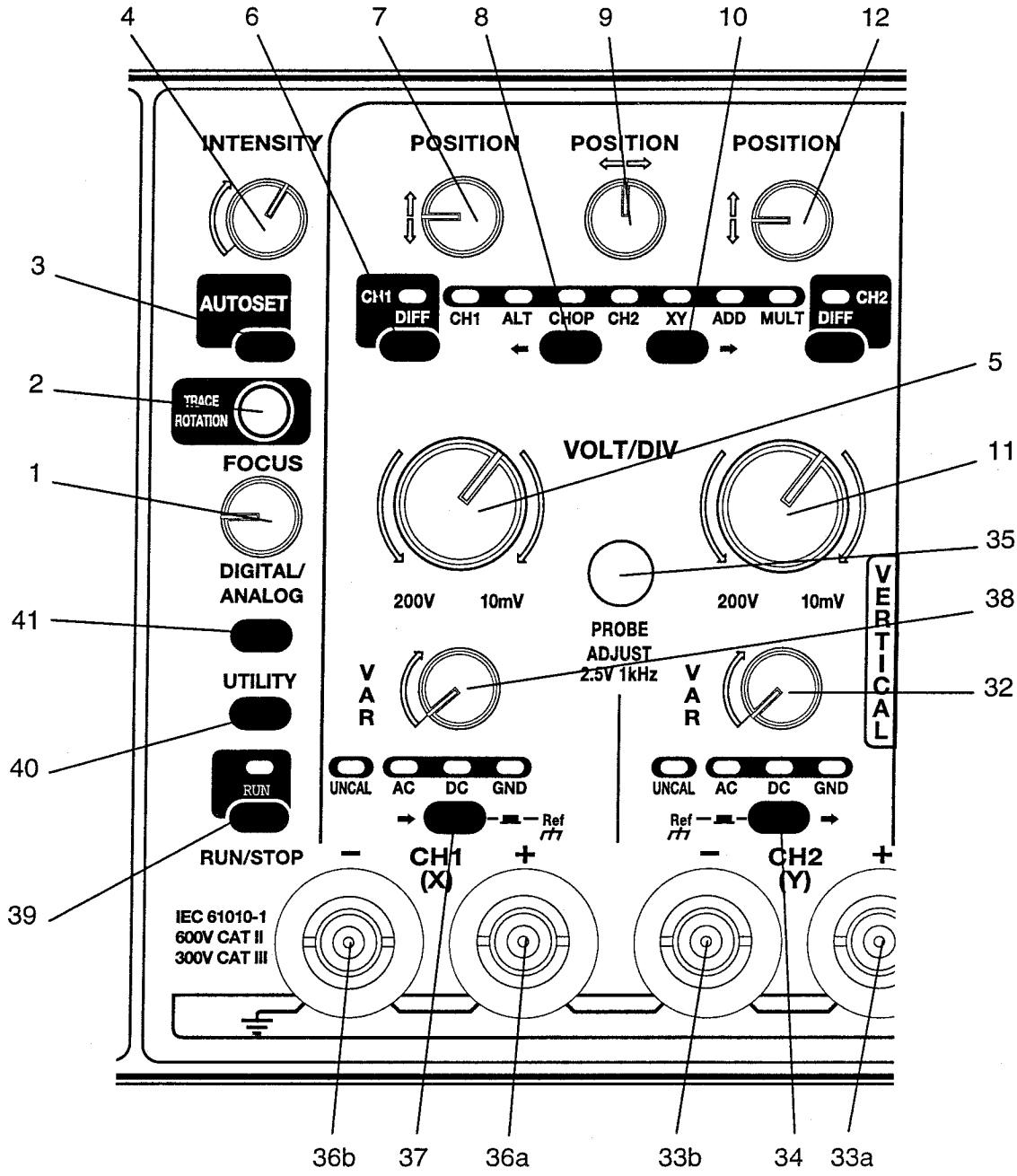

4
6
7
8
9
10
12
INTENSITY
POSITION
POSITION
POSITION
3
AUTOSET
CH1
DIFF
CH1
ALT
CHOP
CH2
XY
ADD
MULT
CH2
DIFF
2
TRACE
ROTATION
5
VOLT/DIV
11
FOCUS
1
35
DIGITAL/
ANALOG
200V
10mV
PROBE
ADJUST
2.5V 1kHz
200V
10mV
VERTICAL
38
41
VAR
VAR
UTILITY
32
UNCAL
AC
DC
GND
UNCAL
AC
DC
GND
40
RUN
Ref
Ref
RUN/STOP
–
CH1
(X)
+
–
CH2
(Y)
+
39
IEC 61010-1
600V CAT II
300V CAT III
36b
37
36a
33b
34
33a

Figure 4

5.2. 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 (7) and (12).

(9) **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 end-stop position, the corresponding UNCAL indicator light is out.

(30) - (36) **AC - DC - GND**

Short press: Input coupling

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

Continuous coupling
Visualisation of the full signal

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: (37) for CH1 or (34) for CH2. Allows the 0 V reference to be located easily; this can be modified vertically with the potentiometers (7) and (12).

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

(36a) - (36b) **CH1+ CH1-** Inputs of signals to be observed on BNC sockets.
In differential mode, connect the signals to the signals to the BNC's + (36a) et - (36b) ; in normal mode, the BNC (36a) is used alone, in a traditional way (coaxial cable or probe).

(33a) - (33b) **CH2+ CH2-** Inputs of signals to be observed on BNC sockets.
In differential mode, connect the signals to the signals to the BNC's + (33a) et - (33b) ; in normal mode, the BNC (33a) is used alone, in a traditional way (coaxial cable or probe).

5.3. Display modes

(6) 

CH1 DIFF - Switch of channel CH1 to normal/differential mode.
In normal mode - LED not lit - the display corresponds to the signal present on channel CH1+.
In differential mode - LED lit - the display corresponds to the difference between the signals present on channel CH1+ (36a) and CH1- (36b).

(8) - (10) **CH1 - ALT - CHOP - CH2 - XY - ADD - MULT**

Select by pressing the key ← (8) or → (10) :

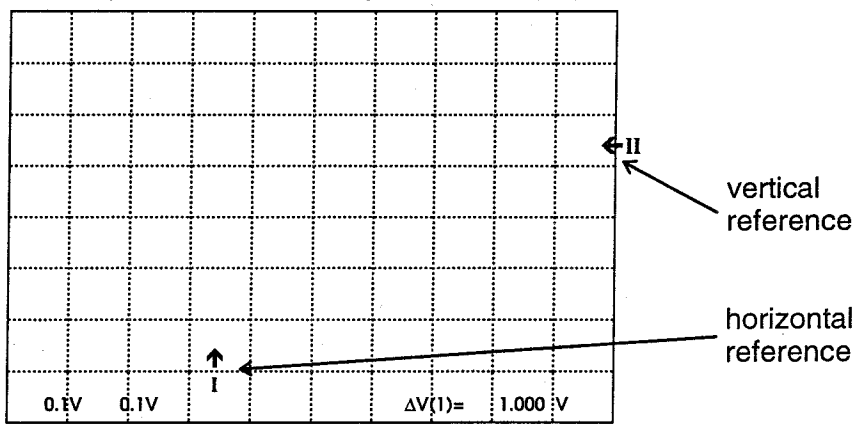
Display of CH1 only.

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 (200 kHz approximately).

Display of CH2 only.

Display of CH1 and CH2 as orthogonal co-ordinates (*analog mode*) (CH1 as X, CH2 as Y). The timebase is inoperative and vertical centring is carried out using the control (12) :



Display of the sum of CH1 and CH2.

Multiplication mode is accessible in digital mode.
Display of the product of channels CH1 and CH2.

MULT display = CH1 display x CH2 display

☞ ***The MULTdisplay can be insignificant, if the CH1 and CH2 sensitivities are different.***

(13) 

CH2 DIFF - Switch of channel CH2 to normal/differential mode.
In normal mode - LED not lit - the display corresponds to the signal present on channel CH2+.
In differential mode - LED lit - the display corresponds to the difference between the signals present on channel CH2+ (33a) and CH2- (33b).

5.4. Timebase

(Refer to figure 5, page 20).

(21) **T/DIV** - Sweep coefficient

- *OX 8042* :
  analog mode — 18 positions (0.5 µs to 200 ms/div.)
  digital mode — 33 positions (5 ns to 200 s/div.)
- *OX 8062* :
  analog mode — 19 positions (0.2 µs to 200 ms/div.)
  digital mode — 33 positions (5 ns to 200 s/div.)

(17) **VAR** - Continuous adjustment of the sweep coefficient of timebase
When the knob is locked in the left-hand position, the UNCAL indicator is out, *in analog mode only.*

(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 in not active in XY analog mode (indicator out) or in any digital display modes (temporary message).

5.5. Trigger

(25) - (26) **SOURCE** - Select by pressing on the → (26) or ← (25) keys:

Synchronisation by CH1.

Synchronisation by CH2.

Trigger source defined according to the display mode:

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

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 BNC EXT- (29a) and EXT+ (29b) socket.

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

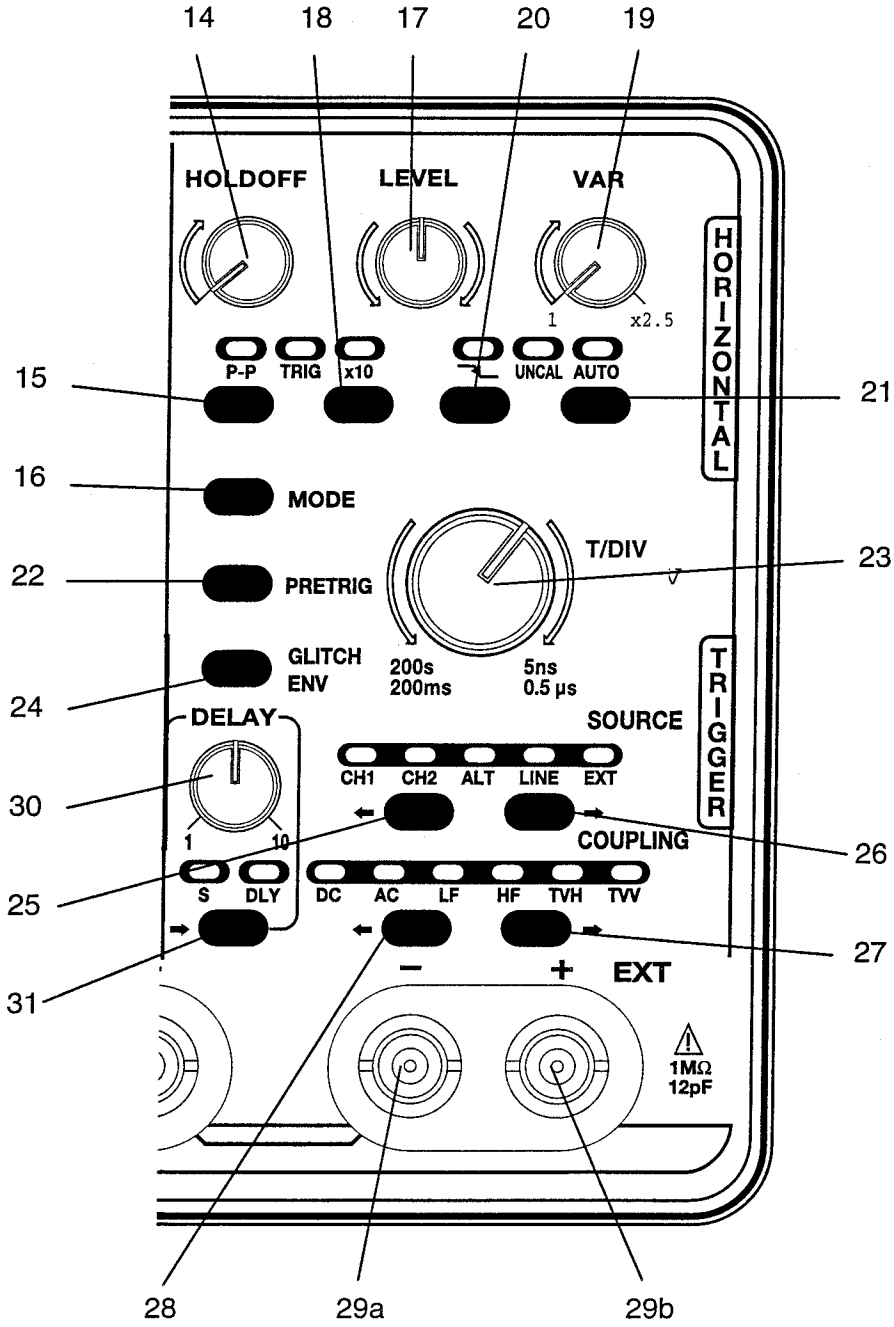

14
18
17
20
19
HOLDOFF
LEVEL
VAR
1
x2.5
HORIZONTAL
P-P
TRIG
x10
UNCAL
AUTO
15
21
16
MODE
T/DIV
23
22
PRETRIG
GLITCH
ENV
200s
200ms
5ns
0.5 µs
24
DELAY
SOURCE
TRIGGER
CH1
CH2
ALT
LINE
EXT
30
1
10
COUPLING
26
25
S
DLY
DC
AC
LF
HF
TVH
TVV
27
31
−
+
EXT
1MΩ
12pF
28
29a
29b

Figure 5

(17) **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 (or) depending on whether the trigger slope is negative or positive.

The TRIG indicator lights up when a trigger event is detected.

(20) **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 area 5 of figures 2 and 3, on condition that the PTP mode is not activated.

> (*) ***NB : When one of the TVV or TVH filters is activated, it is possible to trigger in positive video with the positive trigger edge, in video negaive, with the negative trigger edge.***

(29a) - (29b) **EXT- EXT+** Inputs of the external synchronisation signal by the BNC's 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 or symbols means that the displayed TRIGGER level might be different from the visualised TRIGGER point.***

Select by pressing on the → (27) or ← (28) key:

DC coupling (0 to 60 MHz)

AC coupling (10 Hz to 60 MHz)

Rejection of source signal frequencies < 10 kHz (facilitates observation of signals with a DC 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 Sweep coefficient recommended for the examination of a TV line: 0.5 µs at 20 µs/div. (*)

Trigger on the synchronisation pulse of the raster (*)

> ***The COULPING function is inactive in XY analog mode (indicators out).***

(15) **P - P -** Peak-to-peak trigger

The trigger reference (accurate adjustment by LEVEL) is automatically between the low and the high peaks of the signal chosen, which guarantees the trigger irrespective of the amplitude or the DC 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.

5.6. Trigger delay (DELAY)

This mode - *accessible in analog mode only* - permits a portion of the signal to be examined in detail (at high sweep speed) after the trigger event chosen. The DELAY command (30) enables continuous adjustment of the delay (1 to 9 div.).

(31) **DELAY**- Select by pressing on key (31) :

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

SEARCH mode (S) *(in analog mode only)* :
The trace (s) on the screen present an under-intensified part (corresponding to the trigger delay).
Delay : To modify the delay, operate the DELAY button (30).

DLY delayed mode:
The sweep starts at the point corresponding to the end of the under-intensified area, which has been determined in SEARCH MODE.

5.7. 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.***

5.8. Digital memory

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

The main menus, which are accessible directly by pressing one of the keys on the front face, are :

The **MODE** menu is accessible directly by pressing the key			(16)
GLITCH ENV	-	-	(24)
MEAS	-	-	(47)
CURS	-	-	(48)
UTILITY	-	-	(40)
SAVE	-	-	(43)
VISU	-	-	(44)

The sub-menus of these main menus are accessible by pressing the corresponding 7 keys situated on the front face, under the cathode ray tube.

☞ ***"∧" symbole displayed on the screen signifies that the corresponding keys are active. They enable either to select a function or to scroll through a menu.***

5.8.1. Management of acquisition

☞ ***A modification of the timebase, the acquisition mode, the enveloppe mode, the glitch capture mode or the vertical mode cancels the running acquisition and return it with new parameters.***

5.8.1.1. Different acquisition modes

Press the MODE key (16) to select the acquisition mode :

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

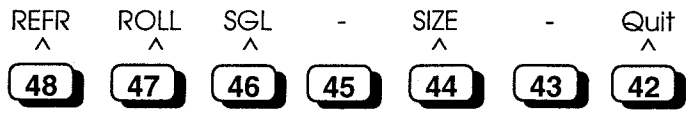
(*) *1 µs/div., if only one channel is selected.*

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.).

5.8.1.2.Selection of the acquisition mode

Press once on the MODE key (16) to bring up the following menu:



Then by pressing on key 48, you can select REFR mode
47, - ROLL
46, - SGL

By pressing on key 44, the SIZE sub-menu appears :

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

5.8.1.3. Pre-trigger (PRETRIG)

Pre-trigger allows the signal to be recorded and displayed before the moment when it is triggered.

Choosing a pre-trigger size amounts to determining where the trigger instant is situated in the recording.

The trigger point is positioned by pressing on the PRETRIG key (22), it functions in 250 byte to 1 k steps, accor-ding to the size of acquisition chosen:

Size of acquisition (SIZE)		**Positioning of the Trigger**
1 k	-	from 0 to 1 k in 4 steps of 250 bytes
8 k	-	from 0 to 8 k in 8 steps of 1 k
16 k	-	from 0 to 16 k in 16 steps of 1 k

Selecting pre-trigger
Each time the user presses on the PRETRIG key (22), the trigger instant marked on the bargraph by a "T", moves in steps of 1 k (or 250 bytes for an acquisition dept of 1 k).

Special case
In ROLL mode, acquisition may be permanent; in this case, one press on the RUN/STOP key (46) stops acquisition. To obtain this mode, press on the PRETRIG key (20) until the letter "T" disappears from the bargraph. This mode is used for surveillance.

5.8.1.4. Glitch capture mode (GLITCH) and Envelope mode (ENV)

Application with Envelope mode

Analysis of the variations of a signal over a period of time (vertical drift) or horizontal (jitter), or visualisation of the modulation of amplitude or frequency.

Envelope mode consists of memorising minimum and maximum values for each abscise (0 to 1000) for several successive acquisitions (repetitive signal in REFRESH mode).

Application with Glitch capture mode

The parasite capture mode can be used to capture transients lasting $\geq$ 20 ns between two sampling points and over the whole range from 5 µs/div. to 200 s/div. (whatever the frequency sampling is).

☞ ***In SINGLE or ROLL modes, envelope mode is inoperative.***

Selecting Envelope and/or/GLITCH mode and Enhanced Analog Dot Join (EADJ) function

- Press on the ENV key (24). The following main menu appears at the bottom of the screen :

- Press on key (43) or (47) to validate or inhibit GLITCH or ENVelope mode.
- To quit the menu, press on key (42).
- The letter E and/or G in area 21 of the screen (figure 3) indicates that ENVelope and/or GLITCH mode or the EADJ function has been selected.

5.8.1.5. Running and stopping acquisition

Running (RUN)

Acquisition is run by pressing on RUN/STOP (39). 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 (39) 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).***

☞ ***A modification of the timebase, the acquisition mode, the enveloppe mode, the glitch capture mode or the vertical mode cancels the running acquisition and return it with new parameters.***

5.8.1.6. Display update of signals

SINGLE or REFRESH Mode

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 vertical bars delimiting the memory and the square brackets delimiting the screen remain.

- As soon as triggering occurs:
  - the pre-trigger area - 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 area 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.

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 area is acquired.***
> - ***Post-trigger :the user may stop acquisition before it is complete.***

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

- 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 areas are at 0 and therefore are invisible on the screen.***

5.8.2. Visualisation of digitised signals

5.8.2.1. 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 volts reference is permanently represented on the right of the screen (figure 3, area 6).***

5.8.2.2. 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 (figure 3, area 21).

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 two timebase positions; 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 case.

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

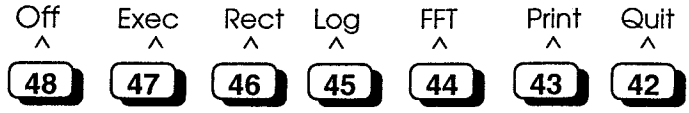
☞ ***When acquisition is run, the window is configured to 1,000 points and the timebase of the signal being acquired takes the value of the current timebase (displayed at the bottom).***

5.8.2.3. Displacement of the window

The screen signal observation window can be displaced over the size of the acquisition, in both directions, using keys (45) and (46) (when no menu is activated in "Menu" area ; refer to figure 3).

5.8.3. Mathematical function

Press on the MATH key (42). The following menu appears :



Select the windowing (46)

Press successively on the key (46), the following windows scroll through the menu :

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

Select the vertical scale (45)

Press successively on the key (45), 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 (47)

Press on key (47).

☞ ***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 (48)

Pressing on the key (48) 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 movd 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).***

Select the windowing (44)

Press successively on the key (44), 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 distorsion of a signal ;
- impulse response analyses ;
- identify noise sources in digital logic circuits.

Description

FFT is computed based on the following equation :

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

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 symetric parts ; only the positive values of frequency are displayed.

Calculation method

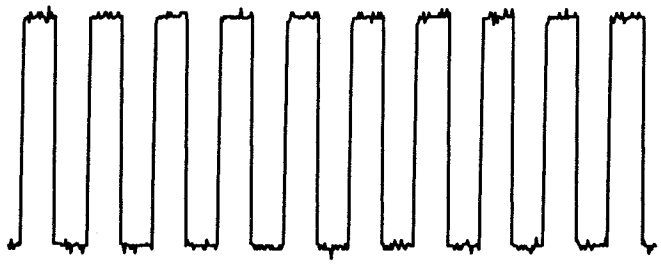
FFT length is 1024 samples.

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

Windowing

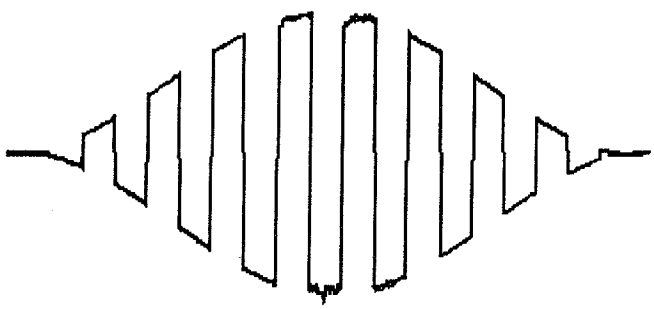
The FFT windowing acts like a pass-band filter.

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

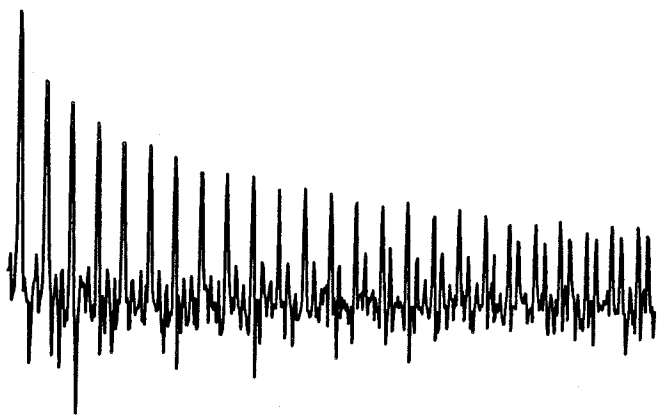


Time domain record

Truncation function (FFT window)



Time domain record after windowing



FFT frequency domain record

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

The side-lobe characteristics of the sinx/x frequency fonction 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.

5.9. Measurements using cursors or automatic 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.

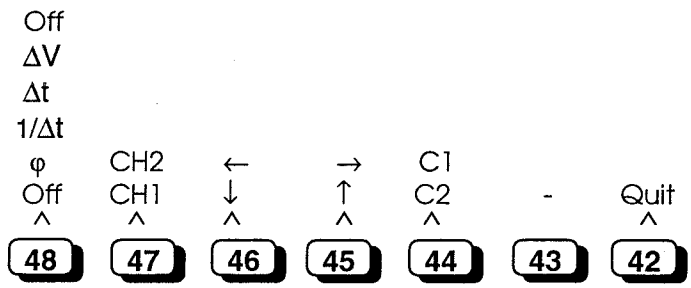
These cases are as follows:

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).

5.9.1. Measurement using cursors (CURS)

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



5.9.1.1. Selecting the type of measurement

Key (48) can be used to scroll through the types of measurement:

initial state	**Off**	no cursors
1st press	**DV**	voltage measurement (in XY mode, the cursors are vertical if the reference is CH1 and horizontal if the reference is CH2)
2nd press	**Dt**	time measurement (vertical cursors, measurement impossible in XY mode)
3rd press	**1/Dt**	frequency measurement (same remarks as for Dt)
4th press	φ	phase measurement (in this mode, three cursors are available)
5th press	**Off**	no cursors

5.9.1.2. Selection of cursor to be moved

You can select the cursor to be moved by pressing key (44):

Case 1 DV, Dt and 1/Dt cursors
You can select cursor C1 or C2 (44).

Case 2 φ phase measurement cursor

- If the reference channel is CH1, select the cursor REF 0° CH1 or REF 360° CH1 or REF 0° CH2 (44).
- If the reference channel is CH2, select the cursor REF 0° CH2 or REF 360° CH2 or REF 0° CH1 (44).

The phase measurement is expressed in degrees relating to the reference channel 0°/360°.

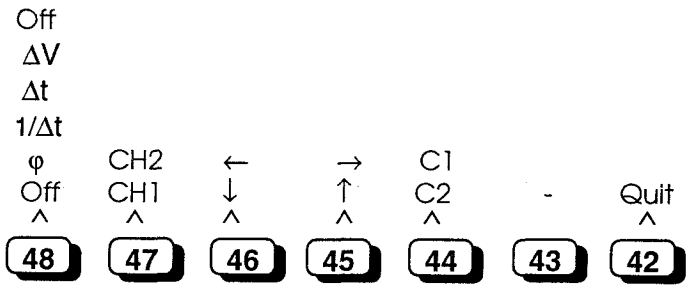
The cursor selected is displayed as an unbroken line and can then be moved using keys (45) and (46).

5.9.1.3. 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.

5.9.1.4.Selection of the reference channel

To select the reference channel, press the CURS key (48) to display the following submenu:



ALT or CHOP vertical mode:
The reference measurement channel CH1 or CH2 can then be selected by pressing key (47).

> ☞ ***It is also possible to change the reference channel by a long press on the CH1 (37) and CH2 (34) coupling key without entering into the menu.***

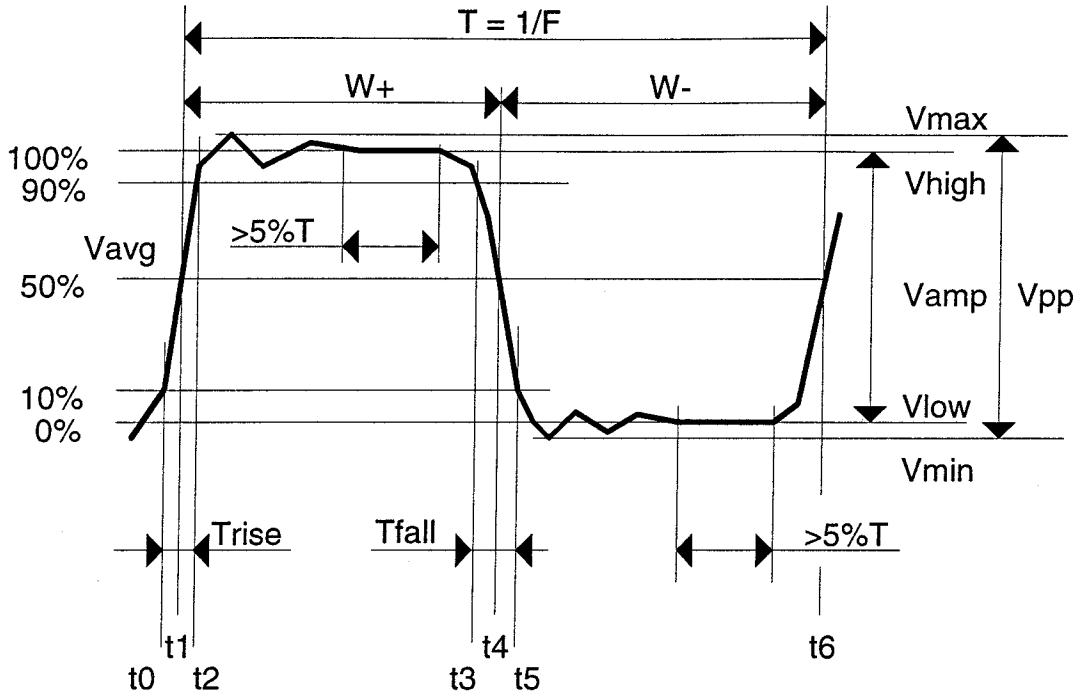
The number of the active reference channel is included in index form in the measurement result (figure 2 or 3, area 4)

✍ Example: Vpp(1) = 2.55 V

> ☞ ***This choice applies to all the cursor or automatic measurements.***

In CH1 or CH2 single-channel mode:
The measurement then corresponds to the channel displayed.

> ☞ ***In analogue mode, when an automatic measurement is selected, the RUN LED comes on to indicate that the measurements are obtained from acquisition results.***



- Vpp = Vmax - Vmin
- Vrms = $[\frac{1}{n}\sum_{i=0}^{i=n}(y_i - y_{GND})^2]^{1/2}$
- Vavg = $\frac{1}{n}\sum_{i=0}^{i=n}(y_i - y_{GND})$
- tr = (t2 - t0)
- tf = (t5 - t3)
- W+ = t4 - t1
- W- = t6 - t4
- DC+ = (W+ / T) x 100
- DC - = (W- / T) x 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:

new value displayed = (old value displayed x 15 + value measured) / 16

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

Figure 6 : Definition of automatic measurements

5.9.1.5. Automatic measurements (MEAS)

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

5.9.1.6. Clearing the menu

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

5.9.2. Automatic measurements (MEAS main menu)

17 automatic measurements are available:

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

☞ ***The automatic measurement are calculated according to the numerised signals displayed on the screen which corresponds to the visualised window ; this part of acquisition must be made of one and a half period at least (4 fronts), except in case of Vrms or Vavg.***

Relative accuracy of automatic measurements

1. Amplitude measurment

* P = 3% + 8 / Amplitude (in div.) for 8 div. : P = 4%

2. Time measurement

2.1 t/div. ≥ 5 µs/div. P = 0,01% + 2 * [t/div. (µs)] / [Tmeasured (µs)]
2.2 t/div. < 5 µs/div. P = 0,01% + 5 / [Tmeasured (µs)]

3. Frequency measurement

3.1 t/div. ≥ 5 µs/div. P = 0,01% + 2 * [t/div. (µs)] * [Fmeasured (MHz)]
3.2 t/div. < 5 µs/div. P = 0,01% + 5 * [Fmeasured (MHz)]

5.9.2.1. 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.

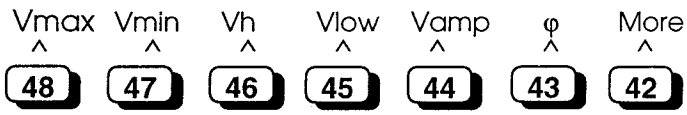
5.9.2.2.Running measurement

Press on the MEAS key (47). The following menu appears:

The MORE key (42) is used to access other automatic measurements.

1st press:

2nd press:



To run a measurement, press on the corresponding key: the menu disappears and the measurement result is displayed in area 4 of the screen (figure 2 or 3).
To stop measurements, press on the MEAS key (47) then on "off" (48). 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 (refer to § 5.9.2.1.)***
  - ***no display: at timebase speeds of between 200 s/div and 100 ms/div, the result of the measurement is displayed as soon as the number of samples is sufficient (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.***

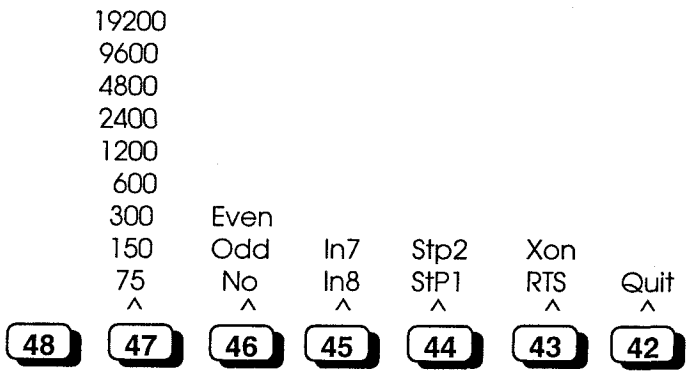
5.10. Screen copy and remote control

The remote programming interface (RS232C) selection may be different from that used for hard copies (RS232C or CENTRONICS).

5.10.1. Configuration of the RS232C interface

To validate the communication interface, press the UTILITY key (40). The following menu appears:

To select and configure the interface, call up the RS232 submenu by pressing key (47). The RS232 interface configuration submenu is then displayed as follows:



Choice of the protocol

By successive presses on key (43), you can scroll through the following protocols in the menu:

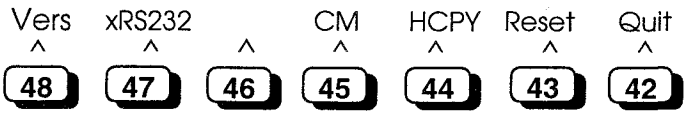
RTS: RTS/CTS protocol (hardware protocol requiring a complete lead

Xon: Xon/Xoff protocol (software protocol allowing use of a three-wire link)

> ☞ ***In both cases, make sure that the peripheral connected supports the same type of protocol.***

Press Quit (42) to validate the configuration of the RS232 interface and leave the RS232 menu.

The RS232 interface validated for the screen copy is indicated by a cross in the UTILITY menu:



5.10.2. Screen copy (HARDCOPY)

Two parameters can be configured:

- The format of data generated:

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

- The interface used to transfer the data when a screen copy is being executed (see figure 7 for typical connection of the oscilloscope to a plotter or printer).

  RS232C Serial port (*)
  CENTRO Centronics (*)

(*) The same 25-pin SUB-D output (*on the back of the oscilloscope*) is used for both the RS232C and CENTRONICS interfaces (use an RS232C lead - see Appendix 2 - or a CENTRONICS lead, depending on the case).

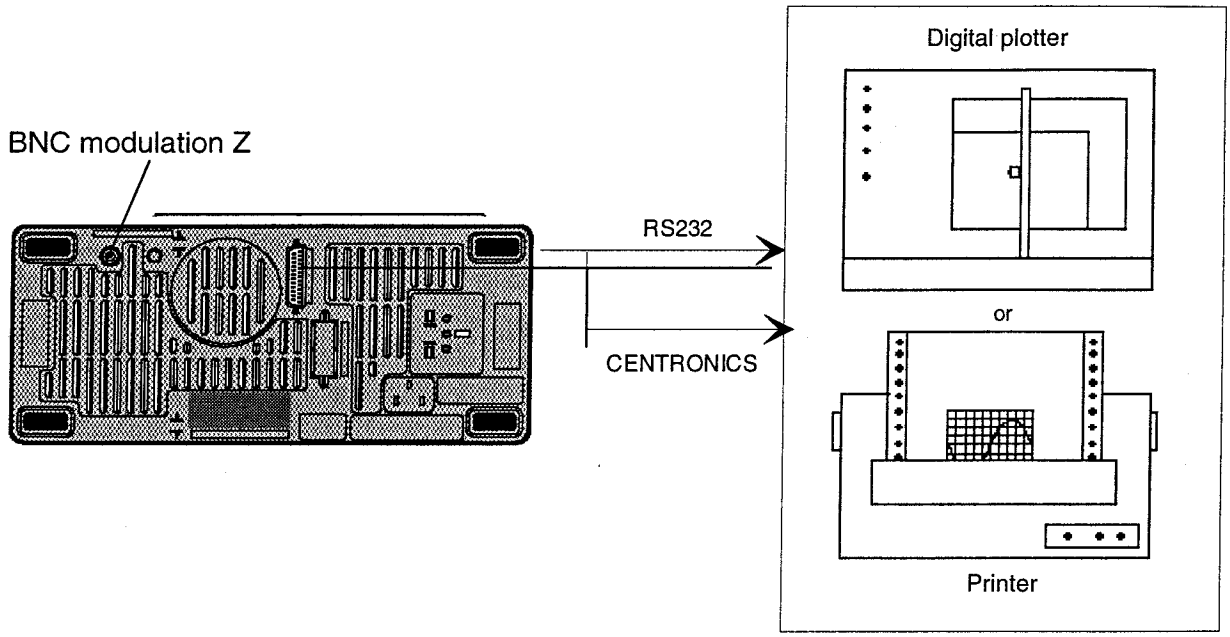
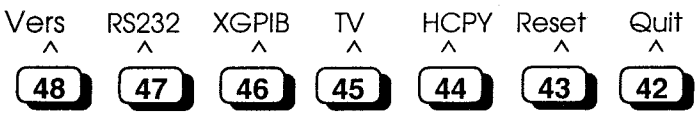


Figure 7: Principle of oscilloscope connection to a plotter or printer

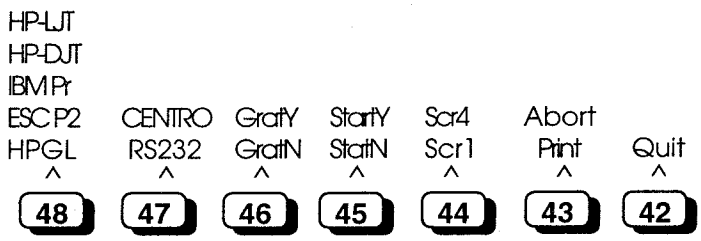
5.10.3. Configuration of printing

Press on the UTILITY key (40). The following menu appears:



To configure printing parameters, call up the HCPY sub-menu by pressing on key (44).

The following menu appears:



It is possible to choose:

1. the printing language (48): IBM Pr, ESC P2, HP-DJT, HP-LJT or HPGL
2. the active interface (47): RS 232C or CENTRONICS
3. printing of the graticule or not (46): GratY or GratN StatN (*)
4. printing of the instrument's configuration or not (45): StatY or StatN (*)
   division of the sheet (*only if the HPGL language has been selected)* (44): Scr4 or Scr1 (Scr 4 = 4 printing areas)

(*) (Y = yes, N = no)

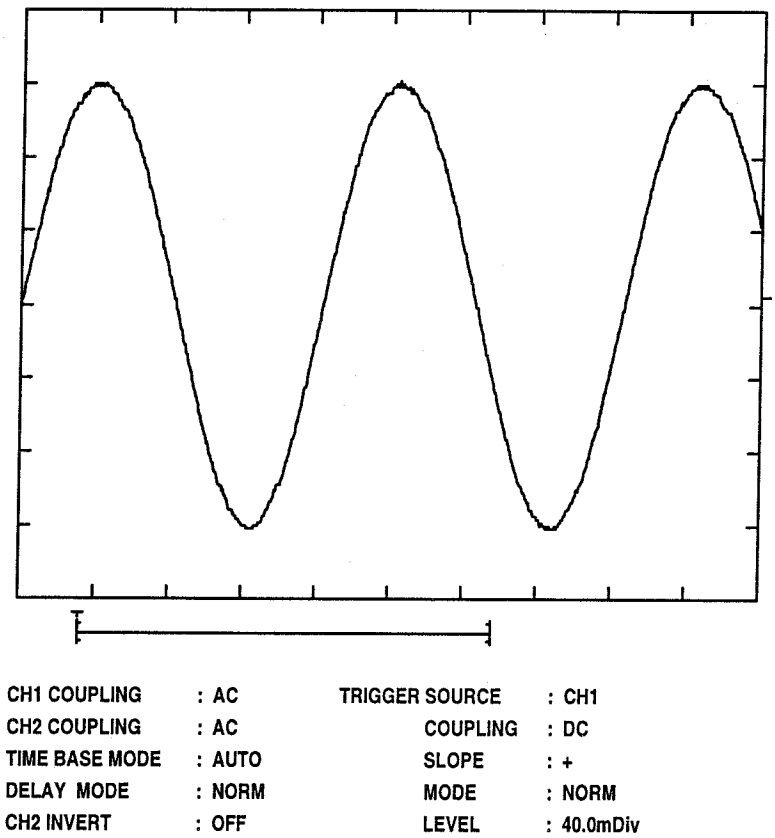


Figure 8: Screen copy with printing of status

> ***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 ca be different from that configured in the UTILITY menu which defines the programming interface by remote selection.***

Selection of the Splitting the sheet into quarters option

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-LJT or HP-DJT), the sheet splitting option is invalidated.

By pressing on key (44), printing of a full sheet (Scr1) or on a 1/4 sheet (Scr4) is validated.

The quarter (1, 2, 3 or 4) will be chosen when the screen copy is initiated (see paragraph 5.10.2.2. Initiating/stopping a screen copy).

Special case: ***When the Splitting the sheet option is validated (see paragraph 5.10.2.1. Configuration of printing), the screen copy will be run in 2 stages:***

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

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

1	2
3	4

5.10.3.1.Initiating / stopping a screen copy

A screen copy is initiated by pressing once on HARDCOPY (39). A message is displayed at the bottom of the screen while data is being transferred :

"Plotting screen... Press HARDCOPY to abort"

or "Printing screen... Press HARDCOPY to abort"

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

5.10.4. Remote control

The oscilloscope can be controlled remotely via the RS232C link (refer to programming instructions for language description).

5.11. Miscellaneous UTILITY menu

5.11.1. Display of the software version

Press on the UTILITY key (40), the following menu appears:

Then press on the "Vers" key (48), the following message will appear temporarily:

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

5.11.2. Common mode voltage display : CM

Press on the UTILITY key (40), the following menu appears:

Press on key (45) : the common mode voltage of channels CH1, CH2 - corresponding to selected vertical sensitivities - will display.

5.11.3. RESET (return to factory configuration)

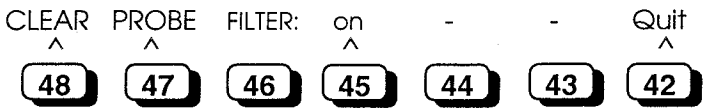
Press on the UTILITY key (40), the following menu appears:

When you press the "Reset" key (43), the instrument is reset to the factory configuration:

- oscilloscope in analog mode
- inputs in DIFF mode and AC coupling
- CHOP vertical mode
- AUTO scanning
- synchro source CH1
- DC synchro filter

5.12. VISU menu (traces and probe coefficient visualisation in digital mode)

Press on the VISU key (44), the following menu appears:



- Pressing on the CLEAR key (48) erases the traces displayed on screen.
- Pressing on the PROBE key (47) accesses to the menu selecting the probe coefficient.
- Pressing on the FILTER key (46) validates or inhibits the function DOT-JOIN (linear interpolation of ON/OFF visualised signals).

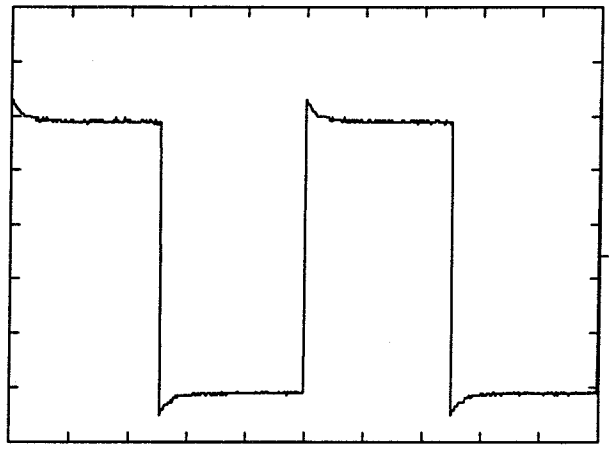


Figure : 9 Probe incorrectly compensated in low frequency

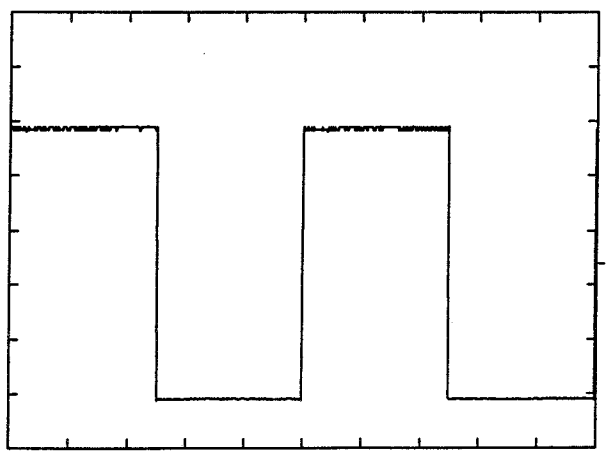


Figure 10 : Low frequency compensation correct

6. APPLICATIONS

6.1. Visualisation of the calibration signal

- Connect the PROBE output (35) to CH1 input (36a) or (36b) by using a 1/1 or 1/10 measurement probe.

- Select the following functions:

  - CH1 sensitivity (5) or CH2 (11) : 0.1 V/div. (1/1); 10 mV/div. (1/10)
  - Sweep speed (23) : 0.2 ms/div.
  - Trigger source (25) or (26) : CH1 or CH2
  - Trigger mode (21) : AUTO (LED on)

- If necessary, adjust vertically using the POSITION (7) or (12) control and stabilise the trace using the potentiometer LEVEL (17).

- Adjust the low-frequency compensation of the probe so that the impulse plateau is horizontal (figure 10).

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

6.2. Measurement of amplitude and frequency

- Connect the PROBE output (35) to the CH1 input (36a) or CH2 (33a) by using a 1/1 or 1/10 measurement probe.

- Configure the oscilloscope in digital mode [press on key (41)].

- Configure REFRESH mode [press on the MODE key (16)] and select REFR mode (48).

- Run acquisition [press on the RUN/STOP (39)]: the RUN indicator is on.

- Adjust CH1 (5) or CH2 (11) sensitivity to 20 mV/div. (if a 1/10 probe) and the timebase to 0.2 ms/div. (23).

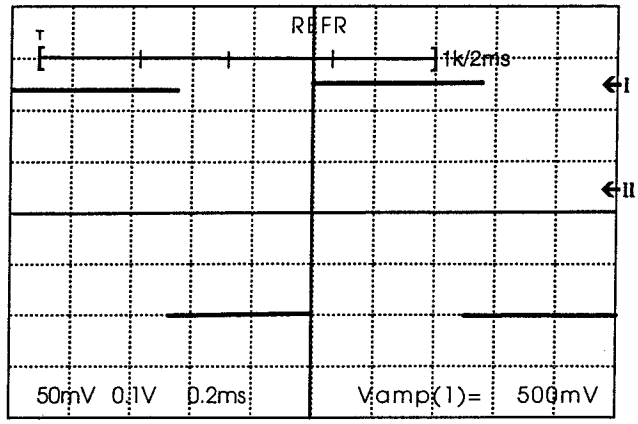


Figure 11 : Acquisition of the calibration signal and automatic measurement of amplitude

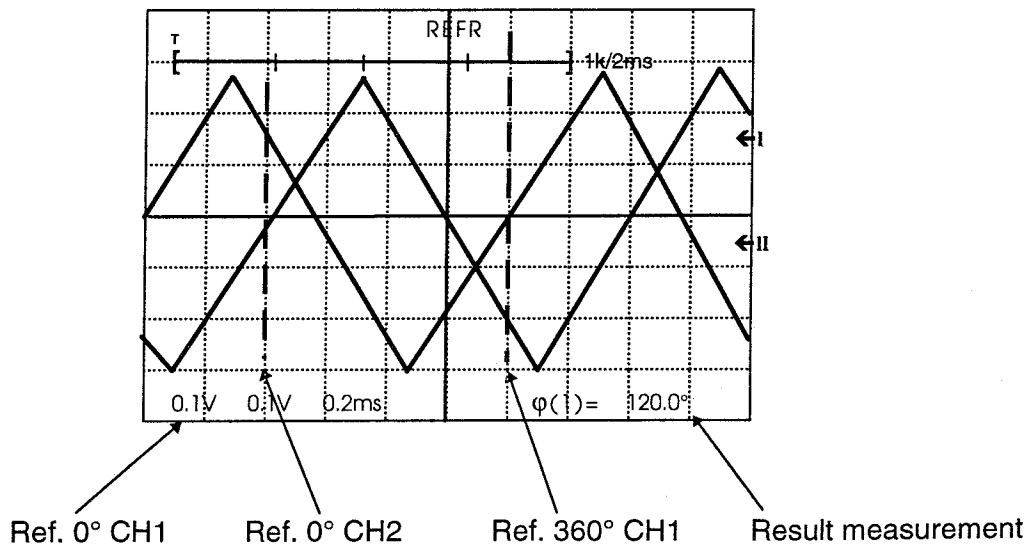


Figure 12 : Measurement of phase shift by cursors

- Run automatic amplitude measurement :
  - press on the MEAS key (47) ;
  - press twice under MORE (42) to display the menu with the amplitude measurement, Vamp.
  - press under Vamp (44).

The following result is displayed in area 4 of the screen (figure 3) :

Vamp(1)= 500.0mV (with a 1/1 probe)

or

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

- Run automatic frequency measurement:
  - press on the MEAS key (47) ;
  - press under F (44).

The following result is displayed in area 4 of the screen (figure 3) :

F(1)= 1.000kHz

6.3. Phase shift measurement

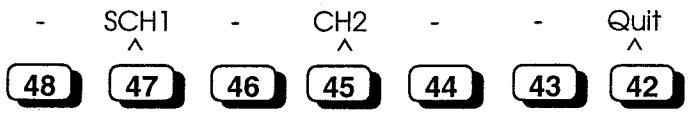
First of all, we will acquire two shifted signals. The first step described below consists of acquiring two artificially shifted signals by using a single generator. If you have two shifted signals, this preliminary step is not necessary.

6.3.1. First step: Acquisition of 2 shifted signals

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

- Configure the oscilloscope in digital mode (41): the MEM indicator is on.
- Configure REFRESH mode (press on the MODE key (16) then select REFR mode.
- Run acquisition [press on the RUN/STOP key (39)]: the RUN indicator is on.
- Press on the AUTOSET 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°/div.).
- Stop acquisition: the signal is stored.

- Save the acquisition:
  - Call up the SAVE menu [SAVE key (43)]. The following menu appears:



  - Press on key (47) under CH1: CH1 becomes SCH1 on the menu and in area 16 of the screen (figure 3) : acquisition has been saved.
  - Quit the SAVE menu [press on key (42)].

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

- Inject this same signal to the CH2 input.
- Configure the vertical mode on CHOP key (8) or (10) and the synchronisation source on CH2 key (25) or (26).
- Run acquisition by configuring the same sensitivity as on CH1: the traces should superimpose perfectly (adjust vertical centring of CH2 (12) if necessary).
- Invert the trigger front (20), operate the trigger level (17) to get the phase shift to 2 divisions (120°).
- Stop acquisition.

We have now acquired 2 shifted signals.

6.3.2. Second step: Measurement of the phase shift

Using the cursors:

- Call up the CURS menu (48).
- Select phase measurement phase, φ using key (48) (refer to § 5.9.1.4.).
- Frame the CH1 signal time (ref. 0° CH1, ref. 360° CH1):
  - choose (ref. 0° CH1) (44): the cursor is then displayed as a continuous line:
  - move it using the arrow keys ← (46) and → (45) ;
  - choose (ref. 360° CH1) (44): the cursor is then displayed as a continuous line;
  - move it using the arrow keys ← (46) and → (45).
- Place (ref. 0° CH2) on the cross-over point of the rising edge of CH2 with the horizontal axis:
  - choose (ref. 0° CH2) (44): the cursor is then displayed as a continuous line.
  - move it using the arrow keys ← (46) and → (45) ;
  - the phase shift value is then displayed on the bottom, right-hand side of the screen (figure 3, area 4).

7. 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.

7.1. Vertical deflection

CH1 - CH2	Specifications		Comments
Characteristics	**Digital**	**Analog**	
Bandwidth at - 3 dB	**OX 8062** > 60 MHz from 100 mV to 200 V/div. > 30 MHz from 10 mV to 50 mV/div. **OX 8042** > 40 MHz from 100 mV to 200 V/div. > 30 MHz from 10 mV to 50 mV/div.	**OX 8062** > 30 MHz from 10 mV to 200 V/div. **OX 8042** > 20 MHz from 10 mV to 200 V/div.	Analog bandwidth measured on 6 div.
Risetime 10 % 90 %	**OX 8062** < 5.8 ns from 100 mV to 200 V/div. < 11.6 ns from 10 mV to 50 mV/div. **OX 8042** < 8.75 ns from 100 mV to 200 V/div. < 11.6 ns from 10 mV to 50 mV/div.	**OX 8062** < 11.6 ns **OX 8042** < 17.5 ns from 10 mV to 200 V/div.	Amplitude square signal 0.5 V (range 0.1V/div.)
Variable vertical deflection coefficients (sensitivity) Common mode max. peak voltage	Ranges : 10 mV/div. to 200 V/div. ± 3 % 20 V 10 mV to 0.5 V/div. 200 V 1 V to 5 V/div. 600 V 10 V to 200 V/div.		14 positions, sequences 1-2-5
Variable vertical deflection coefficients	Multiplication of range V/div. by 1 to 2.5 reduction of amplitude)		Calibrated position : control in left end-stop
Max. input voltage	Protection against transients 4 kV (1.2 µs / 50 µs)		Inputs : 300 V CAT III 600 V CAT II
Limit level F (frequency)	600 V peak from 0 to 2 MHz and decreases -20 dB/decade from 2 to 60 MHz		
Focused trace thickness	50 mV 200 V/div.< 1 mm 10 mV and 20 mV < 3 mm		
Chop frequency (CHOP)	200 kHz approx.		
AC coupling cutoff frequency	< 10 Hz		
Input impedance	1 MΩ ± 1% // 12 pF		

CH1 - CH2	Specifications		Comments
Characteristics	**Digital**	**Analog**	
Response in rectangular signals	Overflow < 3 % Aberration at 100 mV/div.: . on the plateau < 1 mm . before the edge < 2 mm		Square signal 1 kHz to 1MHz 1 MHz (Tm gene < 100 ps)
Crosstalk	10 mV/div. to 50 mV/div. 30 dB typ. 100 mV/div. to 200 V/div. 36 dB typ.		**OX 8062** reference at 30 MHz **OX 8042** reference at 20 MHz same sensitivity on CH1 and CH2, signal amplitude : 6 div.
Display	CH1 ALT CHOP CH2 XY ADD MULT	CH1 ALT CHOP CH2 XY ADD	ANALOG mode: ALT = channel alternate CHOP = chopped DIGITAL mode: The channels are simultaneously sampled.

7.2. Horizontal deflection (timebase)

Characteristics	Specifications		Comments
	Digital	**Analog**	
Sweep coefficients	**OX 8062 and OX 8042** 5 ns to 200 s/div. ± 2 % 35 ranges	**OX 8062** 0.2 µs to 200 ms/div. ± 3 % (i. e. 19 ranges) **OX 8042** 0.5 µs to 200 ms/div. ± 3 % (i. e. 18 ranges)	Sequences 1-2-5
Expansion x 10	no	yes accuracy : ± 5 %	
Variable coefficient	no	yes range division T/DIV from 1 to 2.5	Calibrated position : control in left end-stop (signal horizontal expansion)
Sweep holdoff time (HOLDOFF)	Variable 1 to 10		for the 18 ranges of the analog timebase
XY mode Y bandwidth X bandwidth phase shift	**OX 8062** 0 to 60 MHz in Y 0 to 60 MHz in X $\Delta\varphi$ < 3° to 1 MHz **OX 8042** 0 to 40 MHz in Y 0 to 40 MHz in X $\Delta\varphi$ < 3° to 1 MHz	**OX 8062** 0 to 30 MHz in Y 0 to 2 MHz in X $\Delta\varphi$ < 3° to 120 kHz **OX 8042** 0 to 20 MHz in Y 0 to 2 MHz in X $\Delta\varphi$ < 3° to 120 kHz	The **digital** XY mode uses the timebase. Choose a speed according to applied signals.

7.3. Triggering system

Characteristics	Specifications		Comments
Sensitivity CH1 / CH2	**Digital and analog**		
0 to 10 MHz	0.7 div.		
10 to 20 MHz	1 div.		
20 to 40 MHz	2 div.		
40 to 60 MHz	4 div.		
ALT			Source acc. to vertical mode : CH1 triggers CH1 ALT triggers CH1 then CH2 *(analog)* triggers CH2 *(digital)* CHOP triggers CH1 ADD triggers CH1 CH2 triggers CH2
LINE	Synchro. on network signal		
EXT sensitivity	min. applicable amplitudes		Ze = 1 MΩ // 12 pF Protection against transients 4kV (1.2/50 µs)
0 to 10 MHz	100 mVpp		
10 to 20 MHz	200 mVpp		
20 to 40 MHz	400 mVpp		
40 to 60 MHz	600 mVpp		
Filters	Bandwidth at -3dB		
AC	10 Hz to 60 MHz		
LFR	10 kHz to 60 MHz		
HFR	0 to 10 kHz		
TVH and TVV	Synchronisation on video line (TVH) or on raster (TVV)		
Sweep mode	**Digital**	**Analog**	
AUTO	yes	yes	Relaxed mode Freq > 5Hz
Normal	yes	yes	Trigger mode
SINGLE	yes	no	Single shot mode
Slope	falling edge rising edge		
Level range			
P-P	80 % of amplitude peak peak of sinewave F > 50 Hz		
Normal	±12 divisions		

7.3.1. Trigger delay coefficient : *analog mode only*

Scanning time range	Delay range (approx.)
0.2 µs/div. *(OX 8062 only)*	
0.5 µs/div.	0,5 µs to 5 µs
1 µs/div. 2 µs/div. 5 µs/div.	1 µs to 10 µs 2 µs to 20 µs 5 µs to 50 µs
10 µs/div. 20 µs/div. 50 µs/div.	10 µs to 100 µs 20 µs to 200 µs 50 µs to 0,5 ms
100 µs/div. 200 µs/div. 500 µs/div.	100 µs to 1 ms 200 µs to 2 ms 500 µs to 5 ms
1 ms/div. 2 ms/div. 5 ms/div.	1 ms to 10 ms 2 ms to 20 ms 5 ms to 50 ms
10 ms/div. 20 ms/div. 50 ms/div.	10 ms to 100 ms 20 ms to 200 ms 50 ms to 500 ms
100 ms/div. 200 ms/div.	100 ms to 1 s 100 ms to 2 s

7.3.2. AUTOSET function

Parameters searched for by AUTOSET	Configuration imposed by AUTOSET	Unchanged parameters
Presence of a signal on channels CH1 and CH2	PTP synchro	Horizontal and vertical position
Vertical sensitivities adapted to the signals	AC coupling of the channel	VAR
Time base calibre adapted to the signal	horizontal expansion coefficient: x1	DELAY
		INTENSITY
	AUTO scanning	FOCUS

7.3.2.1. AUTOSET specifications

The AUTOSET function is activated by pressing the AUTOSET key; it automatically searches for the vertical sensitivity and the scanning coefficient adapted to the signal present on channels CH1 and CH2.

- Signal search time approx. 5 seconds
- Frequency range 25 Hz to 60 MHz (OX 8062)
  25 Hz to 40 MHz (OX 8042)
- Min. amplitude 200 mV
- In **analog** mode, automatic switch to CHOP for T/DIV between 200 ms and 1 ms/div.

7.4. Technical specifications of digital mode

7.4.1. Acquisition

Parameters	Specifications	Comments
Resolution	8 bits 1 converter pro chanel	
Real time sampling	100 MS/s max. single channel 50 MS/s max. 2 voies	Precision 100 ppm
Equivalent time sampling ETS	20 GS/s	
Selectable acquisition depth	1 k, 8 k, 16 kbytes	

7.4.2. Digital timebase, sampling frequency and acquisition mode

Timebase coefficient	SINGLE Freq. sampling	REFRESH Freq. sampling	GLITCH Freq. sampling	Modes ACQ
5 ns/div.	50 MS/s	20 GS/s	-	REFRESH or SINGLE
10 ns/div.	50 MS/s	10 GS/s	-	REFRESH or SINGLE
20 ns/ div.	50 MS/s	5 GS/s	-	REFRESH or SINGLE
50 ns/div.	50 MS/s	2 GS/s	-	REFRESH or SINGLE
.1 µs/div.	50 MS/s	1 GS/s	-	REFRESH or SINGLE
.2 µs/div.	50 MS/s	500 MS/s	-	REFRESH or SINGLE
.5 µs/div.	50 MS/s	200 MS/s	-	REFRESH or SINGLE
1 µs/div. bicourbe	50 MS/s	100 MS/s	-	REFRESH or SINGLE
1 µs/ div. monovoie	100 MS/s	-	-	REFRESH or SINGLE
2 µs/div.	50 MS/s	-	-	REFRESH or SINGLE
5 µs/div.	20 MS/s	-	-	REFRESH or SINGLE
10 µs/div.	10 MS/s	-	50 MS/s	REFRESH or SINGLE
20 µs/div.	5 MS/s	-	50 MS/s	REFRESH or SINGLE
50 µs/div.	2 MS/s	-	50 MS/s	REFRESH or SINGLE
.1 ms/div.	1 MS/s	-	50 MS/s	REFRESH or SINGLE
.2 ms/div.	.5 MS/s	-	50 MS/s	REFRESH or SINGLE
.5 ms/div.	.2 MS/s	-	50 MS/s	REFRESH or SINGLE
1 ms/div.	.1 MS/s	-	50 MS/s	REFRESH or SINGLE
2 ms/div.	50 kS/s	-	50 MS/s	REFRESH or SINGLE
5 ms/div.	20 kS/s	-	50 MS/s	REFRESH or SINGLE
10 ms/div.	10 kS/s	-	50 MS/s	REFRESH or SINGLE
20 ms/div.	5 kS/s	-	50 MS/s	REFRESH or SINGLE
50 ms/div.	2 kS/s	-	50 MS/s	REFRESH or SINGLE
.1 s/div.	1 kS/s	-	50 MS/s	REFRESH or SINGLE or ROLL
.2 s/div.	.5 kS/s	-	50 MS/s	REFRESH or SINGLE or ROLL
.5 s/div.	.2 kS/s	-	50 MS/s	REFRESH or SINGLE or ROLL
1 s/div.	.1 kS/s	-	50 MS/s	REFRESH or SINGLE or ROLL
2 s/div.	50 S/s	-	50 MS/s	REFRESH or SINGLE or ROLL
5 s/div.	20 S/s	-	50 MS/s	REFRESH or SINGLE or ROLL
10 s/div.	10 S/s	-	50 MS/s	REFRESH or SINGLE or ROLL
20 s/div.	5 S/s	-	50 MS/s	REFRESH or SINGLE or ROLL
50 s/div.	2 S/s	-	50 MS/s	REFRESH or SINGLE or ROLL
100 s/div.	1 S/s	-	50 MS/s	REFRESH or SINGLE or ROLL
200 s/div.	5 S/s	-	50 MS/s	REFRESH or SINGLE or ROLL

7.4.3. Display

Definition	250 x 200 pixels
Window displayed	1 k pts on 250 pixels
Representation of channel (acquisition or retrieval)	250 vertical segments of 4 ordinates
Compression	Depth 1 kb: no compression possible Depth 8 kb: 1 to 8 Depth 16 kb: 1 to 16
Display	Normal, **Glitch** capture, **Env**elope Enhanced Analogue DotJoin **EADJ**
Indications	Trigger level Earth reference level **I, II** Vertical overruns indicated by an arrow at the top or bottom of the screen (figure 3 ; areas 1 and 2)
Number of simultaneous plots	2

7.4.4. Memory

Saving of the channel(s) acquired using the SAVE MENU

Memory capacity	2 x 1 kb 2 x 8 kb 2 x 16 kb depending on acquisition depth
Organization	1 backup memory per channel
Retention	The signals are saved in FLASH memory if the SAVE function has been activated.

☞ ***When the instrument is switched off, the digitized signal is lost if it has not been recorded using the SAVE function. FLASH saving must be activated manually by the user.***

7.5. Miscellaneous

Calibration signal

Shape	rectangular
Amplitude	0 + 2.5 V ± 1 %
Frequency	1 kHz ± 1 %
Duty cycle	½

Z Modulation

Input BNC	BNC on the back
Sensitivity	TTL level for on/off modulation
Input resistance	≅ 2 kΩ
Max. frequency	4 MHz
Max. voltage	± 20 VDC

7.6. General characteristics

Cathode ray tube

OX 8042	mono-accelerator cathode-ray tube
OX 8062	post-deflecion accelerated cahtode-ray tube
Type	rectangular with 13 cm diagonal internal graticule
Graticule	8 vertical divisions with 5 subdivisions 10 divisions horizontales avec 5 subdivisions 1 division = 1 cm
Screen	GY phosphorus with average persistence
Trace	trace rotation adjustment, focus adjustment, light intensity adjustment
Acceleration voltage	2 kV *(OX 8042)* 14 kV *(OX 8062)*
Contrast screen	BLUE

Power supply

Mains:	two ranges 110 VAC - 230 VAC ± 10 % selectable through the position of the fuse on the main board
Frequency	50 to 60 Hz

Removable mains power cord
Winder with plug holder at the back of the instrument
Consumption : < 80 W

Electromagnetic compatibility

Emission in conformity with EN 50081-1, 1992
Immunity in conformity with EN 50082-2, 1995

Safety

In conformity with EN 61010-1 (1993) +A2 (1995)

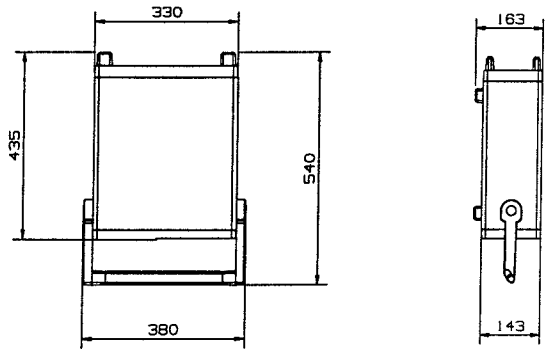
Environment

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: ≈ 8 kg

Dimensions :



Packing

Dimensions : 550 x 460 x 280 mm
Weight : ≈ 9.5 kg

8. SUPPLIES AND OPTIONS

8.1. Accessories

8.1.1. Delivered with the apparatus

• User's manual	906121576
• Programming instructions	906121584
• Power supply cable	AG0416
• T 0.315 A / 5x20 / 250 Vceramic spare fuse located inside the apparatus in a housing on the cathode-ray tube support part	AT0073
• 2 BNC/BANANA cords	AG0438

8.1.2. Provided as option

• 2 attenuating probes 1/10	HA1315
• 1/10, 200 MHz attenuating probe	HA1316
• 1/100, 200 MHz, 2 kV probe	HA1317
• Male/banana female BNC adapter, 5 pins	HA2022
• T BNC male/female, 3 pins	HA2004
• 50 Ω BNC passage load	PA4119-50
• 50 Ω BNC/BNC cable	PA2249-C48
• 100 A clamp-on for oscilloscope	AM0030N
• 600 A clamp-on for oscilloscope	AM0031N
• PC transfer software Driver Labwindows/CVI (VISA standard) available on the NATIONAL INSTRUMENTS site (www.natinst.com)	SX-METROV3
• HPGL A3/A4 plotter	TX7131
• Carry bag	AE0189

8.2. Options

• Rack assembly kit (4U - 19")	RK0008

ATTACHMENT 1
LIST OF TEMPORARY MESSAGE

Version

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

Help mesages

- **AUTOSET running :**
  " Autoset running ... "

- **Signal not found during an AUTOSET :**
  " No signal found "

- **Screen copy in process :**
  Plotter : "Plotting screen ... "

  Printer : "Printing screen ... "

- **Printer or plotter not available :**
  " Printer *(or plotter)* not ready "

- **Acquisition running in ROLL mode if timebase ≥ 100 ms/div. :**
  " Set time base > 50 ms (ROLL) ... "

- **Management of save function when acquisition running :**
  " Acquisition running ... Press RUN/STOP "

- **Call-up of a function not available with the instrument configuration :**
  " Not available with channel(s) saved "
  " Not available with analog mode "
  " Not available with XY mode "
  " Not available with EADJ mode "
  " Available with digital mode "
  " Not available with analog XY mode "
  " Not available with trigger source LINE "
  " Available with analog mode "
  " Not available for this timebase value "
  " Not available with SGL *(or ROLL)* mode "

- **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 "

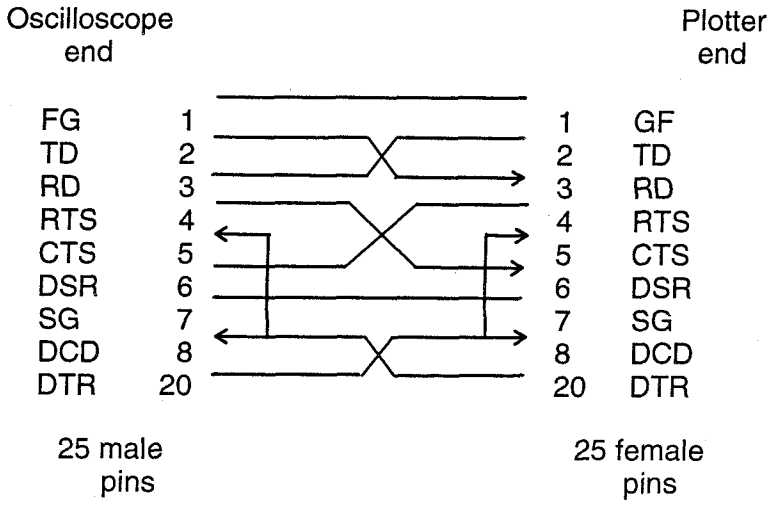
- **Impossible running of acquisition with channel(s) saved :**
  " Channel(s) saved ... Press SAVE then RUN "

- **Error of protocole communication :**
  " RS232 receive error "
  " RS232 receive overrun error "
  " RS232 receive parity error "
  " RS232 receive framing error "

- **Max. value of common mode :**
  " Maximum common mode on CH1 : 200V "
  " Maximum common mode on CH1 : 20V "
  " Maximum common mode on CH2 : 200V "
  " Maximum common mode on CH2 : 20V "

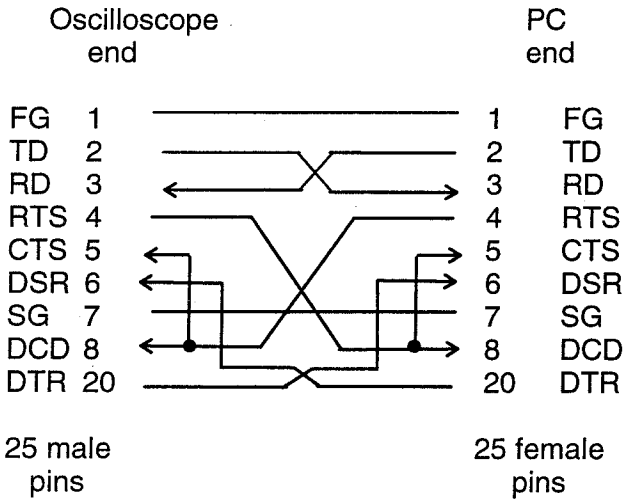
ANNEXE 2
RS232C link cable between oscilloscope and plotter

Simplified cable : 25 pins
(XON/OFF Protocole)

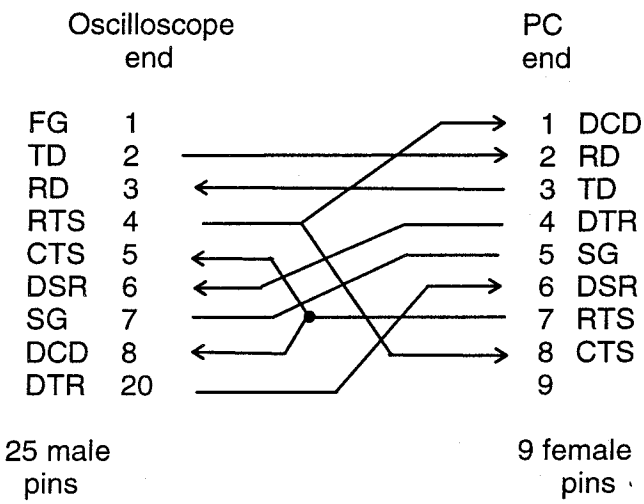


ANNEXE 3
RS232C link cable
between oscilloscope and PC

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



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



☞ ***Links (4-5) and (6-8-20) PC end optionale (depending on software used on the PC).***

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