60MHz 2-channel OX 6062-M
60MHz 2-channel OX 6062-C
150MHz 2-channel OX 6152-C
200MHz 2-channel OX 6202-C

Oscilloscopes

User's Manual

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Contents (cont'd)

Firmware update :
You may use PC software provided on the CD_ROM and consult Internet site www.chauvin-arnoux.com

General Instructions

Introduction

You have just purchased a ***2-channel oscilloscope.***

Congratulations on your choice and thank you for your trust in the quality of our products.

This range of oscilloscopes offers the following models:

OX 6062-M	monochrom	2-channel	60 MHz	1 GHz sample
OX 6062-C	color	2-channel	60 MHz	1 GHz sample
OX 6152-C	color	2-channel	150 MHz	1 GHz sample
OX 6202-C	color	2-channel	200 MHz	1 GHz sample

The ***OX 6062*** and ***OX 6152 models*** integer also a multimeter mode.
Caution : Measurement ground is connected to earth ground.

It complies with safety standard NF EN 61010-1 (2001), class1, relative to electronic measuring instructions.

For optimum service, read this manual carefully and comply with the operating precautions.

Non-compliance with the warnings and/or operating instructions might damage the instrument and/or its components and could prove dangerous for the user.

Precautions and safety measures

- This instrument has been designed for use:
  - indoors
  - in an environment with pollution level 2,
  - at an altitude of less than 2000 m,
  - at a temperature between 0℃ and 40℃
  - with relative humidity of less than 80% up to 31°C.
- The safety of any system integrating the apparatus concerns the responsibility of the assembler of the system.
- It can be used for measurements on circuits 300 V, CAT II in relation to earth and can be powered by a 90 to 264 V mains network.

Definition of measurement categories

CAT I	*Measurement category I is for measurements performed on circuits not directly connected to mains.* *Example : circuits not derived from mains and specially protected mains-derived circuits.*
CAT II	*Measurement category II is for measurements performed on circuits connected directly to the low-voltage installation.* *Example : power supply for domestic appliances and portable tools*

before use

- Comply with environmental and storage conditions.
- Power supply : it must be connected to the mains network (from 90 to 264 VAC). Make sure that it is in good working conditions.

during use

- Read carefully all the notes preceded by the symbol ⚠ .
- The instrument power supply is equipped with an electronic protection system which is reset automatically when the fault is eliminated.
- As a safety measure, use only suitable cords and accessories supplied with the instrument or approved by the manufacturer.

General instructions (cont'd)

Symbols used on the instrument

Warning: Risk of danger.
Refer to the operating manual to find out the nature of the potential hazards and the action necessary to avoid such hazards.

Earth

According to WEEE directive 2002/96/EC

Warranty

This equipment is guaranteed for **2 years** against any defect in materials or workmanship, in accordance with the general terms and conditions of sale, .

During this period, the equipment can only be repaired by the manufacturer. The manufacturer reserves the right to carry out repair or replacement of all or part of the equipment. If the equipment is returned to the manufacturer, initial transport costs shall be borne by the customer.

The **warranty** does not apply following:

- unsuitable use of the equipment or use with other incompatible equipment
- modification of the equipment without explicit authorization from the manufacturer's technical services
- repair carried out by a person not certified by the manufacturer
- adaptation to a specific application, not provided for in the definition of the equipment or by the operating manual
- an impact, a fall or a flooding.

Maintenance and metrological verification

Before the equipment is opened, it must be disconnected from the mains supply and the measurement circuits, and the operator must not become charged with any static electricity. This could cause the destruction of internal parts.

Any adjustment, servicing or repair of the unit *under power* must be undertaken only by qualified personnel, after reading the instructions in this manual.

A **qualified person** is a person who is familiar with the installation, its construction, its use and the hazards that exist. They are authorized to activate and deactivate the installation and equipment, in compliance with the safety instructions.

Information and contact details : contact your nearest distributor.

Unpacking - Repacking

All the equipment was verified mechanically and electrically before shipping.

When you receive it, carry out a quick check to detect any damage that may have occurred during transport. If necessary, contact our sales department immediately and register any legal reservations with the carrier.

In the event of reshipping, it is preferable to use the original package. Indicate the reasons for the return as clearly as possible in a note attached to the equipment.

Cleaning

- Turn the instrument off.
- Clean it with a damp cloth and soap.
- Never use abrasive products or solvents.
- Allow to dry before any further use.

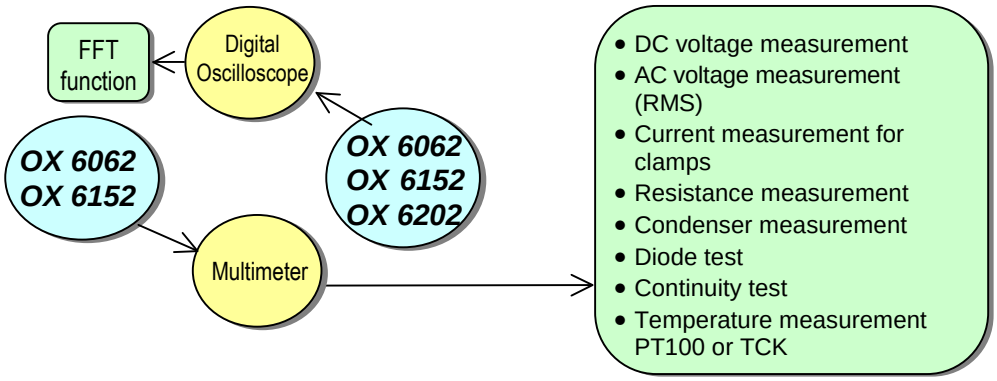
Description of the instrument

This manual describes the operation of an ***OX 6152*** oscilloscope.

The adjustment of the 2 ways is accessible by the opposite keys.

Presentation

This instrument is part of our range of portable oscilloscopes.
Its special feature is that it groups **2 instruments** into one (***OX 6062*** and ***OX 6152*** only) :



- a digital **oscilloscope** for laboratory use, intended for the analysis of the signals encountered in electronics
- ***OX 6062*** and ***OX 6152*** only : an 4,000-count **multimeter**.
  Caution : “measurement ground is connected to earth ground".

The instrument works with a constant acquisition depth of 2500 counts.

Memory management is organized using a "Windows®"-type file system.

A large colour (or monochrome ***OX 6062-M***) **LCD screen** is used to view the signals applied, along with all the settings.

The main control functions are directly accessible using the keys on the front panel and can be modified using a **touch-sensitive pad** with the **stylus** supplied.

A graphical interface similar to a PC's is used to:

- select the advanced functions by means of drop-down menus and the touch-sensitive pad
- act directly on the objects (curves, cursors, etc.) displayed on the screen.

This means that the settings can be modified.

This instrument is completed by **RS232**, **ETHERNET** and **CENTRONICS communication interfaces** (option).

Starting up

- The oscilloscopes are designed to operate on a power source delivering 90 to 264 V (ACrms) at 50 to 60 Hz.
- Take the power cord which is in the trunk (p. 9). The power supply can remain in the trunk.

- Connect the power cord to the mains.
- Press the instrument's ON switch: it lights on and then a clock is displayed on the screen during the start-up sequence.

  The message "Instrument start-up" is displayed.

  The oscilloscope is then ready for use.

By default, the "Advanced" mode is not active (see p. 58).

Description of the instrument (cont'd)

OX 6062
OX 6152
OX 6202

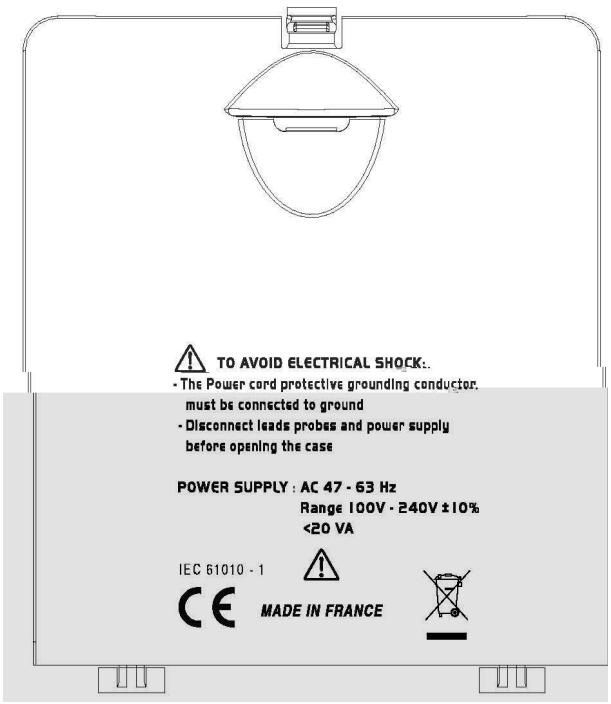
Front Panel

Description of the instrument (cont'd)

OX 6062
OX 6152
OX 6202

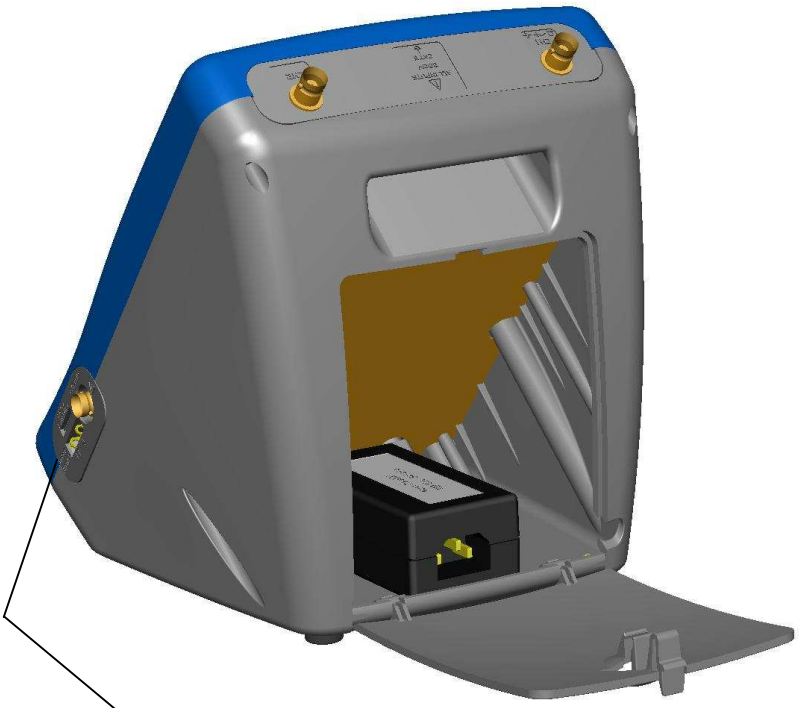
Rear panel

Marking

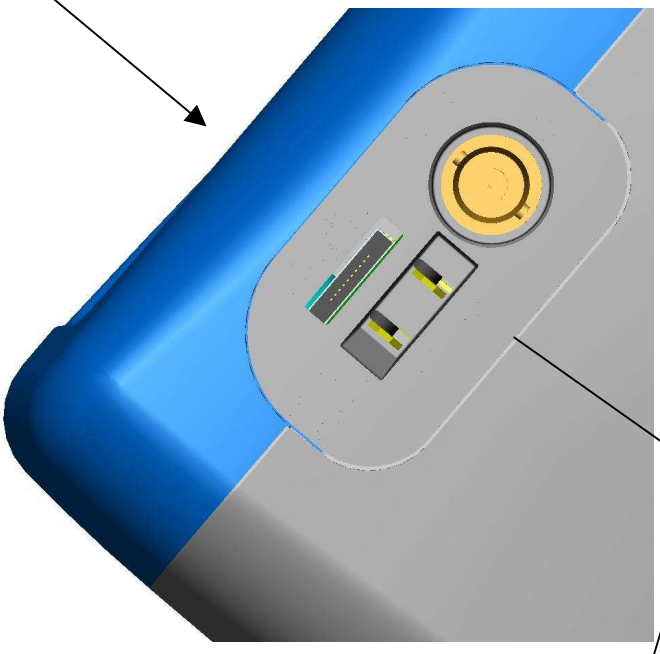


Description of the instrument (cont'd)

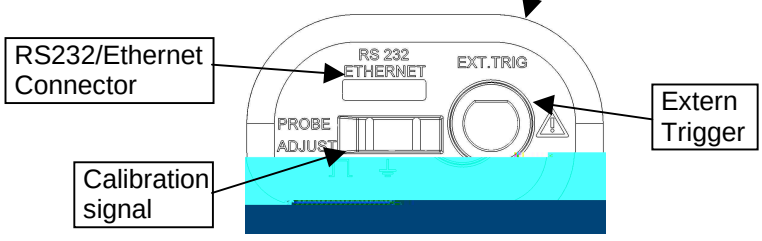
OX 6062
OX 6152
OX 6202



Interface



Marking

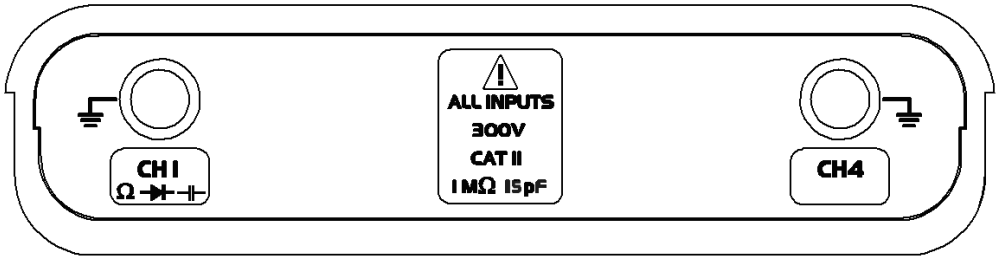


Description of the instrument (cont'd)

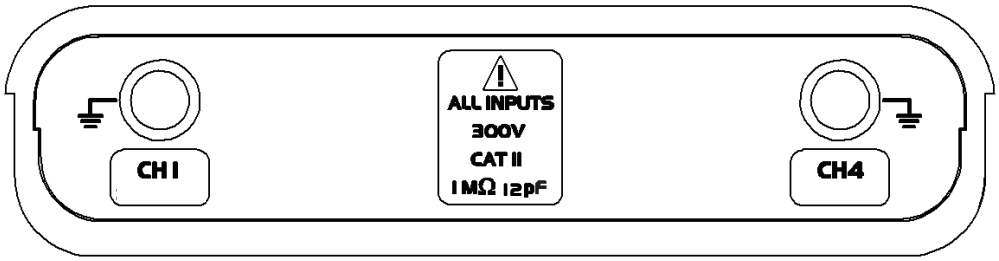
Terminal board

OX 6062
OX 6152
OX 6202

OX 6062
OX 6152
marking

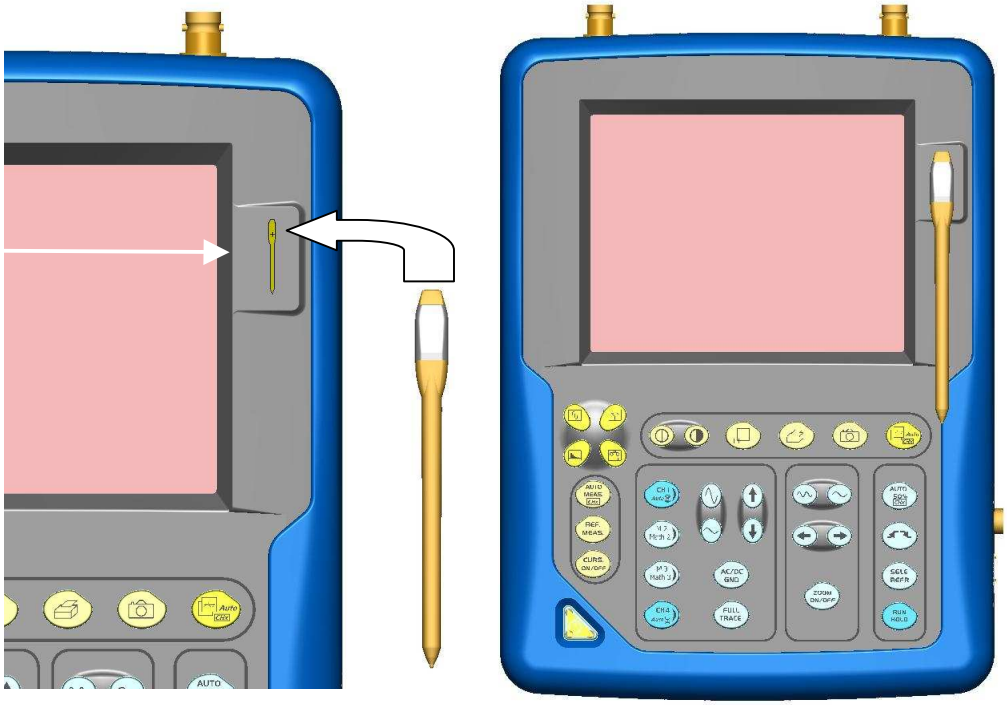


OX 6202
marking



Stylus

Magnetized base



Description of the instrument (cont'd)

Front (description)

The main functions of the instrument are accessible on the front panel and can be modified using the touch-sensitive pad (with its stylus) or the menu bar.

1 On/Standby/Off key

- power on by a short press
- switch the instrument to standby (yellow LED flashing inside the key) by one short press. A second press on the key reactivates the instrument.
- power off by a long press (> 3 s):
  - the recording time of the files and configuration is < 15 s.
  long press on this key.

If the instrument is not equipped with a battery, never disconnect the instrument from the mains while the message "System shut down : Please wait before switch off power" is displayed on the screen. Otherwise, the current file and all the files previously saved will be lost.

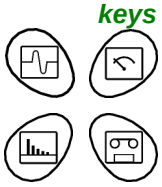
1 touch-sensitive pad and stylus

These can be used for:
selection of menus,
validation of functions,
movement of symbols appearing on the LCD screen.

- The **menus** at the top of the screen and the submenus selected by the pointer open and are validated with the stylus.
- The **menus** in the curve display area,
the command area
the status area
can be opened with the stylus.
- The **stylus** can move the symbols displayed in:
  1. the main display area:
  trigger position
  position of cursors
  reference of the traces displayed
  2. the bargraph:
  trigger position
  position of cursors
  position of zoomed area in the acquisition memory

  Place the pointer on the symbol to be moved and keep the stylus pressing down while you move it to the required position.
- It is possible to use the stylus to **zoom** in the display area: drag to create a rectangle.

4 "operating mode" keys



You can select the operating mode of the instrument by pressing one of these 4 keys:

"**oscilloscope**"
"**multimeter**" (*) (not available on ***OX 6202***)
"**harmonic analyser**" (not available)
"**recorder**" (not available)

(*) Caution : measurement ground is connected to earth ground

28 keys only active when pressed

Shortcut access to the most common functions: see chapter on "The Keys" for the "Oscilloscope", "Multimeter".

Description of the instrument (cont'd)

Network

Configuration of the "Network" interface (ETHERNET).

This interface uses the same connector (RS232/ETHERNET), located on the right-hand side of the instrument, and requires a specific ETHERNET / RJ 45 cable.

General principles of the ETHERNET network

ETHERNET and TCP/IP (Transmission Protocol/Internet Protocol) are used to communicate on a company's network.

Addressing

Each piece of equipment under TCP/IP has a physical address (ETHERNET) and an Internet address (IP).

ETHERNET physical addresses

A physical or ETHERNET address, stored in ROM or PAL, identifies each item of equipment on the network. The physical address enables the equipment to determine the source of data "packet" transmission.
The physical address is a number coded over 6 bytes represented in hexadecimal form. Hardware manufacturers procure physical addresses and allocate them incrementally when the product is manufactured. The physical addresses cannot be modified.

IP addresses

An IP address is coded over 4 bytes, displayed in decimal format.

(✍ *Example:* 132.147.250.10). Each field may be coded between 0 and 255 and is separated by a decimal point.
Unlike the physical address, the IP address can be modified by the user.

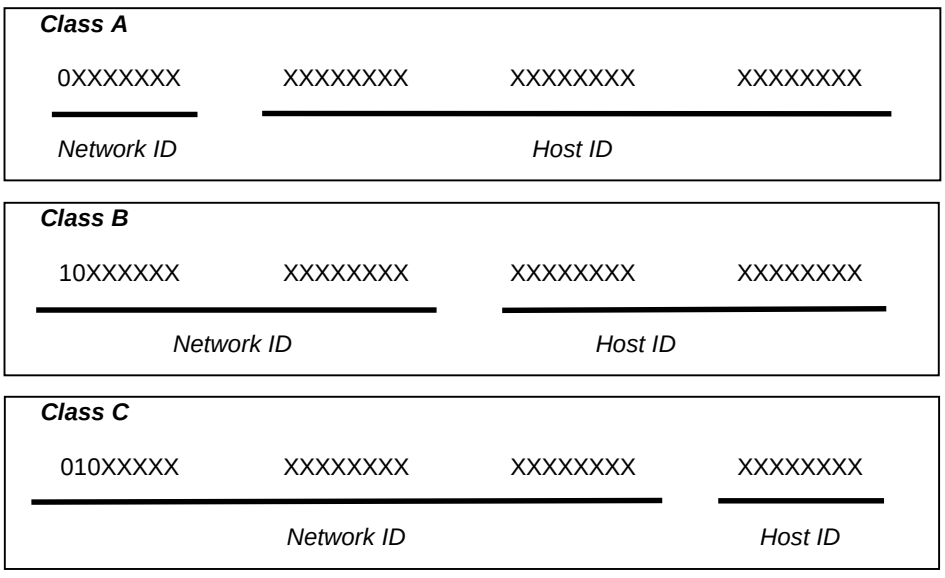
You must ensure that the IP address is unique on your network. If an address is duplicated, network operation becomes random.

The IP address is made up of two parts:

- the network identifier (Network ID) identifying a given physical network
- the host identifier (Host ID) identifying a specific item of equipment on the same network.

There are 5 addressing classes. Only classes A, B and C are used to identify the equipment.

See below:



Description of the instrument (cont'd)

SUBNET mask and GATEWAY

If the result of the operation ' ET LOGIQUE ' between IP address of the recipient of the message and the value of subnet mask is different from the address of the recipient of the message, this message is sent to the gateway which will be given the responsibility to forward it to destination.

The programming of the mask and the address of the gateway is possible on the instrument, in the Advanced mode.

DHCP Protocol

This protocol is used to automatically assign an IP address to the instrument when it connects up to the network.

A **DHCP** (Dynamic Host Configuration protocol) server must be accessible on this network (contact your network administrator to make sure that this server is present).

FTP protocol

FTP (File Transfer Protocol) is used in the oscilloscope for fast file transfers to or from a PC.

To use it, open the browser on the PC and, in the **URL** field, type the IP address of the instrument, preceded by "**ftp:**"

✍ *Example: ftp://192.168.3.1*

The oscilloscope is an **FTP server**.

See §. Applications p. 87 and 82.

HTTP protocol

With this protocol, the instrument can act as a WEB server and you can access the most frequent settings and view traces on your PC using your browser (EXPLORER, NETSCAPE, …)

To use it, open the browser on the PC and, in the **URL field,** type the IP address of the instrument, preceded by "**http:**"

✍ *Example: http://192.168.3.1*

See §. Applications p. 84.

To be able to display the traces, you must install on your PC the Java Virtual Machine JVM SUN 1.4.1 (or higher). This JVM can be dowloaded from the site http://java.sun.com

LPD protocol

This protocol (Line Printer Daemon) is used by most of the printers connected to an ETHERNET network, but also by the printing server units which handle conversion between ETHERNET and CENTRONICS (✍ *Example: Jet Admin*) and UNIX and LINUX workstations.

An **LPD** server can also be installed on a PC (available as an option with WINDOWS 2000 or XP).

In all cases, the instrument is an **LPD** client which has to be configured to indicate to it the IP address of the **LPD** server (the workstation PC or directly the printer) and the logical name of the printer managed by the server.

See §. Applications p. 83.

Oscilloscope Mode

The Keys

By pressing this key, you can select the "**oscilloscope**" mode.

5 "UTILITY" keys or key pad

Direct access to LCD **contrast** adjustment.

When this key is pressed, the display mode switches from normal to "**full screen**" display (and vice versa).

The screen is organized in such a way as to leave an optimum trace plotting surface area: removal of: the menu bar,
the parameters of the traces of the time base,
the bargraph.

Only the permanent settings and the measurements will remain.

The controls on the front panel remain active.

Triggers a **hardcopy** in accordance with the configuration chosen in the "Util" and "Hardcopy" menus.

A second press before the end of the process will interrupt the current printout.

If printing is impossible, a "Printing error" message will be sent.

The "  " symbol is displayed in front of the settings display zone when printing is in progress.

The first press will **freeze** the traces on the screen. They will be displayed in a lighter colour as a reference to be compared with another acquisition.
A second press will **erase** them: they will then be lost.

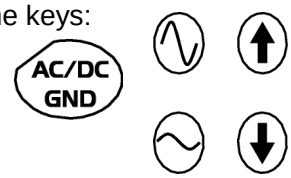
- *Traces will be saved only through the "Memory → Trace → Save" menu.*
- *The reference memories will be accompanied by their reference number.*

1 "AUTOSET" key

Automatic optimum adjustment by **Autoset** on the channels where the signal is applied.
This concerns the following parameters: the coupling, the vertical sensitivity, the time base, the gradient, the framing and the trigger.
The lowest frequency signal is used as the trigger source.
If no trace is detected on the inputs, the autoset will be aborted.

Selective "AUTOSET"

When pressed at the same time as a ***CHx* key** (CH1 or CH4), this defines the corresponding channel as the trigger source. It initiates an autoset which will take this selection into account. Channel CHx then becomes active for adjustment using the keys:



Oscilloscope Mode (cont'd)

4 "Trigger" keys

Sets the trigger **level** to the average value of the signal (50%) without modifying the trigger coupling.
When pressed in combination with a ***CHx*** key, this activates the same the same function, after first selecting the corresponding channel as the trigger source.

selects the trigger **gradient** (up or down) by successive presses.
The gradient is indicated in the status area.

Successive presses can be used select one of the following **acquisition modes**:

Single shot	(Mono) = SINGLE
Triggered	Trig
Automatic	(Auto) = REFRESH

- "**SINGLE" mode**:

  A single acquisition is authorized, triggered by pressing the **RUN HOLD key**.
  For any further acquisition, the trigger circuit must be reset by pressing the RUN HOLD key.

- "**TRIGGERED" mode:**

  The screen's content is only refreshed when there is a trigger event linked to the signals present on the oscilloscope's inputs (CH1, CH4, EXT).

  If there is no trigger event linked to the signals present on the inputs (or if there is no signal on the inputs), the trace is not refreshed.

- "**AUTOMATIC" mode**:

  The screen's content is refreshed even if the trigger level is not detected on the signals present on the inputs.

  When there is a trigger event, screen refreshing is managed as in the "Triggered" mode.

- allows acquisition to be started and stopped in "TRIGGERED" and "AUTOMATIC" modes.
- resets the trigger circuit in "SINGLE" mode.

Acquisition is initiated according to the conditions defined by the acquisition mode (**SGLE REFR** key).
The acquisition status is indicated in the status area:

RUN	= started
STOP	= stopped
PRETRIG	= acquisition

Oscilloscope Mode (cont'd)

3 "MEASURE" keys

activates or deactivates the display of the window for the 19 **automatic** measurements on the reference trace.

When pressed in combination with a ***CHx*** key, it displays the measurements concerning the corresponding channel.

By means of successive presses, this selects one of the displayed traces as the **reference trace** for the automatic and manual measurements.

It appears in the "Measure" menu → Reference.

Activates or deactivates the **cursor** display for manual measurements.

The cursors can be moved directly on the touch -sensitive pad using the stylus.

- The "**dt**" measurements (time difference between the two cursors) and "**dv**" measurements (voltage difference between the 2 cursors) are indicated in the status area.
- The absolute value of the cursor selected is indicated in the "Current Settings" area.

3 "HORIZONTAL" keys or key pads

Adjustment of the **time base coefficient** (T/DIV).

After a Zoom, the "Z-Pos." setting modifies the **position** of the screen in the acquisition memory.

Activates or deactivates the "**Zoom**" function.

By default, the zoom is performed around the samples located in the middle of the screen.

A zone can be zoomed by tracing a rectangle around the area to be enlarged using the stylus on the touch-sensitive pad. The sensitivity, time base and horizontal and vertical alignment values are recalculated automatically.

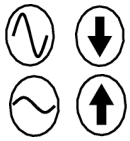
Oscilloscope Mode (cont'd)

Definition of terms used

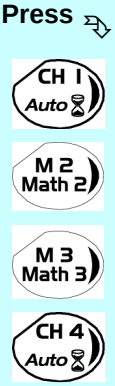
Validated channel: Display enabled, trace displayed after RUN

Displayed channel: Channel validated, trace present on the screen

Selected channel: The parameters of this channel can be set with the keys:

 **and** 

5 "VERTICAL" keys or key pads

Step 1	Step 2	Step 3
Before pressing one of the following keys :	**Press** 	**After** pressing one of the preceding keys:
The channel concerned is not displayed.		The channel is displayed and selected. On CH1 and CH4, the vertical sensitivity and the vertical position are assigned to the channel selected.
The channel concerned is displayed, but not selected.		The channel is selected.
The channel concerned is displayed and selected.		The channel is not selected any longer.

*A long press on one of the keys **CHx** causes a **vertical autoset**:*

- *This modifies the sensitivity and vertical positioning of the channel in question.*
- *It optimizes the display on the screen by activating and selecting the channel.*

The channel is displayed and selected.

Oscilloscope Mode (cont'd)

5 "VERTICAL" keys or key pads (cont'd)

Activates or deactivates **horizontal splitting** of the display zone.

When activated, the "Full Trace" function is indicated by:
- the presence of a continuous horizontal line in the middle of the display area
- horizontal splitting of the graticule.

After activation of the function:
- traces 1 and 3 are assigned to the upper part of the display,
- traces 2 and 4 are assigned to the lower part in order to prevent overlays.

The traces can then be moved vertically in the two zones.

☝ *This function can also be used in "full screen" mode.*

Successive presses allow selection of the **input coupling** (AC, DC or GND) for the last channel selected.

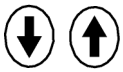
The coupling is indicated in the channel parameters area:

AC : ∿
DC : ⎓
GND : ⏚

Adjustment of the vertical **sensitivity** of the last channel selected:

 increases the vertical sensitivity

 reduces the vertical sensitivity



Adjustment of the vertical **position** of the last channel selected:

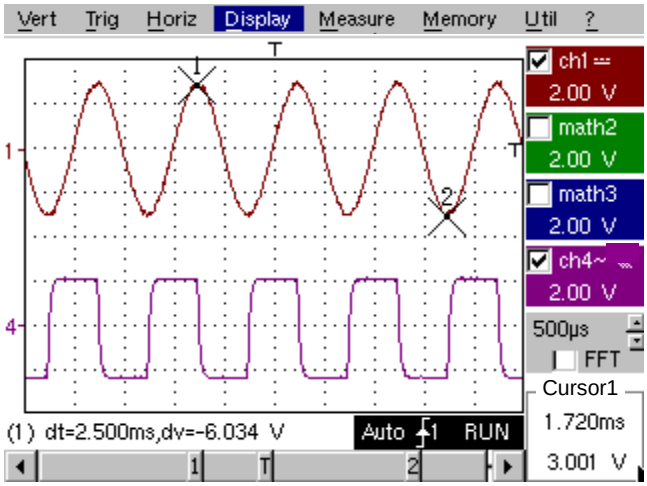
 moves it upwards

 moves it downwards

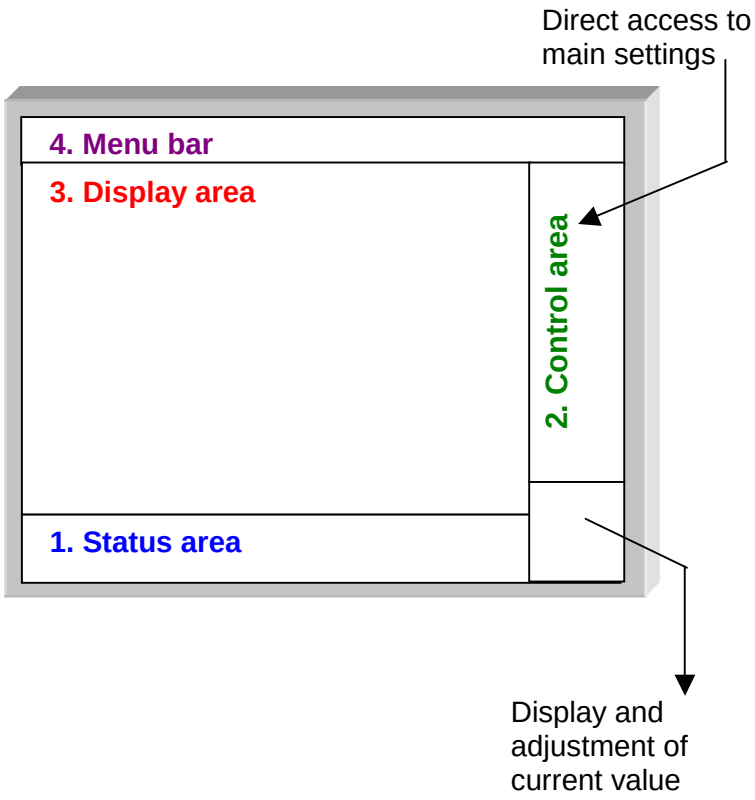
Oscilloscope Mode (cont'd)

Display

Display



Composition The oscilloscope display is divided into 4 functional zones.



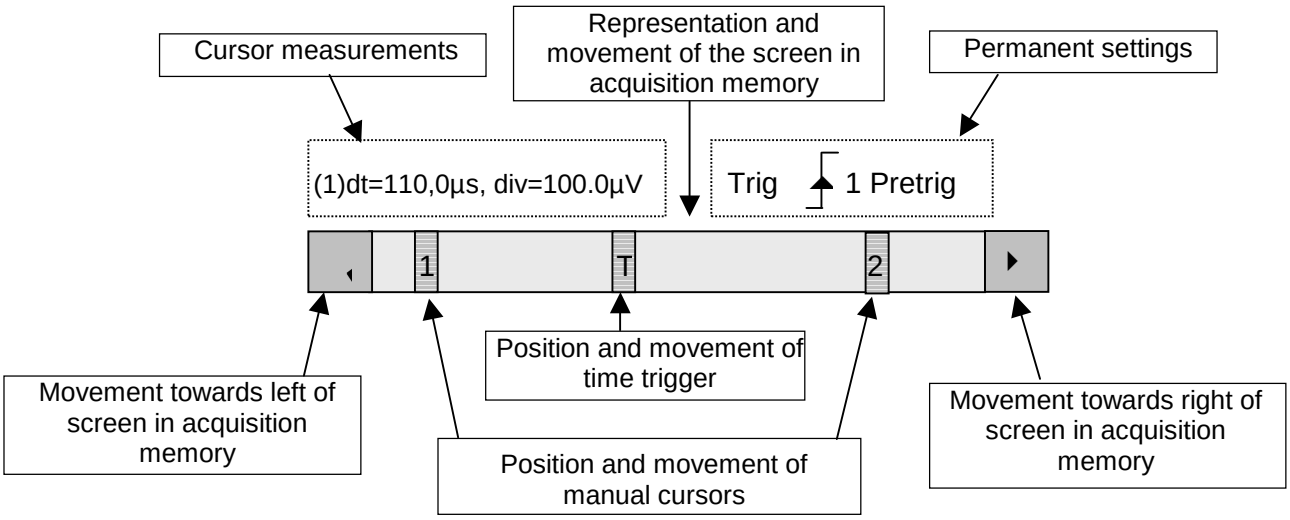
Oscilloscope Mode (cont'd)

1. Status area

Three types of general information appear in this area:

- The **bargraph** representing the screen position, the trigger and the cursors in the acquisition memory.
- The instrument permanent **settings**.
- The **measurements**, when the cursors are present on the screen.

Bargraph



Each element in the bargraph can be moved with the stylus.

Permanent settings

This zone refers to the trigger status (mode, edge, source, current status).

Example: AUTO 1 STOP

When the stylus is placed on this information, the "Trigger Parameters" menu can be opened by pressing twice.

Cursor measurements

This zone refers either to:

- the horizontal (dt) and vertical (dv) differences between 2 cursors in the case of manual measurements

  Example: (1) dt = 110.0 µs, div = 100.0 µV

- phase measurement in the case of manual phase measurement (Ph).

  Example: (1) Ph = 200.0°

- the automatic measurements selected using the "Automatic Measurements" or "Phase measurement" menus

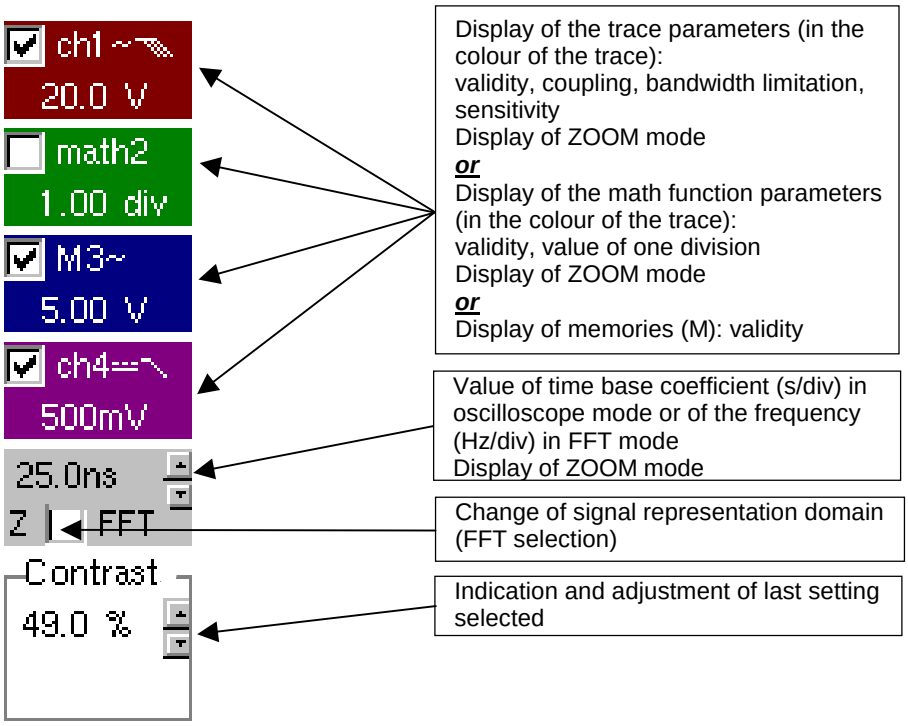
  Example: (2) F = 1.0000 kHz, Vpp = 7,500 V

Oscilloscope Mode (cont'd)

2. Control area

The parameters displayed in this area are:

- The parameters of each channel and trace: display, sensitivity, coupling, bandwidth limitation, vertical scale, function, Zoom.
- The time base value, the presence of a Zoom and a change in the signal representation domain (FFT).
- Active adjustment of the last selected element:
  - trigger level
  - trigger time position
  - channel offset value
  - X & Y position of cursor
- *Time display, if no measurement has been selected.*



- *The channels and functions can be validated using the stylus or the keys.*
- *The "✓" symbol indicates whether a channel or function is selected, or whether FFT mode is selected.*
- *The settings of the time base (or the frequency) and the value of the active parameter can be modified using the UP/DOWN button next to the display of the current value.*
- *After modification of the time base, the corresponding sampling frequency is indicated in the settings area.*
- *Double-tapping with the stylus on the parameters of a channel or on the value of the time base, directly opens the associated menus:*
  - *Sensitivity/Coupling and Vertical Scale, for the channels*
  - *Vertical scale for the functions*
  - *Source, trigger mode and RUN/STOP, for the time base.*

Oscilloscope Mode (cont'd)

The grouped "Source" and "Trigger Mode" menus can be opened by a double press with the stylus on the time base area.

RUN/STOP starts and stops acquisition from this menu. The acquisition status is indicated in the status area on the screen.

The symbol "✓" indicates the source and trigger mode selected.

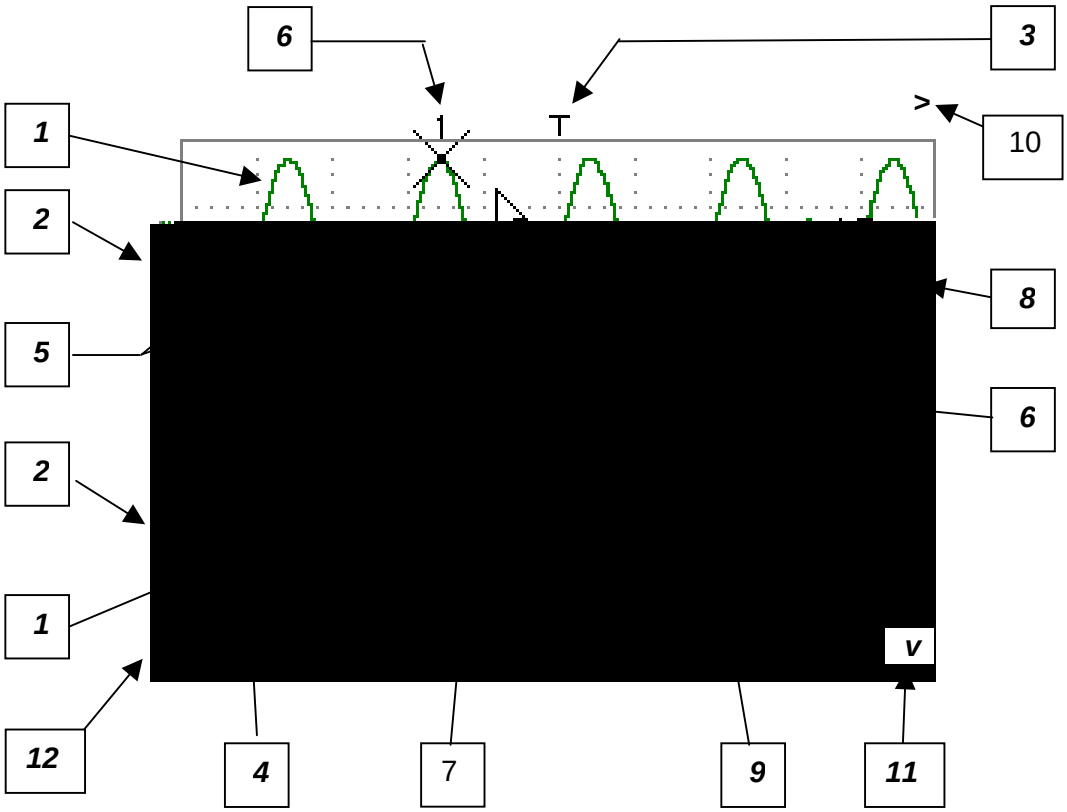
3. Display area

The graphic elements displayed associated with the traces in this area are:

- a trigger time position indicator
- a trigger level indicator
- a trace number identifier
- a vertical position indicator for the reference level of each trace
- cursor position indicators linked to the trace for the automatic automatic measurements
- position indicators regarding the cursors linked or not to the trace for manual measurements
- selection of a zoom zone

Oscilloscope Mode (cont'd)

Display elements

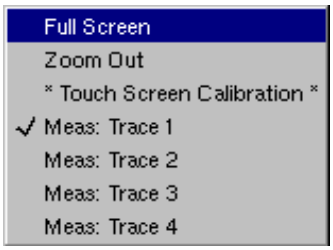


Definition of display

Refs.	Elements selectable using the touch-sensitive pad
1	Trace displayed
2	Vertical position indicator of the reference level of the trace displayed and identification of the trace number
3	Indication of Trigger time position
4	Division of graticule
5	Position indicator of the cursors for the first automatic measurement
6	Manual measurement cursor position indicator
7	Phase measurement cursor position indicator
8	Trigger level position indicator
9	Selection of a zoom zone
10	Indicator of trigger time position overshoot outside the display window
11	Indicator of trigger level position overshoot outside the display window.
12	Indicator of channel level overshoot outside the display window.

Oscilloscope Mode (cont'd)

Menu accessible from display area



By double-tapping with the stylus in the display area, the menu concerning the display can be opened directly.

The "Full Screen" and "Zoom Out" options are directly accessible (see §. Display Menu).
The same applies to the selection of the automatic and manual measurement reference signal (see §. Measure Menu).

It is possible to use the stylus to **zoom** in the display area by pulling a rectangle.

After zooming in on part of the screen, the sensitivities of the traces and the time base are recalculated.

- The symbol "**Z"** appears in the signal and time base parameters display.
- The zoomed section is represented in the bargraph.
- The "Zoom Out" menu (see §. Display Menu) can be used to return to the original display, the zoom key de-activates the horizontal zoom.
- The value of the horizontal zoom is adjusted to assign a calibrated value to the horizontal scale (zoom factor: x 5 max.)
- If the vertical selection of the zoom is greater than 6 divisions, no vertical zoom is performed (zoom factor: x 16 max.).

All the symbols present in the display area:
- trigger indicators,
- trace position indicator,
- manual cursor position indicator,
- etc.

can be moved using the stylus.

The new modified symbol value is indicated in the current settings display area.

Calibration of the touch-sensitive screen

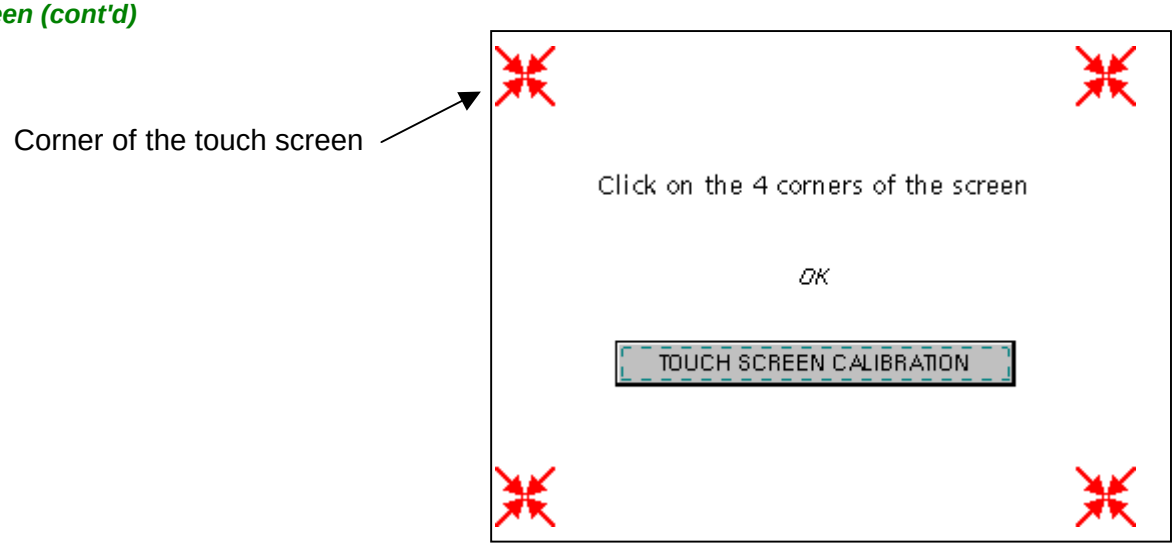
To optimize selection of the different elements present in the display area using the stylus, calibration of the touch-sensitive screen may prove necessary.

Select the "Touch Screen Calibration" option proposed in the display area menu or in the Util menu.

Oscilloscope Mode (cont'd)

Calibration of the touch-sensitive screen (cont'd)

Follow the instructions on the screen

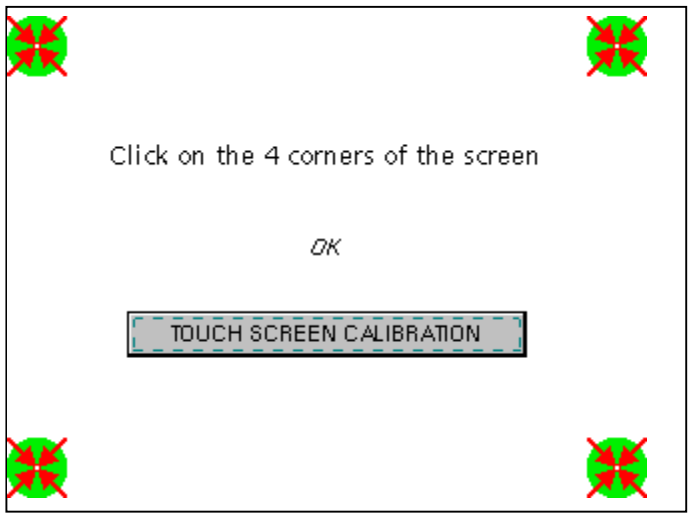


Use the stylus to point at the centre of the 4 patterns displayed on the screen.

Validation of the input is indicated by modification of the pattern.

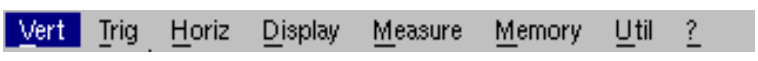
The pointing order is not important.

Once the 4 inputs have been recorded, validate the calibration with **OK**.



The touch-sensitive screen is calibrated and the display returns to normal mode.

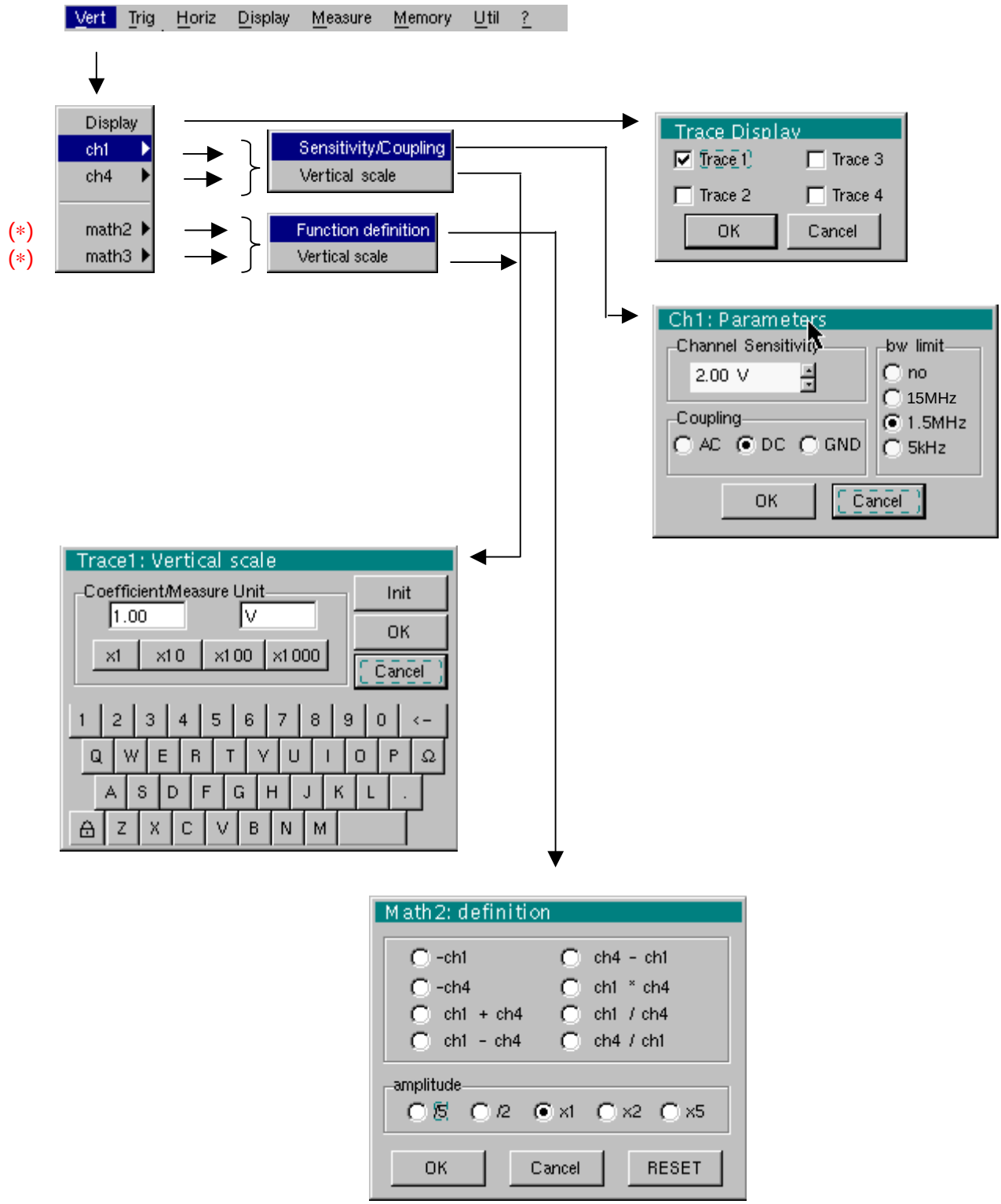
4. Menu bar



All the oscilloscope functions can be accessed via the main menus.

Oscilloscope Mode (cont'd)

The "Vert" Menu



(*) Functions only accessible in "Advanced" mode.
See §. Description, page 58.

Oscilloscope Mode (cont'd)

Display

Opens the "Trace display" menu for validating or devalidating the traces.

The "✓" symbol in front of a trace indicates that it has been validated.

The traces can be validated or devalidated from the control area by using the stylus.

ch1 ch4

Modify the parameters of channels ch1 and ch4 independently, as well as the vertical scale of the trace selected.

Sensitivity / Coupling

Modifies the parameters of the selected channel.

Channel Sensitivity

Modification of the channel's sensitivity using the stylus on the scrollbar, adjustable by sequence: from 2.5 mV to 200 V/div.

☝ *The sensitivity is indicated in the channel parameter display area. It takes into consideration the parameters of the "Vertical scale" menu.*

Coupling

Modification of **AC - DC - GND** coupling

AC: blocks the DC component of the input signal and attenuates the signals below 10 Hz

DC: transmits AC and DC components of the input signal

GND: internally, the instrument links the input of the channel selected to a 0 V reference level

☝ *The "⊙" symbol indicates the coupling selected. Coupling is indicated in the modified channel's parameter display area.*

bw limit

Limits to 15 MHz the bandwidth of the channel and its trigger circuit to reduce display noise and false triggering.

☝ *The bandwidth of each channel can be limited to 5 kHz, 1.5 MHz or 15 MHz. The bandwidth limit of a channel is indicated in the control area by following symbols :*

This menu can also be called up by double-pointing with the stylus on the required channel parameter display area.

Vertical scale

Defines the vertical scale of the channel selected on the basis of the current settings. Readings of the direct measurements of the value analyzed and its unit are provided.

Coefficient

Assignment of a multiplication coefficient to the selected channel's sensitivity.

This can be modified with the stylus, using the table of usable numbers, after selecting the "Coefficient" zone.

The ←

Oscilloscope Mode (cont'd)

Measurement unit

Modification of the selected channel's vertical scale unit.

The modification is performed by means of the stylus, using the table of usable characters after selecting the “measure unit” zone.

The ← key deletes the character preceding the cursor in this area.

The vertical scale unit will be indicated in the modified channel's parameter display.

Init

Reinitializes the multiplication coefficient to 1.00 and returns to the V measurement unit.

Validation of the selections by "**OK**". Exit from the menu without modification by "**Cancel**".

This menu can also be called up by double-pointing with the stylus on the required channel's parameter display area (ch1 or ch4).

math2 math3

Function definition

For the math2 math3 traces, definition of a mathematical function and the vertical scale.
Menus present only in Advanced mode (see §. "Util" Menu).

Defines the mathematical function to be assigned to the selected trace by means of a vertical keyboard, linking traces ch1and ch4, as well as M1 and M4 if necessary.

Functions

8 predefined mathematical functions can be linked to the traces:

- Ch1	- Ch4	Ch1 + Ch4	Ch1 - Ch4	Ch4 - Ch1	Ch1 x Ch4	Ch1 / Ch4	Ch4 / Ch1

Validation of the selections by "**OK**". Exit from the menu without modification by "**Cancel**".

If …	**then …**
... the dynamic calculation of the vertical scale is impossible	... a message indicates that the measuring unit on this function will be vertical division (div).
... the dynamic calculation of the vertical scale is possible	... it takes into account of the sensitivities of the channel sources.

Particular cases : Value of the measuring unit

Ch1 + Ch4 Sensitivity and measuring unit used on channel 1

Ch1 - Ch4 Sensitivity and measuring unit used on channel 1

In each cases, the measuring unit can be re-defined and a coefficient can be applied to the measurement results (refer to §. Vertical scale).

Amplitude

Multiplying or dividing coefficients make it possible to optimize the representation of the result :

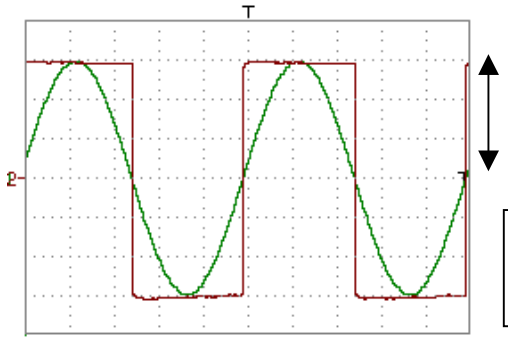
/ 5	/ 2	x 1	x 2	x 5

Oscilloscope Mode (cont'd)

Examples

Example 1

Addition of two traces

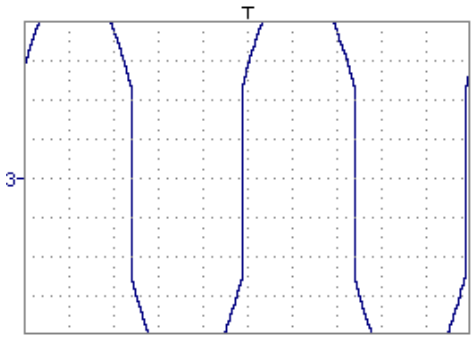


Vpp(ch1) = Vpp(ch4) = 6 V
Sensitivity (ch1) = 1 V/div
Sensitivity (ch4) = 1 V/div

Traces ch1 and ch4 are optimised on 6 vertical divisions.

Vamp ch1 = 6 vertical divisions
Vamp ch4 = 6 vertical divisions

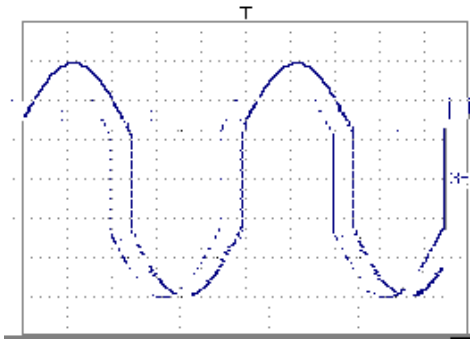
- math3 = ch1 + ch4 (Amplitude : x 1)



Vertical scale math3 = 1.00 div
Vpp math3 = 12.00 div
Vhigh math3 = 6.00 div

There is a high and low overshoot, so division by 2 is necessary to optimize display of the result.

- math3 = (ch1 + ch4) / 2 (Amplitude : / 2)



Vertical scale math3 = 2.00 div
Vpp math3 = 6.00 div = 12.00 V
Vhigh math3 = 3.00 div = 6.00 V

Division by two adjusts the addition to the dynamics of the screen.

Vamp (math3) = 6 vertical divisions

The measuring unit and the sensitivity of ch1 are used during the display of measurements.

You can then open the menu “Vertical Scale" of math3 (see §. **Opening of the menu from: math2, math3,** p. 32) to assign a coefficient to the result and to modify the measuring unit.

Oscilloscope Mode (cont'd)

Example 2

Multiplication of two traces

As for the addition of traces, there is an even more significant high and low overshoot. The overshoot is due to the increase in dynamics of the numbers after a multiplication; to avoid this and standardize the result, the vertical scale adapts. With an amplitude x 1, the product is included in the dynamics of the screen. Moreover, the sensitivity of the **math** function is:

sensitivity $_{math}$ = sensitivity $_{ch1}$ x sensitivity $_{ch4}$ x 4

sensitivity $_{math3}$ = sensitivity $_{ch1}$ x sensitivity $_{ch4}$ x 4

= 5 x 5 x 4

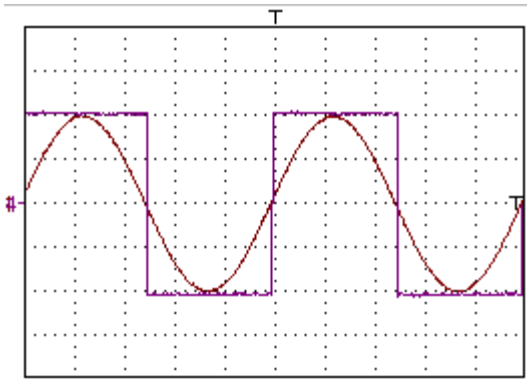
= 100 VV

Vhigh $_{math3}$ = Vhigh $_{ch1}$ x Vhigh $_{ch4}$

= 10 x 10

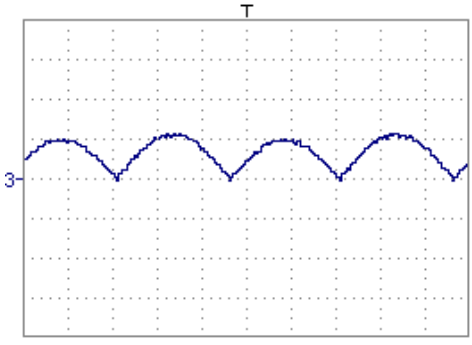
=100 VV

(= 1 div)



Vamp(Ch1) = 4 vertical divisions
Vamp(Ch4) = 4 vertical divisions

math3 = (Ch1 * Ch4) (amplitude : x 1)



The result of the multiplication is translated into divisions on the screen.

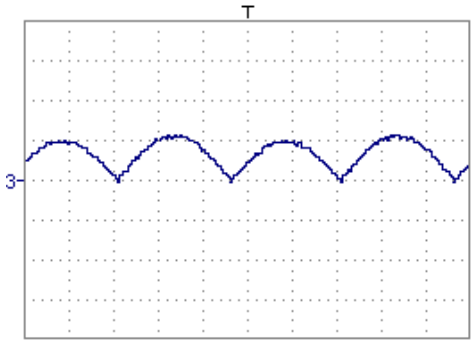
Oscilloscope Mode (cont'd)

You can then open the menu “Vertical Scale" of math3 (see §. **Opening of the menu from: math2, math3**, p. 32) to assign a coefficient to the result and to modify the measuring unit.

In our example (amplitude : x 1) :

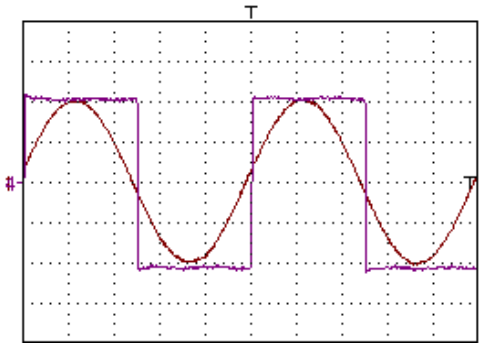
- Then select math3 as the reference for the automatic and manual measurements (see §. "MEASURE" Menu).
- Then display the table of 19 measurements made on the math3 trace math3 (see §. "MEASURE" Menu).

The measurements displayed are the exact result of the multiplication of the two traces Ch1 and Ch4 in the unit (VV).



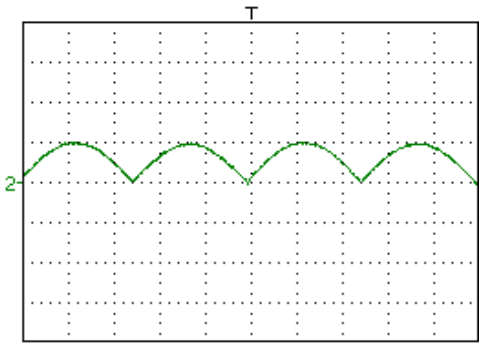
Sensitivity (math3) = 100 VV
Vpp (math3) = 100 VV

Example 3
Division of two traces



Sensitivity (ch1) = 5 V/div
Sensitivity (ch4) = 5 V/div
Vamp(ch1) = Vamp(ch4) = 20V

The ch1 and ch4 traces are displayed on 4 vertical divisions.
math2 = ch1 / ch4
The sensitivity of the math2 function is : $sens_{math2} = sens_{ch1} / sens_{ch4}$
$= 5 / 5$
$= 1\ V / V$



Sensitivity $_{math2}$ = 1 V/V
Vamp $_{math2}$ = 1 V/V

Oscilloscope Mode (cont'd)

Function definition (cont'd)

RESET cancels the selected function and resets the amplitude in x 1.

Vertical scale Definition of the vertical scale for the selected trace

Calling this menu from math2 and math3 is identical to calling ch1 to ch4.

Opening of the menu from: math2, math3

Coefficient Modifies the value of a division (div) in the selected trace.

This can be modified with the stylus, using the table of usable numbers, after selecting the "Coefficient" zone.

The ← key deletes the character preceding the cursor in this area.

The predefined values (x1, x10, x100, x1000) correspond to standard probe coefficients and can be assigned directly.

The value of a division will be entered into the display of the modified trace parameters.

Measurement unit Modification of the unit of the vertical scale (div) for the selected MATH function.

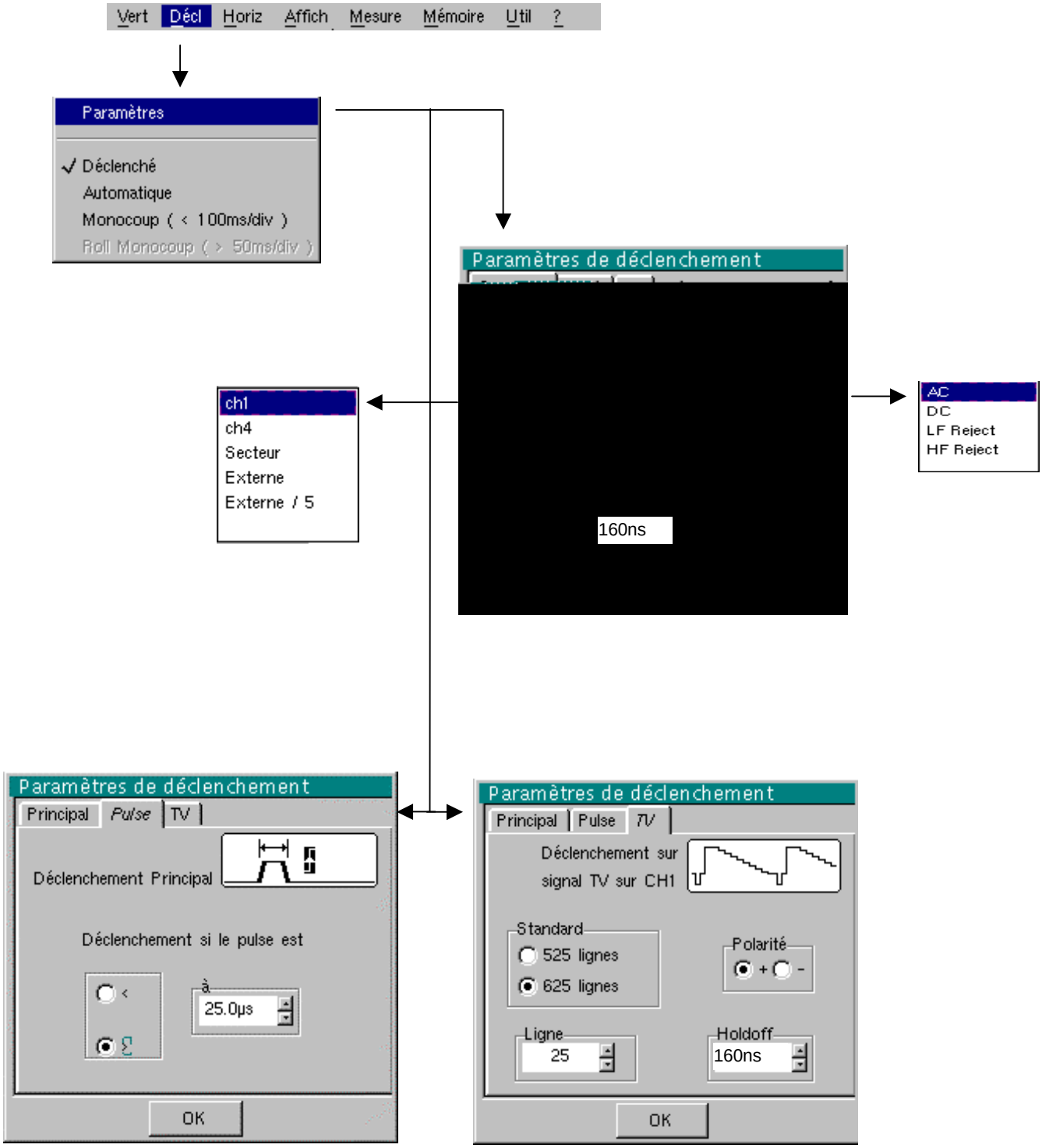
This can be modified with the stylus, using the table of usable numbers, after selecting the measurement unit zone.

The ← key deletes the character preceding the cursor in this area.

The " " key can be used to switch between upper-case and lower-case characters.

Mode Oscilloscope (suite)

Le Menu « Décl »



Mode Oscilloscope (suite)

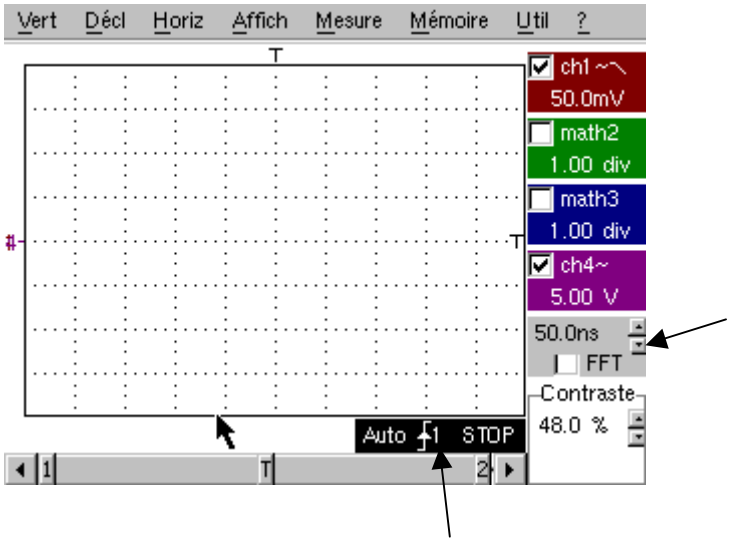
Définition

Cette gamme d'oscilloscopes de table est pourvue de « déclenchements évolués ».
L'onglet « **Principal** » permet de choisir et de paramétrer la source de déclenchement principal.

La validation du choix de déclenchement se fait en quittant le menu.

Si …	**alors …**
… l'utilisateur quitte depuis l'onglet « **Principal** »,	**…** il se trouve en déclenchement « **Principal** ».
… l'utilisateur quitte depuis l'onglet « **Pulse** »,	**…** il se trouve en déclenchement « **Pulse** ».
etc.	**etc.**

- *Il n'existe qu'un seul Holdoff, bien qu'il soit programmable depuis les onglets « Principal » et « TV ».*
  Le Holdoff s'applique à la source de déclenchement principal.
- *Chaque source de déclenchement possède ses propres attributs : Couplage, Niveau, Front, Rej Bruit.*



Le choix de la voie de déclenchement peut être aussi appelée en double pointant avec le stylet dans la zone d'affichage de la base de temps.

Les paramètres de déclenchement peuvent être aussi appelés en double pointant avec le stylet dans la zone d'affichage des paramètres de déclenchement.

Mode Oscilloscope (suite)

Paramètres Sélection des « Paramètres de Déclenchement ».

Principal Déclenchement sur front

Source Sélection d'une **voie** comme source de déclenchement :
CH1, CH4, Secteur, Externe, Externe /5.

Couplage Sélection du **filtre** de la source principale de déclenchement :

AC	Couplage alternatif (10 Hz à 200 MHz) : bloque la composante continue du signal.
DC	Couplage continu (0 à 200 MHz) : laisse passer tout le signal.
LF Reject	Réjection des fréquences du signal source < 10 kHz : facilite l'observation des signaux présentant une composante continue ou une basse fréquence indésirable.
HF Reject	Réjection des fréquences du signal source > 10 kHz : facilite l'observation des signaux présentant du bruit haute fréquence.

Front Sélection de la pente de déclenchement :

+ pente de déclenchement ascendante

- pente de déclenchement descendante

La pente de déclenchement sélectionnée est reportée dans la zone d'état.

Niveau 454mV Réglage du niveau de déclenchement avec le stylet en agissant sur l'ascenseur.

Le niveau de déclenchement est reporté dans la zone d'affichage de la valeur en cours, après modification. Il peut être ajusté finement.

Rejet bruit **Non** Hystérésis de ≈ ± 0,5 div.

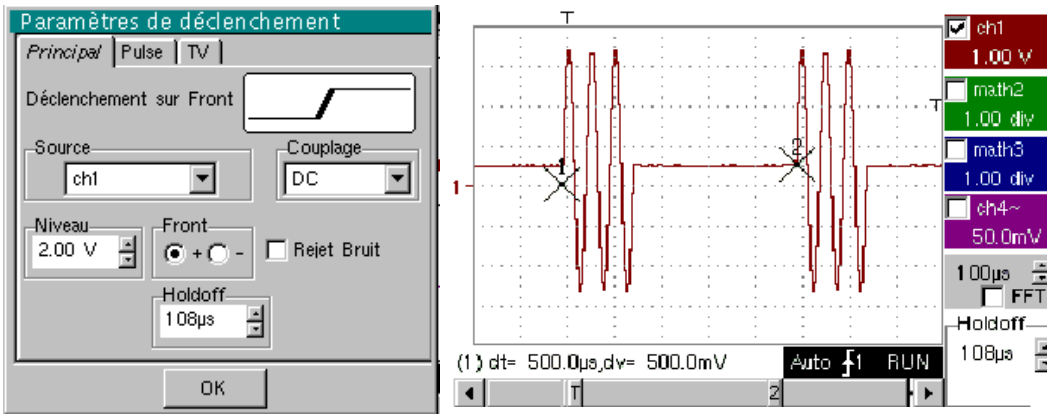
Oui introduit un hystérésis de ≈ ± 1,5 div.

Holdoff 160ns permet :

- d'inhiber le déclenchement pendant une durée prédéfinie
- de stabiliser le déclenchement sur des trains d'impulsions.

Un double pointage sur ce champ fait apparaître à l'écran un clavier numérique virtuel pour une saisie directe de la valeur.

Exemple Signal injecté sur CH1: un train de 3 impulsions à la fréquence de 20 kHz de 6 Vcc avec une composante continue de 500 mV, séparées de 500 µs.



Mode Oscilloscope (suite)

Le déclenchement est réglé avec la voie 1 comme source, un niveau à 2,00 V, sur un front montant.

Le Holdoff stabilise le signal en inhibant le déclenchement pendant 108 µs. Le couplage DC du trigger laisse passer la totalité de signal.

Dans cet exemple, le signal n'étant pas bruité, l'option réjection de bruit n'est pas nécessaire. Le couplage DC de Ch1 fait apparaître la composante continue du signal.

Pulse Sélection du déclenchement sur largeur d'impulsions.

< déclenche sur une impulsion, si sa durée est inférieure à la consigne (le déclenchement effectif survient sur le front de fin de l'impulsion).

> déclenche sur une impulsion, si sa durée est supérieure à la consigne (le déclenchement a lieu à l'issue de la durée définie, sans attendre la fin de l'impulsion).

25.0µs Réglage avec le stylet sur l'ascenseur de la consigne de temps

Un double pointage sur ce champ fait apparaître à l'écran un clavier numérique virtuel pour une saisie directe de la valeur.

Le choix du front ou dans l'onglet « Principal » définit les limites de l'analyse :

- *front définit une impulsion entre et*
- *front définit une impulsion entre et*

Exemple

Mode Oscilloscope (suite)

TV Déclenchement sur un signal TV. ***Ce menu n'est applicable qu'à l'entrée CH1.***

Standard Déclenchement sur un numéro de ligne spécifique. Le déclenchement part du front avant du top de synchronisation ligne.

- 625 lignes (SECAM) ou
- 525 lignes (PAL)

Polarité

+ Vidéo directe

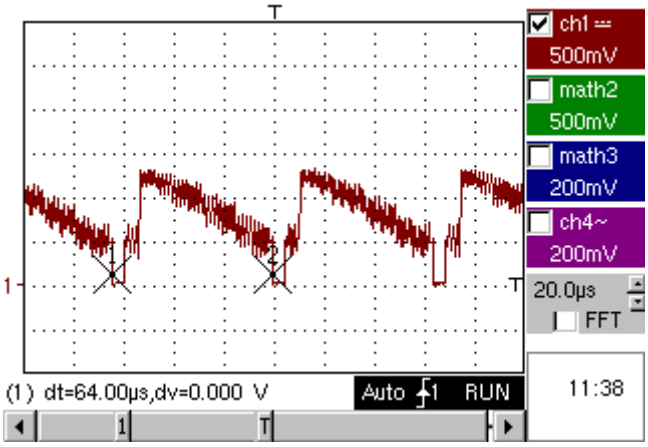
- Vidéo inverse

Holdoff Réglage avec le stylet en agissant sur l'ascenseur, inhibition du déclenchement pendant une durée prédéfinie.

Un double pointage sur ce champ fait apparaître à l'écran un clavier numérique virtuel pour une saisie directe de la valeur.

Ligne **25** Réglage du n° avec le stylet en agissant sur l'asc enseur

Un double pointage sur ce champ fait apparaître à l'écran un clavier numérique virtuel pour une saisie directe de la valeur.



*Les symboles « ⊙ » et « ✓ » indique les paramètres sélectionnés. Validation des sélections par « **OK** ».*

Mode Oscilloscope (suite)

Mode déclenché

Acquisitions et rafraîchissement de l'écran à chaque événement de déclenchement.

Mode automatique

Acquisitions et rafraîchissement automatique de l'écran, même en l'absence d'événement de déclenchement.

Traces visibles, même en l'absence d'événement de déclenchement.

Mode monocoup

Acquisition du signal et rafraîchissement de l'écran, au premier déclenchement survenu après le réarmement du trigger par un appui sur la touche *ci-contre* (ou par le menu de la base de temps).

- *Le symbole « ✓ » indique le mode de déclenchement sélectionné.*
- *Le mode de déclenchement sélectionné est reporté dans la zone d'état (Décl, Auto, Mono).*
- *L'état d'acquisition est indiqué dans la zone d'état : PRETRIG, RUN, STOP, POSTRIG, PRET, …*

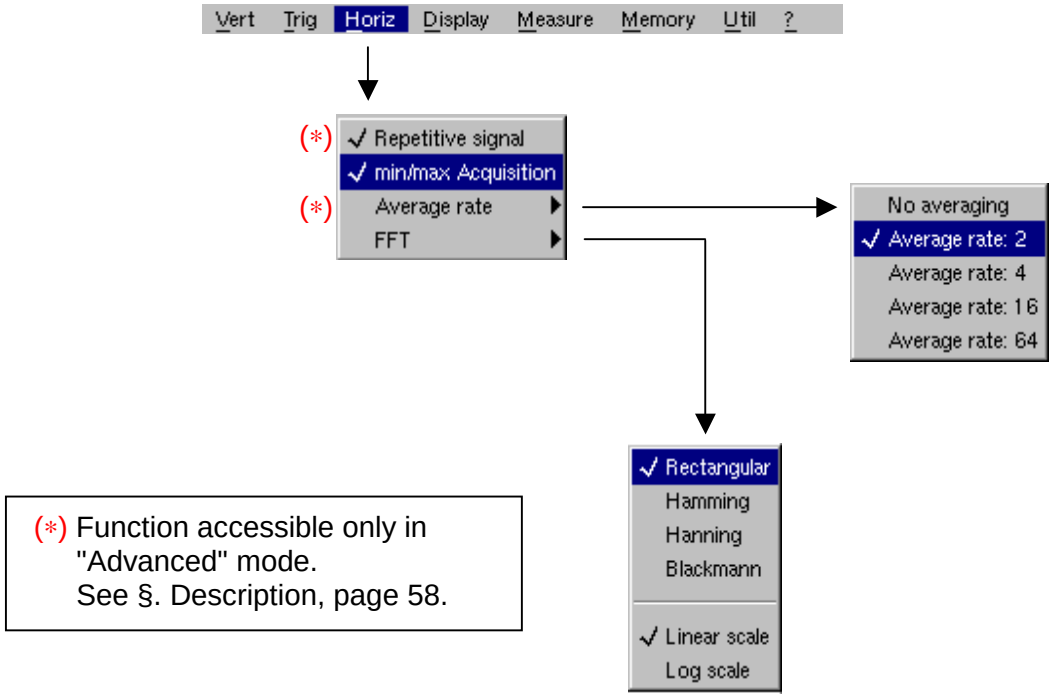
Cette sélection peut aussi être appelée en double pointant avec le stylet, dans la zone d'affichage de la base de temps.

Mode ROLL

Si la base de temps est réglée à une valeur > 50 ms/div, l'activation du mode MONOCOUP entraîne l'enclenchement du mode ROLL (défilement de la trace de la droite vers la gauche de l'écran).
En l'absence de déclenchement, la trace peut être figée en appuyant à nouveau sur la touche RUN HOLD.

Oscilloscope Mode (cont'd)

The "Horiz" Menu



(*) Function accessible only in "Advanced" mode.
See §. Description, page 58.

Repetitive Signal

Increase in the time definition of a trace for a periodic signal. If this option is valid, the signal can be averaged (see below).

Example: measurement on a microprocessor bus.

- For time bases of less than 100 µs/div. (without mode zoom active), the signal displayed is reconstituted on the basis of several acquisitions. The time resolution can reach 40 ps.
- If the signal is not repetitive, do not use this option. The time resolution will then be ± 1 ns.

Menu present only in "Advanced" mode (see §. "Util" Menu).

The "✓" symbol indicates that the "Repetitive Signal" option has been selected.

Min/Max Acquisition

Sampling of the signal, even at slow time-base speeds. The display only takes extreme value samples (min. and max.) into consideration.

This mode:

- detects wrong representation due to under-sampling
- displays short-term events (Glitch, ≥ 2 ns).

Whatever time base is used, short-term events (Glitch, ≥ 2 ns) are displayed.

The "✓" symbol indicates that the "Min/Max Acquisition" mode is active.

Oscilloscope Mode (cont'd)

Averaging

No averaging
Average rate 2
Average rate 4
Average rate 16
Average rate 64

Selection of a coefficient to calculate an average for the displayed samples.

For instance, this is a way of attenuating random noise observed in a signal.

For the averaging coefficient to be taken into account for representation of the signal, the "Repetitive signal" option must be selected.

The calculation is performed using the following formula:
Pixel $_N$ = Sample*1/Average rate + Pixel $_{N-1}$ (1-1/Average rate)
with:

Sample	Value of new sample acquired at abscissa t
Pixel N	Ordinate of pixel with abscissa t on the screen, at moment N
Pixel N-1	Ordinate of pixel with abscissa t on screen, at moment N-1

The "✓" symbol indicates the averaging coefficient selected.

FFT

(Fast Fourier Transform)

The Fast Fourier Transform (FFT) is used for calculating the discrete representation of a signal in a frequency domain from its discrete representation in the time domain.

FFT can be used in the following applications:

- measurement of the different harmonics and the distortion of a signal,
- analysis of a pulse response,
- search for noise source in logic circuits.

The FFT is calculated over 2500 points.

The Fast Fourier Transform is selected by the FFT icon in the control area.
When the trace is zoomed, the FFT applies to the zoomed part of the trace.

Description

The Fast Fourier Transform is calculated using the equation:

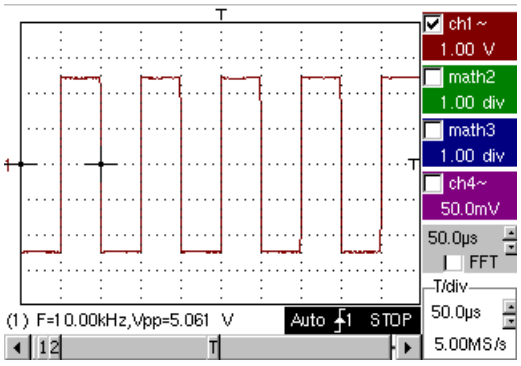
$$X(k) = \frac{1}{N} * \sum_{n=-\frac{N}{2}}^{\frac{N}{2}-1} x(n) * \exp\left(-j\frac{2\pi nk}{N}\right) \quad \text{for } k \in [0\ (N-1)]$$

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

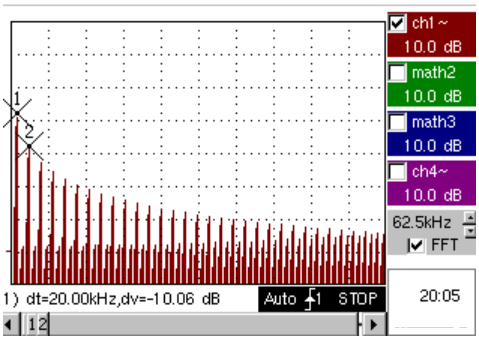
The displayed trace represents the amplitude in V or dB of the various signal frequency components according to the scale selected (linear or logarithmic).

The DC component of the signal is removed by software.

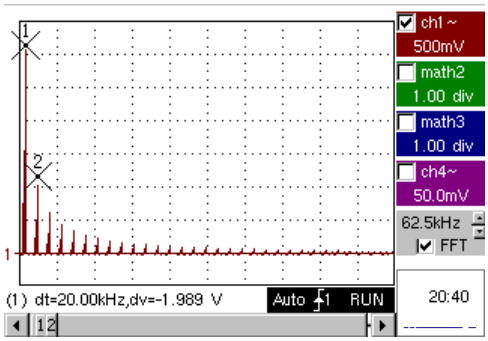
Oscilloscope Mode (cont'd)



10 kHz square signal on CH2 and 5 Vpp



FFT with a Hanning window and a log scale



FFT with a rectangular window and a linear scale

Horizontal unit

This is indicated instead of the time base and is calculated according to the scanning coefficient:

$$\text{Unit (in Hz/div.)} = \frac{12.5}{\text{scanning coefficient}}$$

Vertical unit

Two possibilities are offered by the sub-menus:

a) Linear scale: by selecting the FFT menu and then the linear scale

- in V/div. = $\frac{\text{unit of the signal in its time representation (V/div.)}}{2}$

b) Logarithmic scale: by selecting the FFT menu and then log scale (logarithmic)

- in dB/div. = by assigning 0 dB to a signal with an effective amplitude of 1 in the time representation

The vertical position indicator of the representation is at -40 dB.

Graphic representation

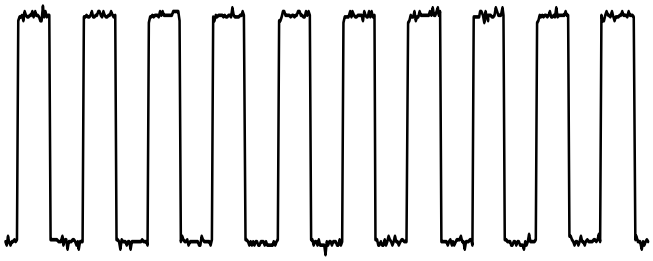
The FFT representation indicates symmetry in relation to the frequency origin; only positive frequencies are displayed.

Oscilloscope Mode (cont'd)

Rectangular
Hamming
Hanning
Blackman

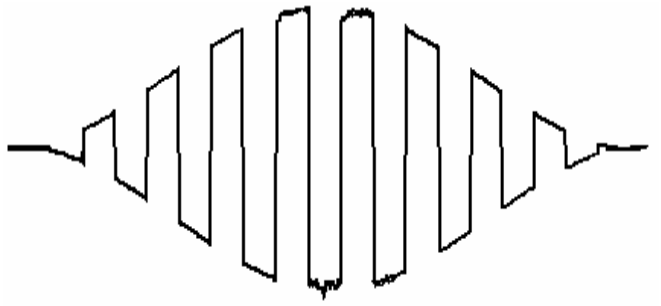
The sub-menus select a type of window.

Before calculating the FFT, the oscilloscope weights the signal to be analyzed by means of a window acting as a band-pass filter. The choice of window type is essential to distinguish between the various lines of a signal and to make accurate measurements.

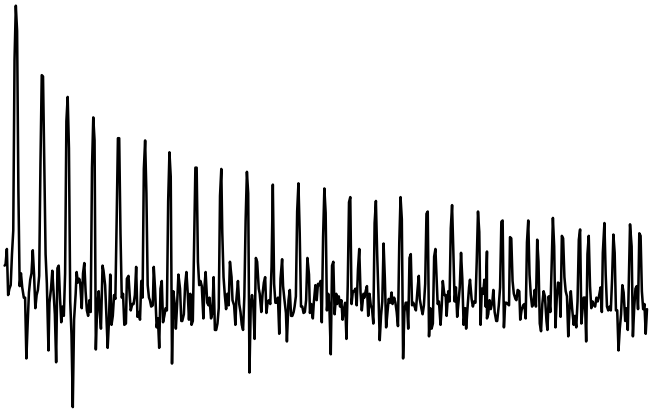


Time representation of signal to be analyzed

Weighting window



Weighted signal



Frequency representation of signal calculated by FFT

Oscilloscope Mode (cont'd)

The finite duration of the study interval results in a convolution in the signal frequency domain with a function sinx/x.

This convolution modifies the graphic representation of the FFT because of the lateral lobes characteristic of the sinx/x function (unless the study interval contains an whole number of periods).

Four types of window selections are available: the menus appear directly on selection of the FFT menu.

Type of window	Width of main lobe	Max. amplitude of secondary lobe (compared with main lobe)
Rectangular window	- 13 dB	4 π/N
Hanning window	- 32 dB	8 π/N
Hamming window	- 43 dB	8 π/N
Blackman window	- 94 dB	12 π/N

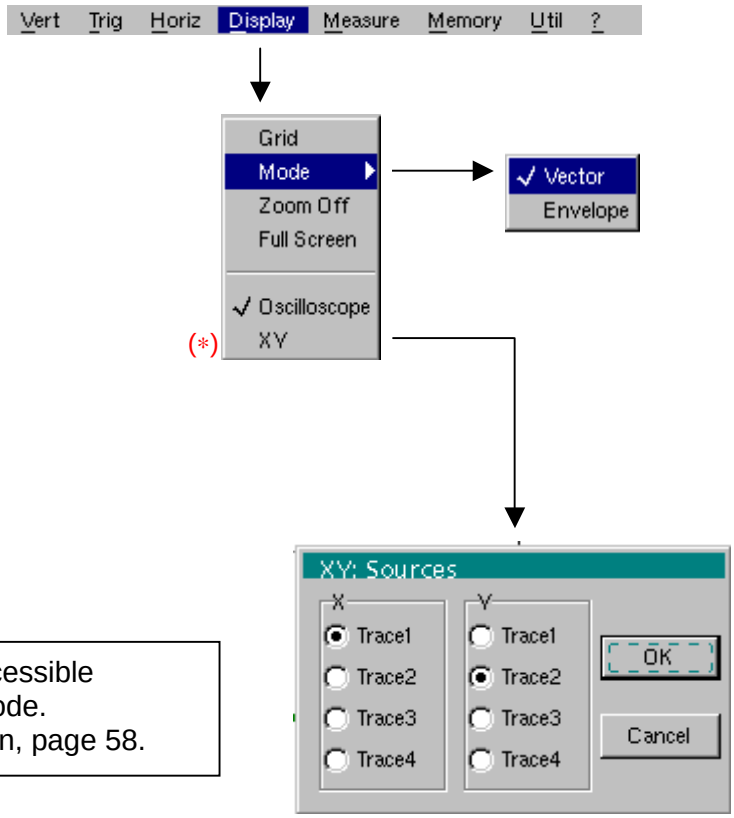
Effects of under-sampling on frequency representation:
If the sampling frequency is not correctly adjusted (less than or twice the maximum frequency of the signal to be measured), the high-frequency components will be under-sampled and appear in the graphic representation of the FFT by symmetry (aliasing).

- The "Autoset" function is active. This prevents the phenomenon above and adapts the horizontal scale: the representation is more legible.
- The "Zoom" function is active.

The "✓" symbol in front of one of the options indicates the function selected.

Oscilloscope Mode (cont'd)

The "Display" Menu



(*) Function only accessible in "Advanced" mode.
See §. Description, page 58.

Grid

Display / Removal of graticule

Display modes

There are two display modes available: vector and envelope.

Vector

A vector is plotted on the basis of each sample.

Envelope

The minimum and maximum observed on each horizontal position of the screen are displayed. This mode is used, for example, to view a time or amplitude variation or a modulation.

The "✓" symbol indicates the active display mode.

Zoom off

Returns to the original screen size after zooming in on part of the screen.

- *This function is inactive unless the screen is in zoom mode.*
- *If the Zoom mode is active, the letter "Z" is displayed in the trace and time-base parameter display area.*

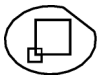
This menu can also be called up by double-pointing with the stylus inside the trace display area.

Oscilloscope Mode (cont'd)

Full screen

Switches from the normal display mode to the “full screen” display mode and vice versa.

The display is organized so as to leave the biggest surface area possible for trace plotting: only the permanent settings and the automatic or manual measurements remain

- *This function has the same effect as the*  key.
- *The “✓” symbol indicates that the full screen mode is active.*

This function can also be called up by double-pointing with the stylus on the trace display area.

The settings defined on the front panel remain active.

The following sub-menus can be used to switch from oscilloscope mode to XY mode.

The “✓” symbol indicates the active mode.

Oscilloscope

This is the basic operating mode.

XY

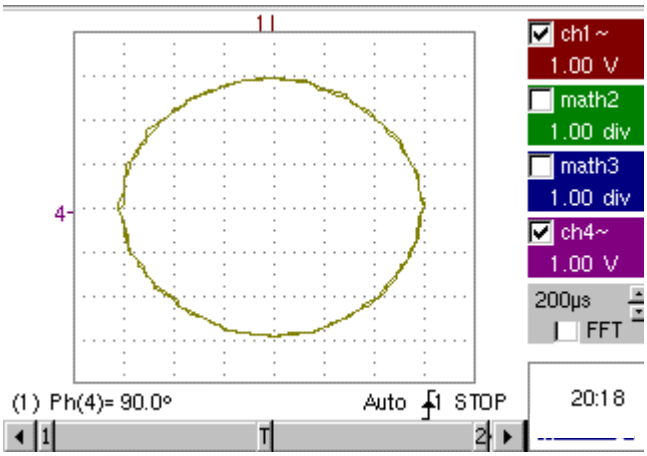
The “XY source” menu is used for assigning the desired traces to the X axis (horizontal) and Y axis (vertical).

Validation of the selections by "**OK**". Exit from the menu without modification by "**Cancel**".

- *Each axis is graduated into 8 divisions*.
- *The selected traces are identified by a figure corresponding to their axis*.
- *The “⊙” symbol indicates the trace selected for each axis.*

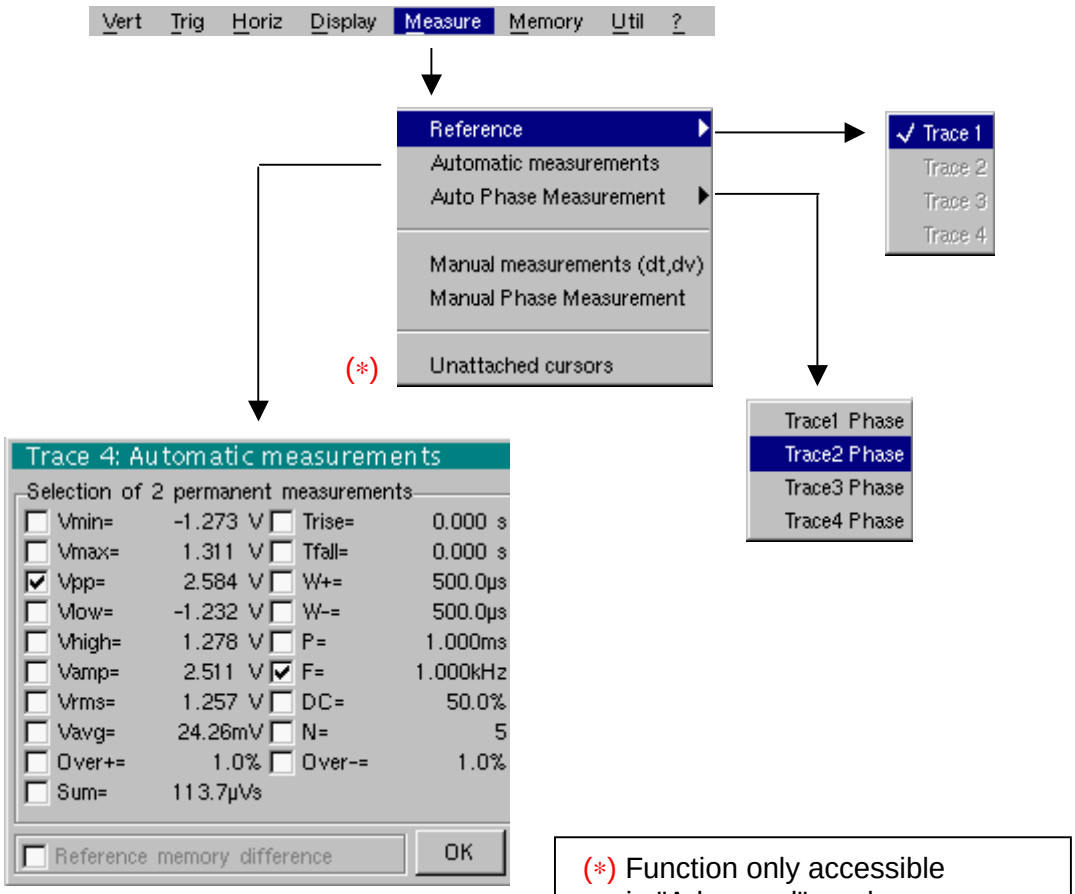
Example

Two sinusoidal signals assigned to the X and Y axis with an offset of π/2 are then represented by a circle.



Oscilloscope Mode (cont'd)

The "Measure" Menu



(*) Function only accessible in "Advanced" mode.
See §. Description, page 58.

Reference

Trace 1
Trace 2
Trace 3
Trace 4

Selection of the trace on which the automatic or manual measurements will be performed.

Only the active traces can be selected. Inactive traces are displayed in a lighter colour.

The "✓" symbol indicates the reference trace.

Automatic measurements

Opens the "Automatic measurements" menu window.

The measurements are performed and refreshed on the selected reference trace. All the measurements that can be performed on this trace are displayed.

(- . - -) is displayed for measurements that cannot be performed.

The window can be validated and closed by pointing to **OK** with the stylus.

The selected measurement(s) will be displayed in the status area.

Oscilloscope Mode (cont'd)

- *It is possible to select two permanent measurements.*
- *The "✓" symbol indicates the measurement(s) that will be indicated in the status area.*
- *Activation of the automatic measurements causes two markers (+) to appear on the curve, if at least one period is visible on the screen.*
- *The display order corresponds to the chronological order of the selection and the markers are assigned to the first measurement selected.*

Automatic measurements in the status area can be deleted by means of this menu, by erasing the selected measurements (no "✓" symbol in the automatic measurements table).

Reference memory difference

Activation of the "Reference memory difference" option is a way of calculating the deviations, for all the automatic measurements, between the selected trace and the memorized reference trace (see §. Memory Menu).

Example

Calculation performed and displayed on one of the 19 automatic measurements:

Vpp (Ref. memory difference) = Vpp (Trace 1) – Vpp (Trace 1 → Ref 1)

The calculation is performed in the same way for all the measurements.

- *This option is only active if a reference trace is present.*
  It must correspond to the trace on which you wish to perform automatic measurements
  (Example: Trace 1 and Trace 1 → Ref. 1).
- *Condition: the reference trace must have the same characteristics as the associated trace (sensitivity and time base)*

19 automatic

Oscilloscope Mode (cont'd)

Measurement conditions

- The measurements are performed on the displayed par

Oscilloscope Mode (cont'd)

Phase measurement

Automatic measurement of a trace's phase compared with a reference trace (See §. Reference Measurement).

Trace1 Phase
Trace2 Phase
Trace3 Phase
Trace4 Phase

This menu selects the trace on which phase measurements are to be performed.

To deactivate phase measurement, deselect the selected phase measurement using the same menu.

- *The "✓" symbol indicates the trace selected for phase measurement.*
- *Activation of the phase measurement, if it is possible, will cause display of 3 markers:*
  2 markers for the reference trace period
  1 marker indicated as φ on the trace for which the phase measurements will be performed.
  These 3 markers are positioned automatically; they cannot be moved.
- *The phase measurement (in °) of the trace selected compared with the reference trace is indicated in the measurement display status area*

  Example: (1)Ph (2) = 180.0°
- *If the measurement cannot be performed, " - . - -" is displayed.*

Manual measurements (dt, dv)

Cursor measurements on the reference signal

The measurement cursors (1 and 2) are displayed as soon as the menu is activated.

The two measurements made are:

dt (time difference between the two cursors),
dv (voltage difference between the two cursors).

The measurements performed and the displayed cursors are linked to the selected reference trace (see §. Reference Measurement).

- *The "✓" symbol indicates that the manual measurements (dt, dv) are active.*
- *the measurement cursors can be moved directly with the stylus. They can also be moved with the stylus by selecting the 1 (cursor 1) or 2 (cursor 2) in the bargraph.*
- *If the free cursor option is not active (see §. "Unattached Cursors" Measurement), the cursors will remain linked to the reference trace during movements. If the option is active, the cursors can be moved anywhere on the screen.*
- *The dt and dv measurements in relation to the selected reference are indicated in the measurement display status area.*

  Example: (1)dt = 500.0 µs, dv = 1.000 V

Manual phase measurement

Phase measurements using 3 cursors:

- Use cursors 1 and 2 to indicate the period of the reference signal.
- Use the φ cursor to measure the phase.

- *The "✓" symbol indicates that manual phase measurement is active.*
- *When this menu is active, the 3 cursors are present if at least one signal is active.*
- *The cursor marked φ can be moved freely, even if the "Unattached cursors" menu is not active.*
- *The phase measurement (in °) between the cursors is indicated in the measurement display status area.*

  Example: (1)Ph = 120.0 °

Oscilloscope Mode (cont'd)

Unattached manual cursors

Used for linking or not linking the manual measurement cursors (1 and 2) to the reference trace.

When the "Unattached cursors" menu is selected, cursors 1 and 2 can be moved freely over the whole screen.

- *The "✓" symbol indicates that the "Unattached cursors" menu is active.*
- *To deactivate this menu, deselect it by pointing with the stylus.*

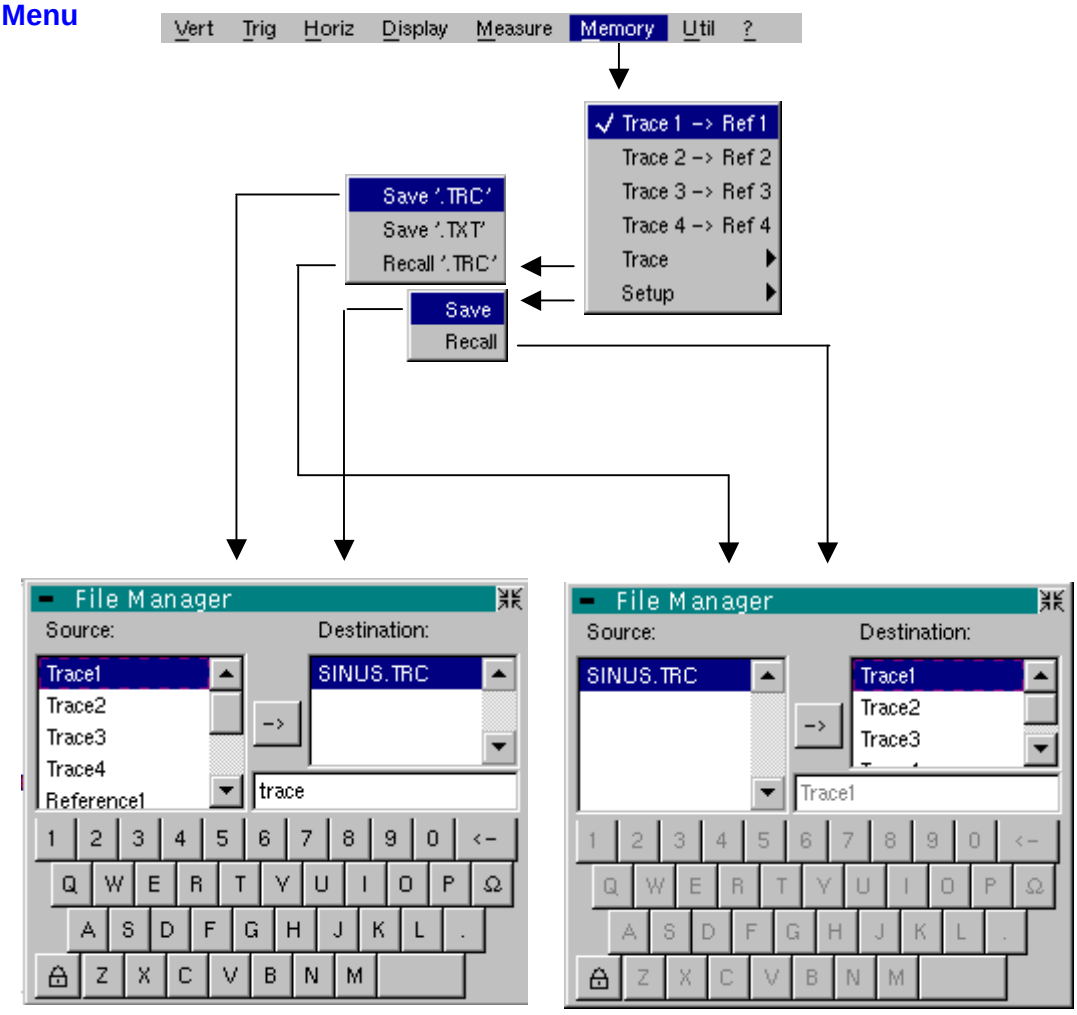
In the case of "Automatic measurements" and manual measurement activation:

If …	then …
… the **manual** cursors and the **automatic** markers are displayed together,	… the **automatic** measurements are performed on the portion of the trace defined between the **manual** cursors.
… the portion defined between the **manual** cursors is too small [in this case, the fixed markers (+) will not be displayed],	… the **automatic** measurements selected are impossible, so "-.--" is indicated in the measurement display area.

Deselect the automatic measurements to validate the manual measurements (dt, dv).

Oscilloscope Mode (cont'd)

The "Memory" Menu



Trace 1 → Ref. 1
Trace 2 → Ref. 2
Trace 3 → Ref. 3
Trace 4 → Ref. 4

Storage of the selected trace in its reference memory (✍ *E.g.:* Trace 1 in Ref. 1).

The 4 traces have their reference memory.

A reference memory is volatile, which means that it is lost when the instrument is switched off.

- *For optimum use, the reference trace must have the same characteristics as the associated trace (sensitivity and time base).*
- *A trace can only be saved in its reference memory if it is present on the screen*
- *The memorized traces are displayed in a light colour, accompanied by their reference number.*
- *The "✓" symbol in the menu means that the corresponding trace has been saved in the reference memory and that it is present on the screen.*
- *A reference trace cannot be moved.*
- *A reference memory can be deactivated by deselecting it in the menu.*

Oscilloscope Mode (cont'd)

Trace

Saving (to the non-volatile memory) or recall of a trace or a reference memory. The back-up can be saved in two formats: ".TRC" or ".TXT".

The "File copy" menu is adapted to the type of format selected.

Save .TRC

Saving of the files for subsequent recall on the oscilloscope screen
The back-up files will take the suffix .TRC; they can be recalled in the "Trace → Recall" menu.

Save.TXT

Saving of files for export to another application
The saved files have the suffix .TXT; they cannot be recalled by the "Trace → Recall" menu for screen display. However, they can be exported in a standard format for use in other software (spreadsheet - e.g. Microsoft EXCEL) using the menu "Util → Files → Export".

The selection made opens a "File Copy" menu.

* Then in the "Source" drop-down menu, select the trace or the reference memory to be recorded.

The trace or reference memory to be saved will appear in grey. The stylus is used for selection.

- *Only traces and reference memories present on the screen are indicated in the "Source" list (selectable).*
- *If all the traces and reference memories are present on the screen, the right scroll bar in the menu can be used to move around inside the list.*

* A default backup file name is proposed above the keyboard. It can be modified using the virtual keyboard with the stylus.
  The ← key deletes the character preceding the cursor in this area.
* Once the name has been written, the → key records it by entering it into the destination menu and closes the menu. The backup file takes the extension .TRC (internal format) or .TXT (text format), depending on the previous selection.

  You can exit from this menu without saving by pointing with the stylus on the icon in the top right-hand corner of the window.

- *The file name is limited to a maximum of 15 characters + the suffix. If this rule is not respected, the message 'File name too long' is displayed.*
- *As soon as the pointer passes over a destination file, the name is displayed with its recording date*
  its recording time
  its size.
- *If the name already exists or is incompatible, an error message 'Impossible! File already exists' will be displayed.*

Oscilloscope Mode (cont'd)

Recall .TRC

When selected, this opens a "File Copy" menu.

In the "Source" list, the .TRC files recorded previously (via the menu "Trace → Save .TRC") are displayed.

The name of the file selected for recall appears in grey. The stylus is used for selection.

* After selecting the file to be recalled, the "destination" list indicates on which trace you want to recall it. The destination trace selected (1 to 4) by pointing with the stylus appears in grey. It is also indicated at the bottom of the screen.
* Once the trace to be recalled and its destination have been selected, the → key is used to execute the operation and close the menu.

You can exit from this menu without recalling by pointing with the stylus on the icon in the top right-hand corner.

- *If the destination trace selected is already present on the screen, it will be replaced by the recalled trace.*
- *When a trace is recalled, "Mx" is displayed in the destination trace parameters.*
- *In this menu, the virtual keyboard cannot be used.*

Configuration

Saving or recall of an instrument configuration.

Save

When selected, this opens the "File copy" menu.

* In the "Source" menu, there is a file called "Configuration". It contains the parameters of the instrument's configuration when this menu is opened.
* A back-up file name is proposed above the Qwerty keyboard. The ← key deletes the character preceding the cursor in this area.
* When the source file name has been entered, the → key is used to record the configuration by transferring it into the destination menu, before closing the menu (save file: .CFG suffix).

You can exit from this menu without saving by pointing with the stylus on the icon in the top right-hand corner of the window.

- *The file name is limited to a maximum of 15 characters + the suffix. For a source file, the name is accompanied by the recording date and time and the file's size, as soon as the pointer passes over its name.*
- *If the name already exists or is incompatible, an error message will appear.*

Recall

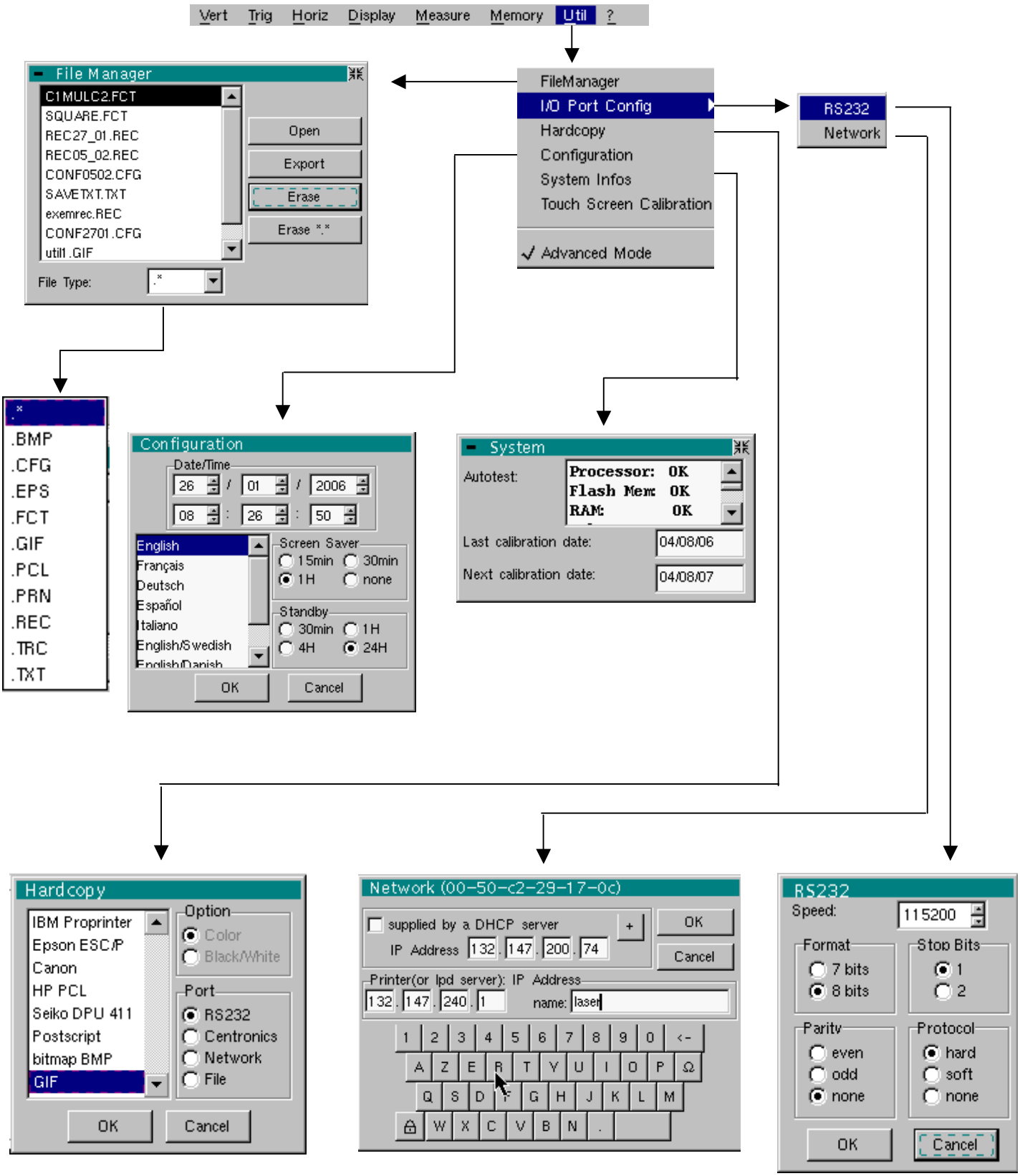
When selected, this opens the "File copy" menu.

* In the "Source" list, the .CFG files recorded previously (via the menu "Configuration → Save") are displayed. The name of the file selected for recall appears in grey. The selection will be made using the left mouse button. The scrollbar on the right is used for moving through the list.
* With the source file selected, the → key is used to perform the recall.
* You can exit from this menu without recalling by pointing with the stylus on the top right-hand corner of the window.

- *In this menu, the virtual keyboard cannot be used.*
- *Use the "**default config**" file to restore the factory configuration.*

Oscilloscope Mode (cont'd)

The "Util" Menu



Oscilloscope Mode (cont'd)

Files

Selection of the "File Management" menu.

It contains the files which have been:

- recorded since the instrument was first used
- created since the last startup. These files will only be saved definitively when the instrument is switched off using the key shown *opposite*.

If there is a mains power cut during saving of the configuration, the files in the file manager will be lost.

The configuration back-up files (.CFG),
for traces (.TRC),
for sampling (.TXT),
for printing (.PRN, .PCL, .EPS, .BMP, .GIF)
are accompanied by the date and time when they were saved and their size.

The selected file appears in grey. The stylus is used to select the file. The scrollbar on the right is used for moving through the list.

File type Selection of the file type required, using the corresponding filter:

.CFG	.TRC	.PRN	.PCL	.EPS	.BMP	.GIF	.REC	.TXT

The stylus is used for selection.

*" . * " can be used to select all the file types.*

The storage capacity of the file manager is 1 Mbyte.

Open causes restoration of the file selected by the “File Copy” menu.

Erase deletes the selected file.

Erase*. deletes all the files the extension of which has been selected in “File type”.

Export transmits the file over the active communication interface (RS232/CENTRONICS), network.

You can exit from this menu by pointing with the mouse on the icon in the top right-hand corner of the window.

I/O port config.

Selection of the "RS232" or "Network" menus.

This menu can be used to configure the "serial" remote programming interface or the "network" interface (ETHERNET).

RS 232

This interface uses the connector (RS232/ETHERNET) on the right-hand side of the instrument. It requires the use of the RS232 / SUBD9 cable (HX0042).

Speed selects the transmission speed : 300 to 115,200 Baud.

Format selects the word length: 7 or 8 bits.

Parity selects the type of parity: even, odd or no parity (none).

Stop bits selects the number of stop bits (1 or 2 stop bits).

Protocol selects the serial link management mode.

Hard Hardware: the protocol is provided by the RTS and CTS lines of the RS232 link.

Soft Software: use of the XON and XOFF characters to synchronize transmission and reception of the messages (reduced "3-wire" link)

None No protocol checking

- *The "✓" symbol indicates the selected option.*
- *The option can be modified using the stylus.*

Oscilloscope Mode (cont'd)

Network Configuration of the ETHERNET parameters

supplied by a DHCP server If this box is notched, the instrument makes a request towards a DHCP server to obtain automatically

- an address IP,
- the value of the subnet-mask,
- the address of the gateway,
- possibly the IP address of a network printer (according to the configuration of the DHCP server).

Physical address corresponds to the address of the oscilloscope on the ETHERNET network.

This address cannot be modified (it is specific to the instrument).

✍ *Example:* 00-01-02-03-04-63

IP address corresponds to the address of the oscilloscope on the ETHERNET network.

This address can be input automatically or manually with the keyboard, after selecting the zone to be modified.

The ← key can be used to delete the value preceding the cursor in the zone to be modified.

An IP address can be assigned automatically by a DHCP server, if the server is accessible, by ticking the box "provided by a DHCP server".

✍ *Example*: 132.147.200.74

Printer or LPD server: IP address corresponds to the IP address of the printer, or of a PC to which the printer is connected. In this case, the "LPD Server" software needs to be installed on the PC.

This address must be input manually with the keyboard, after selecting the zone to be modified.

The ← key can be used to delete the value preceding the cursor in the zone to be modified.

✍ *Example:* 132.147.240.1

Name Name of the printer as it appears in the printing server (or PC). If the printer is connected directly to the network, do not enter anything here.

This key is accessible in the "Advanced" mode only.
It gives access to the manual programming of the Subnet mask and to the programming of the IP address of the gateway.

Validation of the selections by "**OK**". Exit from the menu without modification by "**Cancel**".

Oscilloscope Mode (cont'd)

Hardcopy

The printing format, the type of printer and the communication port are chosen in this menu.

The printer type or selected format will appear in reverse video. The stylus is used for selection. The scrollbar on the right is used for moving through the list of types or the printer languages.

Option

Choice of colour or black/white printing.

Port

Selection of the interface used for print data transfer: RS232C, CENTRONICS (using the adapter provided as an option) or in a file.

- *If the RS232C interface is selected, the parameters (speed, format, parity, stop bit, protocol) must be configured in the "Config I/O Ports" menu. Check that the configuration matches the configuration of the peripheral device connected to the instrument.*
- *If the "Network" option is selected, the parameters (IP address, printer) must be configured in the « Config I/O Ports → Network" menu).*
- *The "File" option is a way of recording the hardcopy in a file. ".bmp" and ".gif" image formats can be used directly in the Windows applications (word processing, presentations, etc.). As soon as the printout is activated, the "File copy" menu opens and you have to enter the name of the file generated (see "Trace → Save" menu).*

A hard copy of the screen can be printed by pressing this key. The hard copy is produced using the parameters defined in the "Hardcopy" menu.

Configuration

Date/time

Updating of the date (day, month, year) and the time (hour, minute, second). You can select the required parameter by using the stylus and the scrollbars located on either side of the parameters to be adjusted.

The clock starts when the menu is closed.

Language

Selection of the language in which the menus are written.
Options available: **French, English, German, Italian, Spanish, etc…**

Screen saver

Sets the screen to standby after a defined period of time to minimize the consumption of the equipment and screen ageing.
4 options are available: **15 min, 30 min, 1 hour, no standby mode.**

The screen can be reactivated by pressing any key on the front panel.

Standby

Shutdown of the instrument after a predefined period, in order to limit its energy consumption.
In this case, the equipment configuration is saved before the shutdown.
4 options are available: **30 min, 1 hour, 4 hour, 24 hour.**

The equipment is reactivated using the key shown *opposite.*

- *The "⊙" symbol indicates the option selected.*
- *The option can be modified using the stylus.*

Validation of the selections by "**OK**". Exit from the menu without modification by "**Cancel**".

Oscilloscope Mode (cont'd)

System Info

Display of data concerning the operation of the instrument since it was first used.

Next calibration date

Periodic equipment calibration is necessary to guarantee the specifications announced.

For verification of the instrument, see §. Maintenance.

You can exit from this menu by pointing with the stylus on the icon in the top right-hand corner.

Touch-screen calibration

See pages 24 and 25.

"Advanced" Mode

When this "Advanced" mode is not active, the advanced equipment functions no longer appear in the menus.

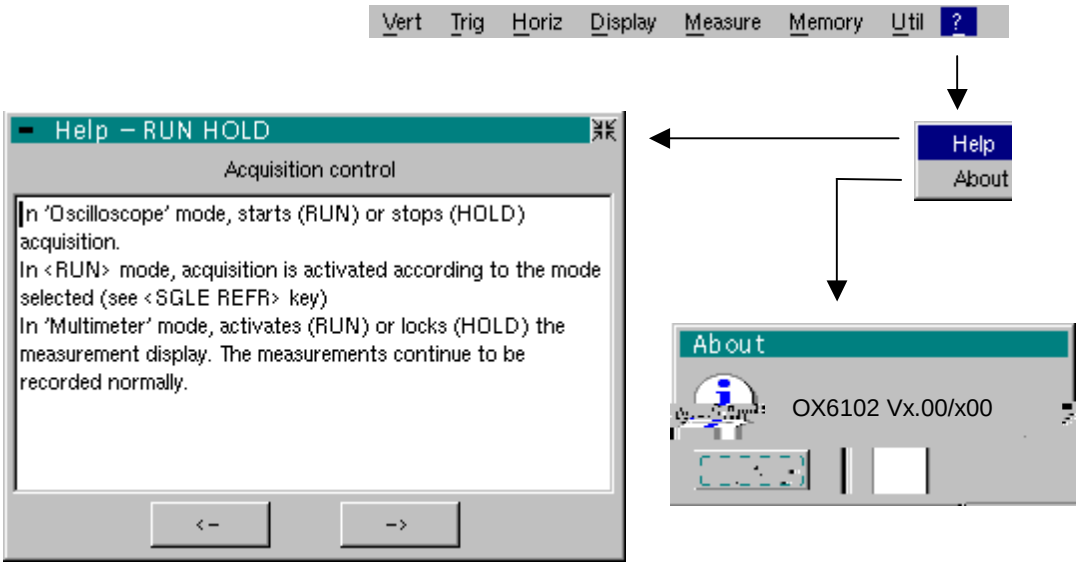
Menus present in "Advanced" mode only

math2, math3	→ accessible via the "**Vert**" menu
Averaging, repetitive signal	→ accessible via the "**Horiz**" menu
XY	→ accessible via the "**Display**" menu
Unattached manual cursors	→ accessible via the "**Measure**" menu

- *The "✓" symbol indicates that the "Advanced" mode is active.*
- *The stylus can be used to modify this.*
- *By default, the "Advanced" mode is not active.*
- *In "non-advanced" mode, the instrument's configuration is not saved when it is shut down using the key opposite and the default factory configuration is loaded at start-up.*

Oscilloscope Mode (cont'd)

The « ? » Menu



Help

When selected with the stylus, this opens the "Help" menu.

The online help concerns the instrument's keyboard.

Use the ← and → keys of the window to scroll through the description of the keys on the front panel.

Whenever a keyboard key is pressed, online help will be displayed regarding the key pressed.
The functions associated with the keys will not be activated.

The key name is indicated above the explanation.

You can exit from this menu by pointing with the stylus in the top right-hand corner of the window.

About

Provides information on:

- the name of the instrument
- the version of the software
- the version of the hardware

You can exit from this menu by choosing **OK**.

Multimeter Mode *(OX 6062 and OX 6152 only)*

The Keys

Press the key *opposite* to select the "**Multimeter**" mode, ***OX 6062* and *OX 6152* only.**

4 "UTILITY"keys or key pads

Direct access to LCD **contrast** adjustment.

No action.

Triggers a **hardcopy** in accordance with the configuration chosen in the "Util" and "Hardcopy" menus.

A second press before the end of the process will interrupt the current printout.

If printing is impossible, a "Printing error" message will be sent.

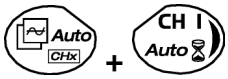
The "  " symbol is displayed in front of the settings display zone when printing is in progress.

No action.

1 "AUTOSET" key

No action.

Selective "AUTOSET"



No action.

4 "TRIGGER" keys

No action.

No action.

No action.

To lock / unlock the display of the measurements. Plotting of the traces never stops.

Multimeter Mode (cont'd)

3 "MEASURE" keys

No action.

For changing the reference trace to which the cursor refers (successive presses).

No action.

3 "HORIZONTAL" keys or key pads

Duration of the recording in the display window: **5', 15', 30', 1h, 6h, 12h, 24h, week, month.**

No action.

No action: zoom not possible in this mode.

5 "VERTICAL" keys or key pads

The instrument contains as many independent multimeters as there are channels in "Oscilloscope" mode (2 or 4).

Same function as in "Oscilloscope" mode.

A long press enables or disables the autorange on the channel concerned.

The channel is displayed and selected.

No action.

If a channel is activated and selected, this key can be used to change the input coupling of the channel. By successive presses, the coupling can be changed from AC to DC to AC+DC.

The coupling is indicated in the multimeter window of the channel concerned.

When selected for ohmmeter, continuity or capacimeter measurements, component testing or temperature measurements on channel 1, the key has no effect, as the input coupling in these functions cannot be adjusted.

Manual modification of the measurement range

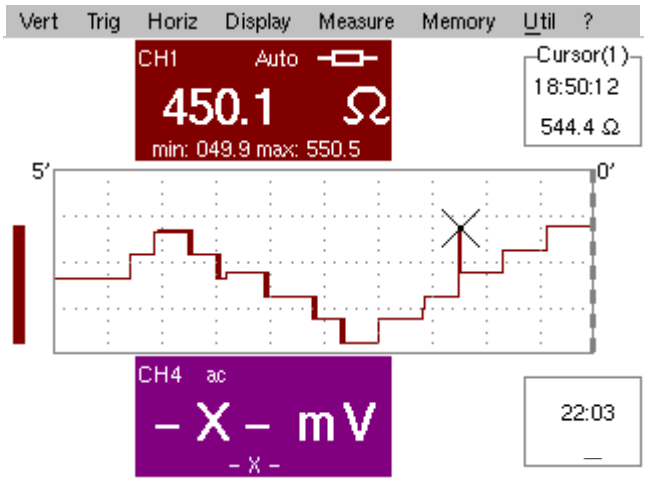
If the autorange mode is activated, the manual adjustment has no effect: the autorange will automatically reset the instrument to the measurement range best suited to the input signal.

No action.

Multimeter Mode (cont'd)

Display

Display



Composition

The multimeter display is divided into 6 functional areas:

1. Menu bar		
2. Channel 1 Multimeter		**3. Cursor value**
4. BarGraph channel 1	**5. Graphic window**	**4. BarGraph channel 4**
2. Channel 4 Multimeter		**6. Current setting**

1. Menu bar

The tool bar gives access to the different menus of the "Multimeter" function.

Multimeter Mode (cont'd)

2. Channel (*x*) multimeter)

There is a display area reserved for each of the instrument's channels. In each of these, the following information is indicated:

Channel CH1 or CH4

Coupling The input coupling selected (see §. Vert. Menu) is indicated in this field. For the Ohmmeter, Capacimeter, Continuity, Component Test and Temperature Measurement modes, the coupling is not shown.

☝ *The symbol « » shows the selected bandwidth limit.*

Autorange Indicates whether range changing is automatic.

Symbols

Multimeter Mode (cont'd)

4. Bargraph

These graphs show the min. and max. values measured on the channels in the range during the observation period.

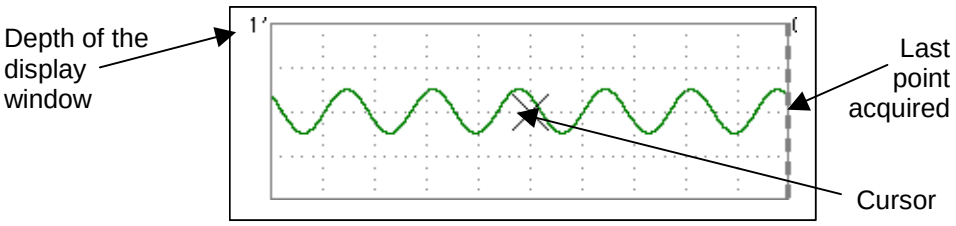
The bargraph is shown with the colour of the channel.

The zero level of the bargraph and the scale are adapted to suit the type of measurement and the range.

☝ *If the range is changed, the bargraph is reinitialized and the curve showing the evolution of the measurement is erased.*

5. Graphic window

This window shows the evolution of the measurements as a function of time. The most recent measurement points are those on the right-hand side of the screen.



The depth of the window, which represents the observation period, can be programmed using the keys *opposite*.

In this way, you can choose to view the measurements with a depth of:
5', 15', 30', 1h, 6h, 12h, 24h, week, month.

☝ *When ROLL mode is activated (see §. HORIZ Menu), the measurements are updated constantly, with the most recent results taking the place of the older results, which disappear.*

6. Current settings

The window has the same function as the oscilloscope window: it serves to indicate and adjust the value of the parameter selected.

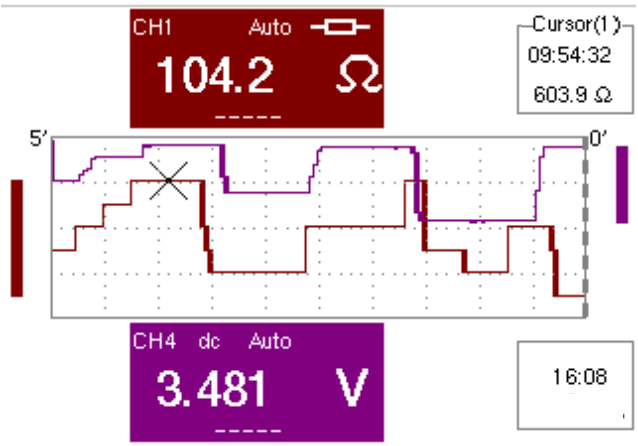
Multimeter Mode (cont'd)

The Menus

Presentation

- Screen display when measurements are possible on all the channels:

Example: CH1 is configured as an Ohmmeter, so CH4 is necessarily set to amplitude measurement (AC, DC or AC + DC)



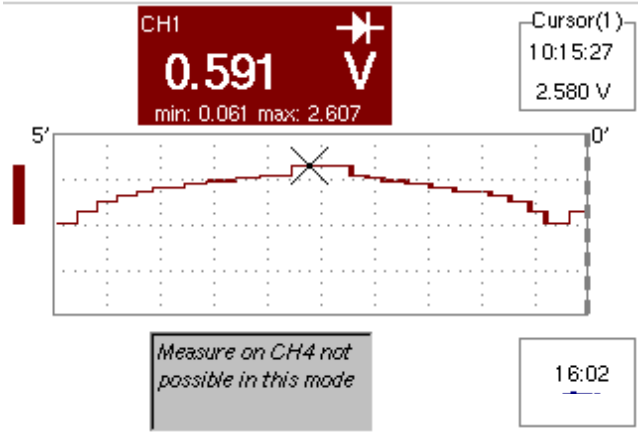
The screen display is identical if CH1 is configured for amplitude measurement, as an ohmmeter or for temperature measurement (PT100).

- Screen display when measurements are possible on CH1 only:

Example: CH1 is configured for a Component Test

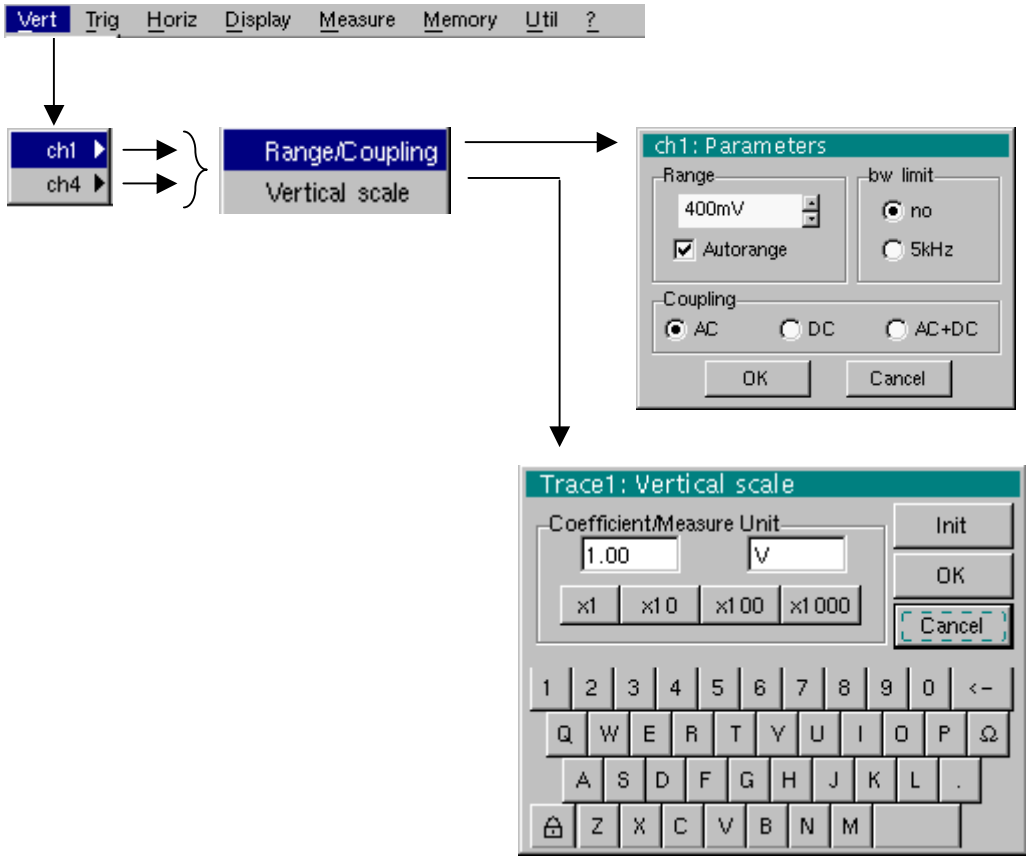
The display is identical when CH1 is configured for capacitance or continuity measurement.

Measurements on channel 4 are impossible.



Multimeter Mode (cont'd)

The "Vert" Menu



ch1 ch4

Modification of:

- the parameters of channels **ch1 and ch4**, independently
- the vertical scale of the selected trace

Range/Coupling

Modifies the parameters of the selected channel.

Range

Choice of the measurement range. The unit displayed depends on:

- the type of measurement selected: amplitude (available on all channels), ohmmeter, continuity, capacimeter, PT100 temperature probe (available only on channel 1, see §. Measure Menu),

For the ranges available for each type of measurement, refer to the technical specifications of the "Multimeter" function.

The Range / Coupling menu is displayed in light grey when the range is not modifiable (single range).

Multimeter Mode (cont'd)

Autorange

When this option is selected, the measurement range changes automatically.

☝ *The "✓" symbol shows that it is active.*

If the option is disabled, the range can be modified manually, using the keys *opposite* or the "Range" menu, depending on the type of measurement being performed.

Coupling

Modification of the AC, DC or AC+DC coupling for amplitude measurement.

AC: AC voltage measurement

DC: DC voltage measurement

AC + DC: Measurement of AC voltage with a DC component

☝ *For AC and AC+DC measurements, the menu "Display → Frequency" can be used to display the frequency of the signal in the secondary display field.*

The "⊙" symbol indicates the type of coupling selected.

The coupling is updated in the modified channel parameter display zone.

Bandwidth limit

If the channel measures an AC or AC+DC voltage (see ***Coupling***), it is possible to filter the signal with a low-pass analogical filter whose cut-off frequency is 5 kHz.

Vertical scale

Id. “Oscilloscope” mode.

Multimeter Mode (cont'd)

The "Trig" Menu

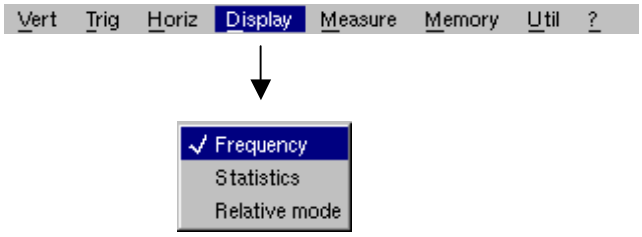
No trigger parameterization is possible in this mode.

The "Horiz" Menu

Roll

- If this mode is activated (presence of "✓" symbol), the measurement history curve is constructed continuously. The oldest points disappear on the left-hand side of the screen, while the most recent ones appear on the right.
- If this mode is deactivated, the point display stops as soon as the first point acquired reaches the left-hand edge of the window. However, the measurements continue and are still refreshed in the area 'Multimeter Channel'x'.

The "Display" Menu



This menu selects the information that you want to display in the secondary measurement field of each 'Multimeter Channel'x' area.

Frequency If this line is ticked and in the case of AC amplitude measurement, the frequency of the signal measured (if possible and consistent) will be displayed.

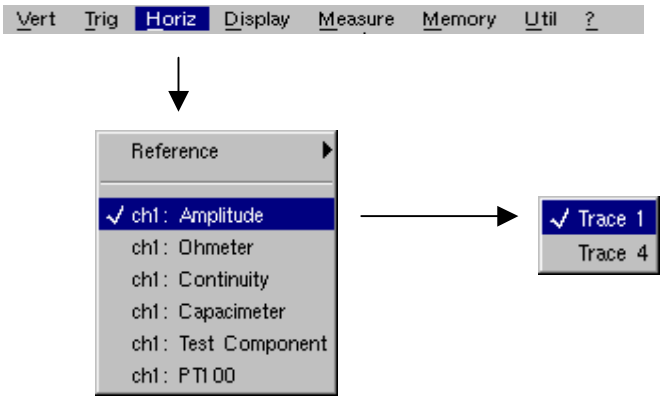
Statistics Display of the Min. and Max. values of the measurements performed.

Relative mode The value displayed is the difference between the value measured and the value displayed when this option was selected.

The "✓" symbol indicates the secondary function selected.

Multimeter Mode (cont'd)

The "Measure" Menu



Reference The reference is used to select the measurement trace on which the cursor is positioned. The cursor value is therefore relative to the measurement on this channel.

It is only possible to choose the reference on activated channels: channels that are not activated are displayed in a lighter colour in the sub-menu.

☝ *The " ✓" symbol indicates the reference selected.*

ch1: Amplitude Channel CH1 is used as a voltmeter and therefore measures the amplitude of the signal present on the input of this channel.

ch1: Ohmmeter Channel CH1 is used as an ohmmeter and therefore measures the resistance of the dipole wired to the input.

ch1: Continuity Channel CH1 is used as a continuity tester: there is a beep if the input resistance is less than ≈ 30 Ohms.

☝ *In this mode, measurements are impossible on the ch4 channel.*

ch1: Capacimeter Channel CH1 is used as a capacitance meter and therefore measures the capacitance of the dipole wired to the channel's input.

☝ *In this mode, measurements are impossible on the ch4 channel.*

ch1: Component Test Channel CH1 is used as a diode tester. This mode measures the threshold of the diode wired to the input.

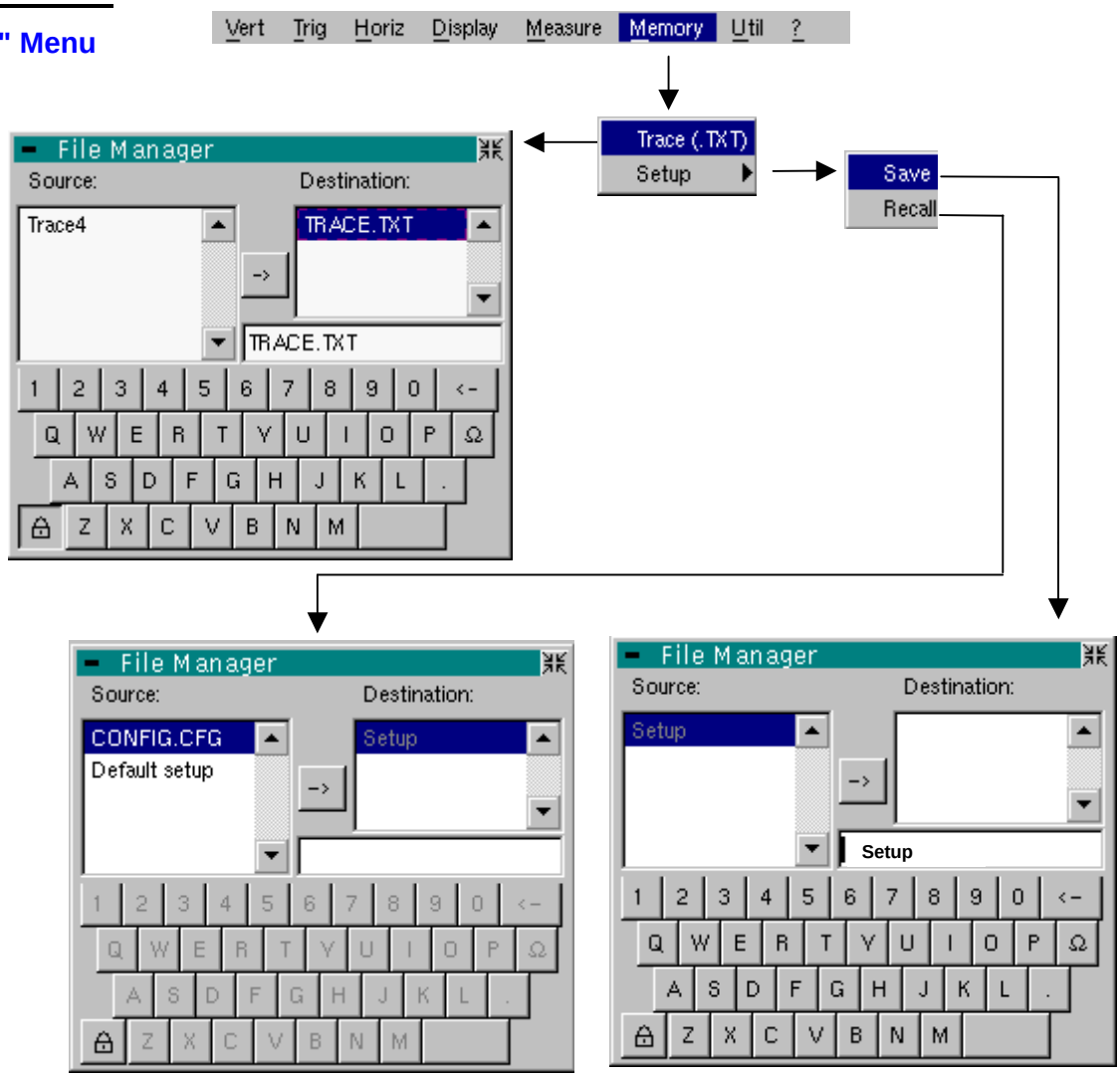
☝ *In this mode, measurements are impossible on the ch4 channel.*

ch1: PT100 These configurations measure a temperature using a 100 Ω (PT100) resistive sensor.

The range of maximum temperatures is - 200℃… + 850 ℃ and depends on the sensor used.

Multimeter Mode (cont'd)

The "Memory" Menu



Trace (.TXT) In "Multimeter" mode, it is only possible to save a trace in non-volatile memory in .TXT format.
Files saved with the suffix .TXT can be exported onto a PC (see §. Util Menu → Files) for processing with other software (spreadsheet, etc.).

Configuration This function is identical to the one in "Oscilloscope" mode.

The"Util" Menu

Configuration This function is identical to the one in "Oscilloscope" mode, excepted :

Screen saver

- If the recording time is over 5 minutes, the screen saver will never be activated.
- If the recording time is equal to 5 minutes, the screen saver and settings operate as in “Oscilloscope” mode, p. 57.

Standby

- If the recording time is over 5 minutes, standby will never be activated.
- If the recording time is equal to 5 minutes, standby and settings operate as in “Oscilloscope” mode, p. 57.

The "?" Menu

This menu is identical to the one in "Oscilloscope" mode, p. 59.

Applications

Display of the calibration signal

- Using the key shown *opposite*, select the "Oscilloscope" mode.
- Connect a 1/10-ratio probe to input CH1.

☝ *A message indicating the characteristics of the probe is displayed briefly, confirming that it has been detected.*

- Validate the signal:
  Vert Menu → Display → Trace 1
  or by pressing the CH1 key
  or on the display of the CH1 trace parameters.

- Adjust the CH1 sensitivity:
  Vert Menu → CH1 → Sensitivity/coupling: 500 mV/div. (1/10 probe)
  or using the keys *opposite.*

- Adjust the CH1 coupling:
  Vert Menu → CH1 → Sensitivity/coupling → AC
  or by pressing the AC/DC GND key.

- Adjust the scan speed:
  using the scrollbar in the time base window: 500 µs/div
  or the keys *opposite.*

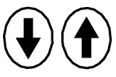
- Select the trigger parameters:
  Trig. Menu → Parameter → Principal → Source: CH1
  Coupling: AC
  Front: + (or using the key *opposite).*

- Adjust the trigger mode:
  Trig. Menu → Automatic mode
  or using the SGLE REFR key.

- Use the RUN HOLD key to start acquisition ("RUN" mode)

If necessary:

- Modify the trigger level using the stylus:
  - by moving the symbol T (Trigger) on the screen. The value of the trigger level is indicated in the bottom right-hand corner of the screen.
  - or through the trigger parameters menu:
    Trig. Menu → Parameter → Principal → Level



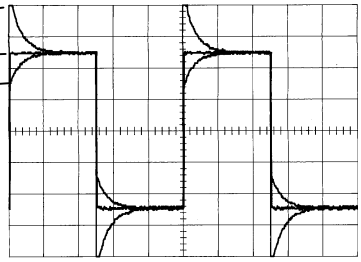
- Modify the vertical positioning of the curve:
  - by using the stylus to move symbol 1, on the left of the screen.
  - or by using the keys *opposite.*

☝ *The key opposite is used to make these adjustments automatically.*

Probe compensation

Adjust the low-frequency compensation of the probe so that the signal plateau is horizontal (see figure below).

Over-compensated probe
Compensated probe
Under-compensated probe



Applications (cont.)

Measurement using cursors

- Select measurement by cursors using the menu:
  Measure → Manual measurements (dt, dv) (see §. Measure Menu).
  - Two measurement cursors (1 and 2) are displayed as soon as the menu has been activated.
  - The 2 measurements indicated under the trace display are **dt** (interval between the 2 cursors as a function of the time base) and **dv** (voltage between the 2 cursors as a function of the vert. sensitivity).

  ✍ *Example:* (1)dt : 2,150 ms, dv = 250.0 mV

Recall

- The two measurement cursors (1 and 2 can be moved directly on the screen by means of the stylus.
  In the same way, they can also be moved horizontally by means of the stylus, by selecting the 1 (cursor 1) or the 2 (cursor 2) in the bargraph of the status zone.
- If the unattached cursors option is not activated (see §. Measure Menu → Unattached cursors), the cursors remain linked to the trace during the moves.
- If the unattached cursors option is active, the cursors can be moved anywhere on the screen.

Phase Offset measurement/cursors

- Initially, there must be 2 out-of-phase signals on 2 channels (ch1 and ch2).

Automatic phase measurement

- Select the reference trace in relation to which you want to perform the phase measurements via the menu:
  Measure → Reference → Trace 1 to Trace 4 (see §. Reference).

  ✍ *Example*: Reference Measurement → Trace 1.
- Select automatic phase measurement via the menu:
  Measure → Phase measurements (see §. Phase measurement).

  ✍ *Example*: Phase Measurement → Phase Trace 2.
  - The 2 cursors (+) of the automatic measurements are displayed on the reference trace. A cursor "φ" is displayed on the trace concerned by the phase measurements.
  - The phase measurement (in °) is indicated under the display of the curves.

  ✍ *Example*: (1)Ph (2) = 180.0°

Reminder

- *The 3 cursors are fixed; they cannot be moved.*
- If it is not possible to perform the measurement , "-.- -" appears.

Applications (cont.)

Manual measurement of phase

- Select manual phase measurement via the menu:
  Measure → Manual phase measurement (see §. Measure Menu).
  - The 2 cursors (1 and 2) of the manual measurements are displayed on the reference trace. A "φ" cursor in relation to which the phase is measured is displayed.
  - The phase measurement (in °) is indicated under the display of the curve(s).

    Example: (1)Ph = 150.0°

Reminder

- The 3 measurement cursors are present if at least one trace is present on the screen.
- The 3 measurement cursors can be moved directly on the screen by using the stylus. They can also be moved using the stylus by selecting 1 (cursor 1) or 2 (cursor 2) in the bargraph in the status zone.
- If the unattached cursors option is not activated (see §. Unattached cursors), the cursors (1 and 2) will remain linked to the trace when moved. If the option is active, these cursors can be moved as required on the screen.

In all cases, the symbol "φ" can be moved freely.

Display of a TV video signal

This example illustrates the TV synchronization functions.

- The parameters in the TV menu (Trigger Parameters menu) for displaying a TV signal only apply to the CH1 input.

- it is recommended to use a 75 Ω adapter for observing a video signal.

- Inject on CH1 a composite TV signal with the following characteristics:
  - 625 lines
  - positive modulation
  - vertical grey scale stripes
- In the Trigger Parameters menu, select the tab:
  Trig. Menu → Parameter → TV:
- Set the standard number of lines: 625 lines
  - polarity: +
  - line: 25 (for a video signal)
  - front: + (or using the key *opposite).*

- Adjust the CH1 coupling:
  Vert Menu → CH1 → Sensitivity/coupling → DC
  or by pressing the AC/DC GND key.

- Adjust the CH1 sensitivity:
  Vert Menu → CH1 → Sensitivity/coupling → 50 Mv/div.
  or using the keys *opposite.*

- Adjust the scan speed:
  using the scrollbar in the time base window: 20 µs/div.
  or using the keys *opposite.*

Applications (cont.)

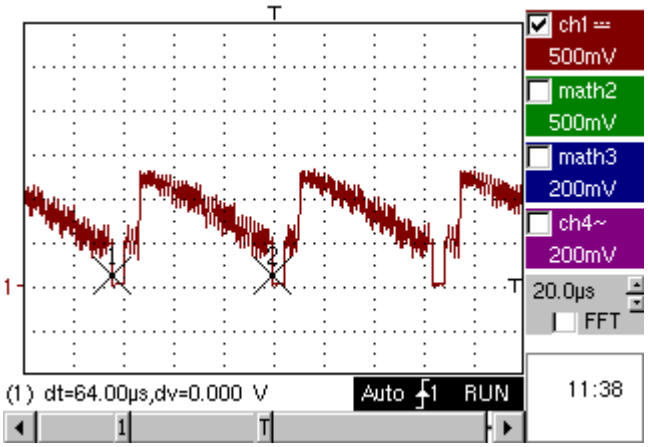
- Select the trigger mode:
  Trig. Menu → Automatic mode
  or using the SGLE REFR key.

- Use the RUN HOLD key to start acquisition (RUN mode)
  or use the time base menu.

Reminder The acquisition status (Ready, RUN, STOP) is indicated on the right, under the display of the trace, in the trigger status display zone.

- Optimize the time base speed to observe several complete TV lines.

Example of a video signal



Use the manual cursors to check the duration of a line

- Display the manual cursors:
  Menu → Measure → Manual measurements (dt, dv)
  or using the key *opposite.*
- To move the cursors freely, select:
  Measure Menu → Unattached cursors.
- Use the stylus to position cursors 1 and 2 on the start and end of the signal, respectively.

The measurements between the 2 cursors are indicated under the curve display.

Example: dt = 64.00 µs = duration of a line

Applications (cont.)

Examination of a specific TV line

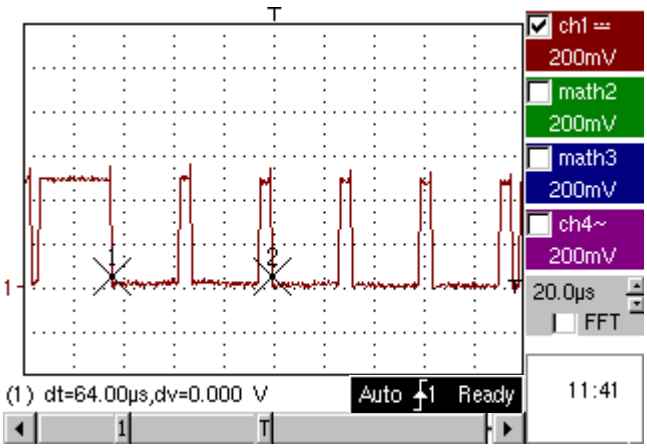
For more detailed examination of a video line signal, the TV trigger menu can be used to select a line number.

- In the Trigger Parameters menu, select the tab:
  Trig. Menu → Parameter → TV:
- Set the standard number of lines: 625 lines

  polarity: +
  line: 1
  front: + (or using the key *opposite).*

- Adjust the ch1 sensitivity:
  Vert Menu → CH1 → Sensitivity/coupling → 100 mV/div
  or using the keys *opposite.*
- Modify the scan speed:
  using the scrollbar in the time base window: 20 µs/div
  or using the keys *opposite.*

Example of video line 1



Applications (cont.)

Display of slow phenomena "ROLL" mode

This example examines the analysis of slow phenomena for time bases ranging from 200 ms to 200 s. The samples are displayed constantly, without waiting for the Trigger (ROLL mode).

Examination of slow phenomena over a significant period of time

- Select "Oscilloscope" mode (key *opposite*).
- Inject on the CH1 input a sinusoidal signal at 1 Hz and 1 Vrms.
- Adjust the scan speed: using the scrollbar in the time base window:
  500 ms/div
  or using the keys *opposite.*
- Validate signal CH 1:
  Vert Menu → Display → Trace 1
  or by pressing the CH1 key
  or on the display of the CH1 trace parameters.
- Adjust the CH1 sensitivity:
  Vert Menu → CH1 → Sensitivity/coupling → 500 mV/div (1/10 probe)
  or using the keys *opposite.*
- Adjust the CH1 coupling:
  Vert Menu → CH1 → Sensitivity/coupling → DC
  or by pressing the AC/DC GND key.
- Select the trigger parameters:
  Trig. Menu → Parameter → Principal → Source → CH1
  Coupling: AC
  Front: + or using the key *opposite.*
- Adjust the trigger mode:
  Trig. Menu → Single mode
  or using the SGLE REFR key.

Use the stylus to move the Trigger level symbol up or down in the display area:

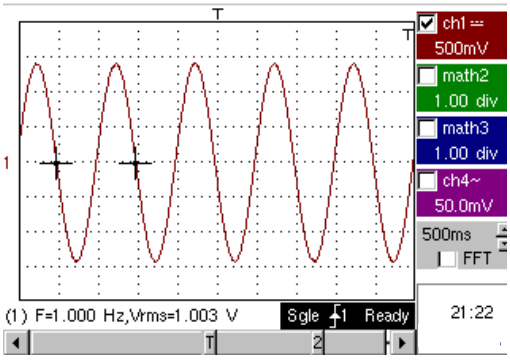
Trigger level is < the signal level → the oscilloscope stops data acquisition once it has filled the acquisition memory (STOP mode).

- Trigger level > Signal level → data acquisition no longer stops and the signal is analyzed constantly.

The trigger level may be set precisely, using the trigger parameters menu: Trig. Menu → Parameter → Principal → Level.

- Start acquisition using the RUN/HOLD key (RUN mode).

Examination of the signal



The signal is analyzed constantly (RUN mode).
This trace scroll function allows the form of the signal to be monitored.
In the absence of trigger, the trace can be fixed while pressing again on key RUN HOLD.

This function is recommended for studying low-frequency signals.

Applications (cont.)

Min / Max Acquisition

Detection of a wrong representation due to under-sampling

Examination of an amplitude-modulate signal

- Using the key shown *opposite*, select the "Oscilloscope" mode.
- Inject on the CH1 input an amplitude-modulated sinusoidal signal at a. frequency of 15 Hz.
- Inject on the CH4 input a sinusoidal signal at 300 Hz and 3 VDC. for synchronization of the signal on CH1.
- Adjust the scan speed:
  using the scrollbar in the time base window: 1 ms/div
  or using the keys *opposite.*

- Validate the CH1 signal: Vert Menu → Display → Trace 1
  or using the key *opposite.*
  or on the display of the CH1 trace parameters.

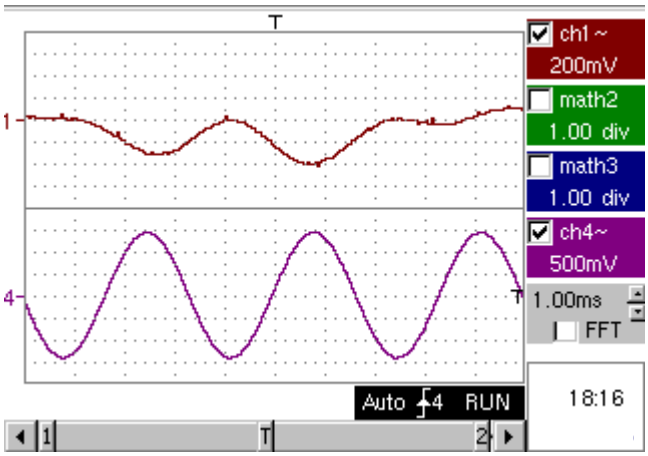
- Adjust the CH1 sensitivity:
  Vert Menu → CH1 → Sensitivity/coupling: 200 mV/div
  or using the keys *opposite.*
- Ditto for CH4 with a sensitivity of: 500 mV/div
- Adjust the trigger parameters:
  Trig. Menu → Parameter → Principal:
  Source: CH4
  Coupling: AC
  Front: + or using the key *opposite.*

- Adjust the trigger mode:
  Trig. Menu → Auto Mode:
  or using the SGLE REFR key.

- Start acquisition using the RUN/HOLD key (RUN mode).

- Use the FULL TRACE key to display the 2 traces separately.

Examination of the signals

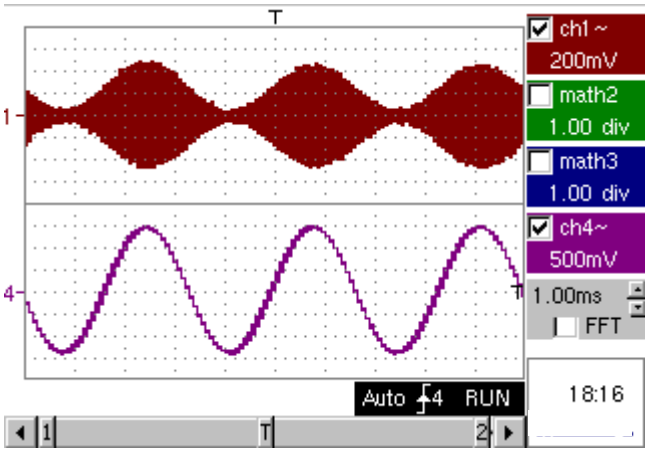


Applications (cont.)

The observation of the amplitude-modulated CH1 trace cannot be used (incorrect display).

- Validate the MIN / MAX mode:
  Horiz → MIN/MAX Acquisition menu, to view the amplitude modulation of the CH1 signal.

Examination of the signals



Applications (cont.)

Measurement in multimeter mode, *OX 6062 and OX 6152 only*

- Press the key *opposite* to activate the "Multimeter" mode.

Measurement in Multimeter Mode

Caution : measurement ground is connected to earth ground.

- Select input CH1 in Ohmmeter mode:
  Menu: Measurement → CH1 → Ohmmeter.

☝ *Ohmmeter mode (Ω) is indicated in the display of the parameters for CH1.*

- Validate the measurements on CH1 by pressing the key *opposite* (- X - disappears).

<u>The resistance measured is not known</u>:

- Select the "Autorange" mode.
  "Channel 1 Parameters" menu under Vert → CH1 → Range/Coupling or by a long press on the CH1 key.

☝ *The autorange mode (auto) is indicated in the display of the parameters for CH1.*

In this case, the instrument constantly seeks the most suitable measurement range.

<u>The resistance measured is known</u>:

- Select the appropriate range:
  "Channel 1 Parameters" menu under Vert → CH1 → Range/Coupling or using the keys *opposite.*

☝ *See the general characteristics for the ranges available.*

- Select the "Statistics" mode.
  Menu: Display → Statistics, to find out the minimum and maximum values when the measurement variations are analyzed.

☝ *The MIN and MAX measurements are indicated in the display of the parameters for CH1.*

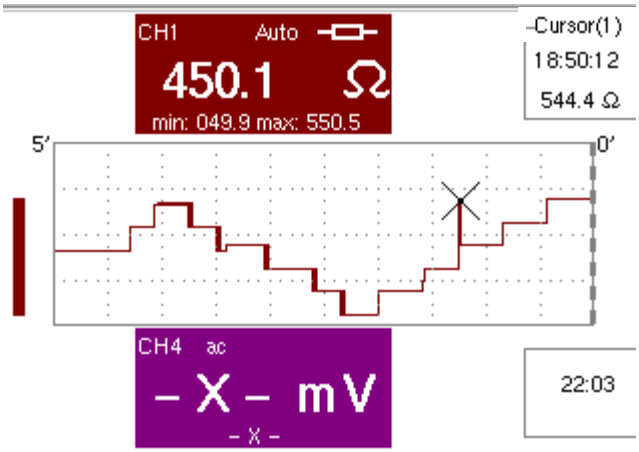
- Use the keys *opposite* to select the duration of the period (5', 15', 30', 1 h, 6 h, 12 h, 24 h, week, month) for analysis of the measurement variations.

☝ *The duration selected is indicated in the top left-hand corner of the graphic window.*

- Deactivate "Roll" mode:
  Menu: Horiz → Roll to stop the measurements at the end of the analysis period.

Applications (cont.)

Example of measurement in Multimeter Mode



The graphic window records the changes in the measurements during the analysis period (5 minutes).

The bargraph shows the amplitude of the variations.

The minimum value (49.9 ohms) and the maximum value (550.5 Ohms) measured are indicated in the CH1 parameter display.

The cursor linked to the trace indicates the measurement a specific point on the trace, along with the time of the event.

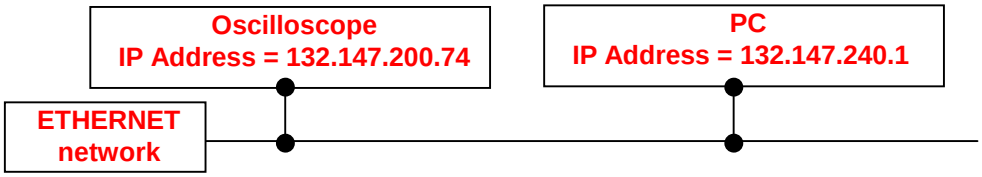
☝ *The value measured which is displayed in the CH1 parameter display remains active after the analysis period has ended.*

Applications (cont.)

ETHERNET network application examples

a) File transfer from a PC via the network

The files in the oscilloscope's "File Management" menu (see §. "Util" Menu) can be downloaded onto a PC (or uploaded from a PC) via an ETHERNET network.



- Use a suitable ETHERNET cable to link the oscilloscope to the network.
- Open the oscilloscope's "Network" menu.
- Enter the IP address manually or automatically using the icon "provided by a DHCP server" (if the server is accessible).
- Then validate the information by choosing **OK**.

- ✍ *Example*: *132.147.200.74*

- Use a PC connected to this network.
- In your browser, type in the URL zone: ftp://132.147.200.74
  A list of the files is then displayed.
- You can use your browser to:

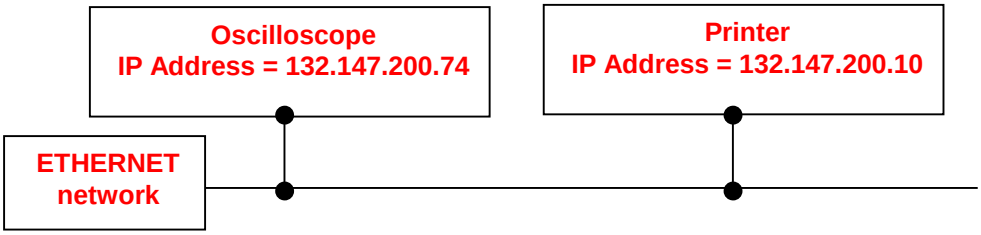
  - copy files (PC → Scope or Scope → PC),
  - delete files,
  - rename files.

☝ *The SX-METRO software (option) simplifies file transfer via the* ETHERNET *network*.

Applications (cont.)

b) Hard copy of the screen on a network printer

Screen copying can be initiated on a network printer.



- Use a suitable ETHERNET cable to link the oscilloscope to the network.
- Open the oscilloscope's "Network" menu.
- Enter the IP address manually or automatically using the icon "provided by a DHCP server" (if the server is accessible).

  ✍ *Example: 132.147.200.74*
- Enter the IP address of the network printer using the table of usable numbers after selecting the zone to be modified.

  ✍ *Example: 132.147.200.74*
- Specify the name of the required printer *(✍ Example: LaserJet 4)*

  ☝ *To find out the IP address of the server or the name of the printer, contact the network administrator responsible for your IT installation.*
- Then validate the information by choosing **OK**.
- Open the "Hardcopy" menu (See §. “Util” Menu) of the oscilloscope.
- According to the printer connected to the network, select the print format or type of printer.
- Validate the colour or black/white option.
- Validate the Network option of the port menu.
- Configure the oscilloscope so that it displays the screen as you wish to print it.

Start the required print operation by pressing the key *opposite*.

Applications (cont.)

WEB Server

Minimum PC Configuration: ***Pentium II, 200 MHz, 64 Mb. RAM. Screen resolution: > 1152 x 864 pixels***

Install JVM SUN (minimum version J2RE 1.4.2) from site //java.sun.com

Recommended browsers: Internet Explorer 6.0 or Netscape 6.0

Screens obtained on PC logged on to same network as the instrument.

In the examples that follow, the IP address of the oscilloscope is: 14.3.250.46 (programmed in the UTIL menu → Config I/O Port → Network).

Connection to WEB SERVER

Connection is done from a PC by using INTERNET EXPLORER.

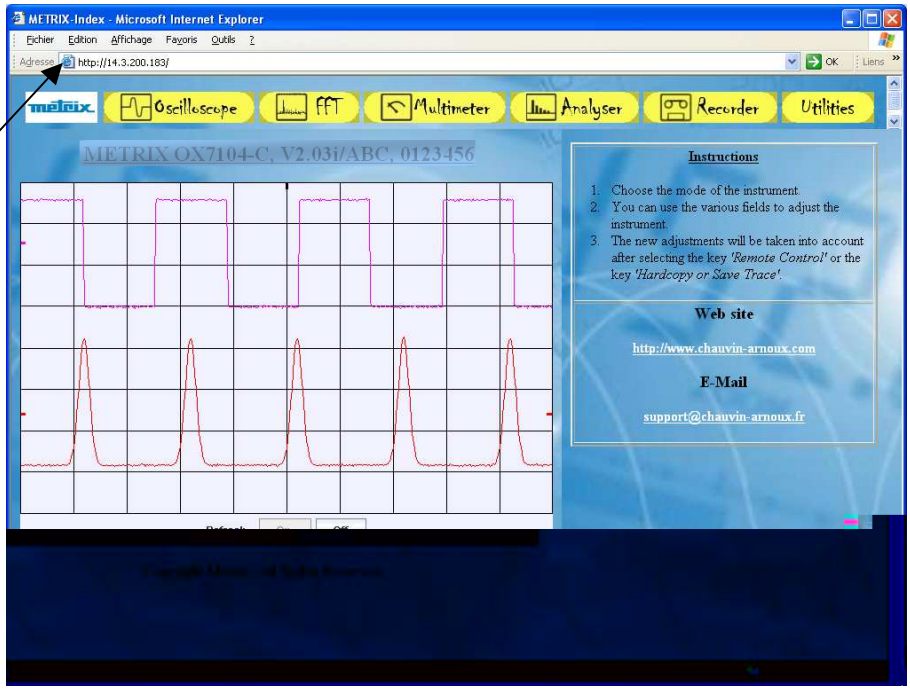
To reach the Web-server, register in the bar of address:

'http://IP Address' of the instrument.

The IP address of the instrument is defined in the following menu:

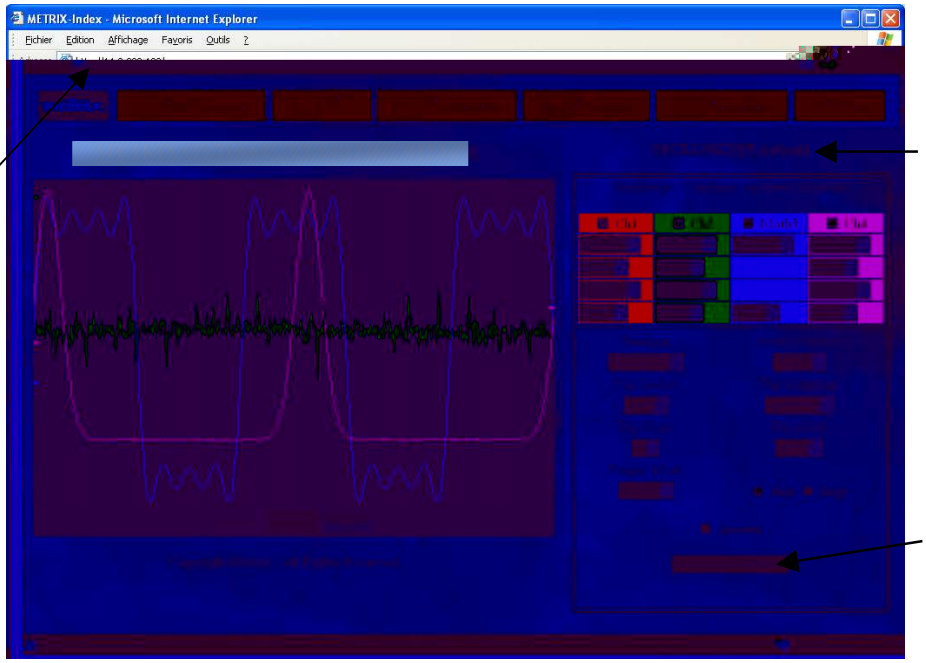
UTIL→ Config I/O Port → Network. See p. 56.

IP Address of instrument: see p. 56.



Applications (cont.)

"OSCILLOSCOPE" mode

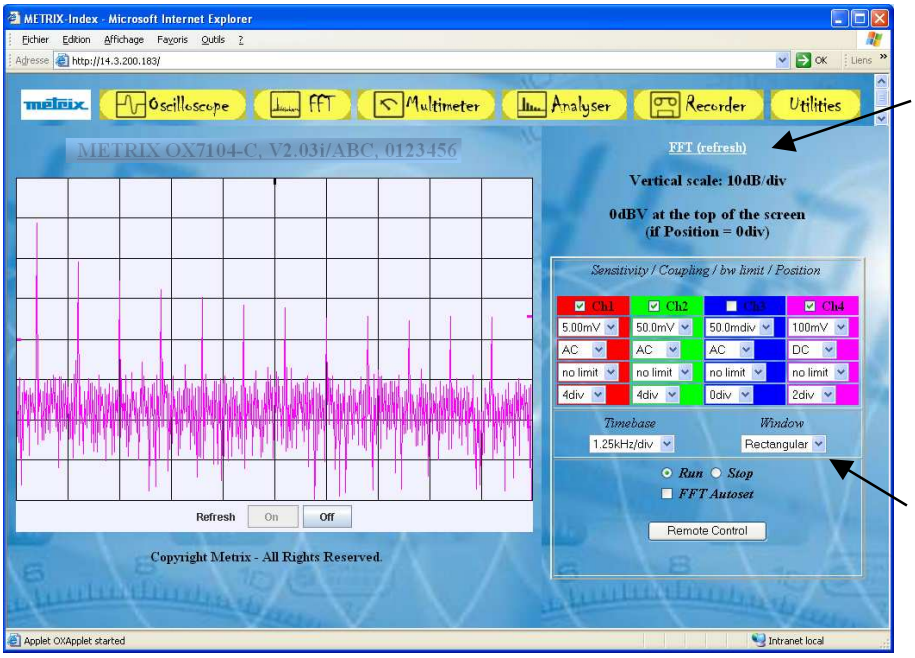


IP Address of instrument: see p. 56

One click on window title triggers refreshing

Window adjustments integrated after a click on "Remote Control".

"FFT" mode

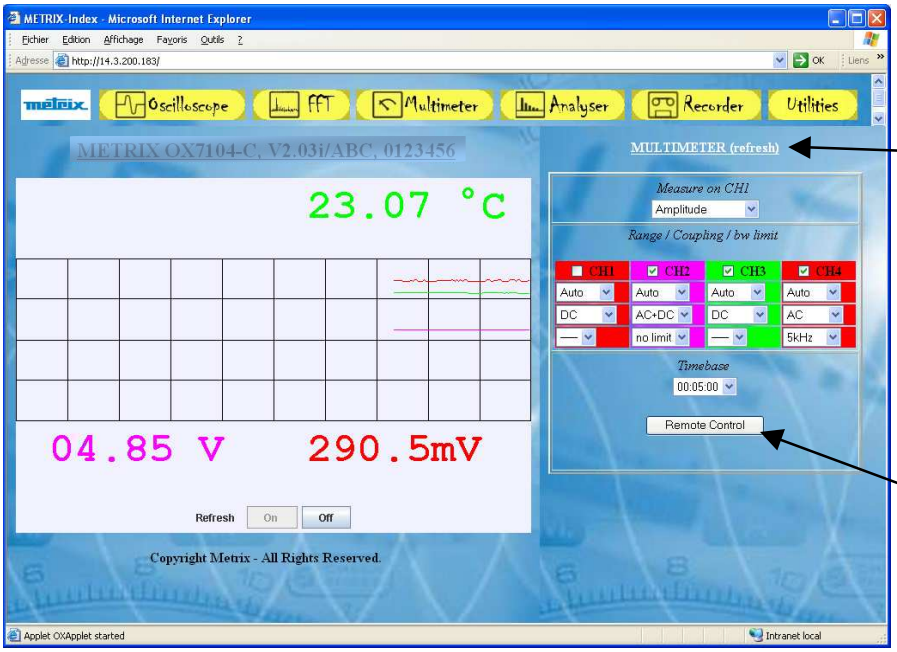


One click on window title triggers refreshing.

Window adjustments integrated after a click on "Remote Control".

Applications (cont.)

"MULTIMETER" mode, OX 6062 and OX 6152 only



One click on window title triggers refreshing.

Window adjustments integrated after a click on "Remote Control".

"UTILITIES"

File name used in the request (hardcopy or save trace)

Display of FTP window, indicating files on virtual disk of instrument. See screen below.

The selection button determines the action:
- launching of screen copy or
- save trace.

Technical Specifications « Oscilloscope » Function

Only the values assigned with a tolerance or limits are guaranteed values (after half an hour warming up). The given specifications apply in the reference area. Values without a tolerance are for information only.

Vertical deviation

Characteristics	OX 6062	OX 6152	OX 6202
Number of **channels**	2 channels: CH1 & CH4		
Vertical **ranges**	2.5 mV to 100 V/div. *Variation in steps (no continuous variable coefficient)*		
BW at - 3dB on all vertical ranges from 5 mV to 100 V/div.	**60 MHz**	**150 MHz**	**200 MHz**
BW at - 3 dB on range 2,5 mV/div.	**60 MHz**	**100 MHz**	**150 MHz**
	Measured on load 50 Ω with a signal of amplitude 6 div. for ranges 2,5 mV/div to 5 V/div. [1]		
Max. input **voltage**	400 VDC, 300 Vrms, 450 Vpk (DC + peak AC at 1 kHz) without 1/10 probe derating -20 dB/decade from 100 kHz to 150 MHz		
Input Type	metallic BNC connected to ground		
Vertical **offset** dynamic	± 10 divisions on all ranges		
Input coupling	AC: 10 Hz to 60 MHz DC: 0 to 60 MHz GND: reference	AC: 10 Hz to 150 MHz DC: 0 to 150 MHz GND: reference	AC: 10 Hz to 200 MHz DC: 0 to 200 MHz GND: reference
Bandwidth limit	15 MHz, 1.5 MHz, 5 kHz		
Rise time[2]	≈ 5.8 ns	≈ 2.34 ns	≈ 1.75 ns
Cross-talk between channels	DC at 60 MHz > 40 dB	DC at 150 MHz ≥ 40 dB	DC at 200 MHz ≥ 40 dB
	☝ *Same sensitivity on both channels*		
Peak-to-peak gain **accuracy**[2]	± 2 % (with averaging of 4) at 1 kHz		
Vertical **resolution** of the display	± 0.4 % of full scale (without ZOOM) 0.1 % in ZOOM mode (10 bits)		
DC vertical measurement **accuracy**[2] with offset and with averaging of 16	± [2,2 % (reading) + 11 % (sensitivity) + 250 µV] applies to : Vmin, Vmax, Vlow, Vhigh, Vavg, curs(1), curs(2)		
AC vertical measurement **accuracy**[2] without offset in 1 kHz and with averaging of 16	± [2 % (reading) + 10 % (sensitivity) + 250 µV] applies to : Vamp, Vrms, Overshoot +, Overshoot -		
Accuracy[2] of vertical offset with averaging of 16	± [0.2 % (reading) + 10 % (sensitivity) + 250 µV]		
Resolution of the measurements	10 bits		
Vertical **ZOOM** function on acquired or saved curve	ZOOM factors: 16 max.		
Electrical **safety** (accessories not)	300 V, CAT II, cl. 1		
Input **impedance**	1 MΩ ± 1 % approx. 15 pF		1 MΩ ± 1 % approx.12 pF
Display modes	ch1, ch4		

[1] *Beyond 5 V/div. range the bandwidth is guaranteed by the respect of the rising time.*

[2] *Specification given for 5 mV/div. to 100 V/div. ranges. Reduced specification for 2.5 mV/div. range.*

Technical Specifications (cont'd)
« Oscilloscope » Function

Horizontal deflection (time base)

Characteristics	OX 6062	OX 6152	OX 6202
Time base ranges	35 ranges, from 1 ns to 200 s/div.		
Time base accuracy	± 0.1 %		
Sampling rate	1 GS/sec. in real time 50 GS/sec. with repetitive signal		
Time measurement accuracy	± [(0.02 div.) x (time/div.) + 0.01 x reading + 1 ns]		
Horizontal **ZOOM**	The horizontal ZOOM factors available range from x 1 to x 10 acc. to seq. 1-2-5 (in ZOOM mode, the same sequence of time base ranges is used as in normal mode). *N.B.: The oscilloscope has a memory capacity for recording of 2,500 counts per channel. Display at screen is 500 counts for 10 divisions.*		
XY Mode	The bandwidth in X and Y is identical		
Phase **error**	< 3° ☝ In XY mode, at each instant t: The smallest time increment between two successive XY points is given by the real acquisition frequency of the oscilloscope. XY mode representation therefore depends on the selected time-base range.		
Bandwidth in X and Y	60 MHz	150 MHz	200 MHz
Representation Fast Fourier Transform	temporal or frequential (FFT) • calculation on the traces present in the screen area • dynamic refreshment as a function of the signal observed in RUN mode • windowing: rectangle, Hamming, Hanning, Blackman • scales: logarithmic or linear • automatic adjustment with autoset function		

Technical Specifications (cont'd)
« Oscilloscope » Function

Trigger circuit

Characteristics	OX 6062	OX 6152	OX 6202
Trigger **sources**	CH1, CH4, EXT, line		
Trigger **mode**	Automatic Triggered Single shot Auto Level 50 %		
Trigger **sensitivity**	DC : 0.6 div. from DC at 10 MHz 1.5 div. from 10 MHz at 60 MHz	DC : 0.6 div. from DC at 10 MHz 1.5 div. from 10 MHz at 150 MHz	DC : 0.6 div. from DC at 10 MHz 1.5 div. from 10 MHz at 200 MHz
Trigger **coupling** without bandwidth limit	AC : 10 Hz at 60 MHz HF Reject : 0 at 10 kHz BF Reject : 10 kHz at 60 MHz	AC : 10 Hz at 150 MHz HF Reject : 0 at 10 kHz BF Reject : 10 kHz at 150 MHz	AC : 10 Hz at 200 MHz HF Reject : 0 at 10 kHz BF Reject : 10 kHz at 200 MHz
Trigger **gradient**	Falling or rising		
Noise **rejection**	≈ ± 1,5 div.		
Trigger **level** Variation range	± 8 div.		
Trigger **type**	on edge		
	on pulse width < t > t from 20 ns to 20 s		
	TV on CH1 only: - Selection of line number and polarity, with 525 lines (PAL) and 625 lines (SECAM), even or odd line field - TV trigger sensitivity: > 1 div.		
Pre-Trigger	Adjustable from 0 to 100 %		
HOLDOFF	Adjustable from 160 ns to 30 sec.		
TRIG-EXT			
↳ Trigger **sensitivity**	EXT: 100 mV p. to p. from DC to 1 MHz 150 mV p. to p. from 1 MHz to 100 MHz EXT / 5 : 500 mV p. to p. from DC to 1 MHz 750 mV p. to p. from 1 MHz to 100 MHz		
↳ Trigger **level** Variation range	EXT : ± 800 mV EXT / 5 : ± 4 V		
↳ Input **impedance**	1 MΩ ± 1%		
↳ **Safety** (access. not)	300 V Cat. II - Class 1		

Trigger in mode LINE is carried out by collecting the ambient electric field at 50 Hz (or 60 Hz).

For a correct operation, the ambient electric field should not be disturbed by signals of raised level, close to 50-60 Hz frequency.

Technical Specifications (cont'd)
« Oscilloscope » Function

Acquisition chain

Characteristics	Specifications	Comments
ADC **Resolution**	10 bits	1 converter per channel
Maximum sampling **rate**	1 GS/sec. in real time	

Sampling **modes:**

Technical Specifications (cont'd)
« Oscilloscope » Function

Processing of measurements

Mathematical functions	Equation editor (functions on the channels or simulated) Addition, subtraction, multiplication, division and complex functions between channels.
Automatic measurements	**Time measurements**: up time, down time, positive pulse, negative pulse, cyclic ratio, period, frequency, phase, counting **Level measurements**: DC voltage, RMS voltage, peak-to-peak voltage, amplitude, max. voltage, min voltage, high plateau, low plateau, overshoot summation
Resolution of the measurements	10 bits / display on 4 digits
Measurements by cursors or automatic measurements	
↳ DC vertical measurement accuracy [3] with offset and averaging of 16	± [2,2 % (reading) + 11 % (sensitivity) + 250 µV] applies to : Vmin., Vmax., Vlow, Vhigh, Vavg., curs(1), curs(2)
↳ AC vertical measurement accuracy [3] without offset in 1 kHz and averaging of 16	± [2 % (reading) + 1 % (sensitivity)] applies to : Vamp, Veff, overshoot $^{+}$, overshoot $^{-}$
↳ Vertical offset accuracy [3] with averaging of 16	± [0.2 % (reading) + 10 % (sensitivity) + 250 µV]
↳ Accuracy of 2-cursor time measurements	± [0.02 x (t/div.) + 0.01 % (reading) + 1 ns] The cursors are attached to the trace, but they can be detached to perform a measurement between channels (offset, delay ...) In XY mode, the cursors are not attached to the trace.

[3] Specification given for 5 mV/div. to 100 V/div. ranges. Reduced specification for 2.5 mV/div. range.

Technical Specifications (cont'd)
« Oscilloscope » Function

Display

Characteristics	OX 6062-M	OX 6062-C - OX 6152-C - OX 6202-C
Display **screen**	LCD 5.7 STN Monochrome	LCD 5.7 STN Colour
	CCFL back-lighting	
Contrast	Continuous adjustment	
Resolution	1/4 VGA, i.e. 320 pixels horizontally x 240 pixels vertically	
Screen saver	Delay can be selected in the Tool Menu → Configuration 15 ‘, 30’, 1h or none	
Window displayed in **normal** mode	Complete memory: 2500	
Horizontal **ZOOM**	500 counts out of the 2500 of the whole memory	
Display modes		
Vector	Acquired points, interpolated points, averaging The acquired points are attached by a segment.	
Envelope	Min. and max. on each horizontal screen position are displayed.	
Averaging	Range of factors: none, 2, 4, 16, 64	
Graticule	Complete Borders	
Indications on screen		
Triggering	Trigger level position (with overshoot indicator) Position of the Trigger point on the bargraph and on the top edge of the screen (with overshoot indicators)	
Traces	Trace identifiers, activation of the traces Position, Sensitivity Ground reference High and low overshoot indicators if traces are off screen	

Miscellaneous

1/10 probe calibration **signal**	Form: rectangular Amplitude: ≈ 0 - 3 V Frequency: ≈ 1 kHz
Autoset	
Search time	< 5 s
Frequency range	> 30 Hz
Amplitude range	15 mVpp to 400 Vpp
Cyclic ratio limits	20 to 80 %

☝ *All the versions of this instrument are equipped with the clock and calendar functions.*

Technical Specifications (cont'd)
« Oscilloscope Mode »

Communication interfaces

***RS232C** link configuration*	Selection of speed in Bauds 300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200 Parity selection None, even, odd Word length selection 8 bits or 7 bits Stop bit number selection 1 or 2 stop bits Protocol selection Hard (for RTS and CTS lines) Soft (for XON and XOFF characters) None (no protocol)
***ETHERNET** Interface*	Type 10BASE-T (Twisted Pair) Lead Interface scope / RJ 45 8-count Standard IEEE 802.3
***RS232** / **ETHERNET** Interface Connector*	Location: right-hand side of the instrument with: 1 RS232C interface cable *(HX0042)* 1 twisted ETHERNET interface cable *(HX0040) option* 1 straight ETHERNET interface cable *(HX0039) option*

Remote programming of the instrument by a PC

	Programming of the instrument via the RS232C or ETHERNET interface with SCPI commands IP protocol available on ETHERNET: FTP server, TELNET, HTTP server, LPD client, DHCP client.
☞	*Refer to the remote programming manual for the list of commands.*

Technical Specifications « Multimeter » Function, *OX 6062* and *OX 6152* only.

Only the values assigned with a tolerance or limits are guaranteed values (after half an hour warming up). The percentage of measuring accuracies refers to the measured value. Values without a tolerance are for information only.

Resistance measurement	***On Channel 1***
Ranges (end of scale)	**Ohmmeter**

Technical Specifications (cont'd)
« Multimeter » Function

Capacitance measurement

On Channel 1

Ranges	**Capacimeter**	**Resolution**	**Measuring current**
	5 mF	1 µF	500 µA
	500 µF	0.1 µF	500 µA
	50 µF	0.01 µF	500 µA
	5 µF	1 nF	500 µA
	500 nF	100 pF	5 µA
	50 nF	10 pF	5 µA
	5 nF	1 pF	500 nA

Accuracy ± 2 % + 10 UR from 10 % to 100 % of scale

Cancellation of series and parallel Rs Parallel R > 10 k
Use cords as short as possible.

Frequency measurement

40 Hz to 198 kHz on a square and sinus signal
Accuracy : 0.1 %

Multimeter operating modes

Selection of modes via menu, with touch-sensitive screen

Relative mode

Monitoring (statistics) MAX and MIN values for all measurements

Frequency Possible display of frequency in AC mode

The modes Relative
Monitoring
Frequency are exclusive

Digital display rate 2 measurements per second

Measurement log Measurement display = f (time)
default window of 5 min (adjustable from 5 min to 31 days)

RUN Initiation of the measurements

HOLD Freezing of the measurement

Display

In numeric form Principal measurement → large-size display
Secondary measurement → small-size display
The touch-sensitive screen allows you to select the secondary measurement via a menu.

Graphic trace History of the measurements over time
Objective: Presentation of the measurements as an amplitude histogram.

Warning !

Error Messages

If one of those codes (or the addition of several codes) is present when getting started : → a default has been detected.
In this case, contact your closest distributor (See §. Maintenance).
Autotest : Error n°0001 : Micro Problem
Autotest : Error n°0002 : Flash Problem
Autotest : Error n°0004 : RAM Problem
Autotest : Error n°0008 : FPGA Problem
Autotest : Error n°0010 : Numerisation problem on c hannel 1
Autotest : Error n°0080 : Numerisation problem on c hannel 4
Autotest : Error n°0100 : Analog problem on channe l 1
Autotest : Error n°0800 : Analog problem on channe l 4
Autotest : Error n°1000 : Problem on ETHERNET link

General specifications

Environment

- Reference temperature 18℃ to 28℃
- Operating temperature 0℃ to 40℃
- Storage temperature -20℃ to +60℃
- Utilization indoors
- Altitude < 2000 m
- Relative humidity < 80 % up to 31℃

Power supply

- **External power supply**

Mains voltage	100 V to 240 V ± 10 %
Frequency	from 47 to 63 Hz
Consumption	< 20 A

Screen saver

(automatic stand-by)	adjustable by menu : 15', 30', 1h, none
Automatic stop	adjustable by menu : 30', 1h, 4h, 24h

CE

Safety

As per IEC 61010-1 (2001):

- Isolation class 1, earth grounded
- Pollution level 2
- "Measurement" input overvoltage category CAT II, 300 V

EMC

This instrument conforms the EMC NF EN 61326-1, 07/97+A1, 10/98 norm :

- Emission
  A class instrument
  A single spectral line corresponding to the clock frequency of the processor (60 to 75 MHz) might exceed the requirement by less than 10 dBµV/m.
- Immunity
  Influence magnitude:
  - ➢ 2 div. in the presence of a 3 V/m electromagnetic field (class B)
  - ➢ 3 div. in the presence of a 10 V/m electromagnetic field. (class A)

Mechanical Specifications

Casing

- Dimensions 215 mm x 190 mm x 225 mm
- Weight 1,2 kg

Packaging

- Dimensions 345 mm x 275 mm x 200 mm

Supply

Accessories

delivered with the instrument

- User's manual on CD-ROM
- Remote programming on CD-ROM
- 2 1/10 probes, according to model ..... *(OX 6062)* ***HX0210***
  (OX 6152, OX 6202) ***HX0220***
- Serial link RS232 ..... ***HX0042***

delivered optionally

- RS232 /SUBD 9-pin lead ***HX0042***
- Straight ETHERNET / RJ45 lead ***HX0039***
- Twisted ETHERNET / RJ45 lead ***HX0040***
- Adapter RS232 / CENTRONICS ***HX0041***
- Adapter DB9M/DB25F ***P01101815***