Digital Oscilloscopes

mtx 3252e-C

Two-channel, 60 MHz, Ethernet, Color, Smart Persistence

mtx3352e-C

Two-channel, 100 MHz, Ethernet, Color, Smart Persistence

Operating Instructions

Test et Mesure CHAUVIN-ARNOUX
6, avenue du Pré de Challes
F - 74940 ANNECY-LE-VIEUX
Tel. +33 (0)4.50.64.22.22
Fax +33 (0)4.50.64.22.00

CA UK Ltd.
Waldeck House
Waldeck Road
GB - Maidenhead SL6 8BR

X03043A00 - Ed. 02 - 06/10

Contents

Firmware update : You may use PC software provided on the CD-ROM and consult Internet site www.chauvin-arnoux.com. The software update involves a rebootstrrapping of the filesystem : all the saved files are erased and lost.

General Instructions

Introduction

You have just acquired a two-channel digital **oscilloscope with "SPO" analog persistence display,** 60 MHz or 100 MHz, ETHERNET.

It can also features a « **harmonic analyser** » (option) mode and a « **recorder** » mode (option).

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

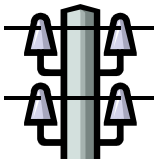
This instrument conforms to safety standard NF EN 61010-1 (2001), single insulation, relative to electronic measurement instruments.
To obtain optimum service, read these instructions with care and comply with the precautions for use.

Failure to comply with these warnings and/or user instructions is liable to cause damage to the equipment. This could be dangerous to the user.

Precautions and safety measures

- This instrument has been designed for use:
  - indoors,
  - in a pollution degree 2 environment,
  - at an altitude of less than 2000 m,
  - at a temperature included between 0°C and 40°C
  - with relative humidity of less than 80 % at up to 31°C.
- It can be used for measurements on circuits at 300 V CAT II, relative to ground and can be supplied by a 240 V CAT II network.

definition of measurement categories



CAT I : Measurement category I is for measurements performed on circuits not directly connected to mains.
E.g.: protected electronic circuits

CAT II : Measurement category II is for measurements performed on circuits directly connected to the low voltage installation.
E.g.: power supply to domestic appliances and portable tools.

CAT III : Measurement category III is for measurements performed in the building installation
E.g.: machine or industrial apparatus power supply.

CAT IV : Measurement category IV is for measurements performed at the source of the low-voltage installation.
E.g.: energy inputs

before use

- Comply with environment storage conditions.
- Make sure that the three-wire phase/neutral/ground power supply cord supplied with the unit is in suitable condition. It conforms to standard NF EN 61010-1 (2001) and must be connected to the instrument on the one hand, and to the network on the other (variation from 100 to 240 VAC).

during use

- Read carefully all the notes preceded by the symbol ⚠ .
- Connect the instrument to an outlet with a ground pin.
- The instrument power supply has automatically reset electric protection operating after the fault has been eliminated.
- Be sure not to obstruct the aeration points.
- As a safety measure, use only suitable cords and accessories supplied with the instrument or type approved by the manufacturer.
- When the instrument is connected to the measurement circuits, never touch an unused terminal.

General Instructions *(cont'd)*

Symbols used

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

Guarantee

This equipment is guaranteed against any material defect or manufacturing faults, in conformity with the general conditions of sale.

During this period, the equipment may only be repaired by the manufacturer. He reserves the right to carry out repair or replacement of all or part of the equipment.

If the equipment is returned to the manufacturer, forward transport is at the expense of the customer.

The guarantee does not apply in the event of:

- unsuitable use of the equipment or by association with incompatible equipment
- modification of the equipment without the explicit authorization of the manufacturer technical services
- operation by a person not approved by the manufacturer
- adaptation to a specific application not provided for in the equipment definition or in the operating instructions
- impact, fall or flooding.

Maintenance and metrological checking

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

Any **adjustment, maintenance or repair** of the *energized* equipment shall only be undertaken by qualified personnel, after referring to the instructions given in this document.

A **qualified person** is a person who is familiar with the installation, construction, use and the hazards that exist. This person is authorized to start up and shut down the installation and equipment in conformity with the safety rules.

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

Unpacking and repacking

All the equipment has been checked mechanically and electrically before shipping.

On reception, carry out a quick check to detect any damage caused by transport. If necessary, contact our commercial department immediately and make all legal reservations with the carrier.

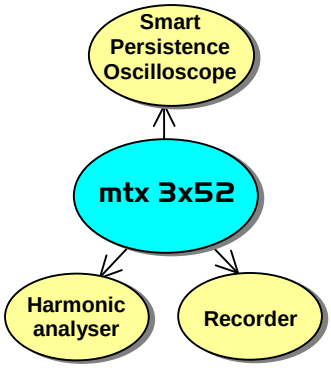
In the event of reshipping, it is preferable to use the original package. Indicate as clearly as possible, by a note attached to the equipment, the reasons for the return.

Servicing

- 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 instrument

Presentation



This instrument has the particularity of grouping together **3** units in **1** :

- a **Digital Oscilloscope** incorporating the
  FFT *(Fast Fourier Transform)* function and
  SPO *(Analog Persistence Display)*

intended to analyze the signals appearing in the electronics and electrotechnical fields

- a **Harmonic Analyser** (option) mode for breaking down four signals simultaneously while representing their fundamental and their first 31 harmonics
- a **Recorder** mode (option) intended for the capture of single or slow signals.

The instrument works at a constant **acquisition depth** of 50,000 points.
Memory management is organized from a system of files “Windows ®” like.

A large-size colour LCD **screen** displays the applied signals, together with all the adjustment parameters.

The main control functions are accessible directly from the front panel.
The adjustment parameters can be modified using the thumbwheel.

A **graphic interface** is similar to that of the PC and is used for:

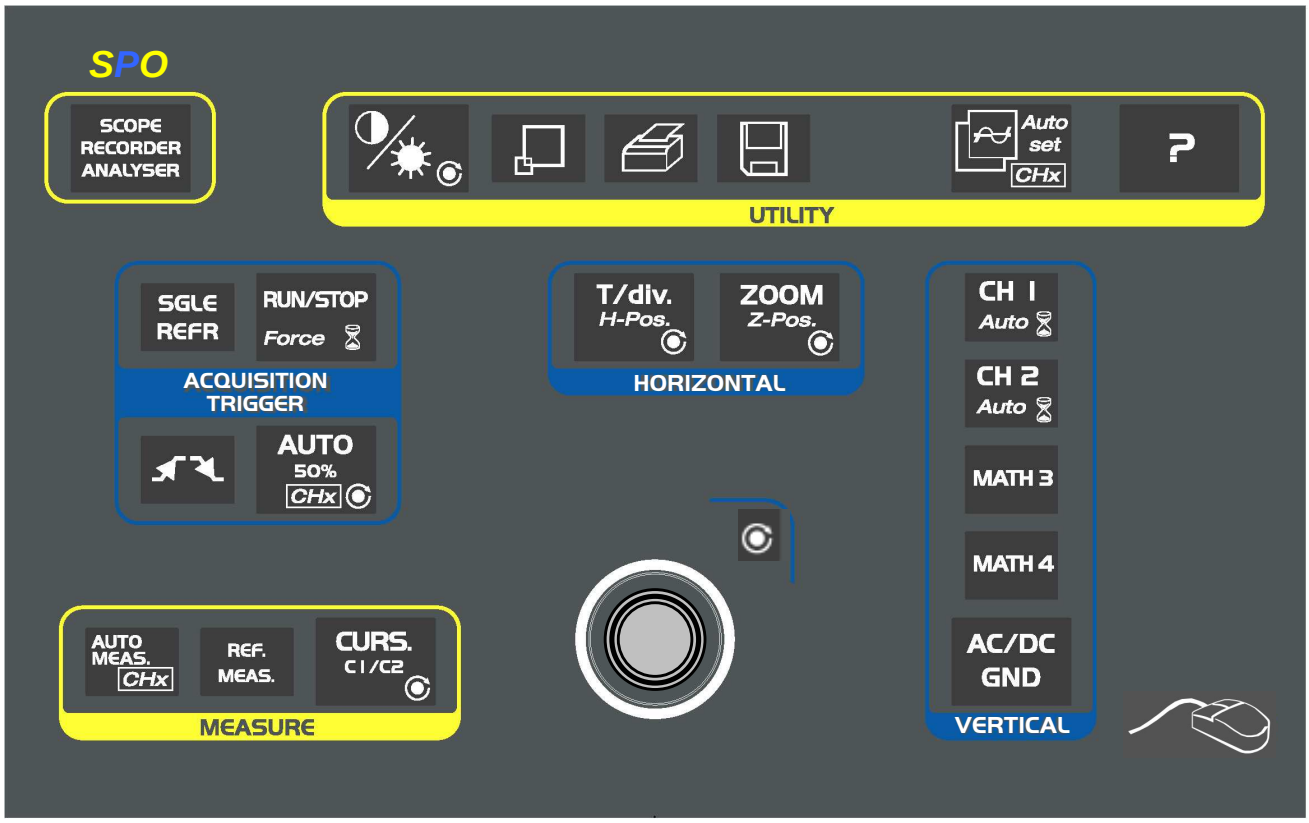
- using the mouse to select the functions proposed by the pull-down menus
- acting directly on objects (traces, cursors, etc.) displayed on the screen.

The adjustment parameters can thus be modified by a variety of means.
This instrument is completed by RS232/CENTRONICS, ETHERNET and USB to RS232 interfaces as standard.

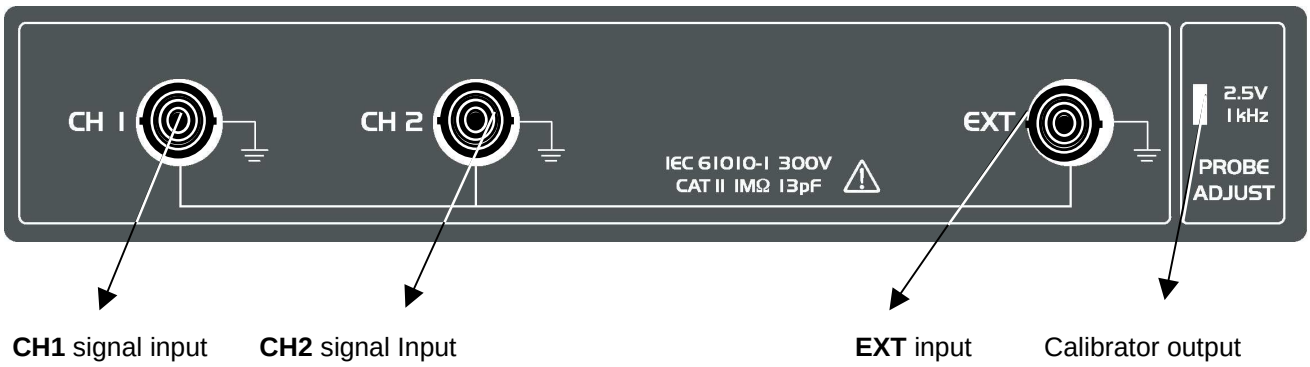
Overall view

Description of instrument *(cont'd)*

Front panel (illustration)



Measurement terminal block



CH1 signal input **CH2** signal Input **EXT** input Calibrator output

Description of instrument *(cont'd)*

Rear panel

USB connector
USB to RS232
interface

ETHERNET RJ45
connector

SUBD 25- pin female
connector
for RS232/CENTRONICS
interfaces

6-pin MiniDin
connector
PS/2 mouse

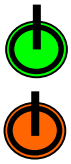
Mains plug

Description of instrument *(cont'd)*

Front panel (description)

The main features of the equipment can be obtained from the front panel. They can also be modified directly by the mouse or using the menu toolbar.

1 startup / standby button



activates:

- startup (green LED) when pressed briefly.
- Setting the oscilloscope to standby (red LED) by a long press (> 3 s). The files and the configuration are saved.

☝ *If a menu is open when the key is pressed, the backup is performed, but no message is displayed.*

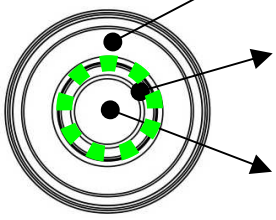
1 mouse / 2 keys

connected to the back of the oscilloscope (PS/2 connector) used for:
selection of menus,
function validation,
movement of symbols appearing on LCD screen.

- The menus appearing at the top of the screen and the submenus selected by the mouse pointer open and are validated by the left key.
- The menus in the trace display zone
  in the control zone
  in the status zone
  are opened with the right mouse key.
- The mouse can be used for moving:
  symbols appearing in the main display zone:
  trigger position, cursor position, display trace reference
  symbols appearing in the bargraph:
  trigger position, zoomed area cursor position

  Position the mouse pointer on the symbol to be moved, holding the left key of the mouse down during the movement to the desired position.
- Zooming in the display zone is possible using the mouse:
  hold the left key down when defining the zone with the pointer (cannot be activated in "SPO" analog persistence display

1 rotary control button



- The outer wheel of this encoder is used for incrementing or decrementing the selected setting (by rotation).
- The LED comes on when adjustment is possible using the wheel. After 20 seconds without action on the wheel, the LED goes out and the function is no longer active.
- While the LED is on, pressing the central part of the encoder (**TOGGLE key**) will toggle the adjustment of the main function to the secondary function of the key.

The symbol  appears on the keys concerned (except for the key opposite which has no secondary function.).

21 fleeting action keys

giving direct access to the more basic functions.

Description of instrument *(cont'd)*

Preparation for use

Instructions before startup

Before initial startup:

- Connect the mouse to the PS/2 connector at the back of the unit.
- Check the power supply cord which will be connected to the back of the unit and to the grounded mains is in good condition.

- When on, the LED shown opposite verifies that the mains voltage is applied to the oscilloscope.

Error messages

Refer to §. Technical Specifications p. 139.

Mains voltage

The oscilloscope power supply is designed for:

- a mains voltage from 90 VAC to 264 VAC (use nominal range 100 VAC and 240 VAC)
- a frequency included between 47 Hz and 63 Hz.

Fuse

The unit is protected by a fuse:

- Fuse range: T, 2,5 A, 250 V, 5 x 20 mm

This protection fuse must only be replaced by an identical model.

Replacement may only be performed by **qualified personnel**.

Contact your closest distributor.

Startup

The pushbutton starts up the oscilloscope (the LED becomes green after loading).

A long press (> 3 seconds) switches the equipment to standby (the LED becomes red).

When the unit is powered up, the last memorized configuration is restored.

At initial startup, the default configuration parameters are applied.

Never disconnect the instrument from the network while the message "System shutdown. Please wait before switch off power !" is displayed on the screen, otherwise the current file and all the files saved beforehand will be lost.

LCD contrast

This key is used for adjusting the LCD contrast. Adjustment is by the thumbwheel as long as the LED associated with it is on.

LCD brightness

The « TOGGLE » key on the thumbwheel is used for switching from LCD contrast adjustment to brightness adjustment (and vice versa).

Description of instrument *(cont'd)*

ETHERNET network

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, 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.

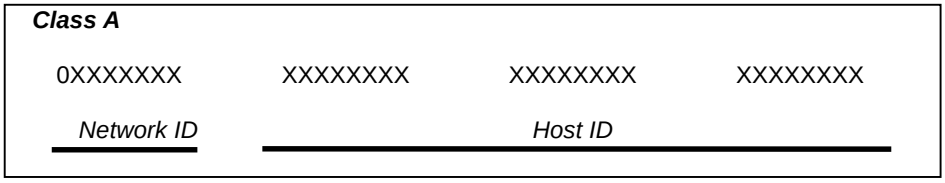
Unlike the physical address, the IP address can be modified by the user.

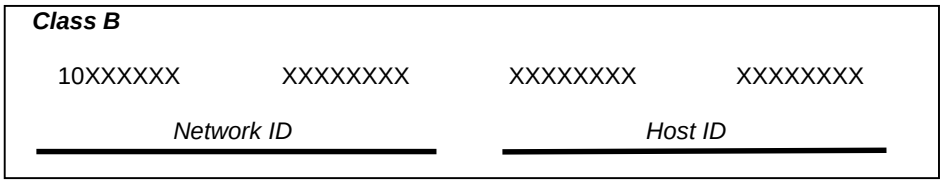
You must ensure that the IP address is unique on your network. If an address is duplicated, network operation becomes random.

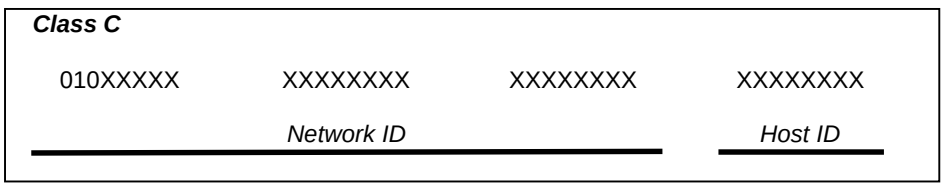
The IP address is made up of two parts:

- 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 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. 126, 132.

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. 128.

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 downloaded 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. 127.

Oscilloscope Mode

Keys

Pressing this key will configure the instrument in the following modes:
« **oscilloscope** »,
« harmonic analyser » (option),
« recorder » (option).

4 «UTILITY» keys

used for access to the LCD **contrast** adjustment using the thumbwheel.

The LED combined with the thumbwheel comes on → adjustment is accessible.

The thumbwheel **TOGGLE** key is used for switching the key assignment from contrast adjustment to LCD **brightness**.

Pressing causes switchover from normal display mode to "**full screen**" display mode (and vice versa).

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

Only permanent adjustments and measurements will remain.

☝ *Attention* *In «**SPO Oscilloscope** » mode, this key has no action : when pressing this key the following message is displayed : « **Not possible in this mode** ».*

launches a **hardcopy** depending on the configuration produced in the « Util » and « Hardcopy » menus.

A second press before the process end will interrupt current printing.

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

The «  » symbol is displayed in front of the display zone of the last selected element when printing is underway.

The first press will freeze the traces on the screen. They will be displayed in plain language as a reference to be compared with further acquisition.
A second press will erase them: the latter will then be lost.

☝
- *Traces will be saved only in the « Memory → Trace → Save » menu.*
- *The reference memory will be accompanied by a reference Nr.*

☝ *Attention* *In «**SPO Oscilloscope** » mode, this key has no action : when pressing this key the following message is displayed : « **Not possible in this mode** ».*

1 «AUTOSET» key

used on channels to which a signal is applied to obtain optimum automatic adjustment (**General Autoset**) of coupling, vertical sensitivity, time base, slope, framing and trigger.

The lowest frequency signal is used as a triggering source.

If no trace is detected at the inputs, the autoset will be aborted.

Selective«AUTOSET»

with


Simultaneously pressing with the ***CHx*** key (ch1 or ch2) will assign the corresponding channel as trigger source, initiating an autoset which will take this selection into consideration.

The CHx channel becomes active for adjustments by means of **AC/DC/GND** key.

1 HELP key

activating or deactivating **help** on the keys.

Whenever a keyboard key is pressed, on-line help will be displayed for the depressed key (except for the key **?**). The functions associated with the keys will not be started up.

On-line help can also be deactivated with the mouse (icon at top right).
The keyboard then resumes normal operation.

Oscilloscope Mode *(cont'd)*

2 «ACQUISITION» keys

SGLE REFR

by successive pressing, select one of the following acquisition modes:

Single mode → Single
Trigger mode → Trig'd
Automatic mode → Auto

« SINGLE » mode:

A single acquisition is triggered by pressing the **RUN STOP** key.

For any further acquisition, the triggering circuit must be reset by pressing the **RUN STOP** key.

«TRIGGER » mode:

The screen content is only refreshed in the presence of a triggering event related to signals appearing at the oscilloscope (ch1, ch2, ch3, ch4 or mains).

☝ *If there is no triggering event linked with the signals appearing at the inputs (or if there is no signal at the inputs), the trace is not refreshed.*

«AUTOMATIC » mode:

The screen content is refreshed even if the triggering level is not detected on the signals appearing at the inputs.

☝ *In the presence of a triggering event, screen refreshing is managed as in the « Triggered » mode.*

RUN/STOP Force

- allows starting or stopping of acquisition in « TRIGGER » and « AUTOMATIC » mode.
- resets the triggering circuit in the «Single» mode.
- A long press forces the trigger (**Force TRIG**).

Acquisition is initiated according to the conditions defined by the acquisition mode (**SGLE REFR** key).

Acquisition status is indicated in the status zone:

RUN = started **READY** = wait **STOP** = stopped
PRETRIG = before trigger **POSTRIG** = after trigger

2 «TRIGGER» keys

selects the trigger slope (positive or negative) by successive pressing.
The slope is indicated in the status zone.

AUTO 50% CHx

sets the trigger level to the average value of the signal (50%) without modifying the trigger coupling.

The thumbwheel is assigned to adjusting the trigger level.

Combined pressing with the ***CHx*** key launches the same function, but previously sets the corresponding channel as triggering source.

☞ *No functions are associated with the* **TOGGLE** *key of the thumbwheel.*

☝ *Attention* *In «**SPO Oscilloscope** » mode, this key has no action : when pressing this key the following message is displayed : « **Not possible in this mode** ».*

Oscilloscope Mode *(cont'd)*

3 « MEASUREMENT » **keys**

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

Combined pressing with the ***CHx*** key displays the measurements on the corresponding channel.

When the automatic measurement window is active, the left mouse button is used for selecting at most 2 measurements that will appear in the status zone at the bottom of the screen.

used for selecting (successive pressing) among the displayed traces, the **reference trace** for the automatic and manual measurements.

Appears in the « Measurement » → Reference menu.

activates or deactivates the **cursor** displays for manual measurements.

The LED combined with the thumbwheel comes on: the latter allows cursor 1 to be moved horizontally over the screen.

The thumbwheel **TOGGLE** key is used for moving from the cursor 1 to cursor 2 horizontal movements and vice versa.

- The **dt** measurements made (time difference between the two cursors) and the **dv** measurement (voltage deviation between the two cursors) are reported in the status zone.
- The selected cursor position is entered into the active adjustment zone.

2 «HORIZONTAL» keys

adjusts the time base coefficient (T/div.) by thumbwheel or the horizontal position (H-Pos.) by the thumbwheel **TOGGLE** key.

The LED associated with the wheel lights up → the selected adjustment is possible with this device.

The H-Pos. adjustment modifies the horizontal (time-related) position of the trigger point.

activates or deactivates the « Zoom » function.

The LED associated with the wheel lights up: the thumbwheel is assigned to the horizontal zoom coefficient adjustment.

Pressing the thumbwheel **TOGGLE** key makes it possible to change from the horizontal zoom coefficient setting to Z-Pos. horizontal movement in the zoomed zone.

A zone can be zoomed by tracing a rectangle around the zone to be enlarged using the left mouse button. The sensitivity, time base and horizontal and vertical alignment values are recalculated automatically.

☝ *If no zones to be zoomed are selected with the mouse, a simple horizontal zoom by default will be performed with respect to the screen center.*

Oscilloscope Mode *(cont'd)*

Definition :

Validated channel = Display enable (trace displayed after RUN)
Displayed channel = Validated channel and trace on screen
Selected channel = Parameter settings enabled for this channel via the opposite key.

AC/DC GND

5 «VERTICAL» keys

CH 1 Auto | CH 2 Auto | MATH 3 | MATH 4

Before pressing one of the four keys:	**Press** on	**After** pressing one of the 4 keys:
The channel concerned is not displayed.	CH 1 Auto CH 2 Auto MATH 3 MATH 4	The channel is displayed and is selected. The thumbwheel is assigned to sensitivity adjustment.
The channel concerned is displayed, but not selected.		
The channel concerned is displayed and selected.		

Double pressing one of those keys devalidates (erases) the concerned signal.

☝ *In « **SPO mode** », the math functions are not authorized. In this case, the MATH {3 , 4} keys validate or devalidate the M {3 , 4} memory channels.*

Pressing one of these 2 keys for a long time generates a **vertical autoset**:

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

Each press gives access, through the thumbweel, to the adjustment of the **sensitivity** (V/div.) of the last selected channel.

By pressing the **TOGGLE**, you switch from the sensitivity adjustment to the **vertical position** adjustment (*V-Pos.)*.

When the LED of the thumbwheel lights on means that you may adjust with the thumbwheel.

AC/DC GND used for selecting, by successive pressing, **input coupling** « AC », « DC » or « GND » for the last channel selected.

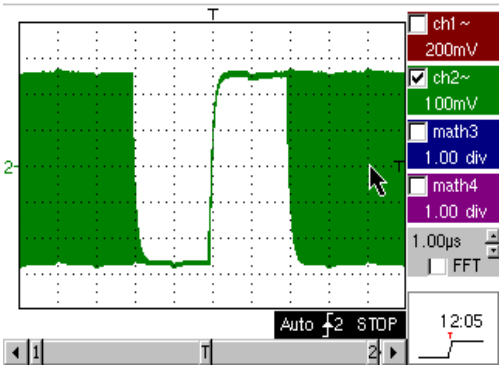
Coupling is indicated in the channel parameters zone:

AC : ∿, DC : ⎓ ground : ⏚

Oscilloscope Mode *(cont'd)*

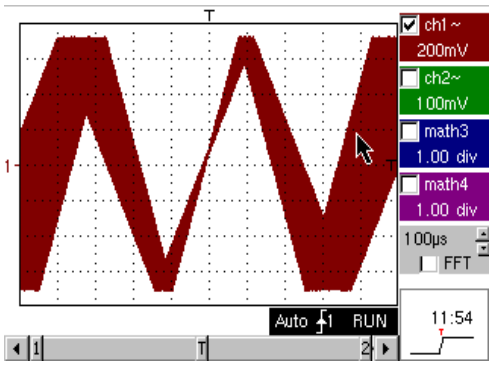
Display

in oscilloscope mode



View serial bus Data in envelope mode.

In this mode, the absence of accumulation of successive acquisitions and multi-colour display does not show infrequent signals. All points displayed at the same colour and intensity.

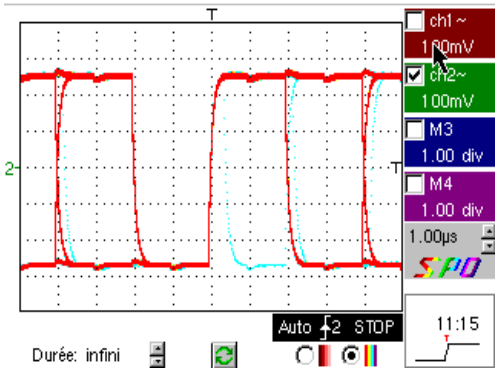


Displays a warbled triangular signal

The modulation amplitude in Envelope mode may be seen on the screen. All points displayed at the same colour and intensity.

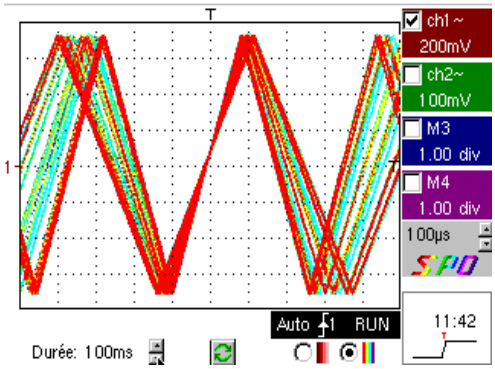
in SPO Persistence mode

See chapter IV, p. 67.



Displays serial bus Data.

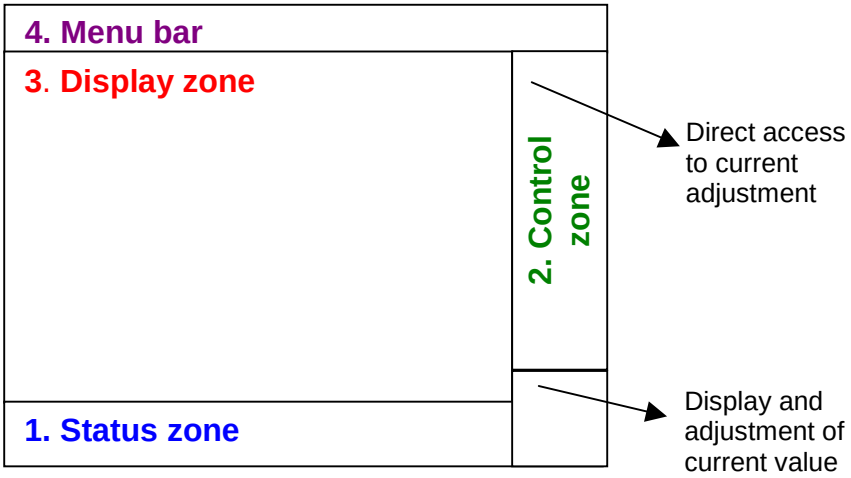
In "Persistence SPO" display, successive acquisitions are accumulated and the multi-coloured view visually represents the frequency with which points (traces) appear, infrequent signals in "blue", and the more frequent signals in "red".



In "Persistence SPO" view, a warbled triangular signal is displayed: the modulation amplitude can be viewed on the screen. The colour of traces varies according to their frequency of appearance (red corresponds to high appearance frequencies and blue to low).

Composition

The oscilloscope display is divided into 4 functional zones.

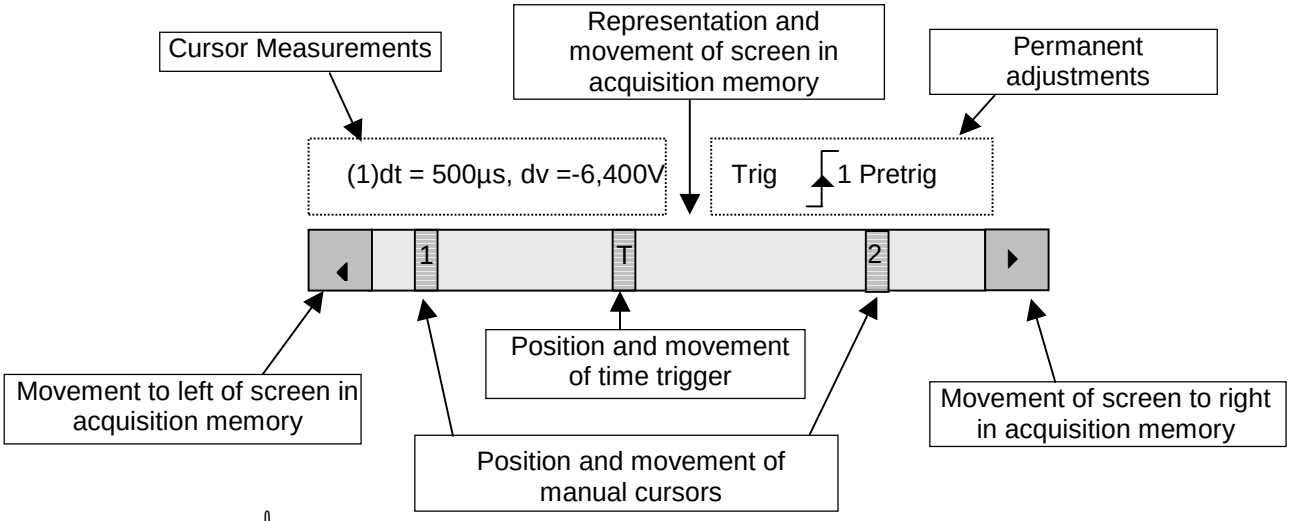


Oscilloscope Mode *(cont'd)*

1. Status zone Three types of general information appear in this zone:

- the **bargraph** represents the screen position, that of the trigger and the cursors in the acquisition memory
- permanent instrument settings
- measurements when the cursors are on the screen or the trigger type

Bargraph



Each bargraph element can be moved via the mouse left button.

Permanent settings This zone refers to the triggering status (mode, front, source, current status).

Example : AUTO 1 STOP

When the cursor of the mouse is placed over this information, the right mouse button will open the "Trigger parameters" menu.

Cursor measurements This zone refers either to:

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

  (*Example* : (1)dt = 500,0 µs, dv = -6,400 V)
- phase measurement in the case of manual phase measurement (Ph)

  (*Example* : (1)Ph = 130.0°)
- automatic measurements selected by the "Automatic measurements" or "Phase measurement" menu.

  (*Example* : (1)F = 1.000kHz, Vpp = 15.00 V)

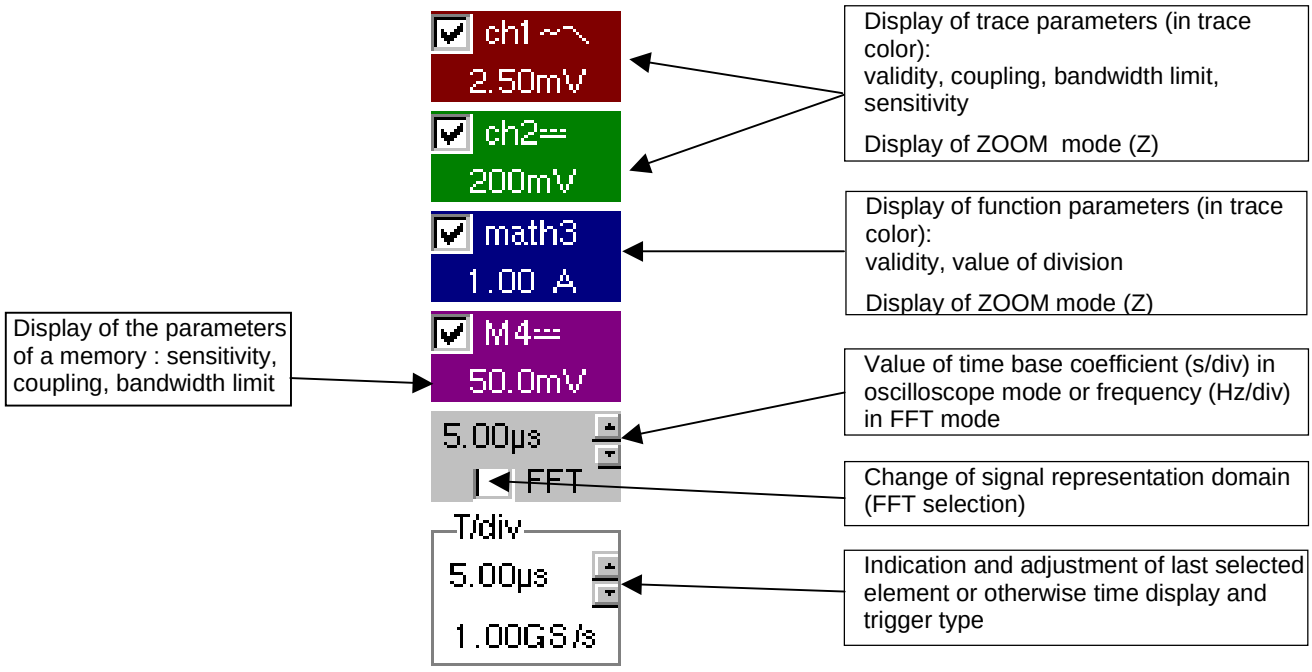
Oscilloscope Mode *(cont'd)*

2. Control zone The parameters displayed in this zone are:

- The parameters of each channel and trace: display,
  sensitivity,
  coupling,
  bandwidth limit,
  vertical scale,
  function,
  zoom.

FFT

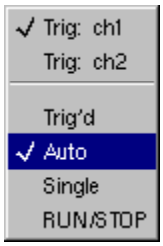
- The time base value and the loading of the signal representation domain
- The indication and the active adjustment of the last selected element:
  - trigger level, trigger type
  - trigger time position
  - channel offset value
  - X & Y position of cursor
  - time display, if no setting has been selected
  - symbol of current printing ….



- ***In SPO mode, the FFT is not available. The SPO logo is displayed.***
- *The mouse left key validates the channels and the functions.*
- *The « ✓ » symbol indicates whether a channel or function has been selected, or whether the FFT mode has been selected.*
- *The adjustments of the time base (or frequency) and the value of the active parameter can be made with the UP/DOWN button alongside the current value display using the mouse key button.*
- *After a change to the time base, the corresponding sampling frequency is entered into the adjustment zone.*
- *When the mouse is placed over the parameters of a channel or time base value, the right mouse button opens the associated menus directly.*
  - *Sensitivity/Coupling and Vertical scale, for channels and functions*
  - *Source, trigger mode and RUN/STOP, for the time base*

Oscilloscope Mode *(cont'd)*

The « Source » and « Trigger mode » menus are grouped together and can be opened using the right mouse button by placing the pointer over the time base zone.



RUN/STOP is used for starting and stopping acquisition from this menu. The acquisition status is indicated in the screen status.

- *The symbol « ✓ » indicates the source and selected trigger mode*
- *The trigger source selectable from this menu is limited to the channels (ch1 or ch2).*

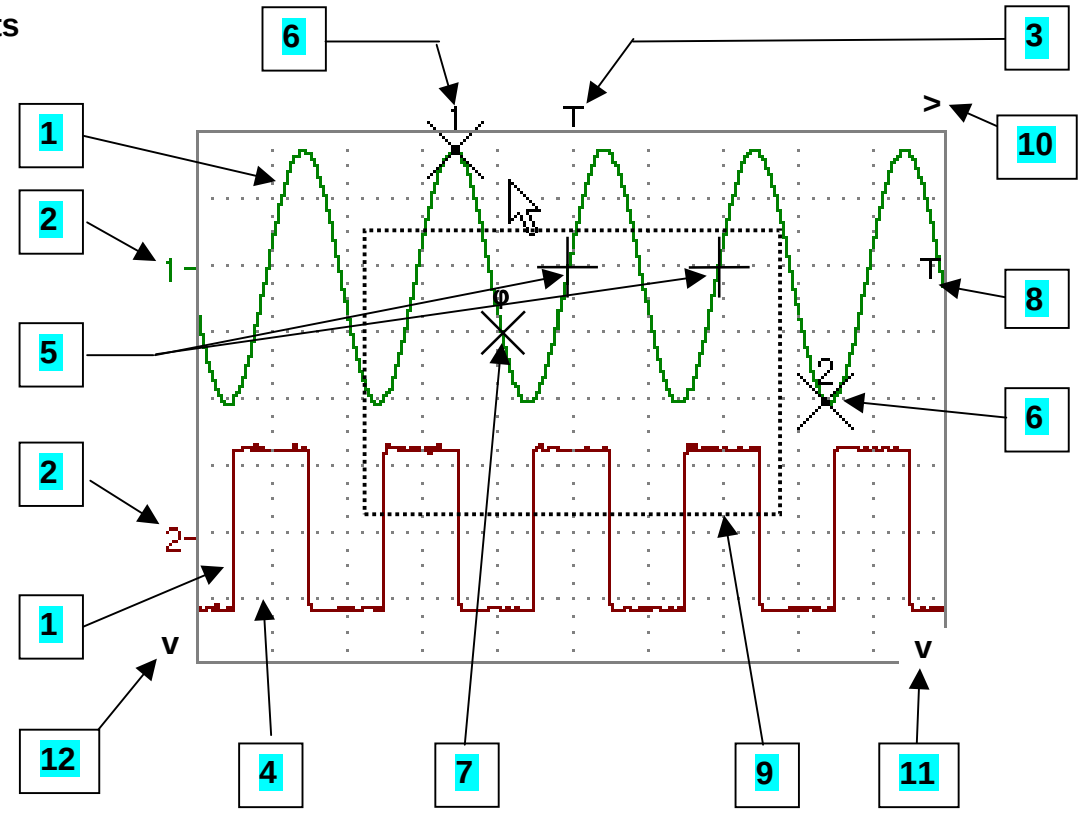
3. Display zone

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

- a trigger time position indicator
- a trigger level indicator
- a vertical position indicator for the reference level of each trace
- cursor position indicators linked with the curve for automatic measurements
- cursor position indicators linked or not linked with the curve for manual measurements
- the selection of a zoom zone

Oscilloscope Mode *(cont'd)*

Display elements

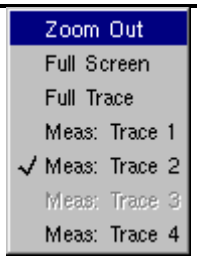


Definition of display

Items	Elements
1	**Trace** displayed
2	Indication of displayed trace **reference** level vertical position
3	Indication of **time-related** position of trigger
4	**Graticule** division
5	**Automatic** measurement **cursor** position indicator
6	**Manual** measurement **cursor** position indicator
7	**Phase** measurement **cursor** position indicator
8	**Trigger** level position indicator
9	**Zoom** zone selection *(not available in SPO)*
10	**Time** position output indicator of trigger outside displayed window *(in SPO the trigger is limited to the view zone)*
11	**Trigger** level position output indicator outside displayed window.
12	**Channel level** output indicator outside displayed window

Oscilloscope Mode *(cont'd)*

Menu accessible from display zone



When the mouse pointer is placed in the display zone, the right key gives direct access to a display menu.

The « Full Screen » and « Zoom out » options are directly accessible (see the Display menu). The same applies to the selection of the automatic and manual measurement reference signal (see Measurement menu).

The « ✓ » symbol indicates that the display is in the « Full Screen » or "Full Trace" mode
(if present) and gives the reference trace for automatic and manual measurements.

How to zoom

Zooming in the display zone is possible using a mouse, holding the left mouse key down when the zone is selected by the pointer.

☝ *Attention*

The zoom function is not available in SPO.

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

- The « z » symbol appears in the parameter display of the signals and the time base.
- The zoomed section is represented in the bargraph.
- The « Zoom Out » mode (see Display menu) returns to the original display.
- The horizontal zoom value is adjusted to assign a calibrated value to the horizontal scale (zoom factor: x 100 max.)

If the zoom vertical selection is greater than 6 divisions, no vertical zoom will be performed.

How to move the symbols

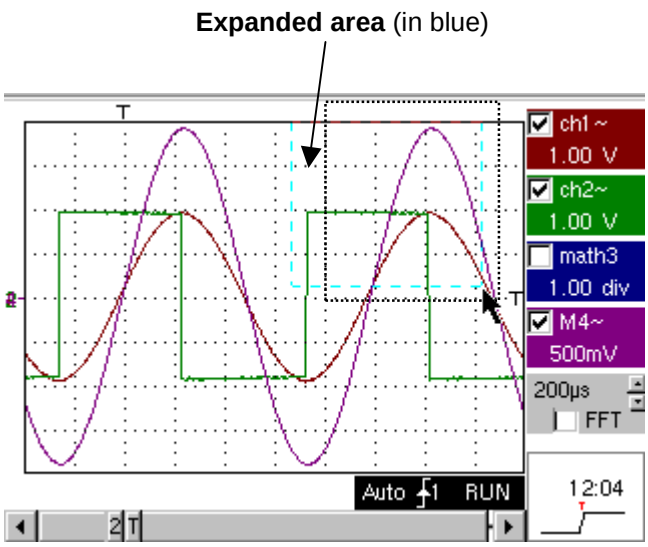
All the symbols appearing in the display zone:
- trigger indicators,
- trace position indicator,
- manual cursor position indicator,
- etc …

can be moved using the left button of the mouse.

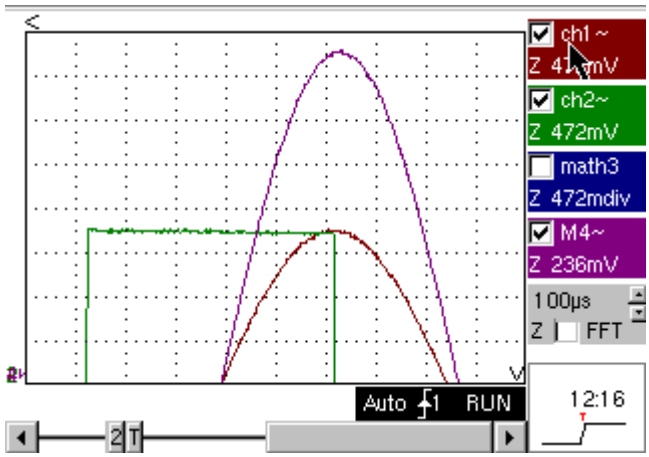
☝ *The new modified symbol value is entered into the current adjustment display zone.*

Oscilloscope Mode *(Cont'd)*

Example of an expanded area



Normal mode screen



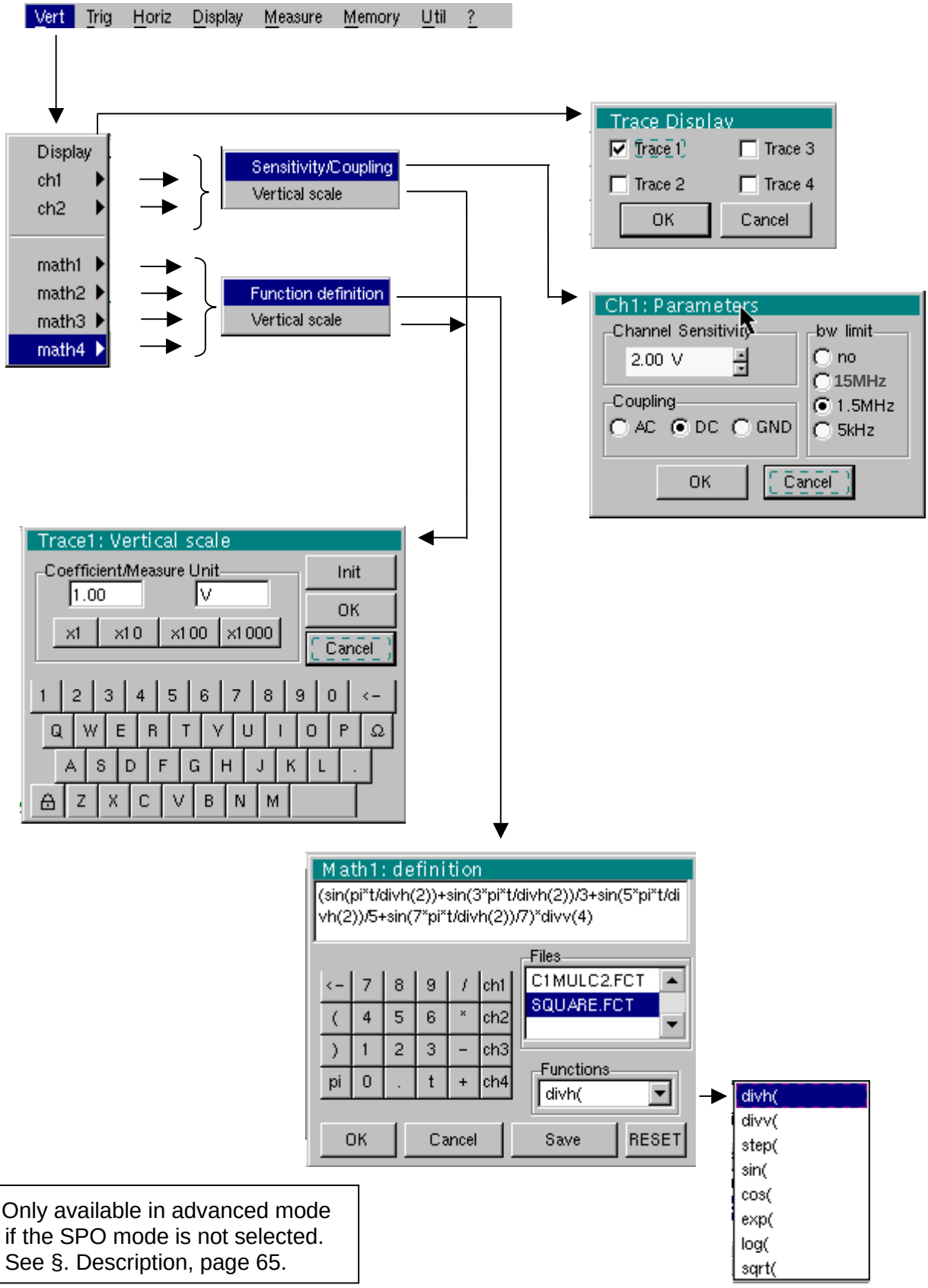
Expanded mode screen

4. Menu bar

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

Oscilloscope Mode *(cont'd)*

The « *VERT* » Menu



(*) Only available in advanced mode if the SPO mode is not selected. See §. Description, page 65.

Oscilloscope Mode *(cont'd)*

Display opens the « Trace display » menu for validating or devalidating the traces.

Validation of selections by « **OK** ». Exit from menu without modification by « **Cancel** ».

☝ *The « ✓ » symbol in front of a trace indicates its validation.*

The traces can be validated or devalidated from the command zone using the left mouse button.

ch1 ch2 modifies independently the ch1 and ch2 parameters and modifies the selected trace vertical scale.

Sensitivity/Coupling modifies the selected channel parameters.

Channel Sensitivity Modifies the sensitivity of the channel using the scroll bar and the left mouse button, adjustable by sequence: from 2.5 mV to 100 V/div.

☝ *Sensitivity is entered into the channel parameter display zone. It takes the « Vertical scale » menu parameters into consideration.*

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

AC : blocks the DC component of the input signal and attenuates the signals lower than 10 Hz.

DC : transmits the DC and AC components of the input signal.

GND : the equipment connects internally the selected channel input to a 0 V reference level.

☝ *The « ⊙ » symbol indicates the selected coupling. Coupling is reported in the modified channel parameter display zone.*

BW limit Limits 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 :* 15 MHz 1.5 MHz 5 kHz

Validation of selections by « **OK** ». Exit from menu without modification by « **Cancel** ».

This menu can also be called by clicking with the right mouse key in the desired channel parameter display zone.

Vertical scale defines the vertical scale of the channel selected from the current adjustments. Reading and direct measurements of the analyzed magnitude and its unit are obtained.

Coefficient assigns a multiplication coefficient to the selected channel sensitivity.

The modification is made using the mouse with the table of usable numbers, having selected the « Coefficient » zone.

The ← key deletes the previous value of the cursor in this zone.

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

☝ *The sensitivity value indicated in the channel parameter display will be modified according to this coefficient.*

Oscilloscope Mode *(cont'd)*

Measure unit modifies the vertical scale unit of the selected channel.

The modification is carried out by the mouse using the table of characters that can be used after selecting the "measure unit" zone.

The ⇦ key is used for deleting the character leading the cursor in this zone. The "*Padlock* 🔒" key can be used to switch between upper-case and lower-case characters.

☝ *The vertical scale unit will be entered into the modified channel parameter display.*

Init re-initializes the multiplication coefficient at 1.00 and returns to a measure unit in Volt.

Validation of selections by **« OK ».** Exit from menu without modification by **« Cancel ».**

This menu can be called by dialogue with the right mouse button in the display of the desired channel parameters (ch1 or ch2).

math1 math2 math3 math4 defines for each trace a mathematical function and the vertical scale.

Menus present only in Advanced mode (see menu « Util », p. 61).

Function definition defines the mathematical function to be assigned to the selected trace.

The function is defined using the usable characters table, and associating the ch1 and ch2 traces.

- *The mathematical function can be defined on 2 lines.*
- *mathx cannot be used in the definition of a function.*

The ⇦ key deletes the character preceding the cursor in the window.

Functions 8 predefined mathematical functions can be linked to the traces :

divh(	("horizontal division")	**cos(**	(« cosine »)
divv(	("vertical division")	**exp(**	(« exponential »)
step(	("step") using "t" (∗)	**log(**	(« logarithmic »)
sin(	("sine")	**sqrt(**	(« square root »)

(∗) t = abscissa of the sample in the 50,000-sample acquisition memory.

☝ *divh(1) is equivalent to 5000 samples (counts) = 1 horizontal div.*

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

CHx + CHy Sensitivity and measuring unit used on CHx

CHx - CHy Sensitivity and measuring unit used on CHx

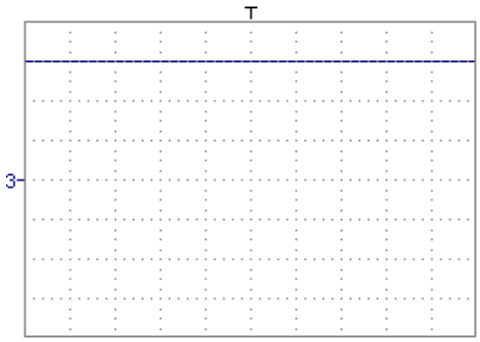
In each cases, the measuring unit can be re-defined and a coefficient can be applied to the measurement results (refer to §. Vertical scale).

Oscilloscope Mode *(cont'd)*

Examples

Use of predefined mathematical functions

- Predefined divv() function used on its own: math3 = divv(3).

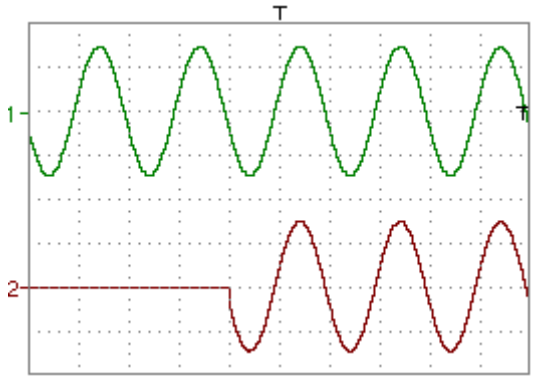


The trace is equal to 3 vertical divisions.

divv(3) = 3 x 32000 LSB = 3 vertical divisions

- Predefined step() function associated with a trace:

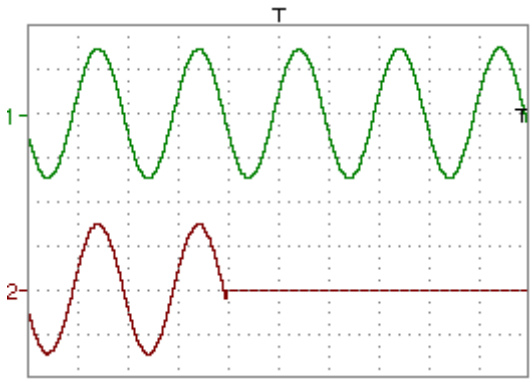
  - math2 = ch1*step(t-divh(4))



math2 is at 0 vertical divisions as long as **t** (time is less than four horizontal divisions).

math2 is equal to ch1 when **t** (time) becomes greater than four horizontal divisions.

- math2 = ch1*step(divh(4)-t)



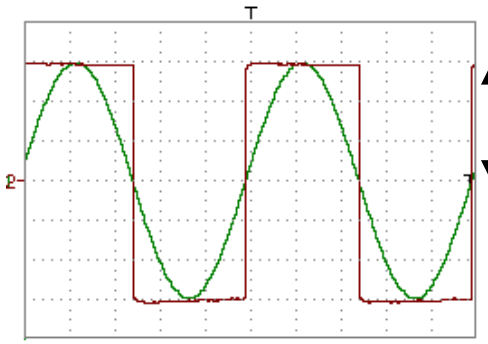
math2 is equal to ch1 as long as **t** (time) is less than four divisions.

math2 is at 0 vertical divisions when **t** (time) becomes greater than four horizontal divisions.

Oscilloscope Mode *(cont'd)*

Example 1

Appropriate use of the operators for display optimisation



Sensitivity: Ch1 = Ch2 = 1 V/div

Vpp: Ch1 = Ch2 = 6 V
Vhigh: Ch1 = Ch2 = 3 V

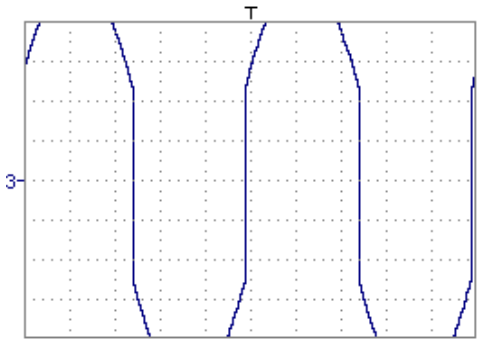
Traces ch1 and ch2 are optimised on 6 vertical divisions.

Vhigh ch1 = 3 vertical divisions => 3 x 32000 LSBs = 96000 LSBs
Vhigh ch2 = 3 vertical divisions => 3 x 32000 LSBs = 96000 LSBs

Note : 1 vertical division = 32000 LSBs

Addition of two traces

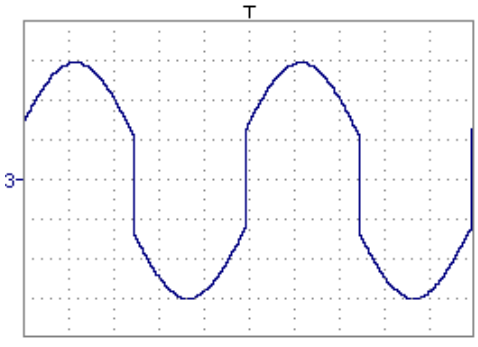
- math3 = ch1+ch2



In this case of trace addition, you can observe a high and low overshoot, division by two is necessary to optimise display of the result.

Vhigh math3 = 6 vertical divisions = 6 x 32000 LSBs =128000 LSBs
> (4 vertical divisions)

- math3 = (ch1 + ch2) / 2



Vertical scale math3 = 1.00 V

Vpp math3 = 6.00 V
Vhaut math3 = 3.00 V

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

Vhigh math3 = 3 vertical divisions = 3 x 32000 LSBs

Note: The results of the automatic Vhigh and Vpp by math 3 must be multiplied by two to be correct.

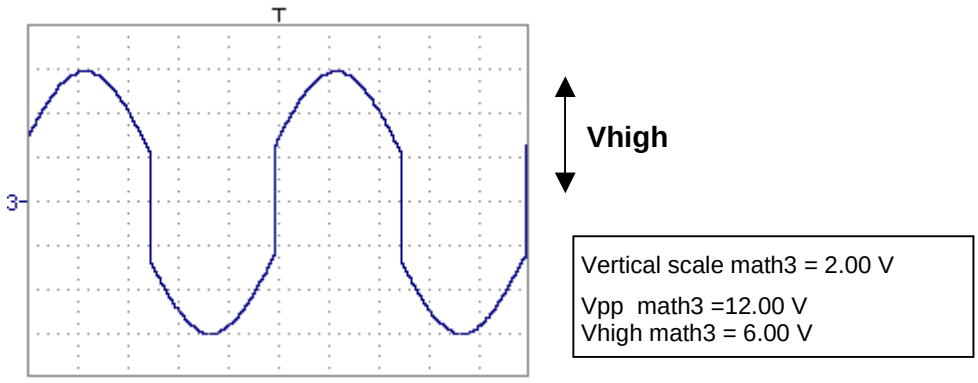
Oscilloscope Mode *(cont'd)*

For immediate interpretation of the results, configure the "Vertical scale" menu of mathx (see §. Opening from math1, math2, math3, math4 p. 35).

In our example:

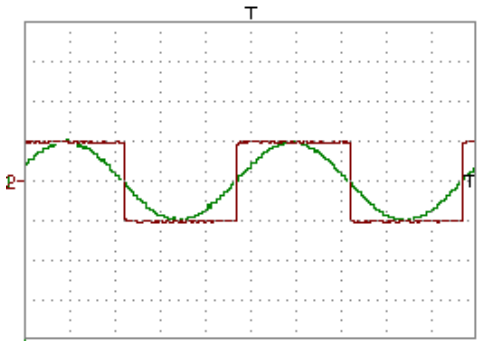
- The sum of ch1 + ch2 is the sum of two values in volts, so the result is expressed in volts.
- The sum of ch1 + ch2 must be divided by 2, so the coefficient of math3 can be replaced with 2 to obtain the automatic measurement results of math3 immediately.
- Then select math3 as the reference for the automatic and manual measurements (see "MEASUREMENT" menu, p. 53).
- Then display the table of 18 measurements made on the math3 trace (see "MEASUREMENT" menu, p. 53).

The measurements displayed are the exact result of the addition of the two traces ch1 + ch2 in the correct unit (Volts).



Oscilloscope Mode *(cont'd)*

Example 2



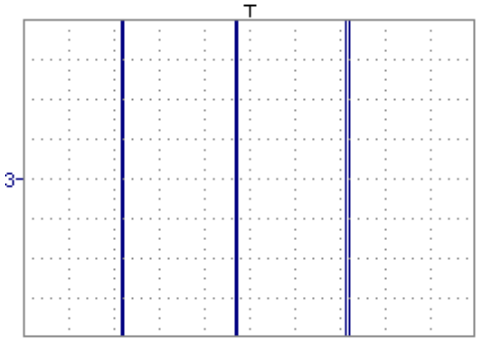
Sensitivity: Ch1 = Ch2 = 5 V/div

Vpp: Ch1 = Ch2 = 10 V
Vhigh: Ch1 = Ch2 = 5 V

Vhigh ch1 = 1 vertical division => 1 x 32000 LSB = 32000 LSBs
Vhigh ch2 = 1 vertical division => 1 x 32000 LSB = 32000 LSBs

Multiplication of two traces

- math3 = ch1*ch2

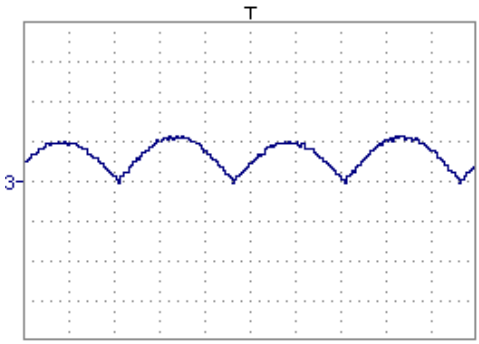


As for the addition of traces, we can observe a much more significant high and low overshoot.

Vhigh math3 = ch1 x ch2 = 1 vertical division x 1 vertical division
= 32000 LSB x 32000 LSB = 1024 10^6 LSB
> (4 vertical divisions = 128000 LSBs)

The function divv (vertical division) is necessary to optimise the display.

- math3 = (ch1*ch2)/divv(1)



Divv(1) can be used to divide by 32,000 (1 vertical division = 32,000 LSBs): the result of the multiplication is translated into divisions on the screen.

Note: If Vpp of ch1 and ch2 had been 8 vertical divisions, the multiplication would have had to be divided by divv(4).

☝ *When mathematical functions associated with traces are used, the dynamics of the result obtained must be verified.*

Correction of the result of the operations by mathematical functions (divv(), divvh(), / …) is recommended to optimise the screen display.

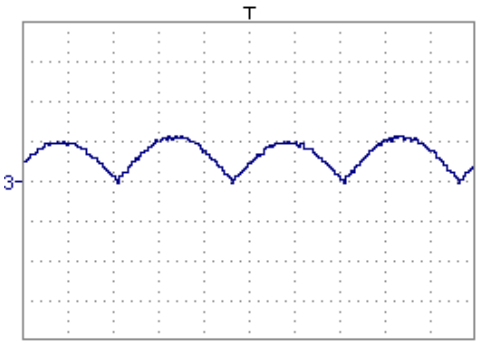
Oscilloscope Mode *(cont'd)*

For immediate interpretation of the results, configure the "Vertical scale" menu of mathx (see §. Opening from math1, math2, math3, math4 p. 35).

In our example:

- The multiplication of ch1 by ch2 is the multiplication of Volts by Volts, so the result is in square volts.
- div of the measurement unit of math3 can be replaced by V2 (Volts).
- A vertical division represents 5 V x 5 V = 25 V2 (vertical sensitivity of ch1 x vertical sensitivity of ch2).
- The coefficient of math3 can be replaced by 25 to obtain the result of the automatic math3 measurements immediately.
- Then select math3 as the reference for the automatic and manual measurements (see "MEASUREMENT" menu).
- Then display the table of 19 measurements made on the math3 trace (see "MEASUREMENT" menu).

The measurements displayed are the result of the multiplication of the two traces ch1 and ch2 in the correct unit (V^2).



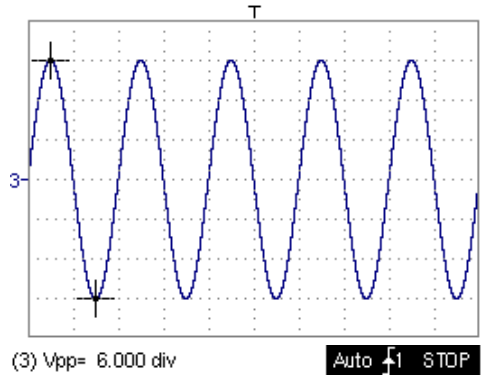
Vertical scale math3 = 25 V2

Vpp math3 =25 V2

Oscilloscope Mode *(cont'd)*

Example 3 - math3 = divv(3)*sin (2*pi*t/10000).

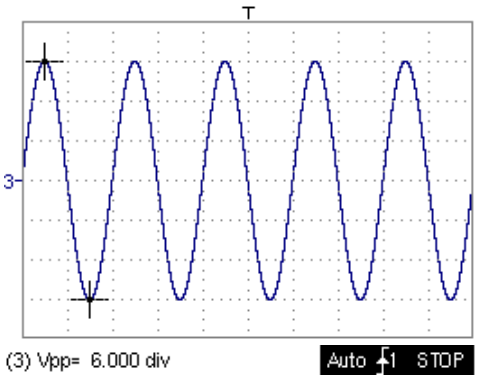
Association of predefined functions



The trace obtained is a sine wave produced using the predefined sin (sine) function, according to its mathematical definition (2 x π x Frequency).
The amplitude is 6 divisions (divv(3) x 2 = 3 x 32000 LSBs x 2).
The period equal to 10,000 samples (2 horizontal divisions) depends on t
time base.

- Same trace produced with the predefined divh function:

  math3 = divv(3)*sin(2*pi*t/divh(2))



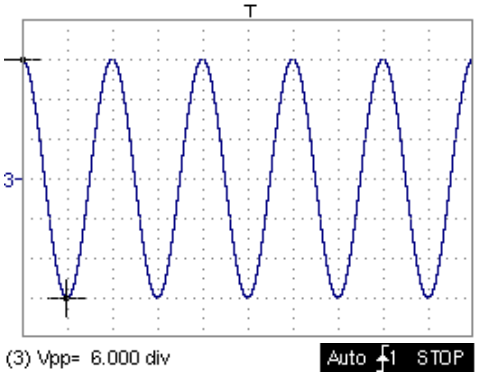
In this example, divh(2) is equivalent to 10,000 samples.

Note: 1 horizontal division = 5,000 samples

The period divh(2) is equal to 10,000 samples (2 horizontal divisions) depends on the time base.

- Production of a sine wave by the predefined cos (cosinus) function:

  math3 = divv(3)*cos(2*pi*t/divh(2))

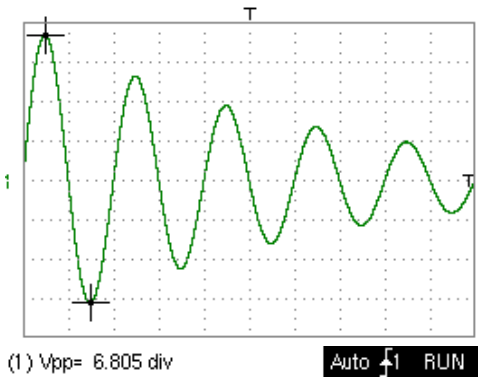


The trace obtained with the predefined cos() function is offset by 90°.

Oscilloscope Mode *(cont'd)*

Production of an attenuated sine wave using predefined functions

math1 = sin (pi*t/divh(1))*exp(-t/divh(6))*divv(4)



sin (pi*t/divh(1)) can be used to modify the number of periods.
exp (-t/divh(6)) can be used to modify the level of attenuation.

exp (-t) represents:

exp(-5000) when you reach the first horizontal division.
exp(-50,000) when you reach the tenth horizontal division.

Oscilloscope Mode *(cont'd)*

Files contains the list of the functions (.FCT) saved by the user, along with two predefined files.

By selecting the name of the function with the left mouse button (function name in blue), you can transfer the definition of the function into the 2 lines provided for that purpose.

The scroll bar can be used to scroll through the list of memorized functions.

The function can be modified with the table of usable characters, associating the ch1 and ch2 traces.

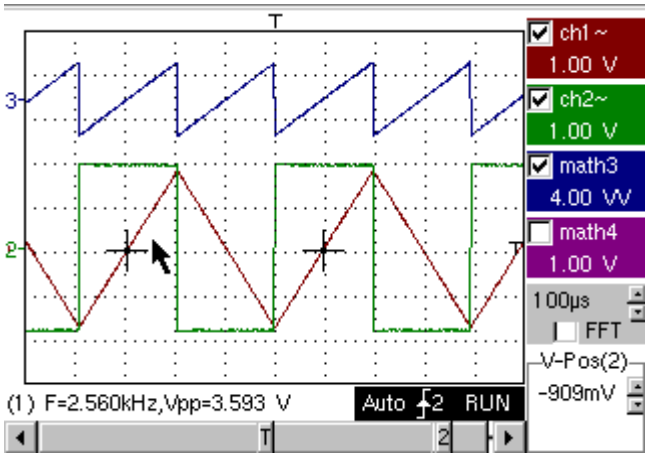
This menu also contains two predefined functions.

C1MULC2.FCT : ch1*ch2/divv(4) is used to calculate the product of 2 traces with rescaling so that the result fits the screen.

The factor divv(4) is used to optimize the display as long as the source signals have sufficient dynamics (> 5 divisions) and no overshooting.

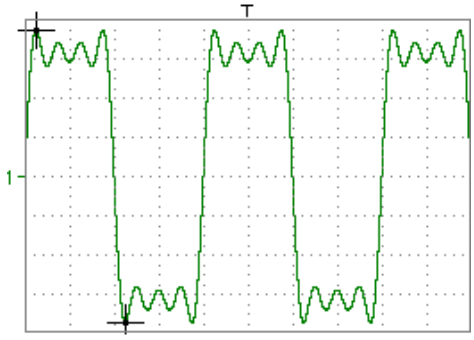
The MATH functions cannot be accessed in SPO mode.

C1MULC2 .FCT function



math3 = ch1*ch2/divv(4) = C1MULC2.FCT

SQUARE.FCT function This is the definition of a square signal using the first 4 harmonics of a Fourier series development.



math3 = SQUARE.FCT

math3 = (sin(pi*t/divh(2)) + sin(3*pi*t/divh(2))/3 + sin(5*pi*t/divh(2))/5 + sin(7*pi*t/divh(2))/7)*divv(4)

Oscilloscope Mode *(cont'd)*

Save backs up the definition of the function by the "File Copy " menu. Extension «.FCT».

Reset completely resets the function definition.

After assigning a function to the ch1 (math1) or ch2 (math2) channels, « mathx » appears in the corresponding channel parameter display zone.

Vertical scale defines the vertical scale of the selected trace.

Calling this menu from math1, math2 is identical to calling ch1, ch2 as long as the functions have not been defined.

Once a function has been defined on mathx, opening the 'vertical scale' menu from math

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

Modification is by using the mouse with the table of numbers that can be used after selecting the coefficient zone.

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

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.

Measure unit modifies the unit of the vertical scale (div) of the selected trace.

Modification is performed by means of the mouse with the table of characters that can be used after selecting the management unit zone.

The ← key deletes the value preceding the cursor in this zone.

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

The vertical scale unit will be entered into the modified trace parameter display (3 characters max).

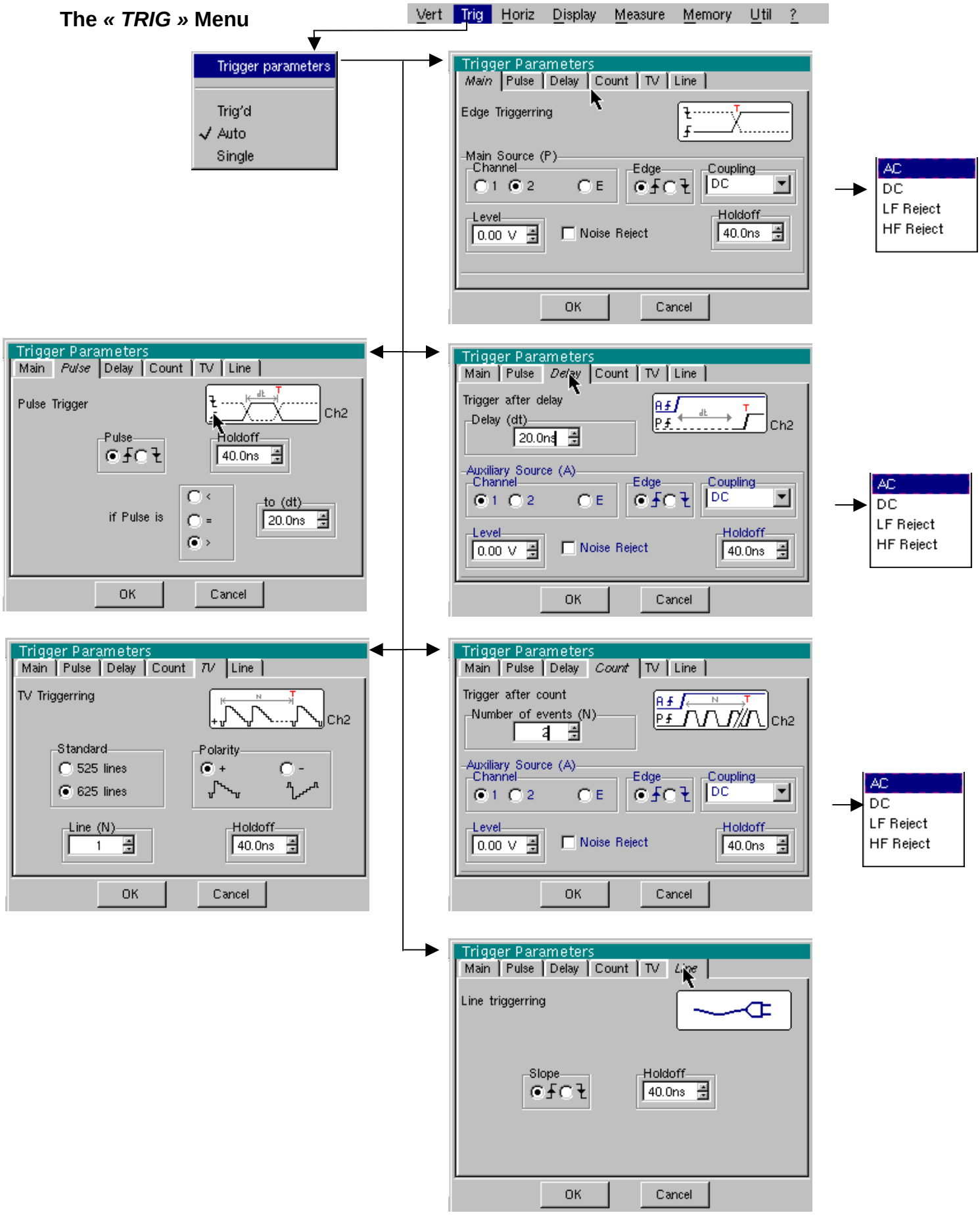
Init re-initializes the coefficient at 1,000 (x1) and returns to a unit of measure in V.

Validation of selections by « **OK** ». Exit from menu without modification by « **Cancel** ».

The « Vertical scale » menu can also be called up by clicking with the right mouse key in the trace parameter display math3 or math4 as desired.

Oscilloscope Mode *(cont'd)*

The « *TRIG* » Menu



Oscilloscope Mode *(cont'd)*

Definition

This range of portable oscilloscopes is equipped with "advanced triggers".

- The "Main" tab can be used to choose and parameterize the main trigger source.
- The "Delay" and "Count" trigger modes require parameterization of a second "auxiliary" trigger source. The auxiliary source may be the same as the main source.

The trigger choice is validated by exiting from the menu.

If …	**then …**
… the user exits from the "**Main**" tab,	**…** "**Main**" triggering is used.
… the user exits from the"**Pulse**" tab,	**… "Pulse"** triggering is used.
etc.	**etc.**

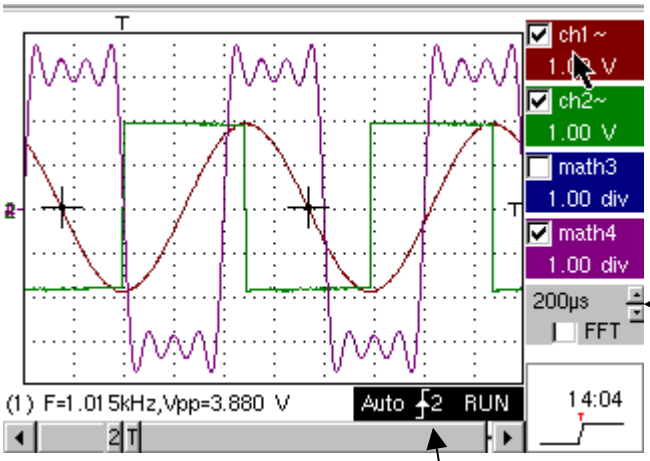
- *There is only one Holdoff, although it can be programmed from the "Main", "Delay", "Count", "TV" and "Line" tabs.*
  When you use "Delay" or "Count", the Holdoff applies to the auxiliary source, i.e. the source of the count pulses or delay trigger pulses.
  In the other cases, Holdoff applies to the main trigger source.
- *Each trigger source has its own specific attributes: Coupling, Level, Edge, Noise Reject, Filter.*

Parameters

Selection of the "Trigger Parameters"

Main Trigger on edge

Source selects channel as main trigger source



You can also choose the trigger channel by double-pointing with the mouse in the time base display area.

Trigger Source : 1, 2 or S (line)

Oscilloscope Mode *(cont'd)*

Coupling Selection of the filter for the main trigger source:

AC AC coupling (10 Hz to 200 MHz):
blocks the DC component of the signal

DC DC coupling (0 to 200 MHz):
allows the entire signal through

LF Reject Rejection of source signal frequencies < 10 kHz:
facilitates observation of signals with a DC component or an unwanted low frequency

HF Reject Rejection of source signal frequencies > 10 kHz:
facilitates observation of signals with high-frequency noise.

Edge Selection of the trigger gradient:

\+ ascending trigger edge

\- descending trigger edge

The selected trigger edge is indicated the status area.

Level 454mV Adjustment of the trigger level with the mouse on the scroll bar.

Clicking with right mouse key in this field displays a virtual numeric keypad which can be used to directly input the value.
The trigger level is entered into the current value display area after modification. Fine adjustment is possible.

Noise reject **No** hysteresis ≈ 0.5 div.

Yes introduces a hysteresis of ≈ 1.5 div.

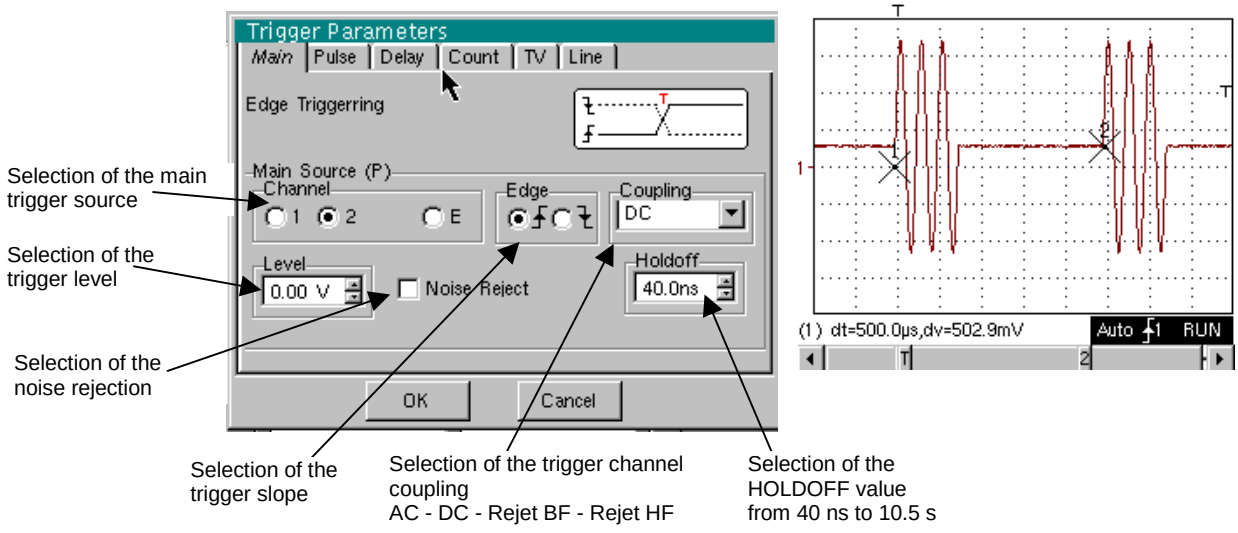
Holdoff 40.0ns allows:

- disabling of the trigger for a predefined period
- stabilization of the trigger on pulse trains.

Double-tapping in this field displays a virtual numeric keypad which can be used to directly input the value.

Clicking with right mouse key in this field displays a virtual numeric keypad which can be used to directly input the value.

Example Signal injected on CH1: a train of three 6 VDC pulses at a frequency of 20 kHz with a 500 mVDC component, separated by 500 µs.



Oscilloscope Mode *(cont'd)*

The trigger is set with channel 1 as the source and a level of 2.04 V, on an ascending edge.

The Holdoff stabilizes the signal by disabling the trigger for 108 µs.

The DC coupling of the trigger lets the whole signal through.

In this example, the signal does not include noise, so the noise rejection option is not necessary.

The DC coupling of ch1 shows the DC component of the signal.

Pulse Selection of pulse-width trigger. In all cases, the effective trigger occurs on the pulse trailing edge.

< triggers on a pulse if its width is less than the value set

= triggers on a pulse if its width is equal to the value set

> triggers on a pulse if its width is greater than the value set

Note : The pulse width is defined by the crossing of the signal with the vertical trigger level.

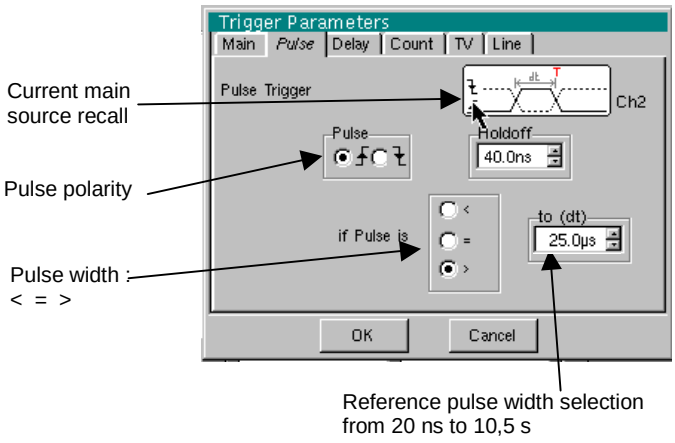
975 µs Adjustment with the mouse using the time setting scroll bar

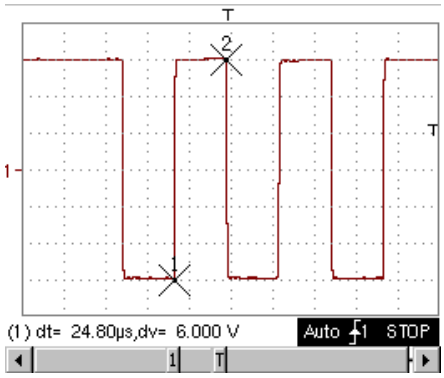
Clicking with right mouse key in this field displays a virtual numeric keypad which can be used to directly input the value.

The choice of the (rising) or (falling) edge in the "Main" tab defines the limits of the analysis:

- *edge defines a positive pulse between or*
- *edge defines a negative pulse between or*

Example Signal injected on CH1: a train of three 6 VDC pulses at a frequency of 20 kHz separated by 500 µs





The trigger parameters in the main menu are active (Source, Level, Edge, etc.).

The oscilloscope is triggered when the signal's pulse width is equal to the specified pulse width (25.0 µs + tolerance).

Positive pulse : the width measurement is triggered on the pulse rising edge and the trigger is effective on the falling edge, if the pulse width respects the chosen comparison criterion (= 25.0 µs in that case).

Oscilloscope Mode *(cont'd)*

Delay Selection of edge trigger with delay

The delay is triggered by the auxiliary source.

Effective triggering occurs after the end of the delay on the next event from the main source.

Trigger delay 12.4µs Adjustment with the mouse using the setting scroll bar to choose the required delay value.

Clicking with right mouse key in this field displays a virtual numeric keypad which can be used to directly input the value.

Holdoff 40ns Adjustment with the mouse using the setting scroll bar, allows disabling of the trigger for a predefined period and, among other things, stabilization of the trigger on pulse trains.

Clicking with right mouse key in this field displays a virtual numeric keypad which can be used to directly input the value.

Auxiliary source selects the channel as the main trigger source

Coupling selects the filter for the auxiliary trigger source:

AC	AC coupling (10 Hz to 200 MHz): blocks the DC component of the signal
DC	DC coupling (0 to 200 MHz): allows the entire signal through
LF Reject	Rejection of source signal frequencies < 10 kHz: facilitates observation of signals with a DC component or an unwanted low frequency
HF Reject	Rejection of source signal frequencies > 10 kHz: facilitates observation of signals with high-frequency noise

Level 454mV Adjustment of the trigger level with the mouse on the scroll bar.

Clicking with right mouse key in this field displays a virtual numeric keypad which can be used to directly input the value.

Edge selects the edge for the auxiliary trigger source:

\+ ascending trigger edge

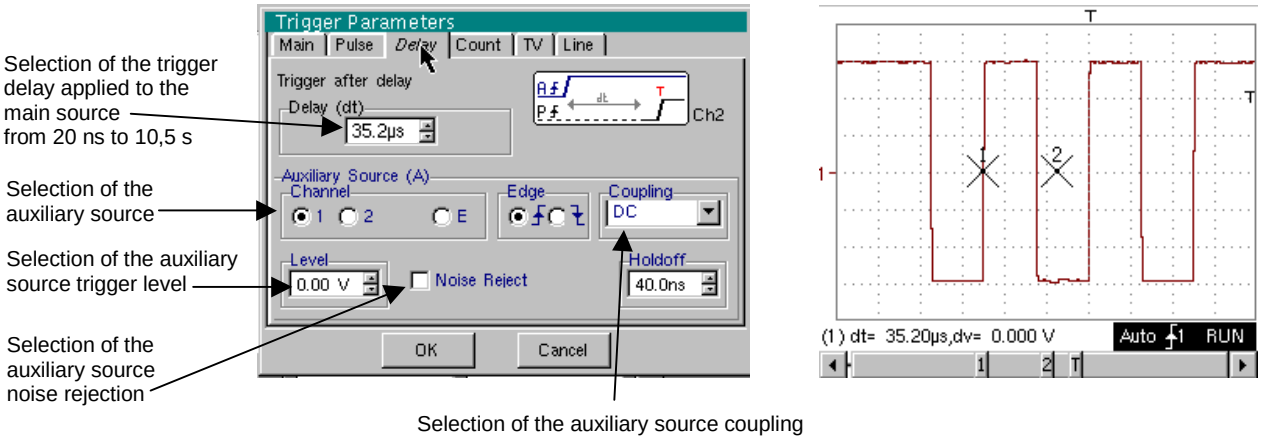
\- descending trigger edge

Noise reject **No** hysteresis ≈ 0.5 div.

Yes introduces a hysteresis of ≈ 1.5 div.

Oscilloscope Mode *(cont'd)*

Example Signal injected on CH1: a train of three 6 VDC pulses at a frequency of 20 kHz separated by 500 µs.



The trigger is active after the end of the delay (35.2 µs) on the first ascending edge.

The Holdoff stabilizes the signal by disabling the trigger for 108 µs.

Count Selects the edge trigger with counting of events.
The count is triggered by the auxiliary source. The main source serves as a clock for the count.
Effective triggering occurs after the end of the count on the next event from the main source.

Number of events [4] Adjustment with the mouse using the setting scroll bar to choose the number of events required.

Clicking with right mouse key in this field displays a virtual numeric keypad which can be used to directly input the value.

Holdoff [40.0ns] Adjustment with the mouse using the setting scroll bar, disabling of the trigger for a predefined period and, among other things, stabilization of the trigger on pulse trains.

Clicking with right mouse key in this field displays a virtual numeric keypad which can be used to directly input the value.

Auxiliary source selects a channel as the main trigger source

Coupling Selection of the filter for the auxiliary trigger source:

AC	AC coupling (10 Hz to 200 MHz): blocks the DC component of the signal
DC	DC coupling (0 to 200 MHz): allows the entire signal through
LF Reject	Rejection of source signal frequencies < 10 kHz facilitates observation of signals with a DC component
HF Reject	Rejection of source signal frequencies > 10 kHz facilitates observation of signals with high-frequency noise

Oscilloscope Mode *(cont'd)*

Edge Selection of the trigger edge of the auxiliary source

\+ trigger on ascending edge

\- trigger on descending edge

Level 454mV Adjustment of the trigger level of the auxiliary source with the mouse on the scroll bar.

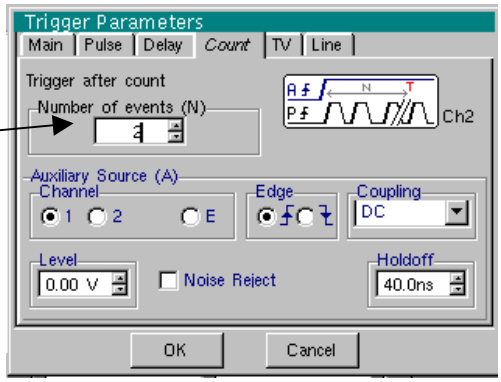
Clicking with right mouse key in this field displays a virtual numeric keypad which can be used to directly input the value.

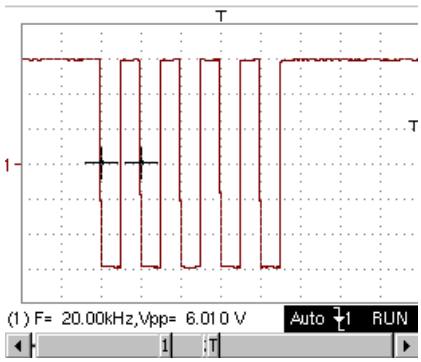
Noise reject No: hysteresis ≈ 0.5 div.

Yes: introduces a hysteresis of ≈ 1.5 div.

Example Signal injected on CH1: a train of five 6 VDC pulses at a frequency of 20 kHz separated by 500 µs.

Selection of the number of events on the main source : from 2 to 16,384





The trigger is set on the descending edge.

The first edge activates the trigger. It is not included in the count.

The trigger is triggered on the third descending edge of the pulse train.

The Holdoff stabilizes the signal by disabling the trigger for 232 µs.

Oscilloscope Mode *(cont'd)*

TV Trigger on a TV line

Standard Trigger on a specific line number. The trigger starts on the front edge of the line synchronization signal.

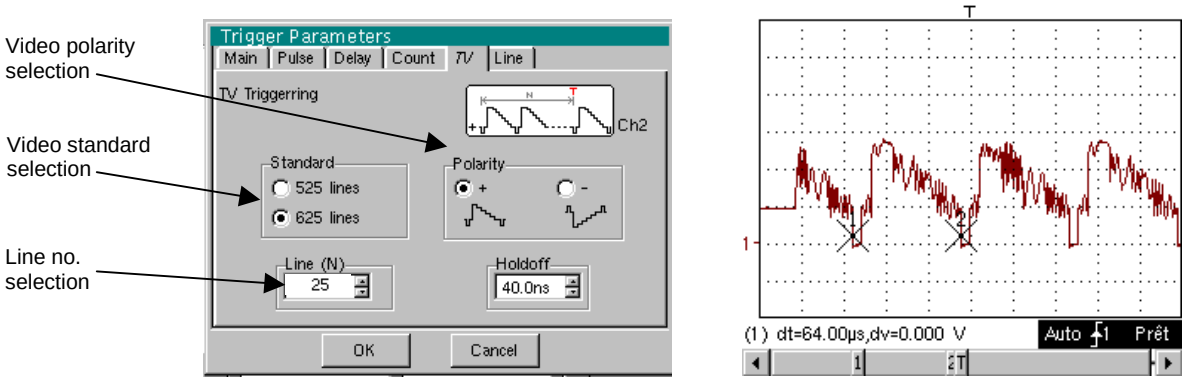
- 625 lines (SECAM) or
- 525 lines (PAL)

Polarity + Direct video
- Reverse video

Holdoff Adjusted by scrolling with the mouse. Triggering impossible for a pre-defined time.

Clicking with right mouse key in this field displays a virtual numeric keypad which can be used to directly input the value.

Example : Video signal



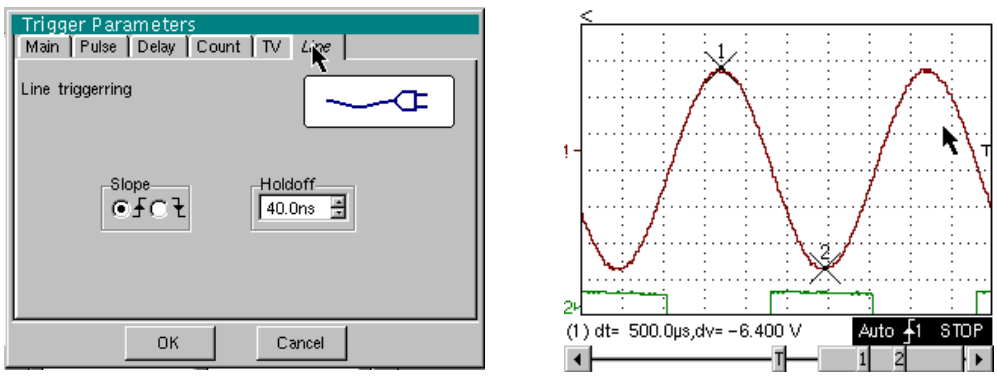
Line Adjustment of the no. with the mouse using the scroll bar.

Clicking with right mouse key in this field displays a virtual numeric keypad which can be used to directly input the value.

The "⊙" symbol indicates the selected parameters.

Validation of the selections by "**OK**".

Line *Example : Signal injected on CH1 : a picture of the power supply voltage of the instrument (line voltage : 230 VAC ± 10 %, 50 Hz)*



The trigger occurs on the rising front.

The trigger source is displayed at the bottom of the screen in the status zone (l : line)

Oscilloscope Mode *(cont'd)*

The 3 following selections define the trigger mode :

Triggered mode Acquisitions and refreshment of the screen at each trigger event.

Automatic mode Acquisition and automatic refreshing of screen even when there is no trigger event.

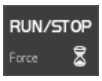
Visible traces, even when there is no trigger event.

Single mode

Acquisition of signal and refreshing of the screen on the first trigger occurring after a trigger reset by pressing the key *opposite* (or via the time base menu).

- *The "✓" symbol indicates the selected trigger mode.*
- *The selected trigger mode is indicated in the status area (Trig'd, Auto, Single).*
- *The acquisition status is indicated in the status area: PRETRIG, RUN, STOP, POSTRIG, READY, …*

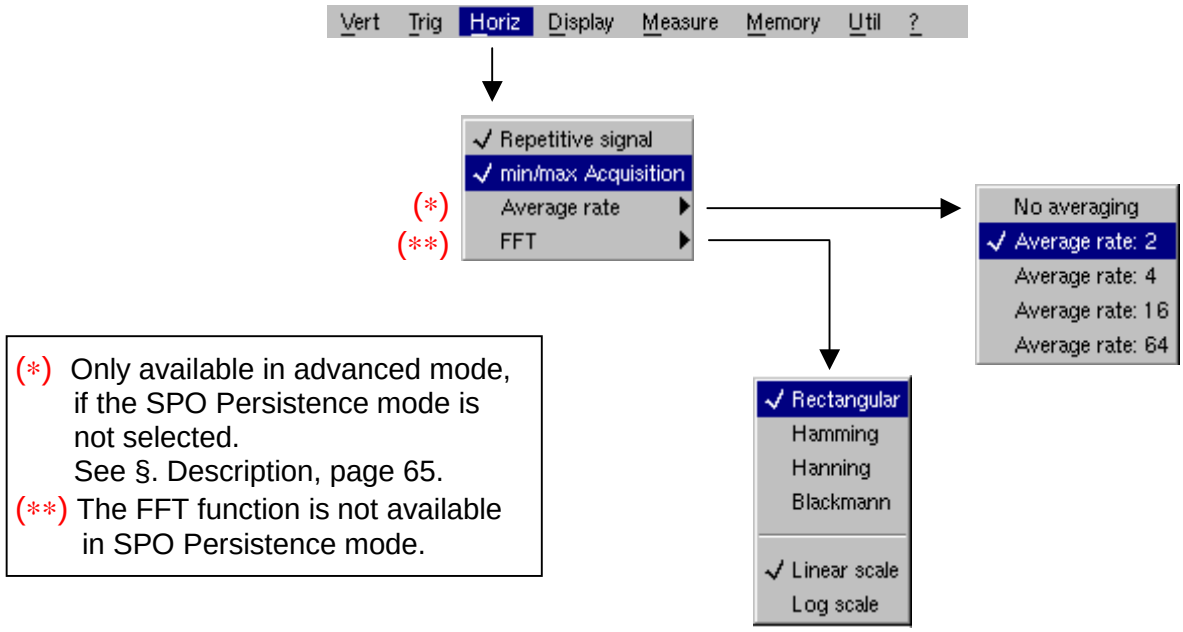
This selection can also be called up by double-clicking on the time base display area.



A long press on this key forces a trigger even without a signal.

Oscilloscope Mode *(cont'd)*

The « *HORIZ* » Menu



(*) Only available in advanced mode, if the SPO Persistence mode is not selected.
See §. Description, page 65.
(**) The FFT function is not available in SPO Persistence mode.

Repetitive Signal

Menu present only in "Advanced" mode (see "Util" menu, p. 65).

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

Activation of this option increases the time definition of a trace (up to 100 GS/s) for a repetitive signal.

For time bases lower than 50 µs/div (without active zoom mode), the signal displayed is reconstituted canceling the acquisitions.

Example : measurement on a microprocessor bus.

If the signal is not repetitive, do not use this option, as the cumulated representation could be wrong. The time resolution will then be 10 ns (or 5 ns if only one channel is active). In this mode, all the displayed points are refreshed with each acquisition.

min/max Acquisition

allows the signal to be sampled at high frequency (100 MS/s), even for slow time base speeds. The display does not take extreme value samples into consideration.

This mode is used for:

- detecting wrong representation due to under-sampling
- displaying short-term events (Glitch, ≥ 10 ns).

Whatever time base is being used, the short-term events (Glitch, ≥ 10 ns) will be displayed.

The « ✓ » symbol indicates the « min/max Acquisition » mode is active.

Oscilloscope Mode *(cont'd)*

Averaging

This menu is used for selecting a coefficient to calculate an average for the displayed samples. For instance, this is a way of attenuating random noise observed in a signal.

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

The averaging coefficient are: no averaging
averaging by 2, 4, 16, 64.

The calculation is made using the following formula:

$$Pixel_N = Sample * 1/Average\ rate + Pixel_{N-1} (1-1/Average\ rate)$$

with: SampleValue of new sample acquired at abscissa **t**

Pixel **N** Ordinate of pixel of abscissa t on screen, at moment **N**

Pixel **N-1** Ordinate of pixel of abscissa t on screen, at moment **N-1**

☝ *The « ✓ » symbol indicates the selected average rate.*

FFT (Fast Fourier Transform)

This menu is used for selecting calculation of the Fast Fourier Transformer in « real time » (FFT).

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-related domain.

The FFT can be used in the following applications:

- measurement of various harmonics and distortion of signal,
- analysis of pulse type response,
- search for noise source in logic circuits.

The FFT is calculated at 2500 points.

☝ *The Fast Fourier Transform is selected by the FFT icon in the command zone.*

When the curve is zoomed, the FFT applies to the zoom part of the curve.

Description

The Fast Fourier Transform is calculated according to the equation:

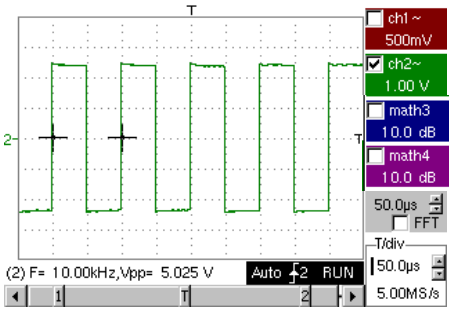
$$X(k) = \frac{1}{N} * \sum_{n=-\frac{N}{2}}^{\frac{N}{2}-1} x(n) * \exp\left(-j\frac{2\pi nk}{N}\right) \quad for\ k \in [0\ (N-1)]$$

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

The displayed trace represents the amplitude in V or dB of the various signal frequency components depending on the selected scale.

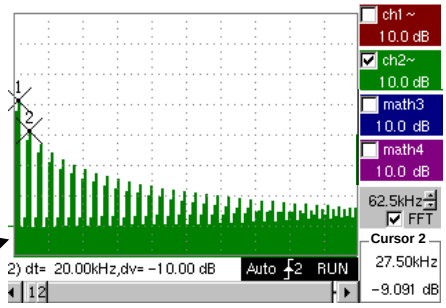
The signal continuous component is deleted by software.

Oscilloscope Mode *(cont'd)*

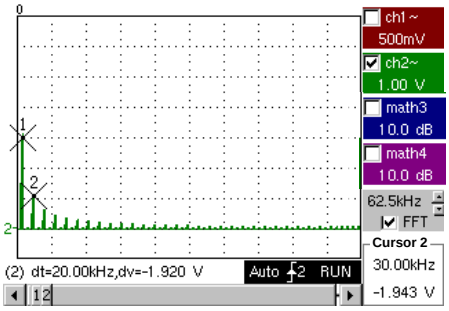


Square signal on ch2 of 10 kHz and 5 Vpp

Attention :
The modification of the sensitivity in FFT mode applies to the input signal.
Check that the signal observed is not saturated in Oscilloscope mode.



FFT with a Hanning window and a logarithmic scale



FFT with a rectangular window and a linear scale

∗ **FFT units**

Horizontal unit: indicated instead of time base; calculated according to the scan factor:

$$\text{Unit (in Hz/div.)} = \frac{12{,}5}{\text{scan factor}}$$

Vertical unit: two possibilities are offered by sub-menus:

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

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

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

- in dB/div.: by attributing 0 dB to a sinusoidal signal having 1 V division in time-related representation.

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

∗ Graphic representation

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

☝
- *The « ✓ » symbol, appearing before one of the options indicates the selected scale.*
- *Manual measurements (dt, dv) can be made using cursors for a frequency representation (see §. Menu « Measurement » p. 53).*
- *The choice of scale appears directly on selection of the FFT menu.*

Oscilloscope Mode *(cont'd)*

The sub-menus are used for selecting a type of window.

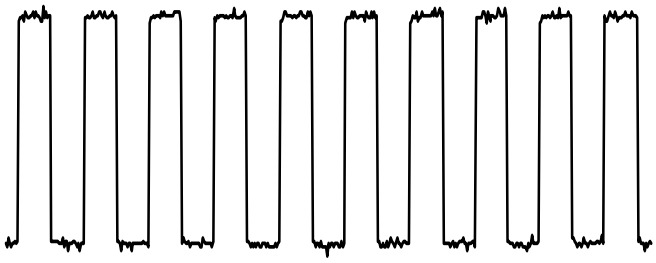
Rectangular

Hamming

Hanning

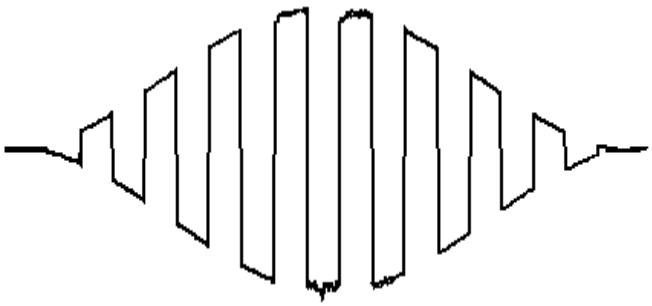
Blackman

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

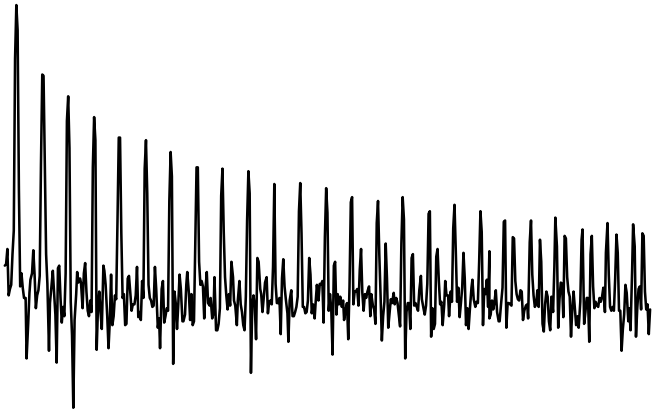


Time-related representation of signal to be analyzed

Weighting window



Weighted signal



Frequency representation of signal calculated by FFT

Oscilloscope Mode *(cont'd)*

The final duration of the design interval results in a convolution in the signal frequency domain with a function sinex/x.

This convolution modifies the graphic representation of the FFT because of the side lobes characteristic of the sinex/x function (unless the interval of design contains an integer of periods).

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

Window type	Main lobe width	Max. amplitude of side lobe (compared to 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 in frequency representation:

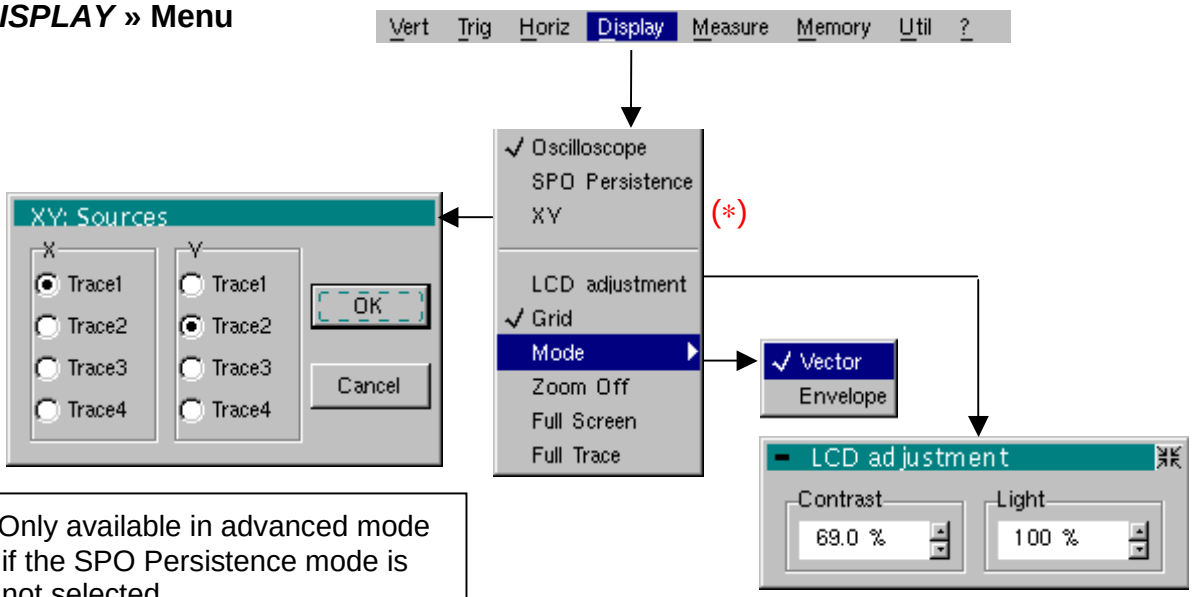
If the sampling frequency is not correctly adjusted (less than or twice the maximum frequency of the signal to be measured), the high frequency components will be under-sampled and appear in the graphic representation of the FFT by a state of symmetry (reployment).

- The « Autoset » function is activated. It is a way of avoiding the above phenomenon and adjusting the horizontal scale: the representation is more legible.
- The « Zoom » function is active.

The « ✓ » symbol appears in front of one of the options, indicating the selected function.

Oscilloscope Mode *(cont'd)*

The « *DISPLAY* » Menu



(*) Only available in advanced mode if the SPO Persistence mode is not selected.
See §. Description, p. 65.

LCD adjustment

LCD contrast and brightness adjustment.

This function has the same effect as the following  key.

Graticule

Used for displaying grid or not.

Display modes

Vector

Envelope

There are two available display modes if the SPO Persistence mode has not been selected :

A vector is traced at the centre of the sample.

The minimum and maximum observed on each horizontal position of the screen are displayed. This mode is used to display drifting in time or modulation.

The "✓" symbol indicates that the display mode is active.

Zoom off

Initiates return to the original screen size, after zooming in on part of the screen.

- *This function is inactive unless the screen is in zoom mode.*
- *The letter Z in the trace parameter and time base zone denotes the zoom mode.*

Attention *This function is inactive if the SPO Persistence mode is activated.*

This menu can also be called up by clicking with the mouse right key inside the trace display zone.

Mode Oscilloscope *(cont'd)*

Full screen

causes changeover from the normal display mode to the "full screen" display mode and vice versa.

Attention *This function is inactive if the SPO Persistence mode is activated.*

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 clicking with the mouse right button in the trace display zone.

Full trace

activates/deactivates the horizontal division of the display area by two.

The « Full Trace » function activated is indicated by :

- the presence of a horizontal continuous feature in the middle of the display area
- a graticule divided vertically into 2 zones of 8 divisions
- traces 1 and 3 assigned to the higher part of display
- traces 2 and 4 assigned to the lower part, so as to remove their superposition.

The traces can be then vertically moved in both areas.

The following submenus make it possible to change from "oscilloscope" to "XY" mode.

The "✓" symbol indicates the active mode.

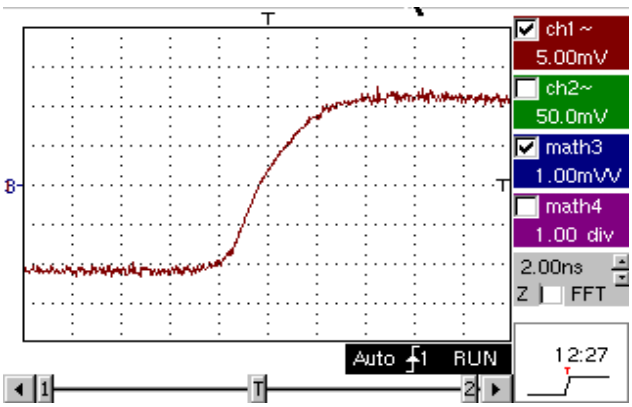
Oscilloscope

This is the basic operating mode.

Each trace is represented by a single colour :
CH1 = red, CH2 = green, Math3 = blue, Math4 = violet.

All the acquired points have the same intensity whatever their occurrence is.

In the example below, all the points appear with the same colour, even those corresponding to a random signal noise.



Mode Oscilloscope *(cont'd)*

XY

(inactive in SPO)

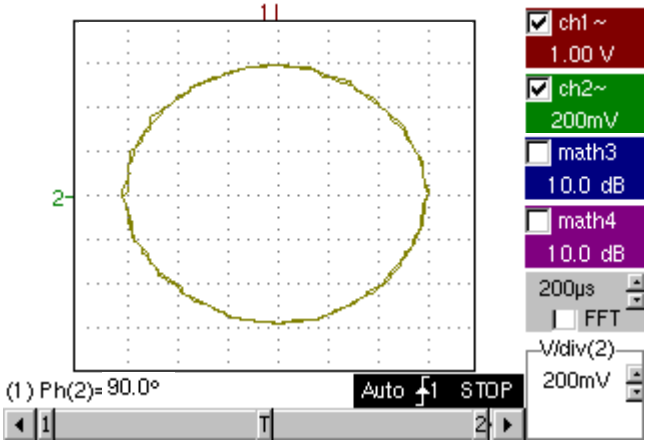
The "XY source" menu is used for assigning the desired traces to the X axes (horizontal) and Y axes (vertical).

Validation of selections by "**OK**". Exit from 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.*

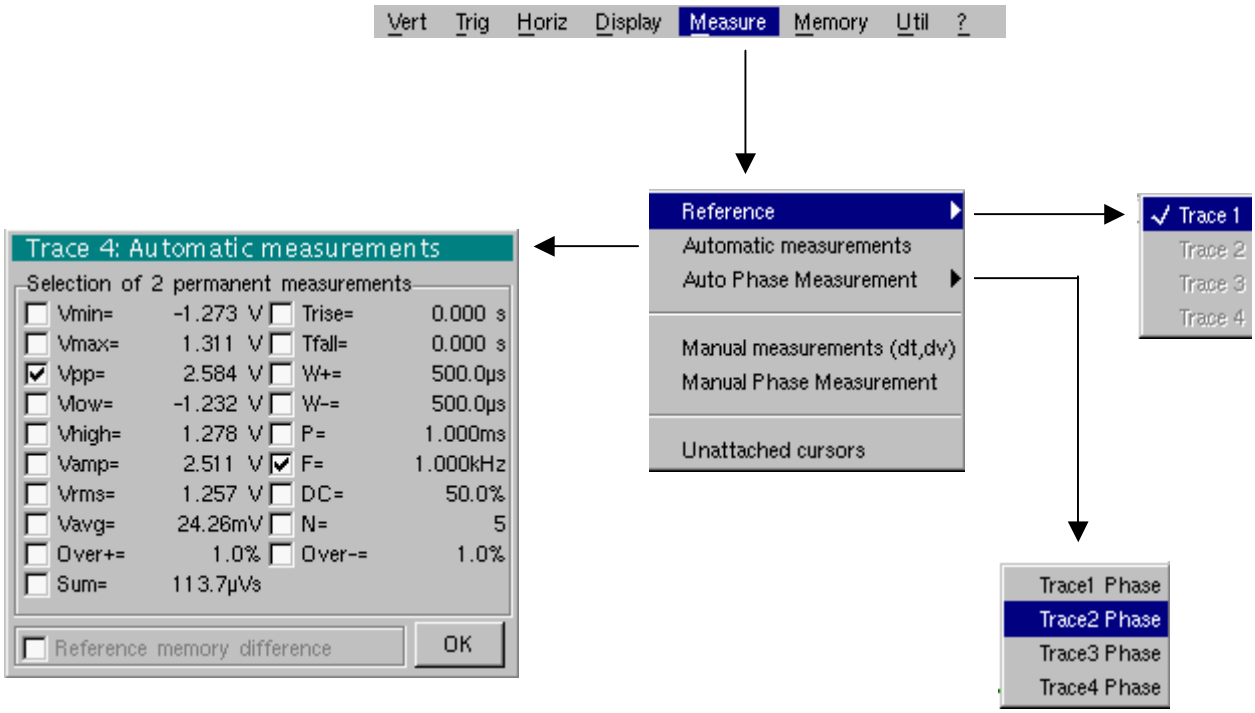
Two sinusoidal signals assigned to the X and Y axis with an offset of π/2 are then represented by a circle.

Example



Oscilloscope Mode *(cont'd)*

The « *MEASURE* » Menu



(*) Only available in advanced mode, if the SPO Persistence mode has not been selected.
See §. Description, page 65.

Attention

The Automatic Measurements, the Phase Measurement of and the Unattached Cursors are not available in "Persistence SPO" mode.

Reference

used for selecting one of the active traces on which you want to make automatic or manual measurements.

Trace 1
Trace 2
Trace 3
Trace 4

Only the active traces can be selected. Inactive traces appear lighter.

The « ✓ » symbol indicates the reference trace.

Automatic measurements

used for opening the « automatic measurements » menu.

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

(**- . - -**) is displayed for the measurements that cannot be made.

The window can be closed and validated by clicking on **OK** with the mouse left button.

The one or two selected measurements will be displayed in the status zone.

Oscilloscope Mode *(cont'd)*

☞
- *It is possible to select two permanent measurements.*
- *The « ✓ » symbol indicates the measurement(s) that will be entered into the status zone.*
- *Activating automatic measurements reveals two cursors (+) on the curve at the beginning and end of the period. Some measurements need to be present at least one period on the screen.*
- *The display order corresponds to the chronological order of the selection.*

Deleting automatic measurements in the status zone is carried out using this menu, by erasing the selected measurements (no « ✓ » symbol in the automatic measurements table).

☝ *Attention* *The automatic measurements are not available in SPO Persistence mode.*

Reference memory difference The 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 p. 58).

✍ *Example* Calculation made and displayed on one of the 19 measurements:
Vpp (Reference memory difference) = Vpp (Trace 1) – Vpp (Trace 1 → Ref 1)
For all the measurements, calculation is made in the same way.

☝
- *This option is only active if a reference trace is present. It has to correspond to the trace on which automatic measurements are to be made (✍ E.g.: 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 measurements

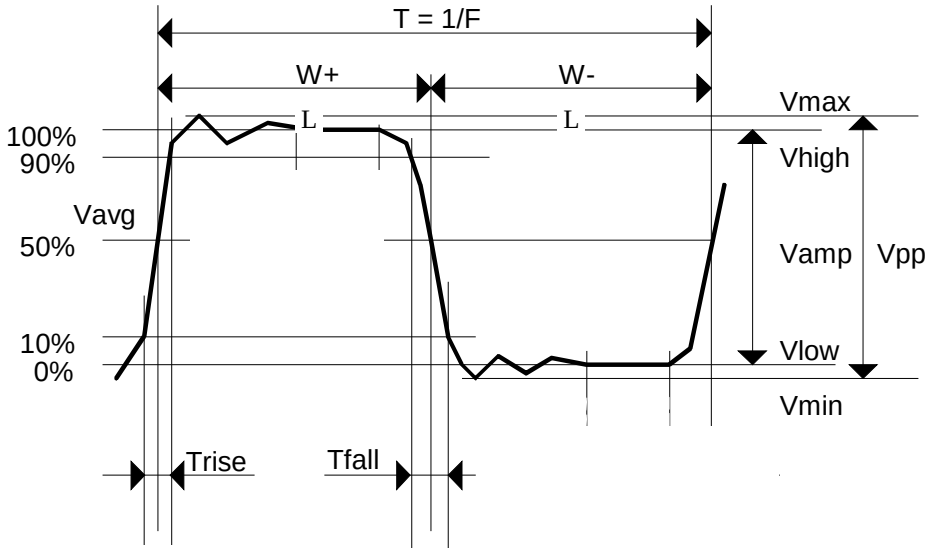
Vmin	minimum peak voltage
Vmax	maximum peak voltage
Vpp	peak-to-peak voltage
Vlow	established low voltage
Vhigh	established high voltage
Vamp	amplitude
Vrms	rms. voltage
Vavg	mean voltage
Over+	positive overflow
Trise	rise time
Tfall	fall time
W+	positive pulsewidth (at 50 % of Vamp)
W-	negative pulsewidth (at 50 % of Vamp)
P	period
F	frequency
DC	duty cylce
N	number of pulses
Over-	negative overflow
Sum	summon of instantaneous values of the signal (Σ elementary areas Vs unit)

Oscilloscope Mode *(cont'd)*

Measurement conditions

- The measurements are made on the displayed part of the trace.
- Any change to the signal will lead to an updating of the measurements. They are refreshed in step with acquisition.
- If several signal periods are displayed on the screen, the measurement will refer to the first.
- To make automatic measurements on specific portions of the signal, enclose the desired measurement zone with manual cursors and markers identifying the zone.
- Measurement precision is optimum, if two complete signal periods are displayed

Automatic measurement presentation



- Positive overflow = [100 * (Vmax – Vhigh)] / Vamp
- Negative overflow = [100 * (Vmin – Vlow)] / Vamp
- Vrms = $[\frac{1}{n}\sum_{i=0}^{i=n}(y_i - y_{GND})^2]^{1/2}$
- Vavg = $\frac{1}{n}\sum_{i=0}^{i=n}(y_i - y_{GND})$
- Vsum = $\sum_{i=0}^{i=n}(y_i \times \delta t)$

Y_{GND} = value of representing zero Volt

Oscilloscope Mode *(cont'd)*

Phase measurement

used for making trace phase measurements with respect to 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 made.

To deactivate phase measurements, de-select it using the same menu for the selected phase measurement.

☝

- *The « ✓» symbol indicates the selected trace for phase measurement.*
- *The activation of the phase measurement, if possible, will reveal 3 cursors:*
  2 automatic measurement cursors on the reference trace,
  1 cursor indicating φ on the trace, on which the phase measurements are made.
  These 3 cursors are fixed; they cannot be moved.
- *The phase measurement (in °) of the selected trace with respect to the reference trace is indicated in the measurement display status zone*
  (✍ E.g.: (1)Ph (2) = 180.0°).
- *If the measurement cannot be made, « **- . - -** » appears.*

Manual measurements (dt, dv)

used for making measurements by cursor.

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

The two measurements made are:

dt (time deviation between the two cursors)
dv (voltage deviation between the two cursors).

The measurements made and the displayed cursors are linked with 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 left mouse button. They can also be moved using the mouse by selecting the symbol 1 (cursor 1) or the symbol 2 (cursor 2) in the bargraph.*
- *If the free cursor option is not active (see §. Measurement « Unattached cursors »), the cursors will remain linked to the reference trace during movements. If this option is active, the cursors can be moved anywhere on the screen.*
- *dt and dv measurements with respect to the selected reference are indicated in the measurement display status zone.*
  ✍ E.g. : (1)dt = 500,0 µs, dv = -6,400 V

Manual phase measurement

used for making phase measurements with 3 cursors: 2 identified cursors « 1 and 2 » identical to those of the manual measurements and a 3rd free cursor with respect to which the phase measurement is made (see "Unattached cursors" menu for the movement of cursors "1 and 2").

☝

- *The « ✓» symbol indicates that the manual phase measurement is active.*
- *When this menu is active, the 3 cursors are present if at least one signal is active.*
- *The cursor identified φ can be moved freely even if the "Unattached cursors" menu is not active.*
- *The phase measurement (in °) between these cursors is indicated in the measurement display status zone.*
  ✍ E.g.: (1)Ph = 130.0 °

Oscilloscope Mode *(cont'd)*

Unattached 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 screen.

☝
- *The « ✓» symbol indicates that the "Unattached cursors" menu is active.*
- *To deactivate this menu, de-select it with the mouse.*
- *For automatic measurements and automatic phase measurements, the cursors are fixed: they cannot be moved. The "Unattached cursors" menu will be inactive.*

Particular case <u>In the case of "Automatic measurements" and manual measurement activation:</u>

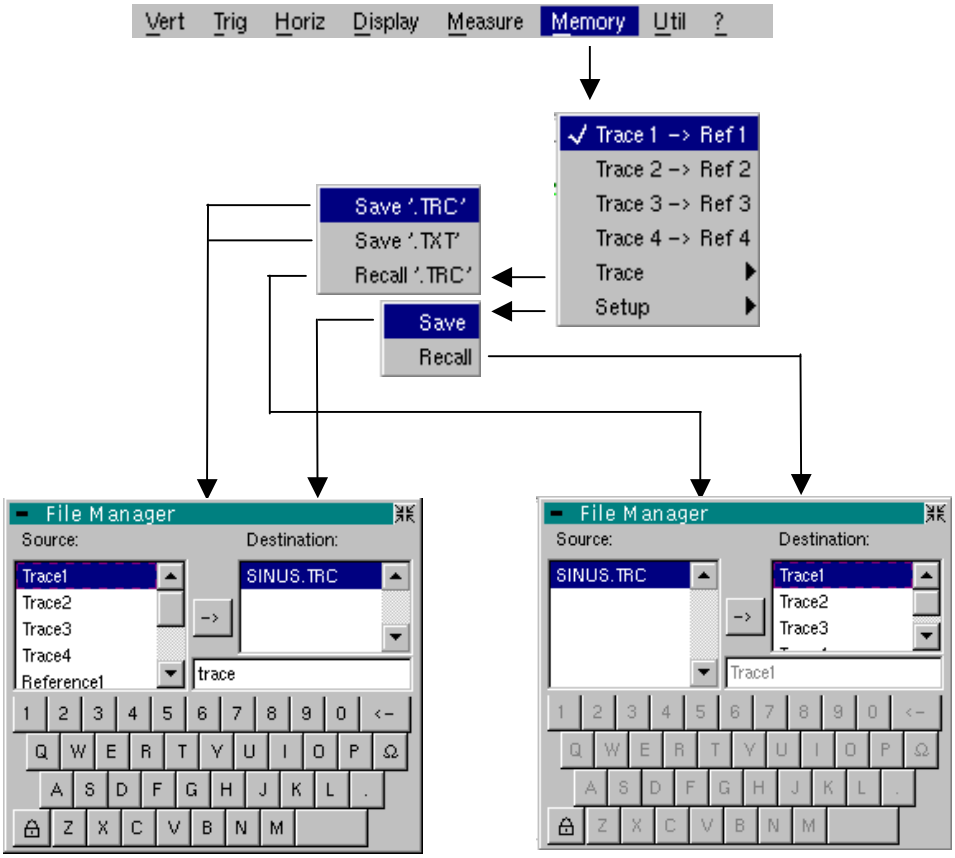
If the manual cursors and automatic markers are displayed together, the automatic measurements will be made on the portion of the trace defined by the manual cursors.

If the portion defined by the manual cursors is too restricted to make the selected automatic measurements [in this case, the fixed markers (+) are not displayed], the selected automatic measurements will be impossible and « **-.--** » will appear in the measurement display zone.

☝ *De-select the automatic measurements to validate the manual measurements (dt, dv).*

Oscilloscope Mode *(cont'd)*

The « *MEMORY* » Menu



Trace1 → Ref. 1
Trace2 → Ref. 2
Trace3 → Ref. 3
Trace4 → Ref. 4

used for storing the selected trace in its volatile reference memory (✍ *E.g.:* Trace 1 in Ref. 1).

The 4 traces have their reference memory.

☝ *Attention*

If the SPO mode is active in the oscilloscope, the traces may not be stored in the reference memories. The references (Ref. 1, 2, 3, 4) appear greyed.

☞

- *For optimum comparison : the reference trace must have the same characteristics as the associated trace (sensitivity and time base).*
- *A trace can only be saved to the reference memory if it is present on the screen.*
- *The memorized traces appear in plain language, together with their reference number.*
- *The « ✓» symbol in the menu indicates that the corresponding trace has been saved to the reference memory and must be present on the screen.*
- *A reference trace cannot be moved.*
- *A reference memory can be deactivated by de-selecting it from the menu.*

A reference memory is volatile, it can be lost at the extinction of the instrument.

Oscilloscope Mode *(cont'd)*

Trace

This menu is used for saving (to the non-volatile memory) or recalling the trace of a reference memory. Saving can be in two formats: « .TRC » or « .TXT ».

The « File copy » menu is suited to the type of selected format.

Save .TRC

Saving of the files for recalling on the oscilloscope screen
The saving files will take the extension **.TRC**; they can be recalled in the « Trace → Recall » menu.

Save.TXT

saving of files for export to another application
Saving files take the extension **.TXT**; they cannot be recalled by the « Trace → Recall » menu for screen display. However, they can be exported in a standard format use in another software (spreadsheet).

(✍ *E.g.:* Microsoft EXCEL) using the menu « Util → Files ».

The selection made opens a « File Copy » menu.

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

The trace or the reference memory to be saved will appear in gray. The selection will be made using the left mouse key.

- *Only the traces and reference memories on the screen will be entered into the "Source" menu and therefore be selectable.*
- *If all the traces and all the reference memories are present on the screen, the scrollbar to the right of the menu will allow movement through the list.*

* A default backup file name is proposed above the keyboard. It can be modified using the virtual keyboard and the mouse.
The ← key is used for deleting the displayed letter preceding the cursor in this zone.

* 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), in accordance with the previous selection.

Exit from the menu without backup is obtained by clicking with the left mouse key on the icon at the top right of the window.

- *The file name is limited to a maximum of 15 characters + the extension, otherwise the following message appears : "File name too long".*
- *As soon as the mouse pointer is dragged over a destination file (without clicking), the name is accompanied by its recording date and time, and its size.*
- *If the name already exists or is not compatible, an error message will appear.*

Oscilloscope Mode *(cont'd)*

Recall.TRC when selected, opens a « File Copy » menu.

In the pull-down Source menu is the **.TRC** file list recorded using the « Trace → Recall.TRC » menu.

The file name selected for recalling appears in gray. Selection is made using the left key of the mouse.

* After selecting the file to be recalled, the destination menu indicates the trace on which it should be restored. The selected destination trace (1 to 4), using the mouse left key to restore the signal, appears in gray. It is also indicated in the lower zone of the screen.

* The trace to be recalled and its destination are selected, then the [→] key is used for performing the operation and closing the menu.

Exit from the menu without using this recall feature is obtained by clicking the mouse left key on the icon at the top right.

- *If the selected destination trace is already present on the screen, it will be replaced by the recalled trace.*
- *When a trace is recalled, Mx appears in the destination trace parameters. The sensitivity, coupling and bandwidth limit become those of the restored trace (they cannot be modified).*
- *In this menu, the virtual keyboard is ineffective.*

Configuration used for saving or recalling an equipment configuration.

Save when selected, opens the « File copy » menu.

* In the Source menu is a file called « Configuration ». It contains the equipment configuration parameters when this menu is opened.
* A save file name is proposed above the virtual keyboard. It is used for modifying it (left mouse key).

* When the source file name has been entered, the [→] key is used for recording the configuration by transferring it into the destination menu and closing the menu (save file: extension **.CFG)**.

Exit from the menu without saving is obtained by clicking the icon at the top right of the window, with the left mouse key.

- *The file name is limited to a maximum of 15 characters + its extension. As soon as the mouse pointer passes over a source file (without a click) it is accompanied by its recording date, recording time and size.*
- *If the name already exists or is incompatible, an error message will appear.*

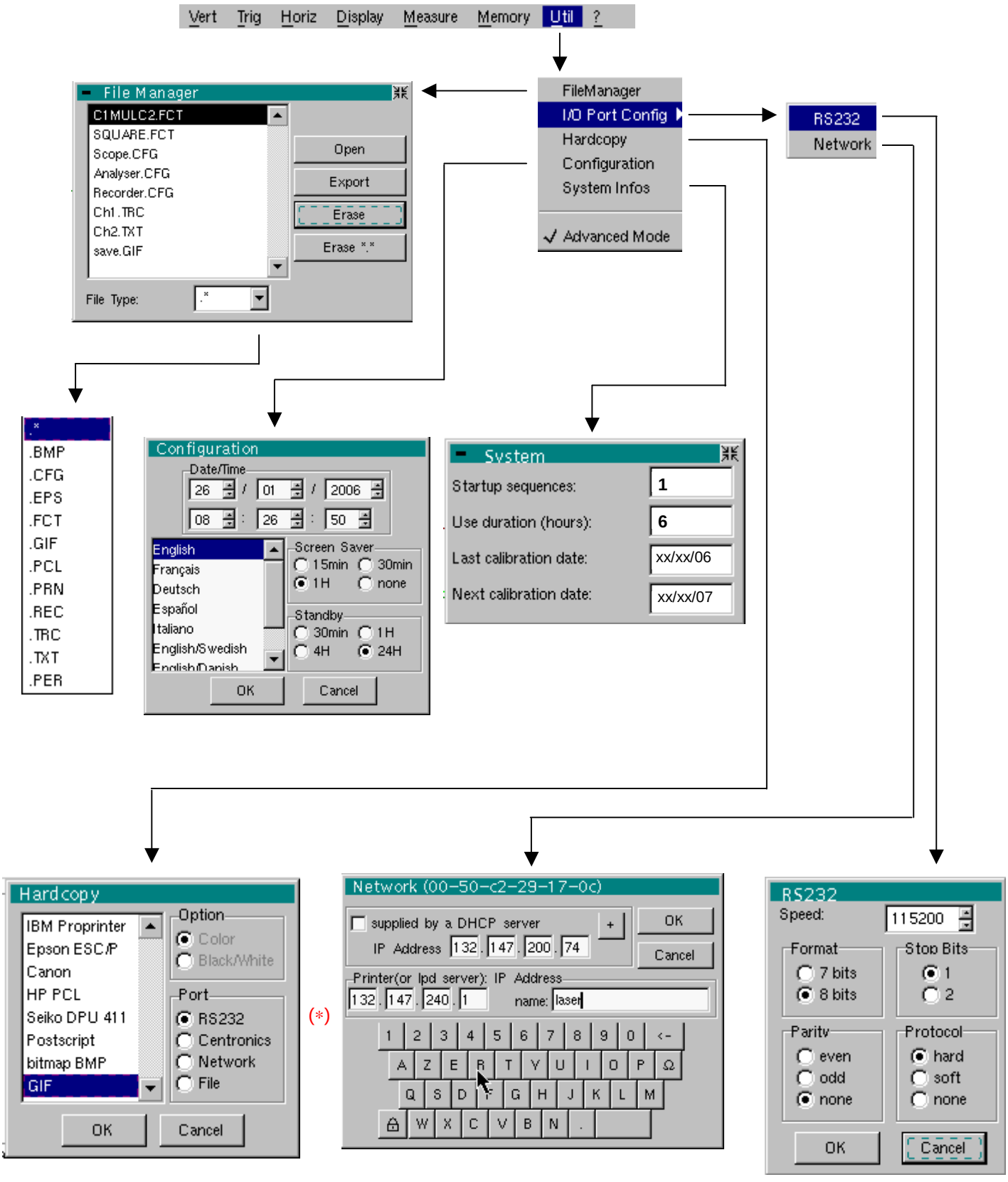
Recall when selected, opens the « File copy » menu.

* In this pull-down "Source" menu is a list of files (**.CFG**) recorded using the "Configuration « Configuration → Save » menu.
  The file name, selected for recalling, appears in gray. Selection is by the left mouse key. The scrollbar on the right is used for moving through the list.
* With the source file selected, the [→] key is used for recalling the item.
* Exit from the menu without recalling is obtained by clicking with the left mouse key at the top right of the window.

- *In this menu, the virtual keyboard is ineffective.*
- *The **default config** file is used for restoring the works configuration.*

Oscilloscope Mode *(cont'd)*

The « *UTIL* » Menu



(*) USB : when the USB cord has been detected

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.

The files will only be saved once and for all when the instrument is switched off using the ON/STD BY key :

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 in oscilloscope mode (.**TRC**),
for traces in SPO persistence mode (.**PER**),
for sampling (.**TXT**),
for functions (.**FCT**),
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 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 .PER .FCT .PRN .PCL .EPS .BMP .GIF .REC .TXT

The mouse is used for selection.

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

The storage capacity of the file manager is 15 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 or USB/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.

Oscilloscope Mode *(cont'd)*

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 (SUBD25) at the back of the instrument.

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.*

Configuration of the "Network" menu ***(Ethernet)***
(RJ45 connector)

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: 00-50-C2-29-10-00

IP address corresponds to the IP 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.

An IP address can be assigned automatically by a DHCP server, if the server is accessible, using the icon "supplied by a DHCP server".

Example: 132.147.200.74

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

This address must be input manually with the keyboard, after selecting 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**".

USB to RS232 ***Configures itself automatically, as soon as the user connects the oscilloscope to the PC by means of a cable USB.***
When USB to RS232 interface is used, exit SUBD25 is automatically configured in CENTRONICS.

Oscilloscope Mode *(cont'd)*

Hardcopy when selected, opens the « Hardcopy » menu.

This menu is used for selecting the print format or the printer type, as well as the communication port that will be used for making hardcopies.

The printer type or selected format will appear in gray. Selection uses the left mouse key. The scrollbar on the right is used for moving through the list of types or the printer languages.

Option used for choosing color or black/white printing.

Port used for selecting the interface to be used for print data transfer: **Network**, **RS232 or USB**, **CENTRONICS** or to **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).*

Configuration when selected, opens the « Configuration » menu.

This menu is used for configuring the equipment.

Date/time updates the date (**day, month, year**) and the time (**hour, minute, second**).

Selection is by the left mouse key using the scrollbars located either side of the parameters to be set.

The clock starts when the menu is closed.

Language selects the language in which the menus are written.

5 options are possible: **french, english, german, italian, spanish**.

Screen saver used for setting the screen to standby after a defined period of time to minimize the consumption of the equipment and screen aging.

4 options are possible: **15 min, 30 min, 1 h, none**.

The screen is reactivated by pressing any unused key on the front panel or moving the mouse.

Automatic switch off used for setting the equipment to standby after a defined period of use so as to limit the consumption of the unit.

In this case, the equipment configuration is saved before cutoff.

4 options are possible: **30 min, 1 h, 4 h, 24 h.**

The equipment is reactivated using the key shown opposite.

- *The « ⊙ » symbol indicates the selected option.*
- *The option can be modified using the left mouse key.*

Selection validation by « **OK** ». Exit from menu without modification by « **Cancel** ».

Oscilloscope Mode *(cont'd)*

System — used for sending the user information about the life of the equipment starting from commissioning.

Startup sequences — indicates the number of equipment starts.

Use duration — indicates the total utilization time in hours.

Last calibration date — indicates the date of the last equipment calibration.

Next calibration date — indicates the date of the next equipment calibration. Periodic equipment calibration is necessary to guarantee the unit within the specifications.

☝ *For any checks of the equipment, see §. Maintenance, Metrological checking.*

Exit from this menu is by clicking on the icon at the top right with the left mouse key.

« Advanced » Mode

When activated, the « Advanced » mode gives access to all the equipment functions.

Conversely, when this mode is not active, the advanced equipment functions no longer appear in the menus.

Menus present in « Advanced » mode only:

math1, math2, math3, math4	→ accessible through the « **Vert** » menu
repetitive signal averaging	→ accessible through the « **Horiz** » menu
XY	→ accessible through the « **Display** » menu
unattached cursors	→ accessible through the « **Measurement** » menu

☞

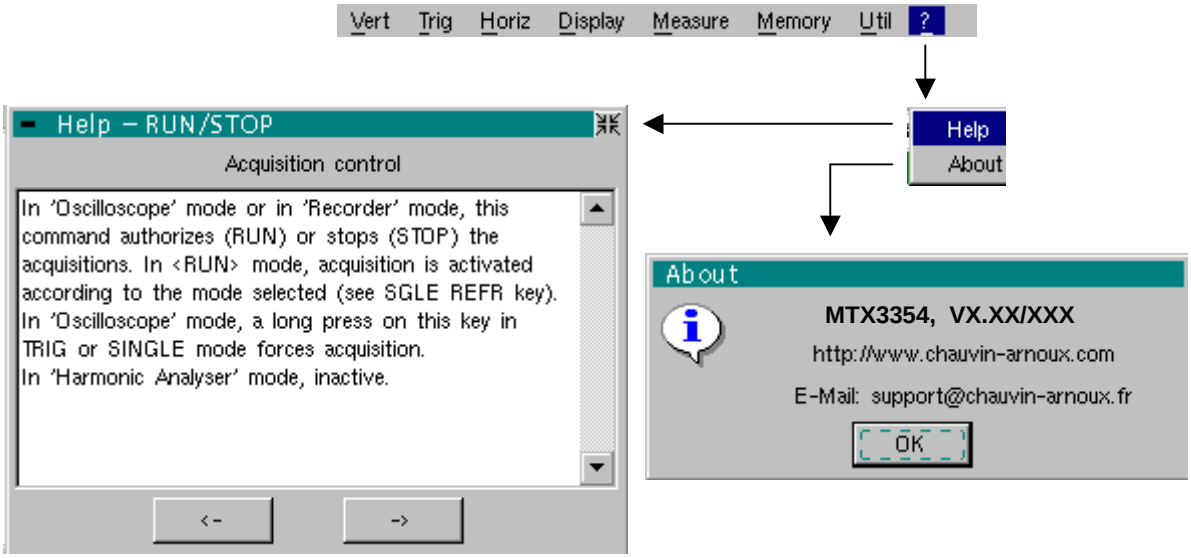
- *The « ✓ » symbol indicates that the "Advanced" mode is active.*
- *Modification uses the mouse left key.*
- *By default, the "Advanced" mode is not active.*

☝ *Attention* *In “Persistence” display, Math {1, 2, 3, 4} functions, Repetitive signal, Averaging and XY modes are inactive and appear in grey ...*

In "non-advanced" mode, the instrument's configuration is not saved when it is shut down using the ON/STD BY key and the default factory configuration is loaded at next start-up.

Oscilloscope Mode *(cont'd)*

The « ? » Menu



Help

when selected, opens the « Help » menu.

This menu is used for activating on-line help using the equipment keys, in the same way as the key shown opposite.

The ← → keys are used for scrolling through the description of the keys on the front panel.

Any press on a key of the keyboard causes the display of the on-line help of the depressed key. The functions associated with the keys are not launched.

The key name is used above the explanation.

Exit from the menu is obtained by clicking with the left mouse key on the icon at the top right of the window.

About

when selected, opens an information file with :

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

This file refers to the equipment software version and gives its date of creation.

Exit from the menu is by **OK**.

Reminder

By connecting you on the website www.chauvin-arnoux.com you will be able to record the software, then to download the updates.

By the E-mail address, you will contact a technical hot-line ; a technician will answer your possible questions.

Oscilloscope Mode with "SPO"

Smart Persistence Oscilloscope

The Keys

With "SPO", the keys operate exactly as described for the Oscilloscope mode without "SPO" (see p. 13).

The message "Impossible in this mode!" is displayed if the key pressed is not active.

Display

Presentation

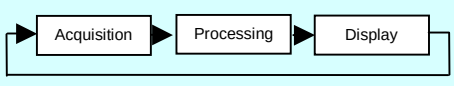
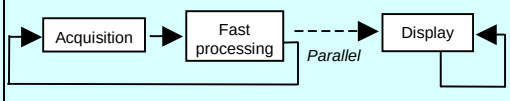
The "Smart Persistence Oscilloscope" mode (SPO) is activated using the "Display" menu in Oscilloscope mode (see p. 50).

"SPO" persistence:

- reveals unstable phenomena, transients and glitches
- shows the evolution of the signal over time, jitters and modulations as in analogue oscilloscopy
- causes persistence of the acquisitions during a preset time for observation of an accumulation of traces.
  The brightness or the colour allocated to the point on the screen will diminish if it is not renewed in a subsequent acquisition.
  3 dimensions are involved in acquisition:
  - time
  - amplitude
  - occurrence, which is a new dimension. See next page.

Acquisition

The "SPO" processing optimizes detection of transient phenomena:

without "SPO"	with "SPO"
The acquisition, display and processing tasks are sequential. *1 acquisition = 1 display*  	The acquisition and processing tasks are in parallel. The number of acquisitions per second can be multiplied by 100. The interval between two acquisitions is therefore significantly reduced. *n acquisitions = 1 display* 
Screen representation of 500 points out of 50,000 points acquired.	Screen representation of 50,000 points acquired, using a smart compression system.
Display of a segment to link the points together.	Display of a cloud of points which are not linked together. No interpolation.

Oscilloscope Mode with "SPO" *(cont'd)*

Smart Persistence Oscilloscope

Occurrence

This provides a statistical dimension to the distribution of the samples.

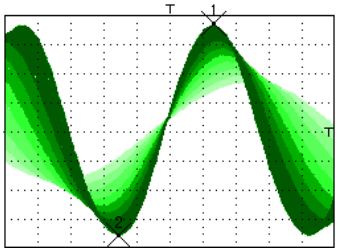
The colour or brightness highlight the irregularities in the signal. They are also used to differentiate between rare points and frequent points.

It is possible to modify this parameter by adjusting the duration of persistence (see p. 72, Display menu with "SPO").

Examples

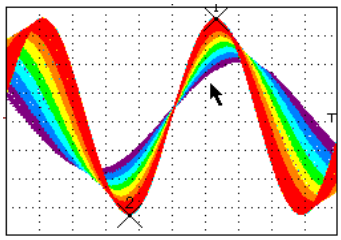
- *Monochrome representation in green:*

  - the dark green points are renewed frequently,
  - the light green points are renewed less frequently.

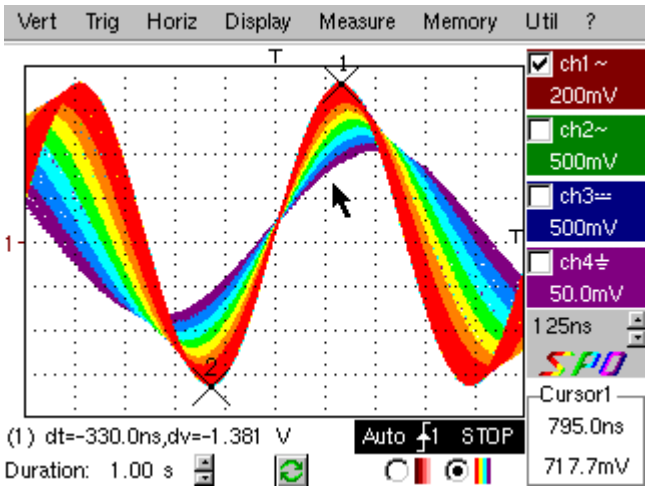


- *Multi-colour representation:*

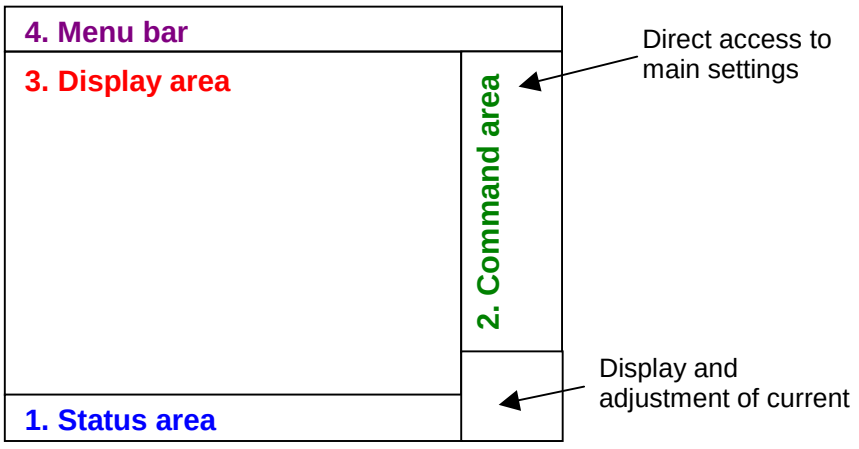
  - the red points are renewed frequently,
  - the violet points are renewed less frequently.



Display



Composition



Oscilloscope Mode with "SPO" *(cont'd)*

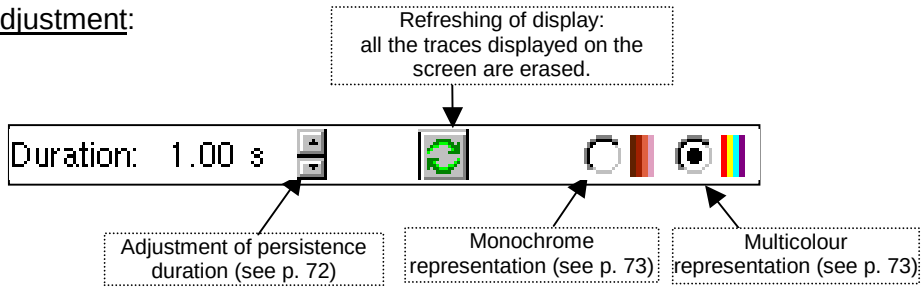
Smart Persistence Oscilloscope

1. Status area

Tool bar

Bargraph: see p. 18.

Adjustment:



Permanent adjustments

See p. 18.

Cursor measurements

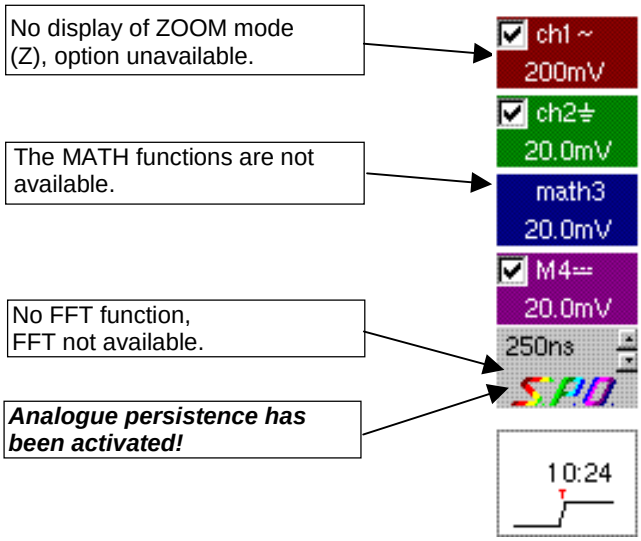
See p. 18.

Automatic measurements

Impossible in this mode.

2. Control area

The parameters which differ are described below:



3. Display area

See p. 21.

Notes

This symbol (ref. 5, p. 21) is not visible: automatic measurements are not available in "SPO" mode.

The Zoom box (ref. 9, p. 21) is present, but inactive because the Zoom option is not available in "SPO" mode.

Oscilloscope Mode with "SPO" *(cont'd)*

Smart Persistence Oscilloscope

Menu accessible from display area

When the mouse pointer is placed in the display zone, a right click gives direct access to a menu concerning the display.

Note *These options are also accessible via the Display menu in "SPO", see p. 72.*

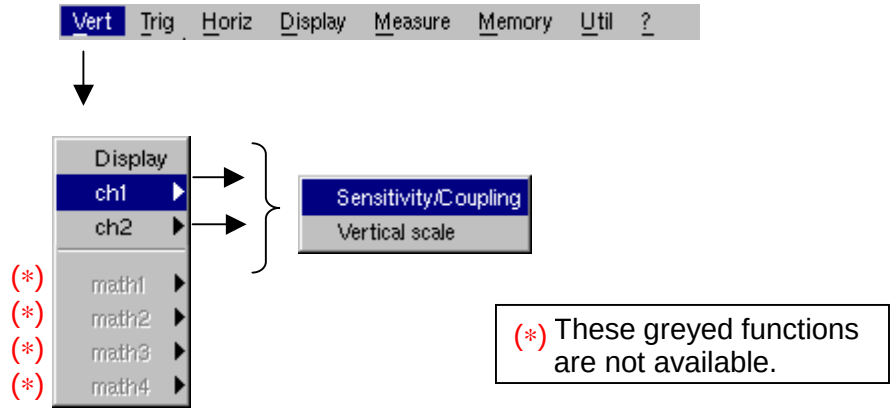
4. Menu bar

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

Oscilloscope Mode with "SPO" *(cont'd)*

Smart Persistence Oscilloscope

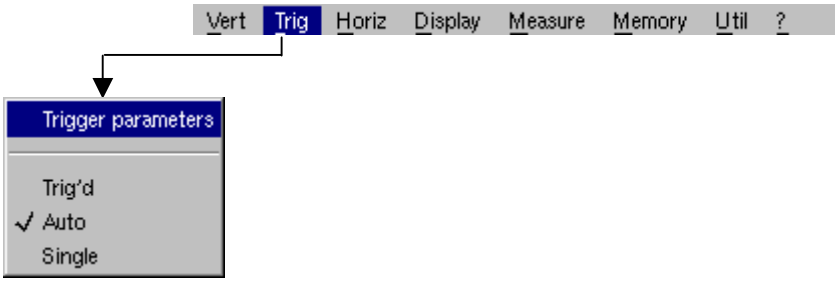
The "*VERT*" menu



Display See p. 25.

ch1 ch2 ch3 ch4 See p. 25.

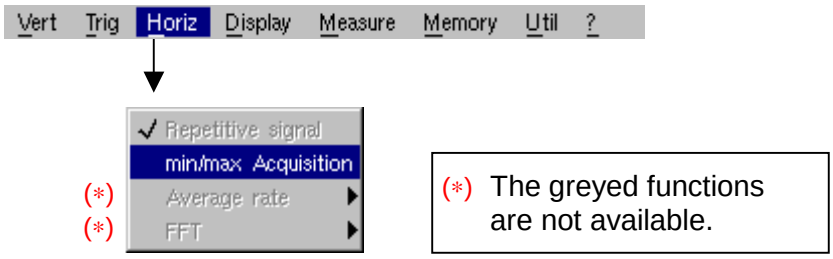
The *"TRIG"* Menu See p. 36.



☝ *Special case*

Single mode:
The persistence duration is forced to "Inf." (no ageing of the samples).
Every time there is a new acquisition, the traces are cumulated.
To refresh the screen, use the button  .

The *"HORIZ"* Menu



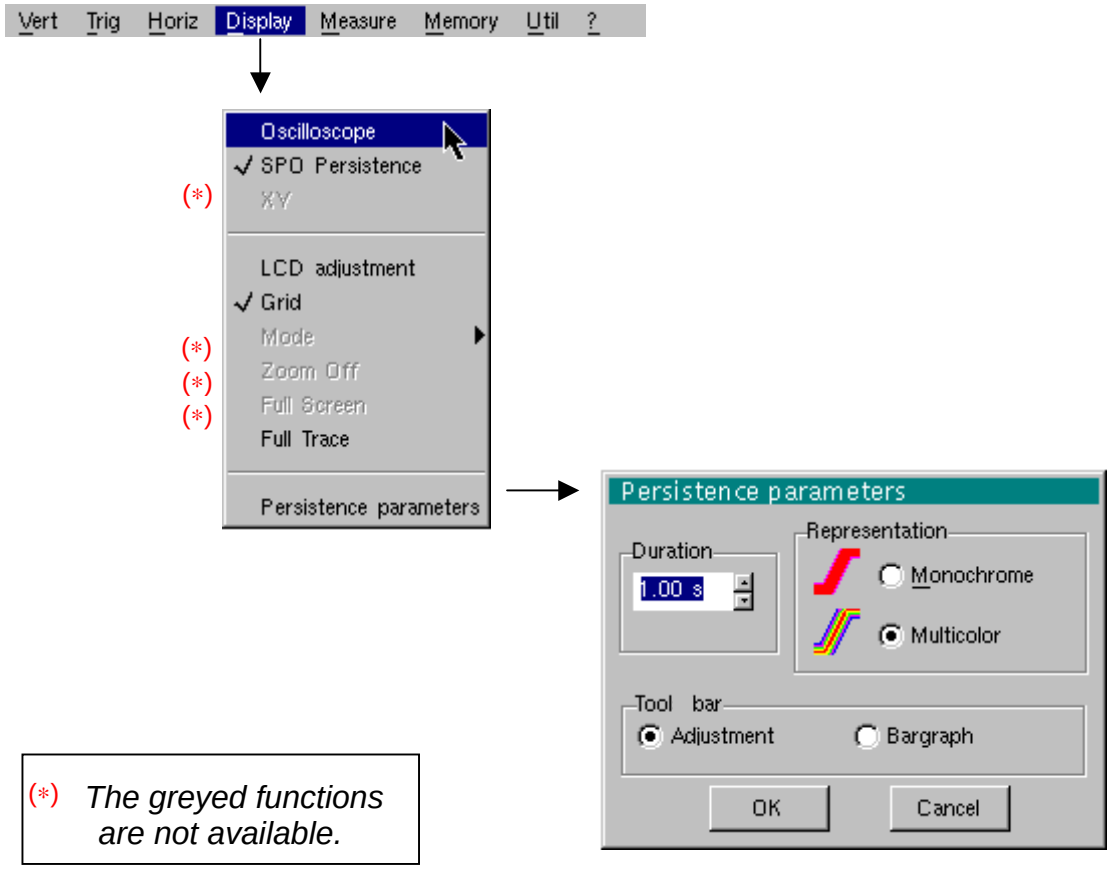
Repetitive Signal This greyed function is permanently active. It is ticked by default and cannot be deselected.

Min/Max Acquisition See p. 45.

Oscilloscope Mode with "SPO" *(cont'd)*

Smart Persistence Oscilloscope

The "*DISPLAY*" Menu



(*) *The greyed functions are not available.*

Oscilloscope	Select the "Oscilloscope" mode. ☝ *The "✓" symbol indicates that this mode is active.*
SPO Persistence	Select the "Smart Persistence Oscilloscope" display mode. ☝ *The "✓" symbol indicates that this mode is active.*
XY	This display mode is not available with "SPO".
Adjustment of LCD	See p. 50.
Grid	See p. 50.
Mode	This function is not available with "SPO".
Zoom off	This function is not available with "SPO".
Full screen	This function is not available with "SPO".
Full trace	See p. 50.

Oscilloscope Mode with "SPO" *(cont'd)*

Smart Persistence Oscilloscope (SPO)

Persistence parameters

opens a dialogue box giving access to all the specific "SPO" settings.
These settings are also available in the settings bar (see p. 69).

Duration

selects the display duration (100 ms, 200 ms, 500 ms, 1 s, 2 s, 5 s, 10 s, infinite) for the points acquired.

A point which is not renewed will disappear according to the duration set for it. On the screen, this point will fade until it disappears.

Example

Ageing only comes into effect in the presence of a trigger.

In "Trigger mode", a trace will not age if the oscilloscope is not triggered.

Instructions

- To detect rare phenomena, you must set a duration ≥ 2 s, i.e.: 2 s, 5 s, 10 s or infinite.
- You are advised to adjust this duration to show the statistical distribution of the points displayed.

Representation

Selects the representation:
- monochrome or
- multi-coloured

This is a unilateral choice: either all the channels are monochrome, or all the channels are multi-coloured,

Monochrome

The intensity of a point is represented by a single colour, from the darkest shade to the lightest:

- the darker the colour, the greater the frequency of point renewal
- the lighter the colour, the rarer the point is

Example: Monochrome channel: shading of green for channel 2

Direction of decreasing occurrence of the points

Multicolor

The intensity of a point is shown by several colours:

- the warm colours (red, orange, yellow) show the points renewed frequently,
- the cold colours (green, blue, violet) show the rarer points.

Example: Multi-colour channel

Direction of decreasing occurrence of the points

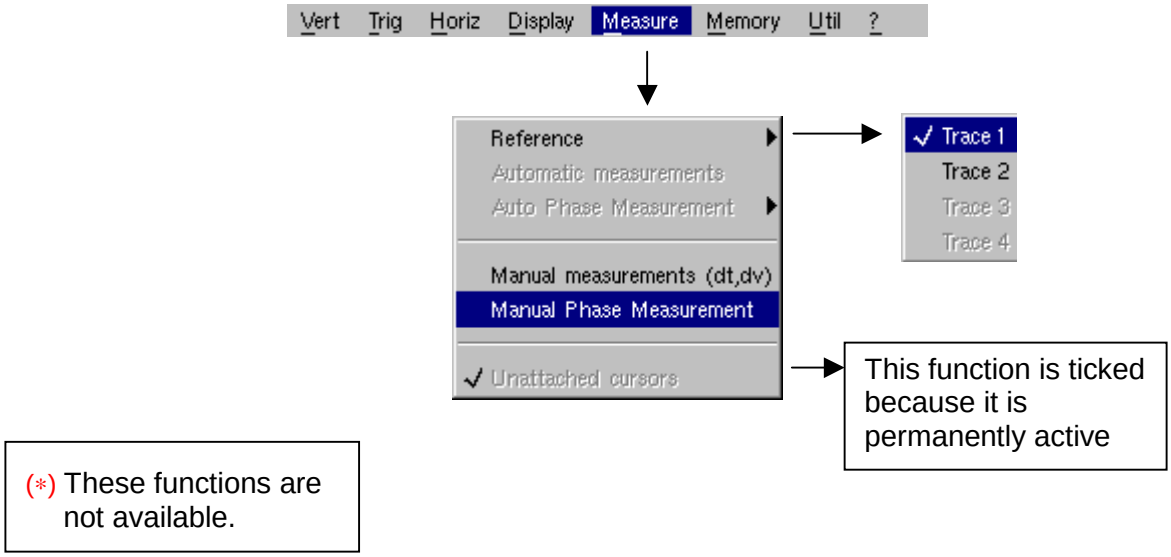
Tool bar

Choice of representation in the status area:
- if "Bargraph" is selected, it is displayed (see p. 69),
- if "Adjustment" is selected, the settings bar is displayed (see p. 69).

Oscilloscope Mode with "SPO" *(cont'd)*

Smart Persistence Oscilloscope

The *"Measurement"* Menu



Reference
Trace 1
Trace 2
Trace 3
Trace 4

See p. 52

Automatic measurements

Automatic measurements are not available.

Phase measurement
Phase Trace 1
Phase Trace 2
Phase Trace 3
Phase Trace 4

This function is not available.

Manual measurements (dt, dv)

See p. 52.
The function with the cursor attached to the curve is not available.

Manual phase measurement

See p. 52.
The function with the cursor attached to the curve is not available.

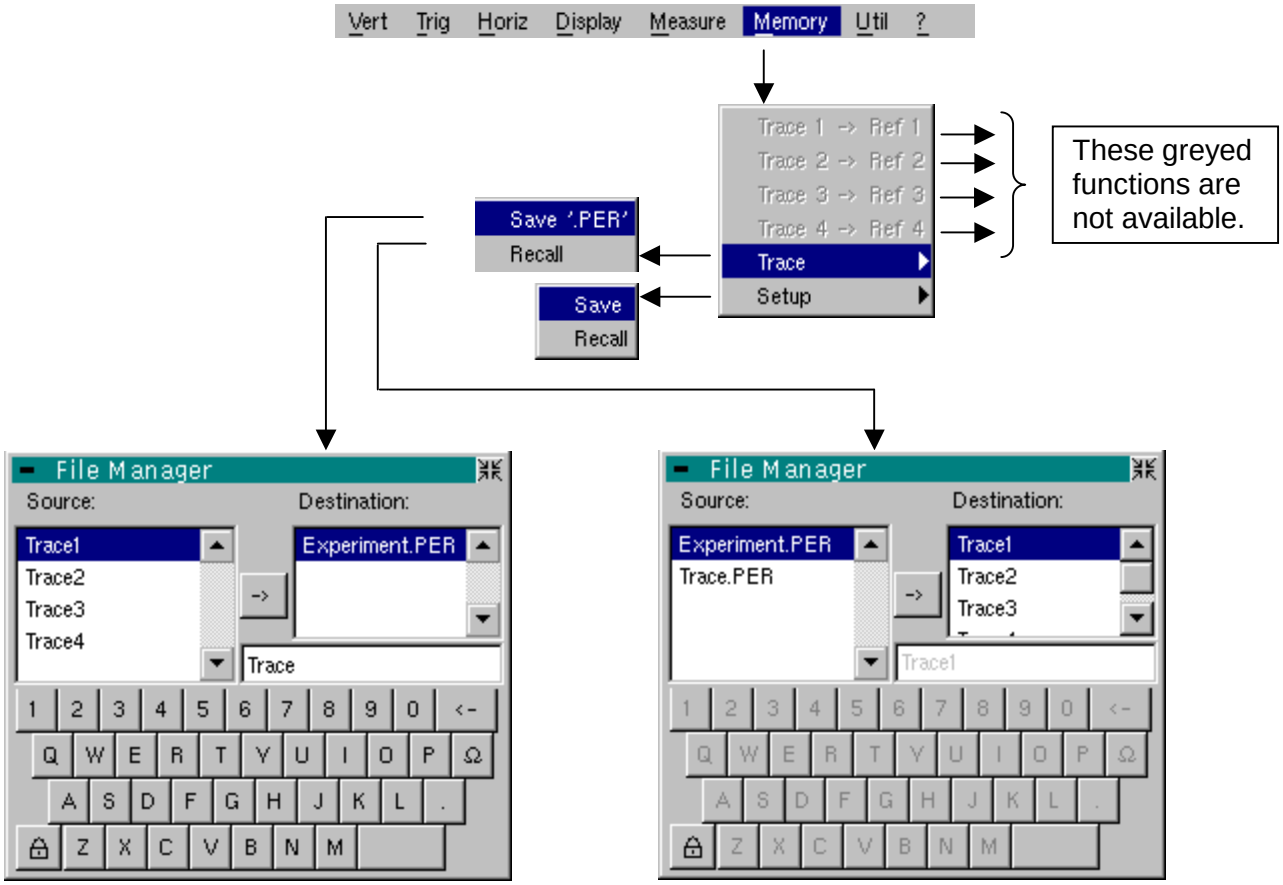
Unattached cursors

See p. 52.
This function is permanently active. It is not possible to deselect it.

Oscilloscope Mode with "SPO" *(cont'd)*

Smart Persistence Oscilloscope

The "*MEMORY*" Menu



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

These functions are not available.

Trace

Saving (in non-volatile memory) or recall of a trace.
It is saved in the format: '.PER'.

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

Save '.PER'

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

The back-up procedure for a file is identical to the procedure in oscilloscope mode (see p. 59). Only the file's suffix changes.

Recall

Opens a "File Copy" menu when selected.

The "'Source" list contains a list of the '**.PER'** files which have been recorded using the "Trace → Save.PER".

The recall procedure for a file is identical to the procedure in oscilloscope mode (see p. 59). Only the file's suffix changes.

Configuration

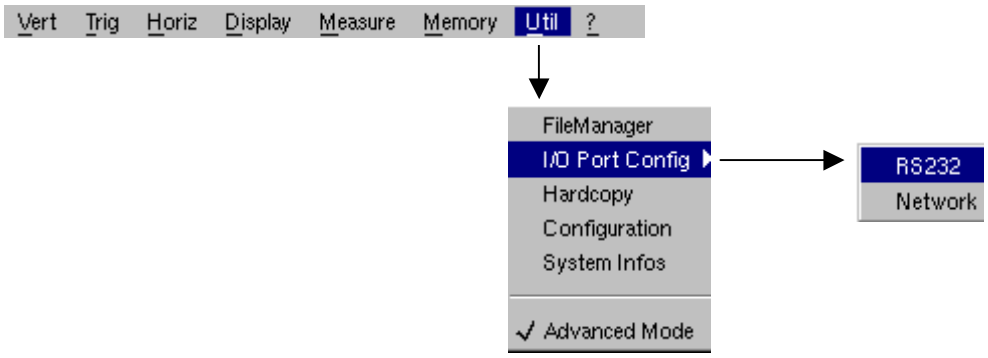
Saving or recalling of an instrument configuration. The procedure is identical to the procedure in oscilloscope mode (see p. 60).

Oscilloscope Mode with “SPO” *(cont’d)*

Smart Persistence Oscilloscope

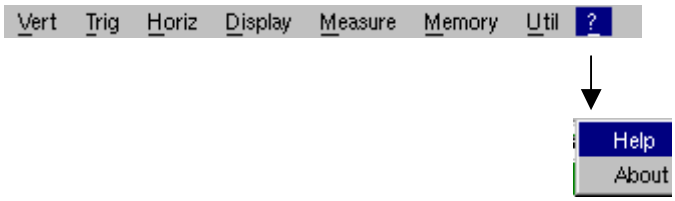
The « *UTIL* » Menu

See p. 61.



The « *?* » Menu

See p. 66.



« Harmonic Analysis » Mode

Installation

The « **Harmonic Analysis** » mode is an option of the oscilloscope which must be installed to function.

The instructions of installation are on the diskette (readme.txt file) delivered with this option.

The keys

Same as the ones described in the « Oscilloscope » mode (see p. 13).

If a function is impossible, a corresponding message is displayed on the screen.

Display

Presentation

Harmonic analysis displays the **fundamental** and the **31 harmonics** of the signal present at ch1 or ch2 input.

In this mode, the trigger is automatic and the time base is adaptive, and not manually adjustable.

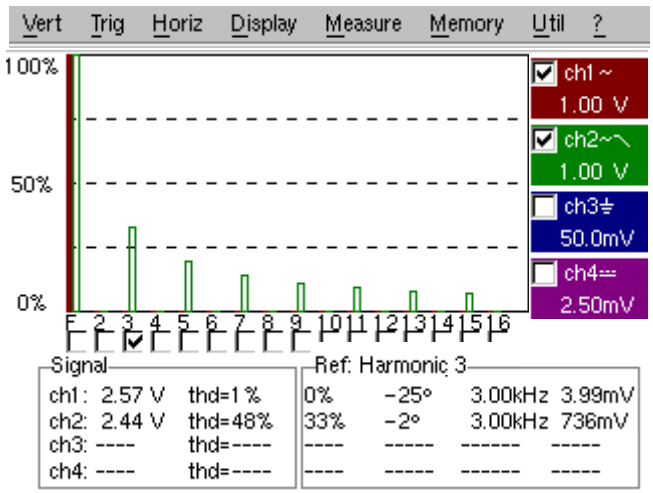
This analysis is reserved for signals whose fundamental frequency is included between 40 Hz and 5 kHz.

The adjustments of the channel parameters remain active (Sensitivity/ Coupling, Vertical scale, Bandwidth limit).

Only the channels (and not the functions) can be the subject of harmonic analysis.

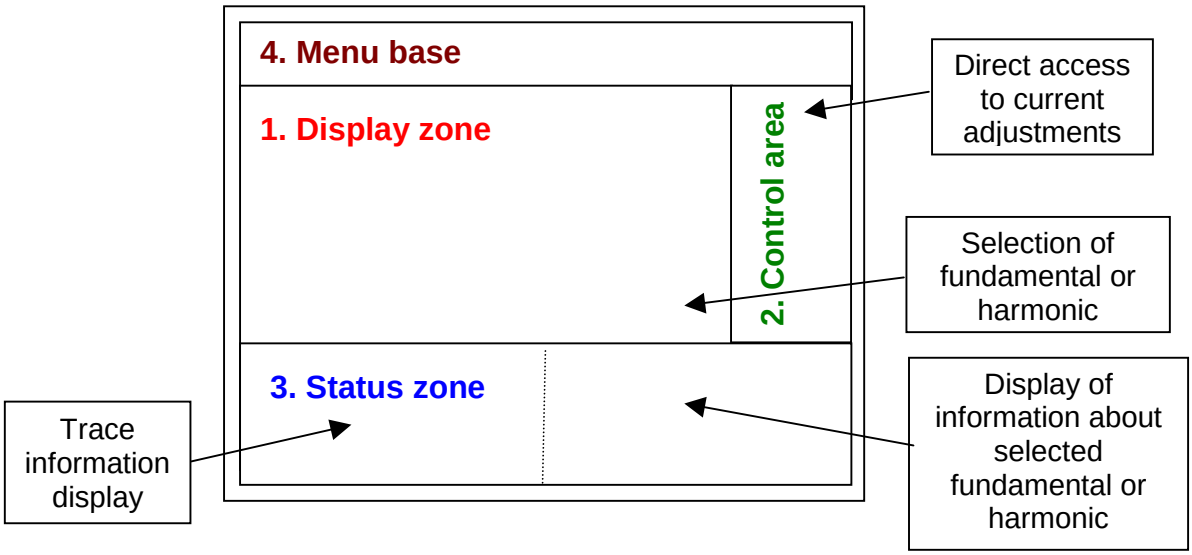
The harmonic analyses of the two signals can be displayed simultaneously.

Display



« Harmonic Analysis » Mode *(cont'd)*

Composition Harmonic mode display is divided into 4 functional zones:



1. Display zone displays the result of harmonic analysis of a single trace (ch1 **or** ch2) or the 4 traces simultaneously (ch1 **and** ch2).

The harmonic analysis of the ch1 and ch2 trace is shown in the same color as the trace.

The display appears as a bar chart, whose vertical axis is graduated as a percentage of the fundamental amplitude (from 0% to 100% every 25%).

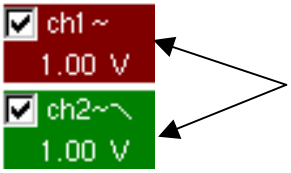
The horizontal axis represents the harmonics, i.e.:

- the fundamental (F) and the first 16 harmonics
- the even harmonics from 2 to 30
- the odd harmonics (from 3 to 31) and the fundamental (F)

This breakdown of the harmonics is used for selecting, with the mouse left key, the fundamental (F) or one of the harmonics, (✎ *E.g.: Ref. Harmonic 5*) for making automatic measurements of the selected element.

- *The « ✓» symbol indicates the selected harmonic.*
- *See the "Display" menu for the selection of the harmonics.*

2. Control zone



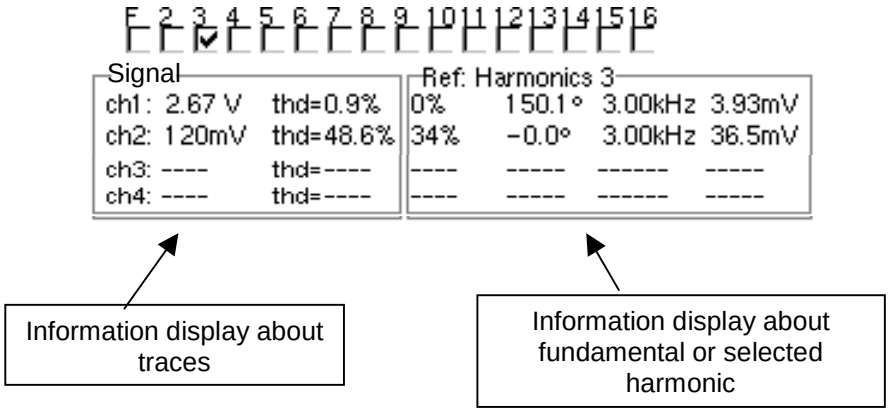
Display of trace parameters in trace color: validity, coupling, bandwidth limit, sensitivity

- *When the mouse is dragged over the parameters of a channel, the right button is used for directly opening the associated menus « Sensitivity/Coupling » and « Vertical scale ».*
- *The left key of the mouse is used for channel validation.*
- *The « ✓» symbol indicates whether the channel is selected.*

« Harmonic Analysis » Mode *(cont'd)*

3. Status zone

The status zone returns the automatic measurements made on the signals and the selected harmonic.



The « Signal» zone indicates:

- the active channel(s): **ch1** and/or **ch2**
- the root mean square (RMS) of the signal in V
- the harmonic distortion factor (THD) in %

The « Fundamental Ref. » or « Harmonic » zone indicates, for the fundamental or the selected harmonic, (✎ *E.g.: Ref. Harmonic 3*) :

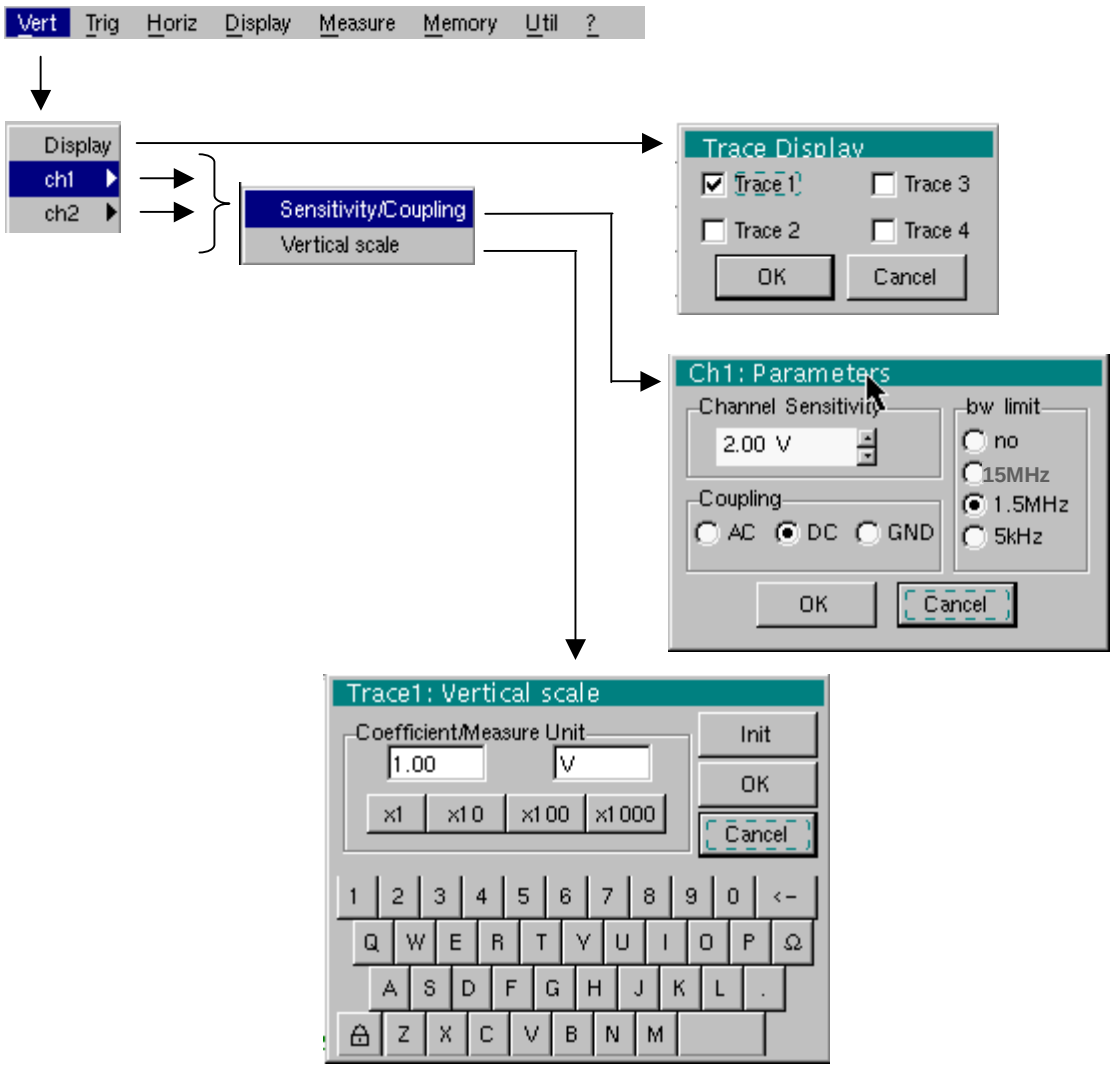
- its value as a % of fundamental
- its phase in °with respect to the fundamental
- its frequency in Hz
- its rms. voltage in V

4. Menu toolbar

The same menu toolbar is used as in "Oscilloscope" mode; some menus are adapted to the "Harmonic Analysis" mode and the others are not active.

Harmonic Analysis Mode *(cont'd)*

The « *VERT* » Menu



Display

when selected, opens the "Trace display" menu used for validating or invalidating the traces.

Validation of selections by « **OK** ». Exit from menu without modification by « **Cancel** ».

- *The « ✓» symbol in front of a trace indicates its validation.*
- *Harmonic analysis of the **ch1** and **ch2** signal is represented in the colour of the trace.*
- *In the "Harmonics" mode, only the channels (and not the functions) are the subject of harmonic analysis.*

Harmonic Analysis Mode *(cont'd)*

ch1 ch2 modifies independently the **ch1** and **ch2** channels parameters and the selected trace vertical scale.

Sensitivity/Coupling modifies the parameters of the selected channel.

Channel Sensitivity modifies sensitivity of channel by scrollbar with left mouse key: from 2.5 mV to 100 V/div.

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

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

AC : blocks DC component of the input signal and attenuates the signals lower than 10 Hz.

DC : transmits the DC and AC components of the input signal

GND : the instrument connects intern the selected channel input to the 0 V reference level.

☝ *The « ⊙ » symbol indicates the selected coupling.*
It is entered into the modified channel parameter display zone.

Bandwidth limit Limits 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 :* 15 MHz 1.5 MHz 5 kHz

Validation of selections by « **OK** ». Exit from menu without modification by « **Cancel** ».

This menu can also be called by clicking with the right mouse key in the selected channel parameter display zone (ch1 ch2).

Vertical scale defines the vertical scale of the selected channel from the current settings.

Coefficient Assignment of a multiplication factor to the selected channel sensitivity.

Modification is by the mouse using the table of usable numbers after selecting the "Coefficient" zone.

The ← key is used for deleting the value preceding the cursor in this zone.

Predefined values (x1, x10, x100, x1000), corresponding to standard probe coefficients and can be assigned directly.

☝ *The sensitivity value indicated in the channel parameter display will be modified according to this coefficient.*

Measure Unit Modification of the selected channel vertical scale unit.

This modification is made using the mouse and the table of usable characters, after selecting the "Measure Unit" zone.

The ← key is used for deleting the value preceding the cursor in this zone.

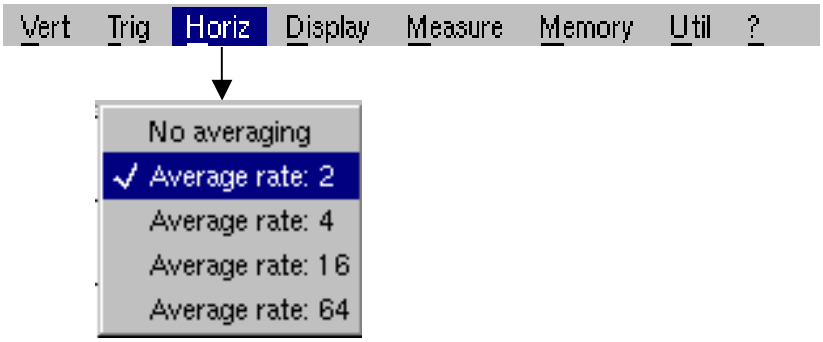
☝ *The vertical scale unit will be entered into the modified channel parameter display.*

Init re-initializes the multiplication coefficient at 1.0 and returning a measure unit in V.

This menu can also be opened by clicking with the right mouse key in the selected channel parameter display (ch1 ch2).

Harmonic Analysis Mode *(cont'd)*

The *« HORIZ »* Menu



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

These menus are used for selecting an average rate to calculate an average according to the coefficient selected on the displayed samples.

This selected coefficient attenuates any random noise observed in a signal.

The selectable average rates are:

no averaging,
average rate: 2,
average rate: 4,
average rate: 16,
average rate: 64.

Calculation is to the following formula:

Pixel N = Sample * 1/Average rate + Pixel N-1 (1-1/ Average rate)

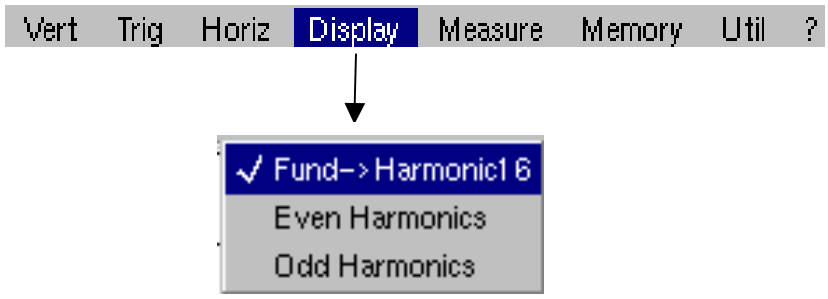
with:

- Sample: value of new sample acquired at abscissa t
- Pixel N : ordinate of abscissa pixel t on screen at instant N
- Pixel N-1 : ordinate of abscissa pixel t on screen at instant N-1

☝ *The « ✓» symbol indicates the selected average rate.*

Harmonic Analysis Mode *(cont'd)*

The « *DISPLAY* » Menu



These menus allow the display, according to 3 groups, of the harmonic composition of one or four selected signals.

Fund→Harmonic 16 displays fundamental and first 15 harmonics.

Even harmonics displays fundamental even harmonics from 2 to 30.

Odd harmonics displays fundamental and odd harmonics from 3 to 31.

The chosen selection appears under the composition display.

- *The « ✓» symbol under fundamental F or one of the 31 harmonics indicates the one selected.*
- *The selection is preserved during a change of display.*

Harmonic Analysis Mode *(cont'd)*

The « *MEMORY* » Menu

See description in "Oscilloscope" mode, p. 58.

In the "Harmonics" mode, this menu is limited to saving and recalling the instrument configuration.

The « *UTIL* » Menu

See description in « Oscilloscope » mode, p. 61.

The « *?* » Menu

See description in « Oscilloscope » mode, p. 66.

Recorder Mode

Installation

The « **Recorder** » mode is an option of the oscilloscope which must be installed to function.

The instructions of installation are on the diskette (readme.txt file) delivered with this option.

The Keys

Same as the ones described in the « Oscilloscope » mode (see p. 13).

If a function is impossible, a corresponding message is displayed on the screen.

Pressing this key will configure the instrument in the following modes:
- « oscilloscope »,
- « harmonic analyser » (option),
- « **recorder** » (option).

4 "UTILITY" keys (or keypad)

LCD **contrast** and **brightness** setting (see “Oscilloscope” mode, p. 13).

Full screen display (see “Oscilloscope” mode, p. 13).

Take a **screen shot** (see “Oscilloscope” mode, p. 13).

No action.
(Pressing this key displays the message: “Impossible in this mode!”).

1 "AUTOSET" key

No action.
(Pressing the key displays the message: “Impossible in this mode!”).

Selective «AUTOSET»

with


No action.
(Pressing the key displays the message: “Impossible in this mode!”).

1 help key

activating or deactivating **help** on the keys.

Whenever a keyboard key is pressed, on-line help will be displayed for the depressed key (except for the key ?).
The functions associated with the keys will not be started up.

On-line help can also be deactivated with the mouse (icon at top right).
The keyboard then resumes normal operation.

Recorder Mode *(cont'd)*

2 "ACQUISITION " keys

No action.
(Pressing the key displays the message: "Impossible in this mode!").

This key has two functions:

RUN = launches an acquisition
STOP = stops an acquisition

If the recorder is in memory display (see §. Memory Menu → Recall ".REC", p. 107), the message "Impossible in this mode!" appears when this key is pressed.

2 «TRIGGER» keys

By successive pressing, selection of the different **Trigger** of the last selected channel (see §. Trigger Menu, p. 97).

No action.
(Pressing the key displays the message: "Impossible in this mode!").

3 "MEASURE" keys

The 19 **automatic** measurements of the reference trace are displayed (see "Oscilloscope" mode, p. 54).

☝ *Particular case*

In "fault capture" (or "file capture") mode, if the screen shows several faults at once, the "automatic measurement" function is impossible and the message "Impossible in this mode!" is displayed.

Selection (by succesive presses) from the traces displayed, of the **reference** trace for automatic and manual measurements (see "Oscilloscope" mode, p. 53).

No action.
(Pressing the key displays the message: "Impossible in this mode!").

2 "HORIZONTAL" keys

Setting of **" the recording time / sampling "** by the encoder wheel.

H-POs. has no action. The message :"Impossible in this mode" is diplayed, if the thumbwheel TOGGLE key is pressed.

- Action identical to that in "Oscilloscope" mode, when fault capture and file capture mode are **not selected** (see p. 15).
- Fault capture or file capture mode is **selected**:

↳ 1st press: "Zoom on" → full screen display of the fault on the left of the screen
The main cursor is positioned over the trigger, on the magnified fault while the auxiliary cursor is on the right of the screen.
Displacement in the list of defects by the encoder wheel.

↳ 2nd press: "Zoom off" → 10 consecutive faults are displayed on the screen.
The cursors are no longer displayed.

Note : Z-pos is not active.

Recorder Mode *(cont'd)*

Definition of terms used (id. "Oscilloscope" mode)

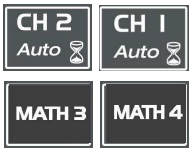
Validated channel: Display enabled, trace displayed after RUN

Displayed channel: Channel validated, trace present on the screen

Selected channel: enables the modification of the sensitivity (V/div) of this channel through the thumbwheel. The TOGGLE key authorizes the vertical displacement of the channel (V-POs.)

The parameters of this channel can be set using the following key :

5 "VERTICAL" keys



Stage 1	Stage 2	Stage 3
Before pressing one of the next keys :	**Press**	**After** pressing one of these previous keys:
The signal concerned is not displayed.	CH 1 Auto CH 2 Auto MATH 3 MATH 4	The signal is displayed and the verical channel is selected. The wheel encoder is assigned to the adjustment of its sensitivity.
The signal concerned is displayed but the channel is not selected.		
The signal concerned is displayed and the channel is selected.		

Double pressing of one of those keys devalidates and erases the concerned signal.

No action.
(Pressing the key displays the message: "Impossible in this mode!").

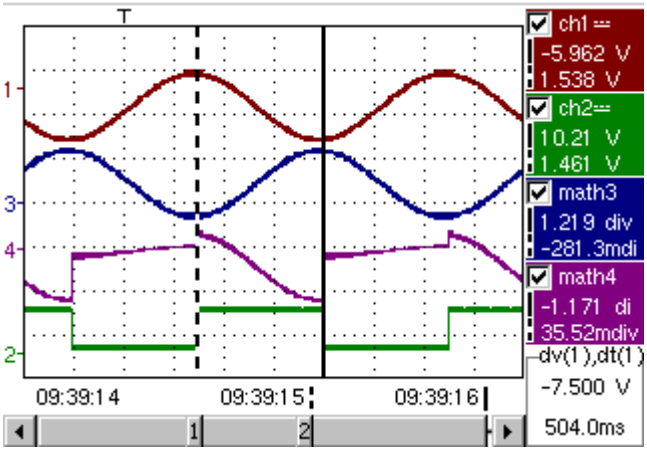
In "Recorder" mode, the DC input coupling is constant. The DC symbol ⎓ is permanently displayed.

The « Recorder » mode is adapted to very low signals. In « Fault Capture » mode : if a periodic signal of frequency > 65 Hz is injected at the inputs (horizontal scale duration of recording = 2 s), there is no trigger.

Recorder Mode *(cont'd)*

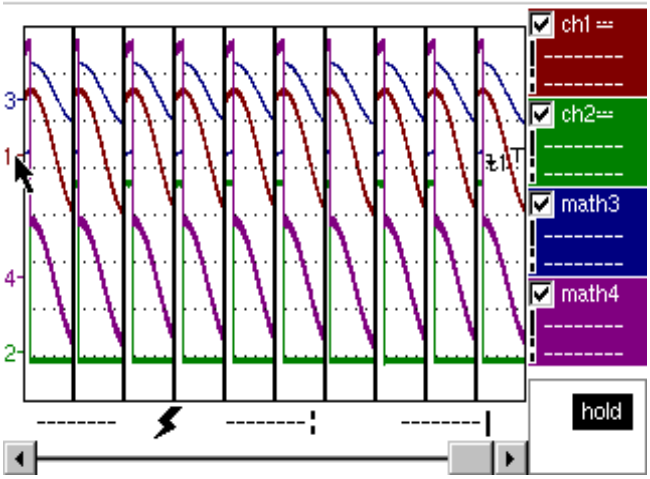
Display

Normal mode display



The user views 500 points on the screen (in "MIN/MAX" mode) to eliminate the risk of information loss involving the 50,000 points in the memory.

Display in fault capture and file capture modes



The memory is segmented to allow the acquisition of 100 faults.

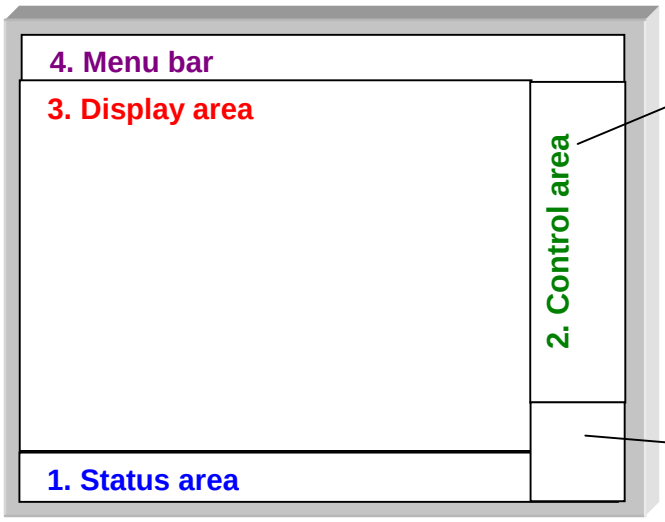
A fault corresponds to a triggerd acquisition of 500 samples.

2 modes of visualization:·
- 10 contiguous faults
- only 1 full-screen fault

Composition

The composition of the "Recorder" mode display is identical to that in "Oscilloscope" mode.

Reminder: The display is divided into 4 functional zones.

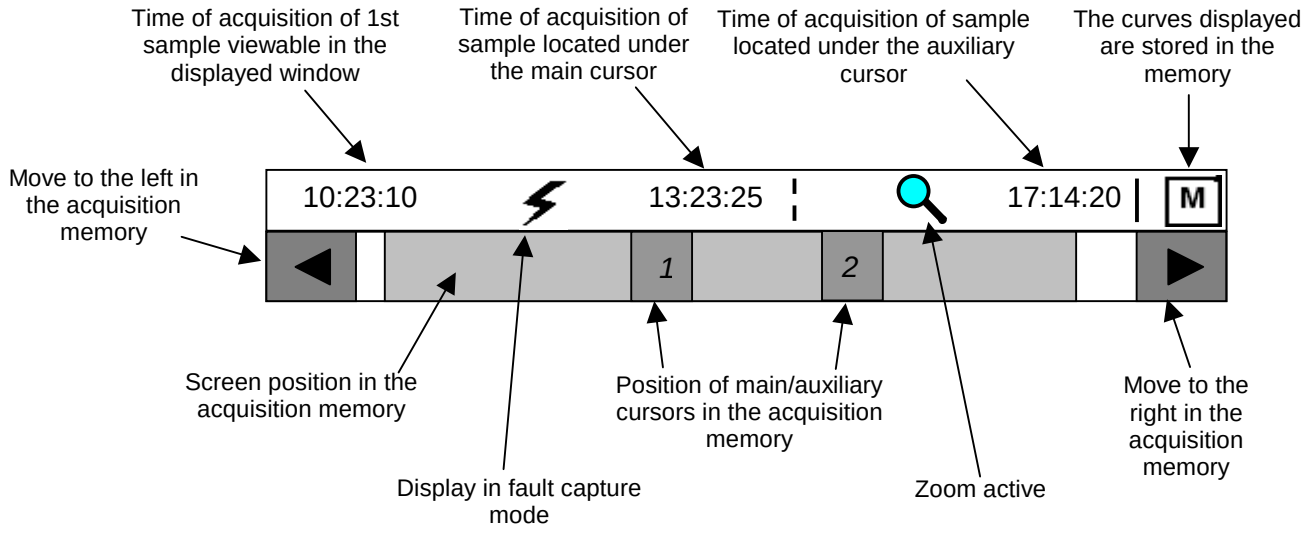


Recorder Mode *(cont'd)*

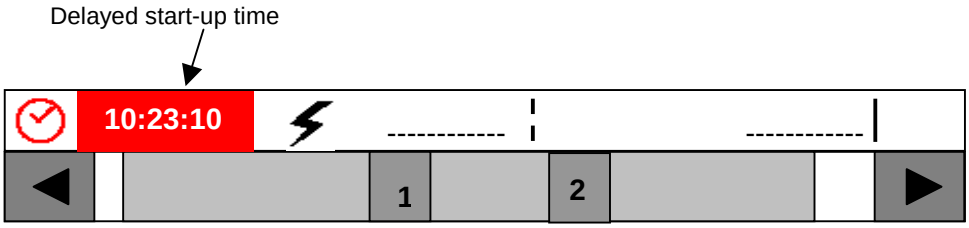
1. Status area Three pieces of general information appear in this area:

- The **bargraph,** representing the screen position and the cursors in the acquisition memory;
- Instrument **settings** (fault capture mode, zoom, etc.);
- **Acquisition times:**
  of the first sample that can be viewed,
  of the sample under the main cursor,
  of the sample under the auxiliary cursor.

Standard configuration



Configuration if delayed start-up is enabled



When the acquisition starts, the display returns to its standard configuration.

Recorder Mode *(cont'd)*

Bargraph

In fault capture and file capture mode, the bargraph indicates the position of the screen and cursors in the acquisition memory.
The main cursor is positioned on the displayed fault and the auxiliary cursor on the right of the screen.

Settings

Signification of symbols appearing on the bargraph:

The recorder is in **fault capture** or **file capture** mode.

The horizontal zoom is active.

The curves displayed are stored in the memory.

Delayed start-up is activated.

10:23:10

This symbol is displayed only when delayed start-up is active.
It indicates the time at which recording will commence.
Start-up date: see §. Trigger Menu → Delayed start-up, p. 98.

Acquisition times

These represent the times of:

10:23:10 - the first sample viewed;

13:23:25 - the sample located under the main cursor;

17:14:20 - the sample located under the auxiliary cursor.

2. Control area

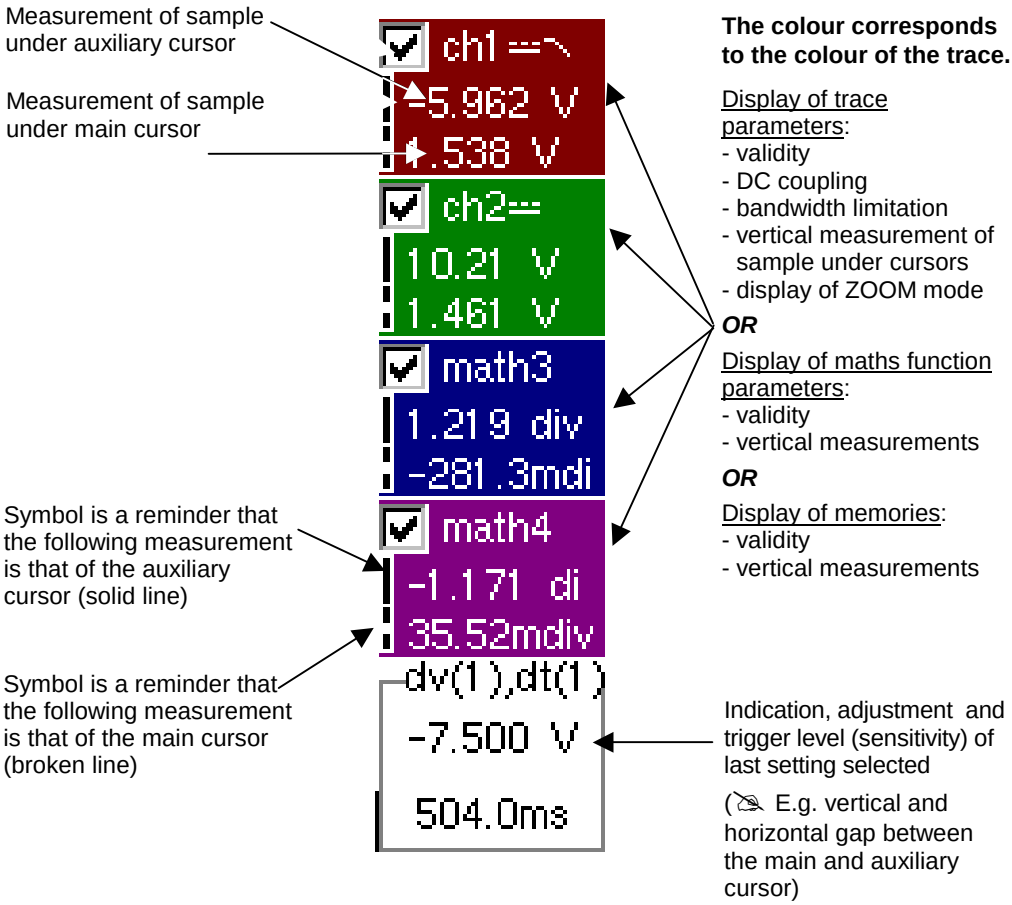
- Parameters of each channel and trace:
  - display
  - coupling
  - bandwidth limit,
  - zoom function,
  - vertical measurements of samples under the main and auxiliary cursor.
- Indication and active adjustment of the last selected element:
  - trigger level (main and auxiliary),
  - horizontal gap between the time position of the auxiliary cursor and that of the main cursor,
  - vertical gap between the measurement of the auxiliary cursor and the main cursor on the reference trace (see §. Menu Measurement → Reference p. 105),
  - number of faults acquired and number of fault viewed,
  - duration of recording and acquisition interval.

The time position of the trigger is not displayed as it is fixed (20 % of the memory). The horizontal scale is not displayed.

- The device indicates if the acquisition is in RUN or HOLD mode.
- The other displays (battery, etc.) are identical to "Oscilloscope" mode.

Recorder Mode *(cont'd)*

2. Control area
(cont'd)



- The use of controls,
- the validation of channels with the mouse,
- the menus relating to the channels and functions

are identical in "Recorder" and "Oscilloscope" mode.

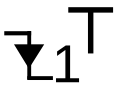
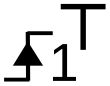
It is not possible to mix memorised curves (Mx) and acquired curves in real-time Chx on the display (see §. Memory Menu → Trace → Recall ".REC" p. 107).

Recorder Mode *(cont'd)*

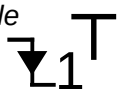
3. Display area Graphic elements displayed associated with the traces in this area:

- Vertical position indicator for the reference level of each trace
- ZOOM area selection.
- Main cursor (permanent, moved using mouse) located at the left of the screen by default.
- Auxiliary cursor (permanent, moved using mouse) located at the right of the screen by default.
- Trigger time position indicator (fixed and located 20% across from the left of the screen).
  Its graphical representation is as follows :

Level indicators representing 5 different triggers:

	- "**Lower** trigger" option (of the last channel selected).
	- "**Upper** trigger" option (of the last channel selected).
	- "**Upper/lower** trigger" option (of the last channel selected).
	- "**External** window trigger" option (of the last channel selected).
	- No symbol is displayed: **no trigger** (on the last channel selected).

☝ ***The level indicator figure represents the channel concerned by this indicator:***

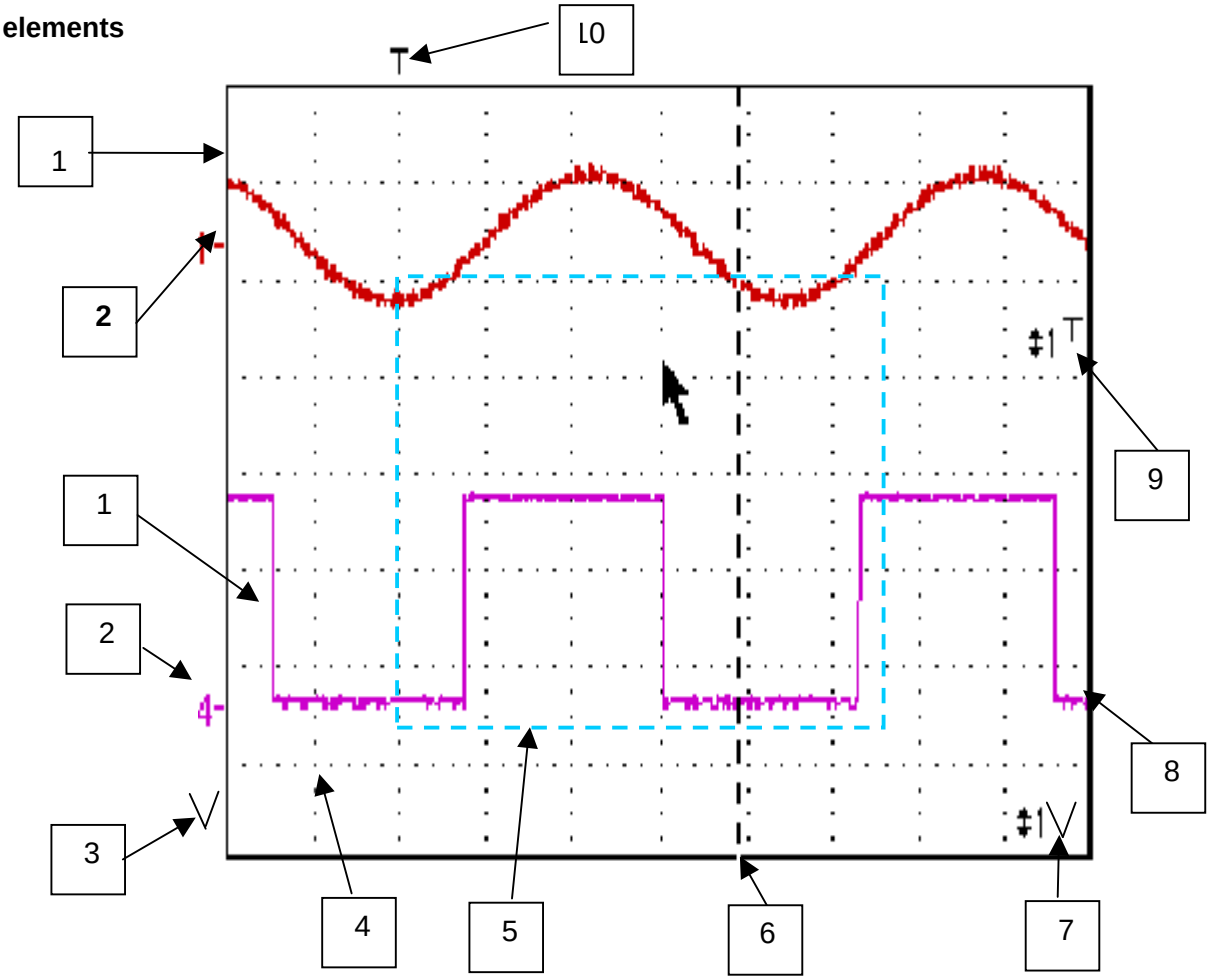
✍ *Example* 	- Lower trigger option on channel 1. There can be trigger conditions on several channels at the same time: display by selecting the channel concerned.

☝ ***In fault capture and file capture mode, the grid is divided into ten sections; i.e. one section for each fault.***

The cursors are no longer displayed: they reappear when a single fault is displayed on the screen (horizontal zoom enabled: see help for key shown here).

Recorder Mode *(cont'd)*

Display elements



Definition of display

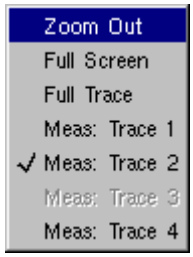
Items	Display elements
1	Trace displayed
2	Indication of vertical position of reference level of the displayed trace and identification of trace number
3	Indicator of trace outside display window
4	Graticule division
5	Zoom area selection
6	Main measuring cursor
7	Trigger level position outside window indicator
8	Auxiliary measuring cursor
9	Trigger level position indicator *(here, for example: upper/lower trigger)*
10	Trigger time position indicator → fixed at 20%

Recorder Mode *(cont'd)*

Menu accessible from display area

Like in "Oscilloscope" mode, the menu concerning the display can be opened directly by clicking with the right key of the mouse in the display area.

This menu, as well as the functions of the proposed options, are identical to those in "Oscilloscope" mode.

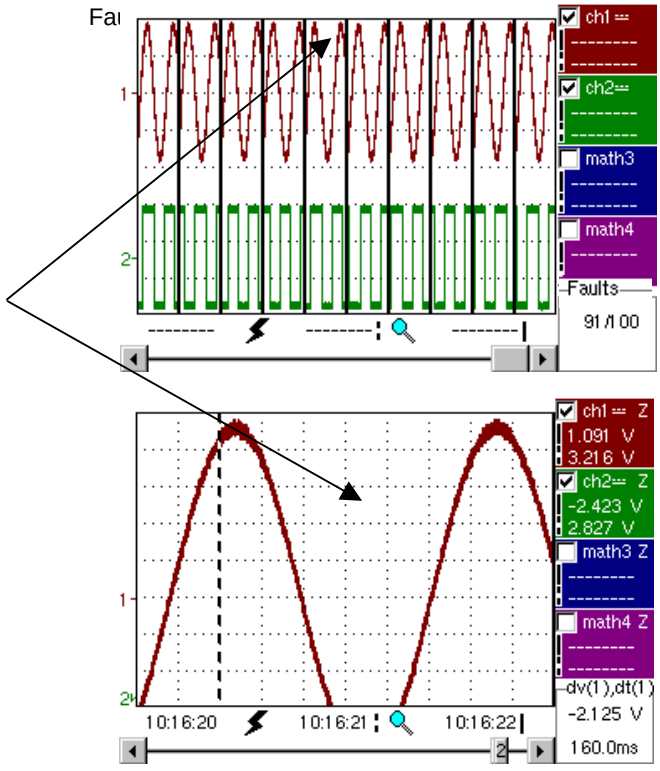


Zoom creation in Fault Capture mode

Case 1

Draw a rectangle around the part you wish to zoom in on with the left key of the mouse. The screen displays, with a vertical zoom, the fault on which you began the rectangle.

Fault 5 is magnified.



To return to a normal display (10 faults displayed on the screen), select "Disable zoom" in the menu,

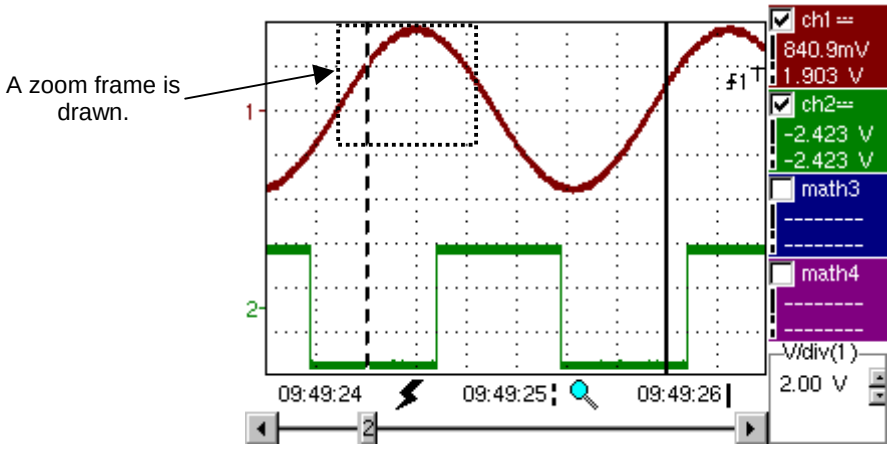
Disabling the horizontal zoom with the zoom key allows the user to return to a screen displaying the ten faults, but the vertical zoom remains enabled.

Recorder Mode *(cont'd)*

Case 2

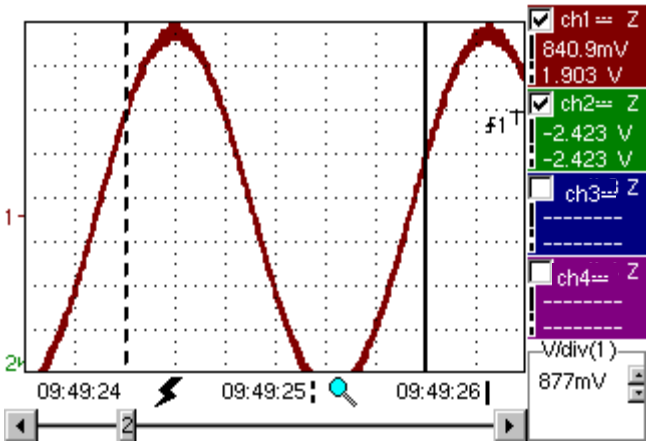
ZOOM Z-Pos.

The horizontal zoom is enabled, the screen displays the captured fault which has been selected :



Fault capture mode: the horizontal zoom is enabled.
A single fault is displayed on the screen.

On the displayed fault, it is possible to vertically zoom delimitating a zone with the mouse.



A vertical zoom is applied to the area containing the fault.

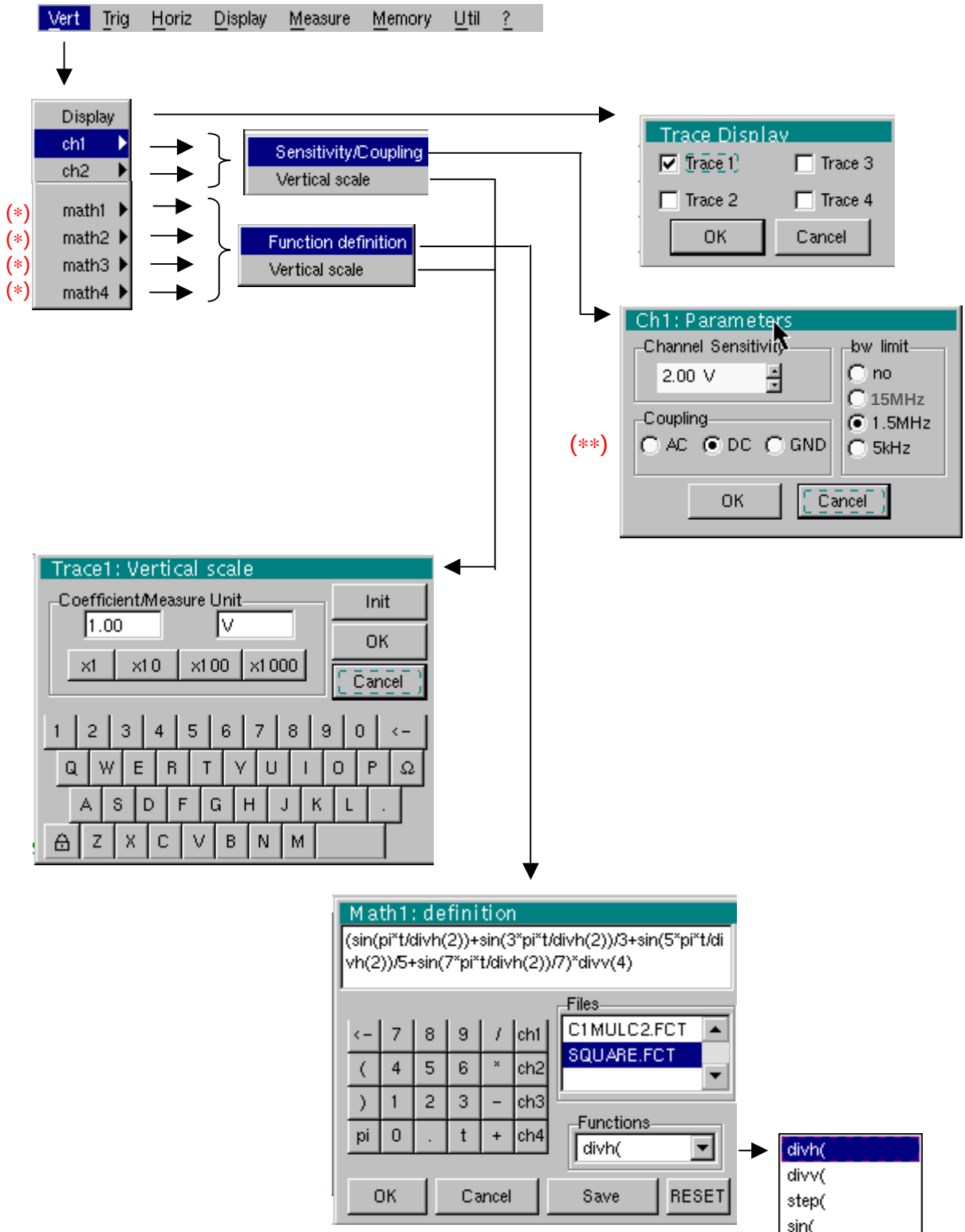
As in the first case, select "disable zoom" in the menu above to disable the zoom. The screen returns to the initial "10 faults on the screen" display.

ZOOM Z-Pos.

Disabling the horizontal zoom with the zoom key allows the user to return to a screen displaying the ten faults, but the vertical zoom remains enabled.

Recorder Mode *(cont'd)*

The "*VERT*" Menu This menu is identical to that described in "Oscilloscope" mode.

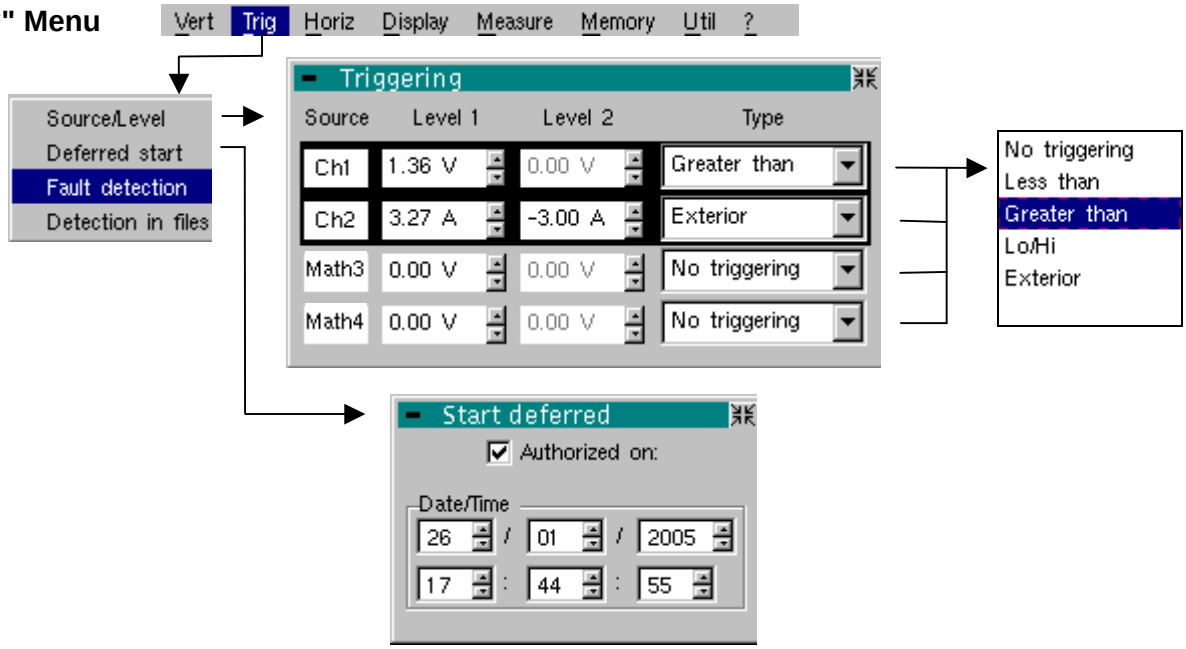


(*) Functions only accessible in "Advanced" mode.
See §. Description, p. 65.

(**) The DC coupling is the only option in "Recorder" mode.

Recorder Mode *(cont’d)*

The "*TRIG*" Menu



Triggering

Selection of trigger type and level on each channel. Triggering takes place if a condition described by a line of the “Trigger” table is verified.
This trigger level must be present in the display area.

Source Indicates the channel number.

Level 1 The main trigger threshold level can be set using the mouse.

Level 2 The auxiliary trigger threshold level can be set using the mouse. This tab is enabled only if external trigger type is selected.

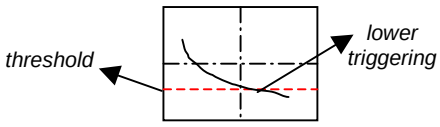
Trigger levels are entered into the current value display area after modification. Fine adjustment is possible.

Trigger type This tab indicates each channel’s trigger type. Recorder mode enables several conditions to be monitored at the same time.

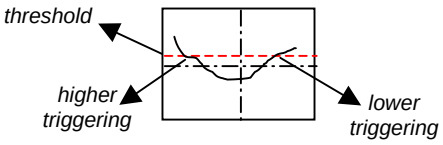
“No trigger”: if all the channels are in this mode, the device records indefinitely.

The Pretrig is monitored for each type of trigger.

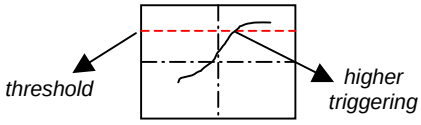
- **“Lower than”:** triggering takes place when the signal drops below the threshold.



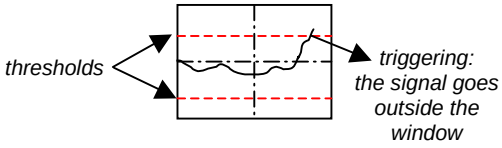
- **“Lower/higher than”:** triggering takes place when the signal drops below or rises above the threshold.



- **“Higher than”:** triggering takes place when the signal rises above the threshold.



- **“Outside window”:** triggering takes place when the signal goes outside the window defined by the two thresholds.

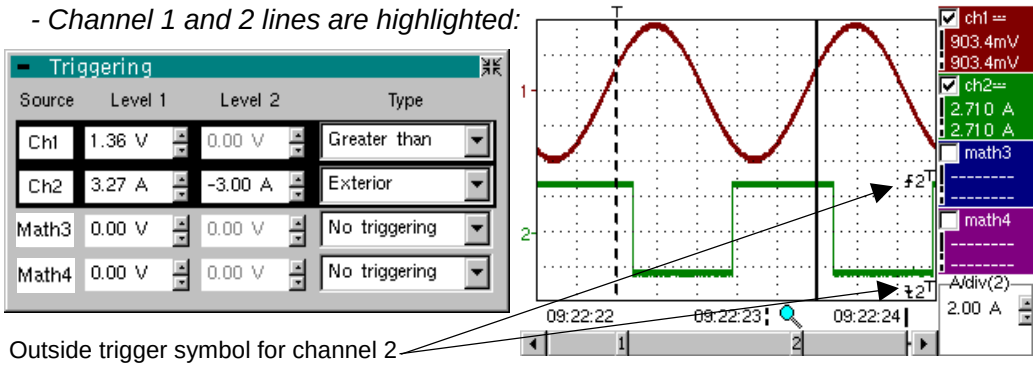


A *half-division hysteresis is applied to prevent ill-timed triggers.*

Recorder Mode *(cont’d)*

Example

- Channel 1 is set with a 1.36V “higher than” trigger.
- Math 3 and 4 do not wait for a trigger.
- Channel 2 is set with an “outside” type trigger.
- Channel 1 and 2 lines are highlighted:



Toggle through the trigger conditions for the different channels using the keys shown opposite.

Start deferred

Deferred start offers the possibility of starting up an acquisition at a date and time chosen by the user.

This option can be related to the previous trigger conditions.

Authorised on

This tab allows the user to validate – or not – delayed triggering.

- If the symbol “✓” is displayed, delayed triggering has been validated.
- If there is no symbol, delayed triggering has not been validated.

Use the mouse to validate or unvalidate the tab.

- *When deferred start has been validated, the user can no longer make an acquisition in recorder mode. He/she may, however, use the other modes (oscilloscope, analyser) as desired.*
  If the user wishes to make an acquisition in recorder mode, he/she must:
  - either unvalidate delayed start-up,
  - or wait until the delayed start-up acquisition begins.
- *At the time the acquisition is set to start (deferred start time), the instrument must be in operation and the user must have enabled recorder mode.*

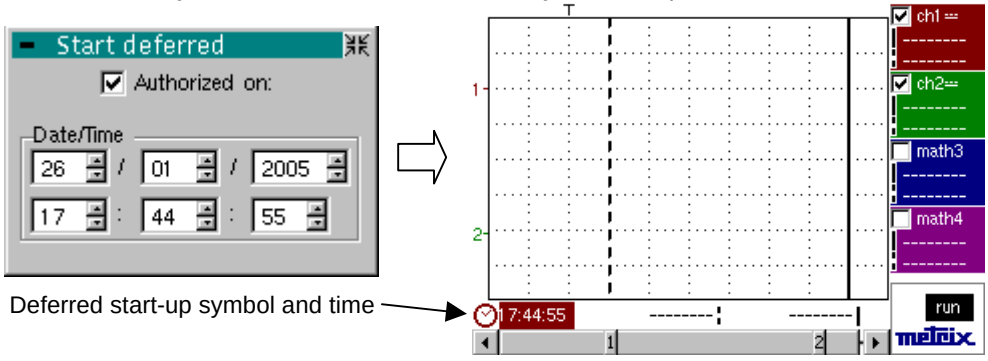
Date/Time

Different scroll boxes allow the user to set the date and time he/she wishes the acquisition to commence.

Use the mouse to scroll.

Example

Deferred start: the acquisition will commence on 26 January 2005 at 17:44.
The red clock symbol shows the user that delayed start-up is enabled.



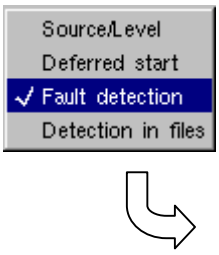
Recorder Mode *(cont’d)*

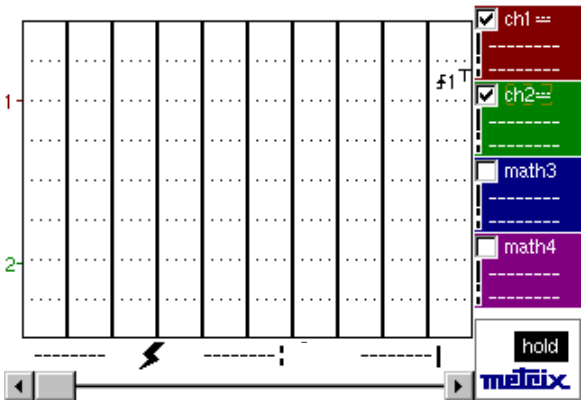
Fault capture

The fault capture mode allows 100 recordings of 500 samples to be made around the trigger point.

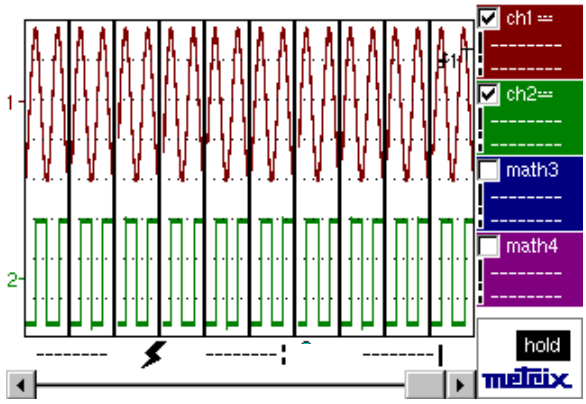
These 10 recordings will be displayed on the screen. Each recording is separated by a solid vertical line. They are recorded in volatile memory.

Example





The fault capture mode is selected:
the screen is divided into 10 sections.



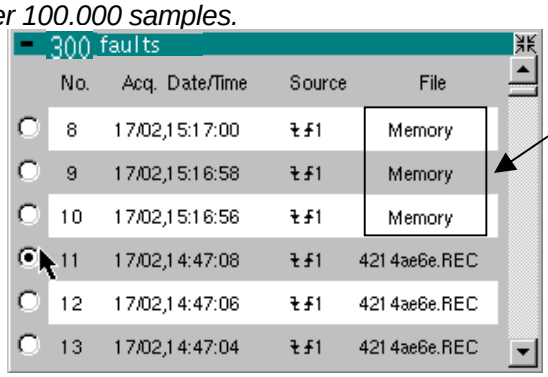
Display after an acquisition in fault capture mode

File capture

This mode is similar to fault capture mode:

- It carries out several series of 100 recordings of 500 samples.
- Each series of 100 recordings is stored in a file in the memory (.REC).
- The number of total recordings that may be made depends on the space remaining in the memory.

If the memory is empty, it is possible to make up to 300 recordings of 500 samples (200 recordings saved in a file and 100 recordings in volatile memory), totalling over 100.000 samples.



Recorder Mode *(cont’d)*

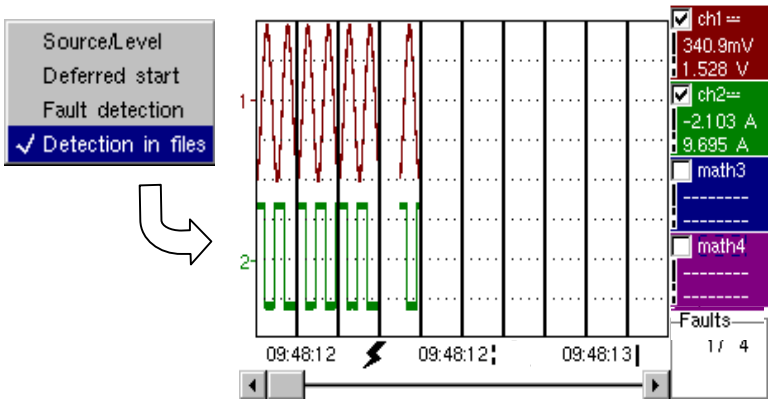
File capture *(cont’d)*

- *When the memory is full, the acquisition is stopped and a message appears on the screen “**Write error/Auxiliary storage full**!”. The message is validated by selecting **OK** with the mouse. The user can then begin to study the recordings.*
- *They are displayed folder by folder. There is a file on the screen. A file contains 100 recordings. Fault capture option display mode is available.*
- *Use the Fault window to move from file to file (see §. Display Menu).*

The acquisition can be interrupted at any time by pressing the RUN/STOP key. The user can then study previously recorded faults.

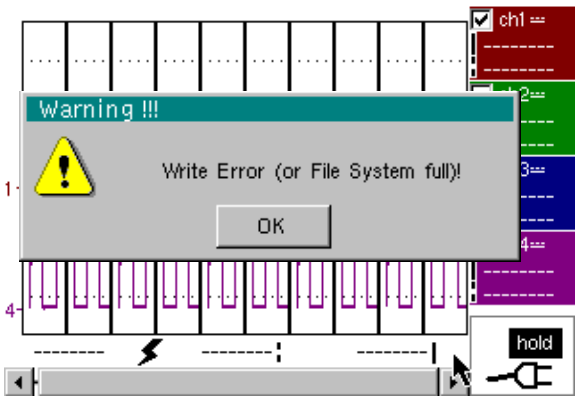
Example

File capture until the memory is full:



File capture acquisition is launched.
When 100 faults are captured, a file is created with these 100 recordings.

The memory is full: the acquisition is stopped and a message is displayed.



Final stage:
Message validation.
In order to access all the recorded faults, go to Display menu → Fault.
See Display Menu §. Faults.

Recorder Mode *(cont’d)*

Display (fault capture, file capture)

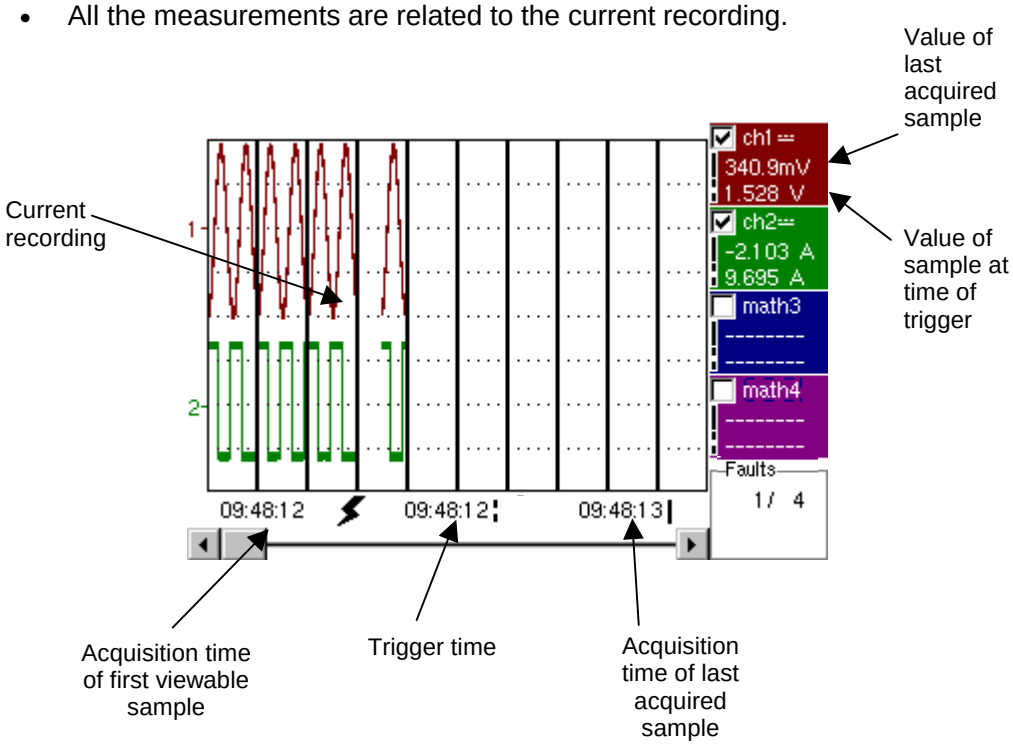
Two cases arise:

- the horizontal zoom is enabled,
- the horizontal zoom is disabled.

Horizontal zoom disabled

Modification of display:

- The cursors are no longer displayed.
- The measurements displayed do not have the same significance.
- All the measurements are related to the current recording.



- “Trigger time” and “Sample value at trigger time” measurements are only displayed if the trigger has taken place.
- Maximum and minimum searches cannot be enabled (see §. Display Menu, p. 103).
- The automatic measures cannot be enabled (see §. Measurement Menu, p. 105).

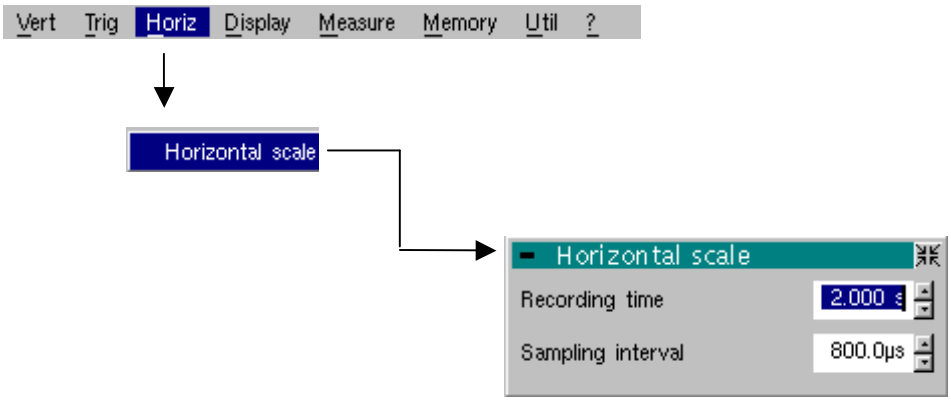
Horizontal zoom enabled

The display is identical to normal mode.

- The measurements displayed have the same significance as in normal mode (see §. Display Menu, p. 103).
- Maximum and minimum searches are possible (see §. Display Menu, p. 103).
- Automatic measurements can be enabled (see §. Measurement Menu, p. 105).

Recorder Mode *(cont’d)*

The "*HORIZ*" Menu



Horizontal scale

This function allows the user to set:

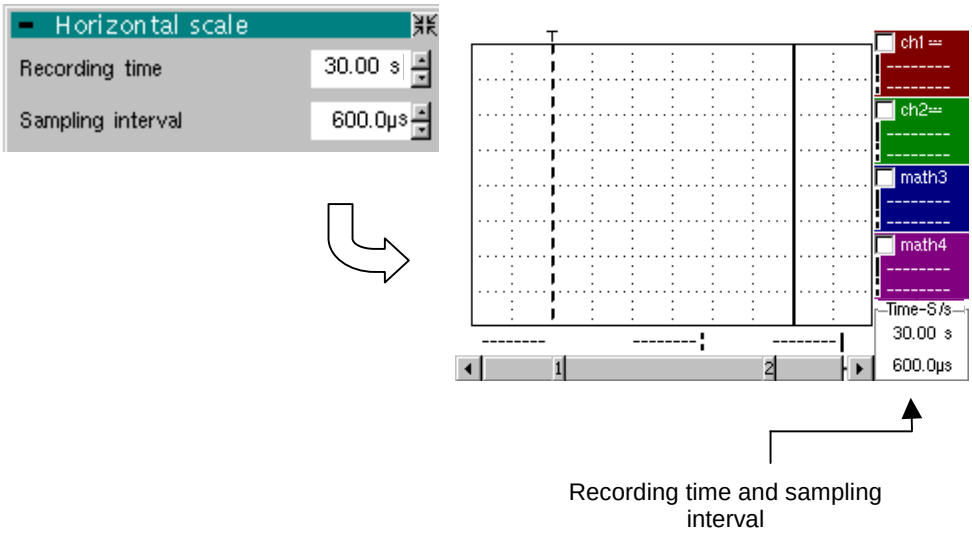
- the recording time : variation range, from 2 s to 31 days
- the sampling interval : variation range, from 40 µs to 53,57 s

These two values are correlated. When the user modifies one, the other is modified.

Adjust the scroll boxes with the mouse to set these values.

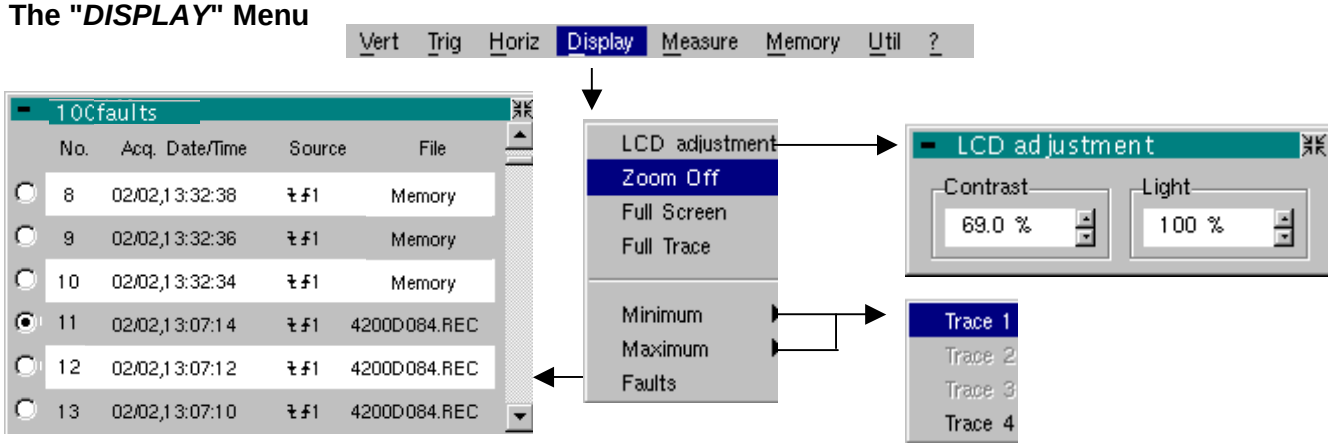
Recording time and sampling interval settings are also accessible via this key and the thumbwheel.

Example *The recording time is 30 seconds and the acquisition interval is 12 mins.*



Recorder Mode *(cont’d)*

The "*DISPLAY*" Menu



LCD adjustment

LCD contrast and brightness adjustment.

This function has the same effect as the following  key.

Zoom off

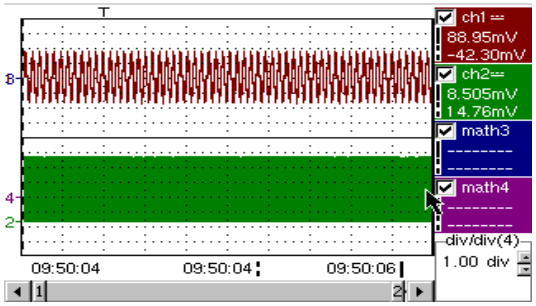
Returns to the original screen size after zooming in on part of the screen.

- *This function is disabled 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 clicking with the right key of the mouse inside the curve display area.

Full trace

activates/deactivates the vertical division of the display area by two.



La fonction « Full trace » activée est indiquée par :
- la présence d’un trait continu horizontal au milieu de la zone d’affichage,
- la division verticale par deux du graticule (2 fois 8 divisions verticales).

The « Full Trace » function activated is indicated by :

- the presence of a horizontal continuous feature in the middle of the display area
- a graticule divided vertically into 2 zones of 8 divisions
- traces 1 and 3 assigned to the higher part of display
- traces 2 and 4 assigned to the lower part, so as to remove their superposition.

The traces can be then vertically moved in both areas.

Maximum/Minimum

The minimum (or maximum) option consists in:

- searching for the min (or max) value of samples on trace X ;
- centring, if possible (zoom), the curve on this specific point. The main cursor is now fixed on this sample.

Particular case

Display of 10 faults on the screen when fault capture mode (or file capture mode) is validated and the horizontal zoom is not enabled: “Minimum/ Maximum” functions cannot be used. They are greyed out in this configuration.

Recorder Mode *(cont’d)*

Faults

The search for faults enables successive recorderings in “fault capture” or “file capture” (memory) mode to be explored (.REC).

All files with a “.REC” extension are analysed and each fault is displayed. When one of these faults is selected, it is displayed on the screen. The main cursor is fixed at the fault’s trigger point and the auxiliary cursor is placed at the right of the screen: the window is accessible from: Display → Faults.

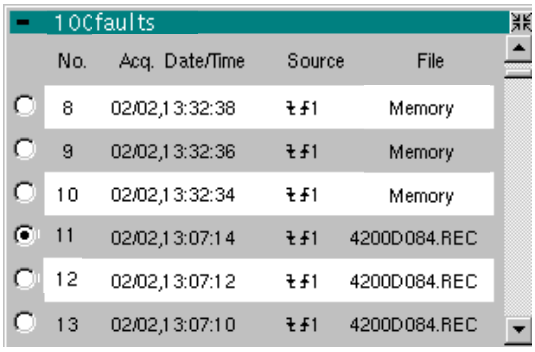
Various information is provided in this window:

- **Title**: total number of faults contained in the memory
- **No**: fault number
- **Acq. date/time**: date (day, month) and time of fault acquisition
- **Source**: symbol for type of trigger used for this fault and source
- **File**: name of file in which the fault is recordered

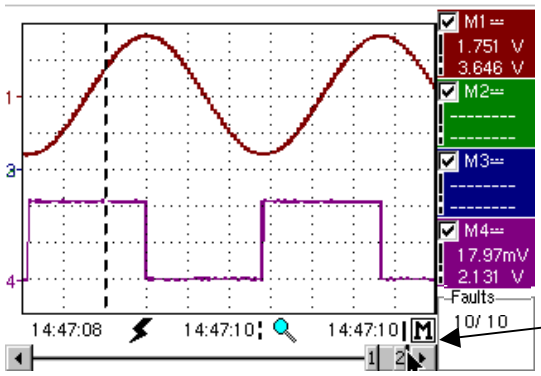
The term “memory” in filenames means that the fault captured is in <u>auxiliary</u> storage. If a “.REC” file is displayed, all the faults in the “volatile memory” will be lost.

Example Following a file capture, the “Faults” option will allow the different recordings to be analysed:

Fault n°11 in file selected: 4214ae6e.REC. Its triggering source is outside window. It was captured on 17 February at 14:47:08.



Display of fault n°11 with the main cursor on the trigger point and the auxiliary cursor on the last sample acquired. The recorder er is in memory display. To return to normal display, deselect Recall ‘.REC’ in the Memory menu.



The symbol **M** is a reminder that the recorder is displaying a memory (.REC).

Full screen

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

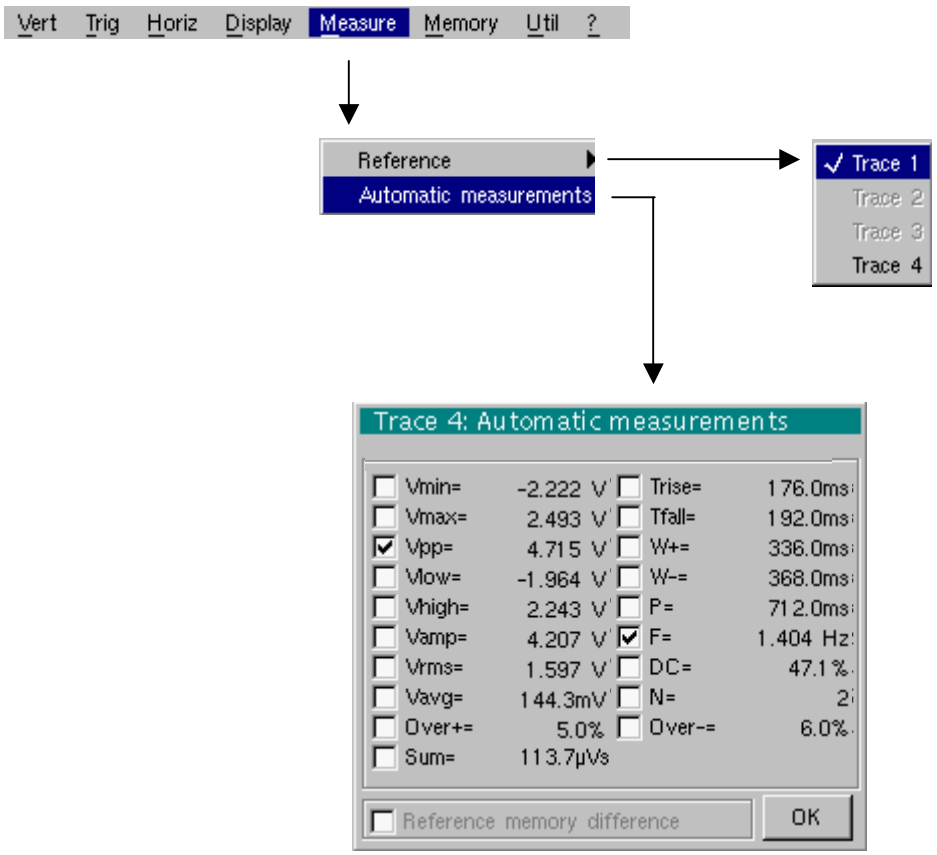
The display is organised so as to leave the biggest surface area possible for curve plotting: only the permanent settings remain, as well as the option to display the automatic measurement window.

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

This function can also be accessed by clicking on the trace display area with the right key of the mouse.

Recorder Mode *(cont’d)*

The "*MEASURE*" Menu



Reference

Trace 1
Trace 2
Trace 3
Trace 4

Identical to “Oscilloscope” mode.

Automatic measurements

This window is nearly identical to the one in "Oscilloscope" mode.

The automatic measurement calculation area is defined by the two cursors.

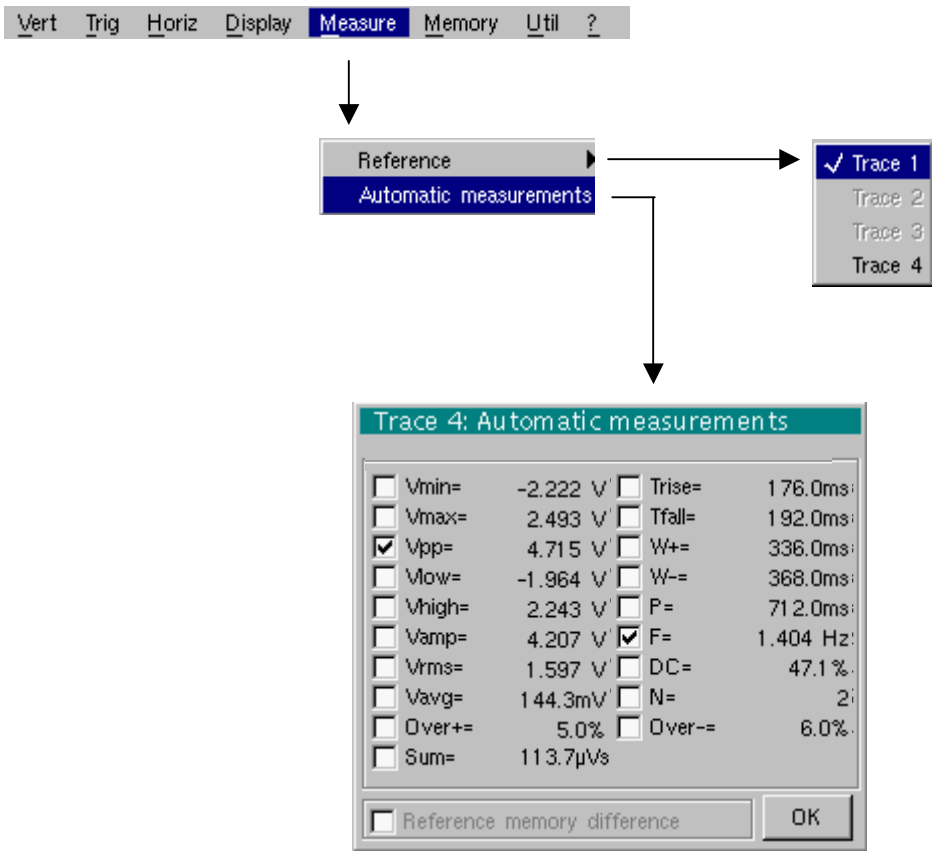
It is not possible to select measurements in order to display them in the status area.

Particular case

In the fault capture mode (or file capture mode) with the horizontal zoom not enabled: the “automatic measurements” function is not active.
The message “Impossible in this mode” or “ Measurement impossible” is displayed

Recorder Mode *(cont’d)*

The "*MEASURE*" Menu



Reference

Trace 1
Trace 2
Trace 3
Trace 4

Identical to “Oscilloscope” mode.

Automatic measurements

This window is nearly identical to the one in "Oscilloscope" mode.

The automatic measurement calculation area is defined by the two cursors.

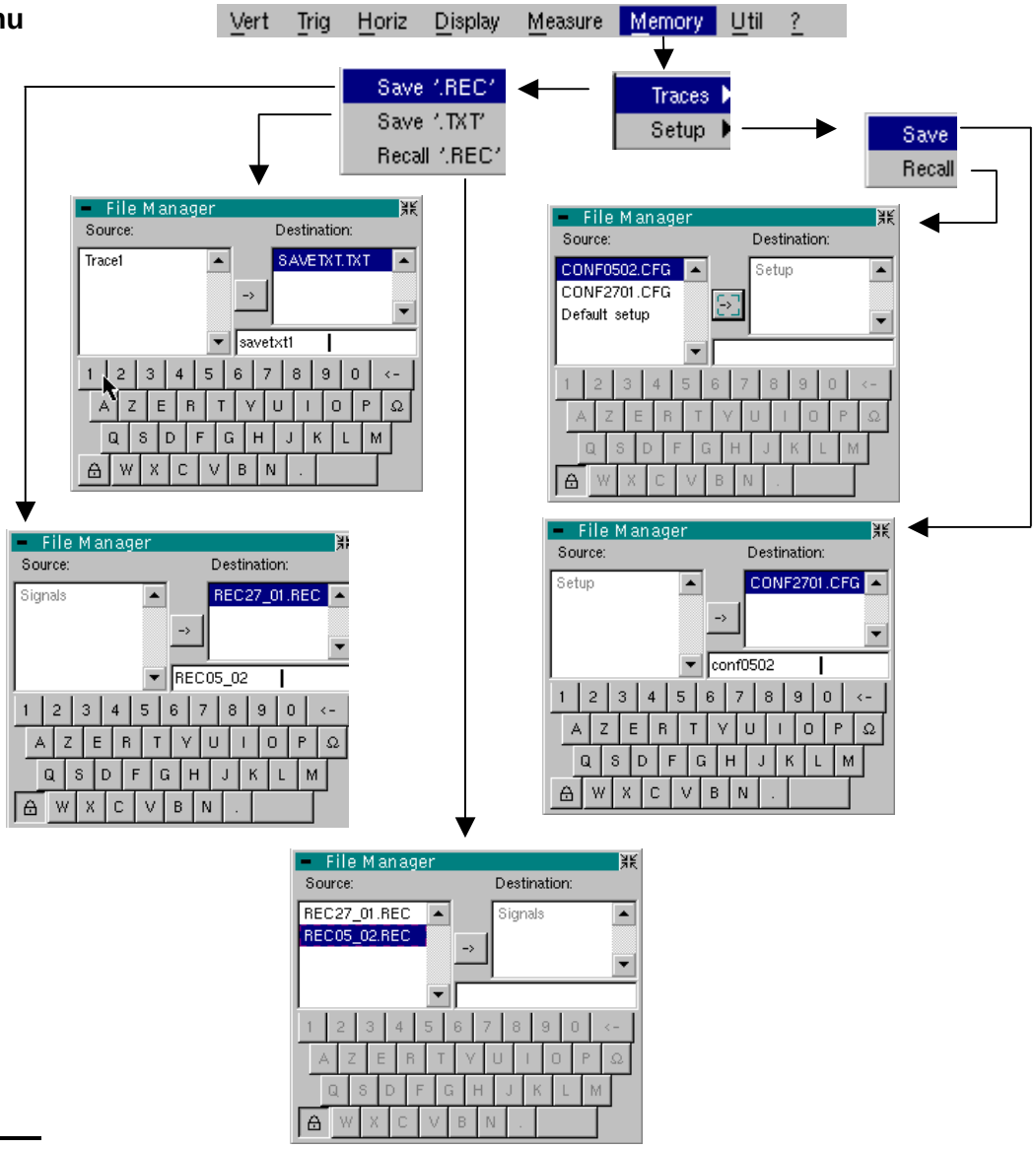
It is not possible to select measurements in order to display them in the status area.

Particular case

In the fault capture mode (or file capture mode) with the horizontal zoom not enabled: the “automatic measurements” function is not active.
The message “Impossible in this mode” or “ Measurement impossible” is displayed

Recorder Mode *(cont’d)*

The "*MEMORY*" Menu



Trace

Save .REC In this mode, all the traces are saved in one file (extension .REC).

The selection opens a "File Copy" menu.

A default backup filename is proposed above the keyboard. It can be modified using the virtual keyboard and mouse. The ← key deletes the character preceding the cursor in this area.

Once the name has been entered, the → key saves the data, puts it into the “destination” list and closes the menu. The backup filename takes the extension .REC (format that can be reread on the instrument). The menu can be exited without backing up by tapping the icon in the top right-hand corner of the window with the mouse.

- *The filename is limited to a maximum of 15 characters + extension. If this format is not observed, the message 'Filename too long’ is displayed. When the pointer passes over a destination file, its name, date and time of saving and size are displayed.*
- *If the name already exists or is not compatible, the error message : “Impossible ! File already exists” appear.*

Recorder Mode *(cont’d)*

‘.TXT’ save Identical to “Oscilloscope” mode (see §. Memory Menu → Trace → Save ‘.TXT’). In this mode, traces are saved individually.

Recall ‘.REC’ Opens a "File Copy" menu when selected.

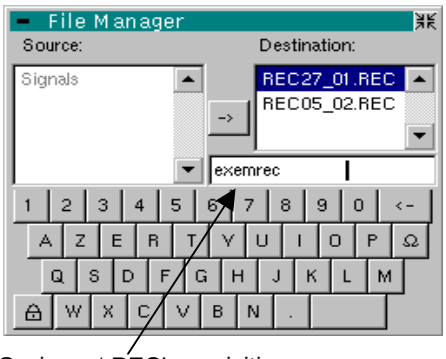
In the "Source" list, the previously saved .REC files (via the menu "Trace → Save.REC") are displayed.

The file name to recall is highlighted. It is selected using the mouse.

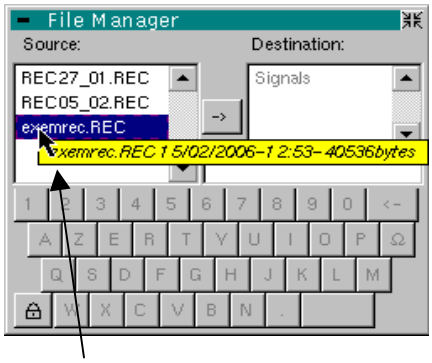
Once it has been selected, the → key opens the file and closes the menu. The menu can be exited without recalling by tapping the icon in the top right-hand corner with the mouse.

- *It is impossible to launch an acquisition or deselect a channel while the recorder er is in memory display mode*.
- *It is not possible to switch from a normal acquisition to a fault capture while the recorder er is in memory display mode.*
- *This symbol – which is in the bottom right-hand corner of the screen – is a reminder that the recorder er is in memory display mode.*
- *The “✓” symbol in front of Recall ‘.REC’ in the Memory menu is a reminder that the recorder er is in memory display mode.*
- *When a .REC file is recalled, the symbol “Mx” is displayed in the parameters of all the traces.*
- *The virtual keyboard cannot be used in this menu.*
- *To exit memory display mode, deselect Recall ‘.REC’ in the Memory menu by tapping it with the mouse.*

Example

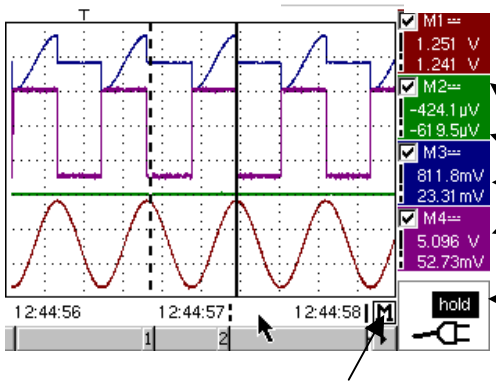


Saving a ‘.REC’ acquisition:
Enter the filename.
Then click on → to validate the save.



Recall ‘.REC’: Select the file to recall.
Then click on → to validate your choice.

To deactivate the memory display, deselect recall ‘.REC’ with the mouse.



Mx symbol: all the traces come from the memory.

Acquisition impossible in memory display mode.

The symbol **M** is a reminder that the recorder er is in memory display mode.

Recorder Mode *(cont’d)*

Configuration Saving or recalling an instrument configuration.

Save Opens a "File copy" menu when selected.

* There is a file called “Configuration” in the “Source” list.
  It contains the configuration settings for the device at the time this menu is opened. A backup filename is proposed above the virtual keyboard. The ← key deletes the character preceding the cursor in this area.
* Once the source filename has been created, the → key saves the configuration by transferring it into the “destination” list and closes the menu (backup file: extension .CFG).
  The menu can be exited without saving by tapping the icon in the top right-hand corner of the window.

- *The filename is limited to 15 characters + extension. For a source file, the name is accompanied by the date and time of saving and the file size when the pointer passes over its name.*
- *If the name already exists or is not compatible, an error message appears.*

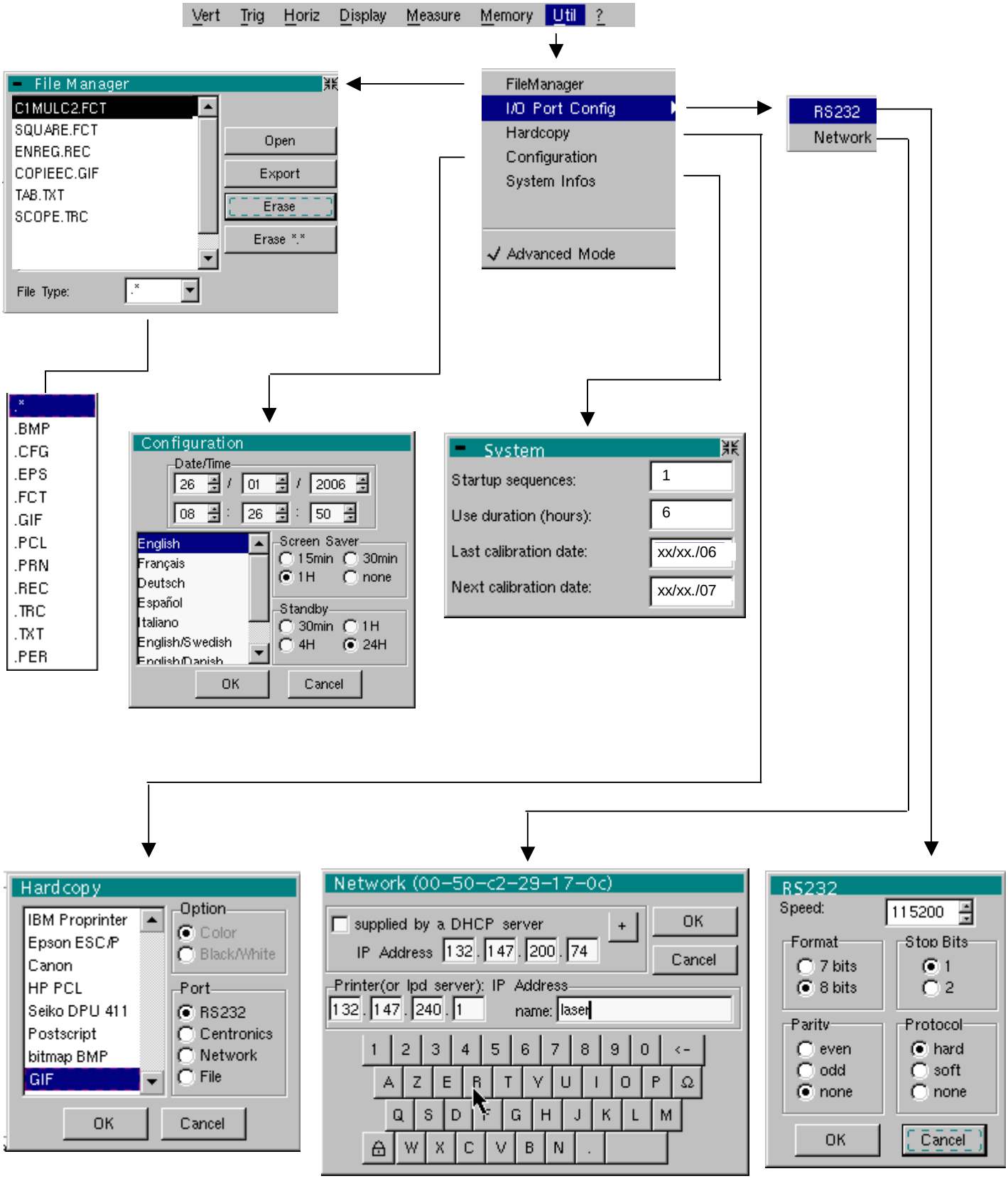
Recall This opens a “File Copy” menu when selected.

* The previously saved files (.CFG) (saved via the Configuration → Save menu) are displayed.
  The filename that has been selected for recall is greyed out.
  The right-hand scroll bar is used to move down the list.
* Once the source file has been selected, the → key carries out the recall.
* The menu can be exited without saving by tapping the icon in the top right-hand corner of the window.

- *The virtual keyboard cannot be used in this menu.*
- *Use the “default config” file to restore the factory configuration.*

Recorder Mode *(cont’d)*

The "*UTIL*" Menu



Recorder Mode (cont.)

Files

This function is identical to that described in “Oscilloscope” mode.

I/O port config

Identical to “Oscilloscope” mode.

Screen shot

Identical to “Oscilloscope” mode.

Configuration

Identical to “Oscilloscope” mode.

Screen saver

- If the recording time is over 2 seconds, the screen saver will never be activated.
- If the recording time is equal to 2 seconds, the screen saver and settings operate as in “Oscilloscope” mode .

Standby

- If the recording time is over 2 seconds, standby will never be activated.
- If the recording time is equal to 2 seconds, standby and settings operate as in “Oscilloscope” mode.

System info

Identical to “Oscilloscope” mode.

"Advanced" mode

When "Advanced" mode is not enabled, certain instrument functions no longer appear in the menus.

Functions available in "Advanced" mode only

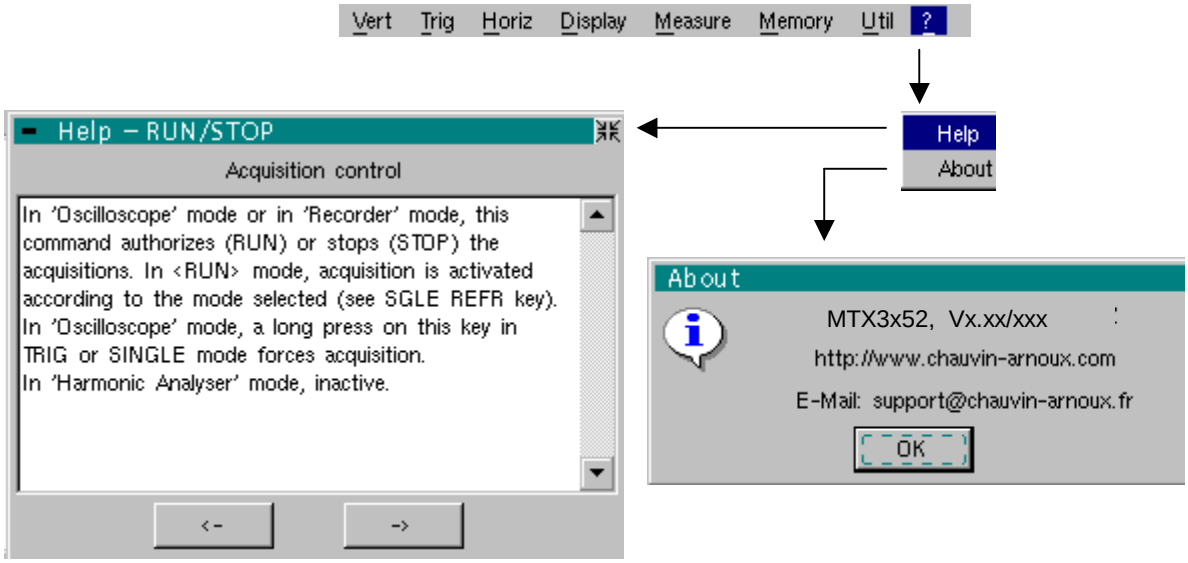
math1, math2, math3, math4 → accessible via the "**Vert**" menu.

☝

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

Recorder Mode *(cont'd)*

The "?" Menu



Help	Menu identical to "Oscilloscope" mode.
About	Menu identical to "Oscilloscope" mode.

Applications

1. Calibration signal display

- Connect the calibrator output (2.5 V, 1 kHz) of the connection zone to the CH1 input using the 1: 10 ratio measurement probe (for instance).
- Using the key shown *opposite*, select the « Oscilloscope » mode.
  - Confirm the signal: Vert Menu → Display: Trace 1
  - Adjust the ch1 sensitivity: Vert Menu → ch1→ Sensitivity/Coupling: 50 mV/div. (1:10 probe)
  - Adjust the coupling: Vert Menu → ch1→ Sensitivity/Coupling: AC
  - Adjust the sweep speed (time base window): 200 µs / div.
  - Adjust the trigger source: Trig. Menu → Parameter → Main source: ch1
  - Adjust the trigger mode: Trig. Menu → Automatic mode: automatic
  - Using the key shown *opposite*, start acquisitions (RUN mode)

If necessary:

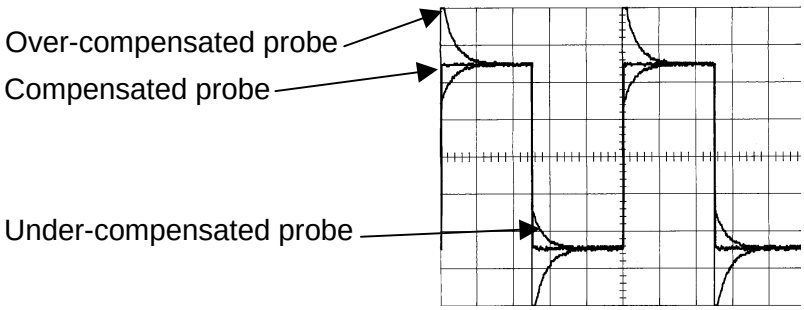
- Modify the trigger level by the left mouse key by dragging the symbol T (Trigger) over the screen. The trigger level value is displayed at the bottom right of the screen.
- Modify the vertical framing of the curve by moving the symbol 1 on the left of the screen using the left mouse key.

The Autoset 

button is used for automatically checking these adjustments.

2. Probe compensation

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



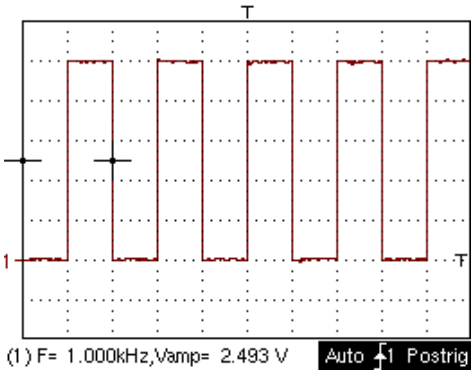
Refer to the manual attached to the probe when making compensation.

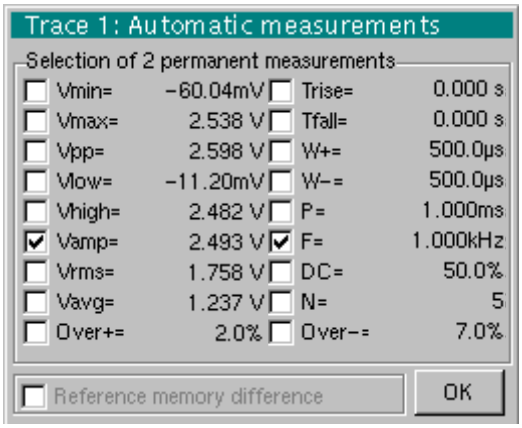
Applications *(cont'd)*

3. Automatic measurements

- Connect the calibrator output (2.5 V, 1 kHz) of the connection zone to the CH1 input using a ratio 1 : 10 measurement probe.
- For probe adjustments, see the §. Calibration signal display.
- Opt for: 50 mV/div. vertical range
  time base coefficient 500 µs/div.
  vertical scale coefficient 10
  ch1 DC coupling
- Display the channel 1 signal automatic measurements table using the menu: Measurement → Automatic measurements
  (see §. Measurement) or the key shown *opposite*.

The table of all the measurements made on the trace is displayed.





The « ✓ » symbol indicates the 2 measurements that will be displayed on the trace once the table has been closed.

The deletion of automatic measurements beneath the trace is obtained by deleting the last 2 selected measurements.

The validation of the "Reference memory difference" option is used for calculating, for the same measurements, the difference between a selected trace and a memorized reference trace (see §. Memory).

Reminder

For a better precision of measurements, display at least two periods of the signal and select the range and the vertical position in order to represent the amplitude peak-to-peak of the signal to be measured on 4 to 7 vertical divisions.

The activation of automatic measurements reveals 2 cursors on the trace at the beginning and end of a period if at least one period can be viewed on the screen.

Applications *(cont'd)*

4. Measurements by cursors

- Select measurements by cursors using the menu: Measurement → Manual measurements (dt, dv) (see §. Measurement).
  - Two measurement cursors (1 and 2) are displayed as soon as the menu has been activated.
  - The 2 measurements made, entered under the trace display, are **dt** (interval between 2 cursors depending on time base) and **dv** (voltage between 2 cursors depending on vertical sensitivity).

    ✍ *E.g.:* (1)dt = 2,150 ms, dv = 250.0 mV

Note

- The two measurement cursors (1 and 2) can be moved directly over the screen using the mouse left key.
  In the same way, they can also be moved horizontally by the mouse by selecting 1 (cursor 1) or 2 (cursor 2) in the status zone bargraph.
- If the free cursors option is not activated (see §. Measurement → Free cursors), the cursors will remain linked with the trace during movements.
- If the free cursors option is active, the cursors can be moved anywhere over the screen.

5. Cursor offset measurements

- Initially, it will be necessary to have 2 offset signals on the 2 channels.

a) Automatic phase measurement

- Select the reference trace with respect to the one on which phase measurements are to be made from the menu: Measurement → Reference → Trace 1, Trace 2, Trace 3 or Trace 4 (see §. Reference).

  ✍ *E.g.:* Reference Measurement → Trace 1.

- Select automatic phase measurement from the menu: Measurement → Phase measurements (see §. Phase measurement).

  ✍ *E.g.:* Phase measurement → Trace 2 Phase.

  - The 2 cursors (+) for automatic measurements are displayed on reference trace. A « φ » cursor is displayed on the trace on which the phase measurements are made.
  - The phase measurement (in °) is indicated under the curve display.

✍ *E.g.:* (1)Ph (2) = 180.0°

Note

- The 3 cursors are fixed and cannot be moved.
- If the measurement cannot be made, « **-.- -** » appears.

b) Manual phase measurement

- Select manual phase measurement from the menu: Measurement → Manual phase measurement (see §. Measurement).
  - The 2 cursors (1 and 2) for manual measurements are displayed on a reference trace. A « φ », cursor with respect to which the phase measurement is made, will be displayed.
  - The phase measurement (in °) is indicated under the display of the curve(s).

    ✍ *E.g.:* (1)Ph = 150.0°

Applications *(cont'd)*

Note

- The 3 measurement cursors are present if there is at least one trace on the screen.
- The 3 measurement cursors can be moved directly over the screen using the left mouse key. They can also be moved by the mouse, by selecting 1 (cursor 1) or 2 (cursor 2) in the status zone bargraph.
- If the "free cursors" option is not activated (see §. Free cursors), then the cursors (1 and 2) will remain linked with the trace during the movements. If the option is active, these cursors can be moved freely over the screen.

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

6. Display of a 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 to observe a video signal.

- Inject on CH1 a composite TV signal with the following characteristics:
  - 625 lines
  - positive modulation
  - vertical grey scale stripes

- Select CH1 input with the *opposite* key.
- In the Trigger Parameters menu, select the tab: Trig. Menu → Parameter → Main.
- Validate CH1 as the main Trigger source.
- In the Trigger Parameters menu, select the tab : TV.
- Set the standard number of lines: 625 lines
  - polarity: +
  - line: 25 (for a video signal)

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

- Adjust the CH1 sensitivity:
  Vert Menu → CH1 → Sensitivity/coupling → 500 mV/div.
  or by pressing *opposite* key, then using the thumbwheel.

- Adjust the sweep speed:
  using the scrollbar in the time base window: 25 µs/div.
  or using the *opposite* keys.

Applications *(cont'd)*

- Select the trigger mode:
  Trig. Menu → Automatic mode
  or using the *opposite* key.

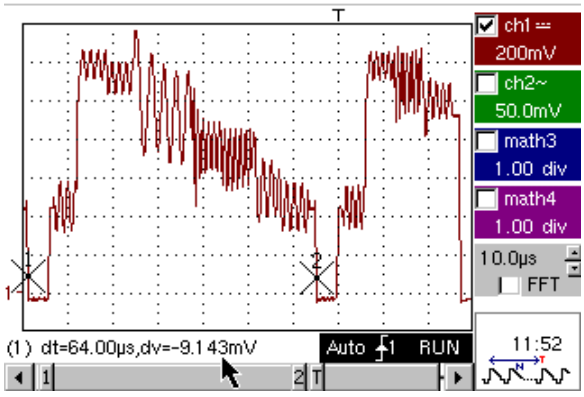
- Use *opposite* key to start acquisition (RUN mode)
  or use the time base menu.

Reminder

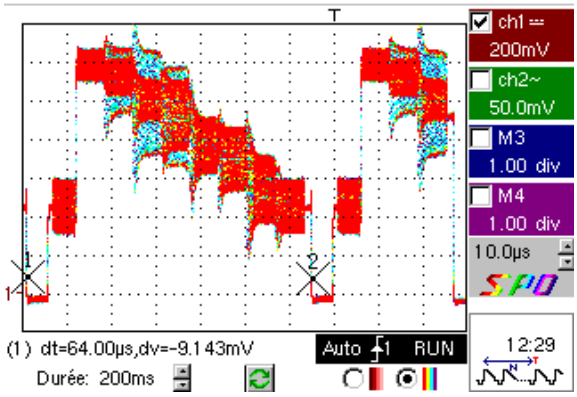
The acquisition status (Ready, RUN, STOP) is indicated on the right, under the display of the trace, in the trigger status display zone.

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

Video signal



Oscilloscope



Persistance SPO

Use the manual cursors to check the duration of a line.

- Display the manual cursors:
  Menu → Measure → Manual measurements (dt, dv)
  or using the *opposite* key.

- To move the cursors freely, select:
  Measure Menu → Unattached cursors.

- Use the mouse 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'd)*

7. Examination of a specific TV line

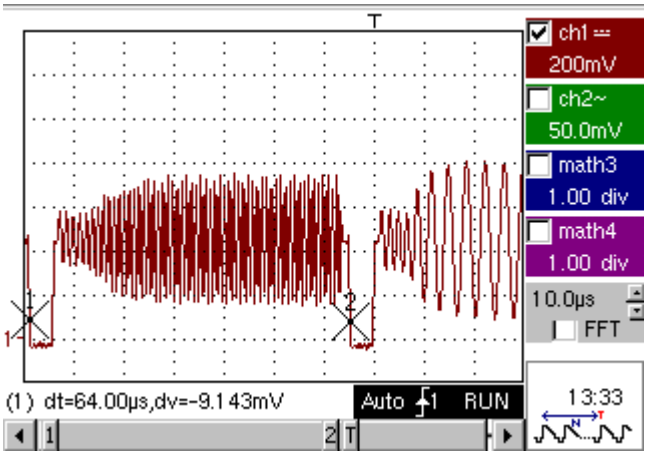
For more detailed examination of a video line signal, the TV trigger menu can be used to select a line number.

- 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 *opposite* key*).*

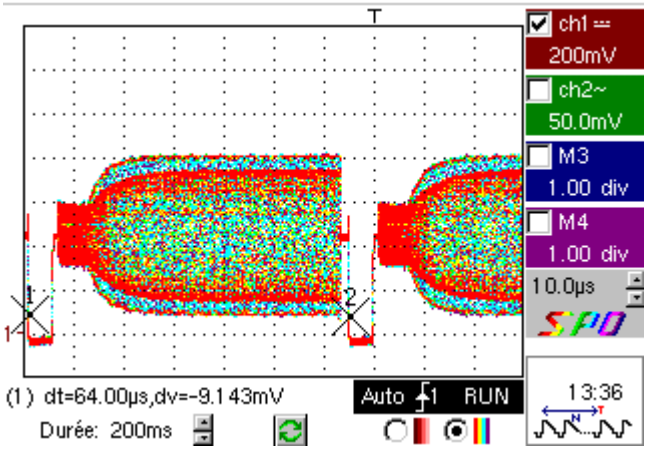
- Adjust the ch1 sensitivity:
  Vert Menu → CH1 → Sensitivity/coupling → 200 mV/div
  or using the *opposite* key*.*

- Modify the scan speed:
  using the scrollbar in the time base window: 25 µs/div
  or using the *opposite* key*.*

Example of video 1 line



Oscilloscope



Persistance SPO

Applications *(cont'd)*

8. "SPO" applications

Select the "SPO" display mode in the "Display" menu of the "Oscilloscope with SPO" mode (see p. 72).

a) "Statistical Distribution"

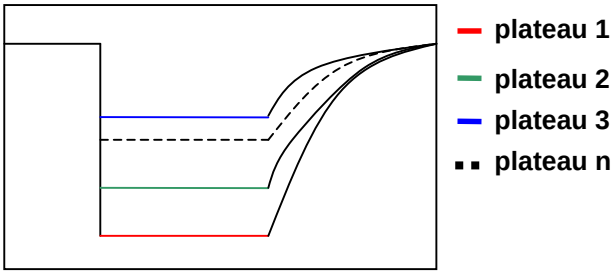
This example shows the third dimension of the "SPO" display: occurrence.

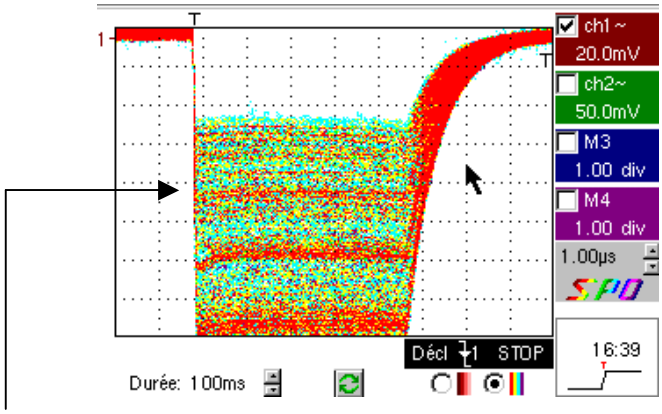
To do this, a signal representing several stable voltages (plateaux) is injected on the terminals of a capacity. The persistence cumulates these plateaux.

- Inject the signal of the capacity on CH1:

Settings

- CH1 sensitivity:	20 mV/div.
- CH1 coupling:	AC
- Scan speed:	1.00 µs/div.
- Trigger source:	CH1
- Trigger mode:	Triggered mode
- Trigger edge:	trailing edge
- Persistence duration:	100 ms
- SPO representation:	multi-coloured





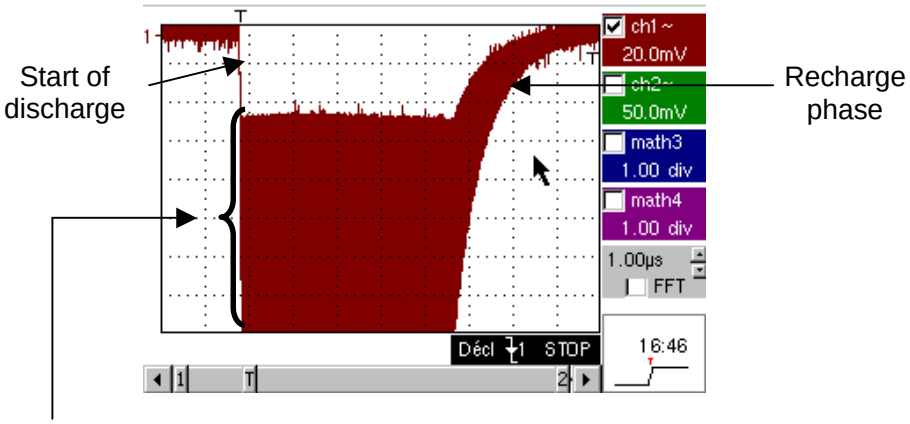
In this distribution, it is possible to observe different colours, indicating different voltage levels:
- red for high probabilities of occurrence,
- blue for low probabilities.

The distribution is almost equiprobable, but 3 plateaux have a higher probability.

Applications *(cont'd)*

"Statistical Distribution" (cont'd)

Below, the same signal observed without "SPO" and with the "Envelope" display mode validated (see p. 50).



Different voltage levels: with this representation, it is still possible to observe the overall shape of the signal. However, there is no longer any indication regarding repair of the different voltage levels.

Conclusion

This example indicates the occurrence of the points. The distribution of the voltage levels should theoretically be uniform.
The experiment with "SPO" display shows slight disparities which it is impossible to analyse with a standard display.

Applications (*cont'd*)

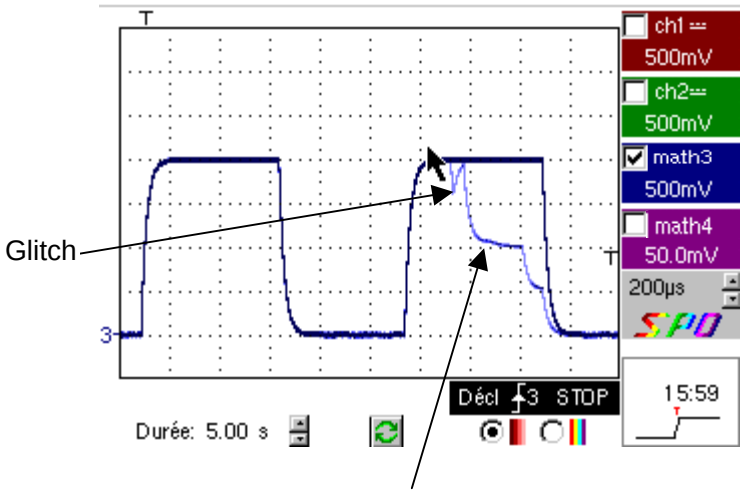
b) "Rare event" This second application shows the speed and the cumulation of the "SPO" acquisitions.

For certain signals, the user needs to search for intermittent anomalies. If you do not know exactly what you are seeking, it is very difficult to detect the problem. The "SPO" acquisition speed facilitates identification.

Example Square signal with interference of unknown origin:

Settings

- CH3 sensitivity:	500 mV/div.
- CH3 coupling:	DC
- Scan speed:	1.00 µs/div.
- Trigger source:	CH3
- Trigger mode:	Triggered mode
- Trigger edge:	leading edge
- Persistence duration:	5 s
- SPO representation:	monochrome



Interference of signal:
the light blue colour shows that this interference is rare.

Conclusion

- The "SPO" display quickly revealed the interference.
  If this interference occurs once in 1,000 periods, it will be detected in less than 2 s.
- The entire acquisition depth (50,000 samples) is shown on the screen. This allows the observation of glitches lasting 40 ns. If the nature of the interference is known, it is possible to select this problem with complex triggers.

Applications *(cont'd)*

9. Automatic measurement in Harmonic Analysis mode

Initially, a frequency signal between 40 Hz and 5 kHz must be injected to ch1 or ch2 channel.

Note
- Only the channels (and not the functions) can be the subject of harmonic analysis.
- In this mode, the time base is not adjustable.

- Adjust correctly the ch1 and ch2 channel traces in the "Oscilloscope" mode (the signals must not be saturated).

- Using the key shown *opposite*, select the "Harmonic Analysis" mode.

Note The harmonic contents of the signal of the
ch1 channel is represented by red "full bars"
ch2 channel by "hollow bars" of green color

- Select using the "Display" menu (see §. Display) the desired harmonic breakdown.
  - fundamental (F) and the first 15 harmonics
  - even harmonics (from 2 to 30)
  - odd harmonics (from 3 to 31) (+ fundamental)

Note *The chosen selection appears under the breakdown display.*

- The « SIGNAL » table under the breakdown indicates:
  - the active channel(s) (ch1 ch2)
  - the rms. voltage of the signal in V
  - the harmonic distortion factor (in %) of the signal
- The « ✓ » symbol on the fundamental (F) or on one of the harmonics can be modified using the mouse left button to make measurements on the selected harmonic.

Applications *(cont'd)*

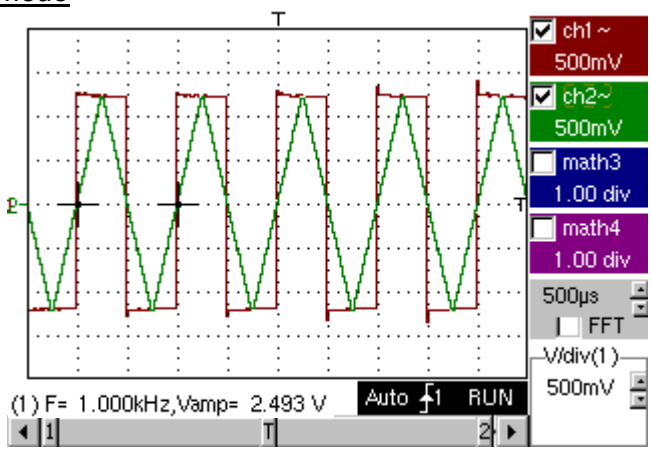
- The « Ref.: Harmonic X » » feeds into the selected harmonic:
  - its value as a % of the fundamental
  - its phase in °with respect to the fundamental
  - its frequency in Hz
  - its RMS voltage in V

Example harmonic breakdown

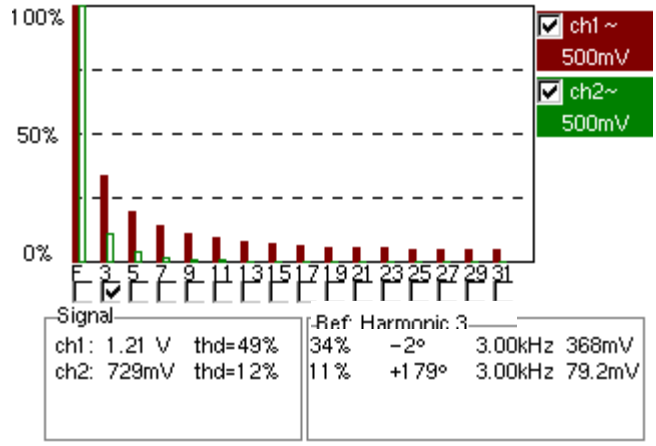
On ch1 : the signal of the output calibrator (2.5 V, 1 kHz) (see §. Calibration signal display)

On ch2 : triangular signal of 1 kHz and 2.5 V amplitude

Oscilloscope mode



Harmonic Analysis mode



Display « Odd Harmonics » selected
« Harmonics 3 » selected

Applications *(cont'd)*

10. Display of slow events
« ROLL Mode»

The purpose of this example is the analysis of slow events for time bases ranging from 200 ms to 200 s.

The samples are displayed constantly without waiting for the Trigger ("Roll" mode).

Examination of a slow event

SCOPE RECORDER ANALYSER

- Select the « Oscilloscope » mode with the *opposite* key.
- Inject to the CH1 input a sinusoidal signal at 1 Hz and 1 Vrms.
- Adjust the time base to 500 ms.
- Select Trace 1 : Menu : Vert → Display → Trace1.
- Select the sensitivity and coupling for ch1 : Menu : Vert → ch1 → Sensitivity / Coupling:
  - Channel Sensitivity : 500 mV
  - Coupling : DC
- Select the trigger parameters : Menu : Trig → Parameters :
  - Trigger source : CH1
  - Trigger edge : +

SGLE REFR

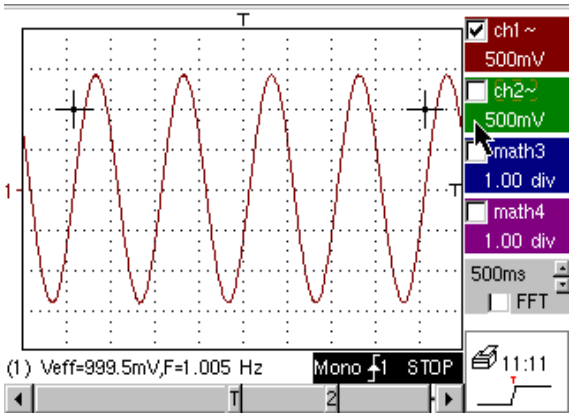
- Select the « Single Shot » trigger mode : Menu : Trig → Single mode
- Using the mouse, move the trigger level symbol (Trigger) up (or down) with respect to the display area.

If the trigger level is reached, the oscilloscope will stop data acquisition once it has filled the acquisition memory (STOP mode).

RUN/STOP

- Start acquisition using the *opposite* key (RUN mode).

Examination of a signal



The signal is constantly analysed (RUN mode).

Applications *(cont'd)*

11. Measurement in « Recorder » mode

✍ *Example* : Monitoring of a voltage variation and detection of a level crossing

SCOPE RECORDER ANALYSER

Select the “Recorder” mode with the *opposite* key.
Then check that the normal mode is active (‘Fault capture’ and ‘File capture’ modes not active. See Menu → TRIG).

- Inject to CH1 input the signal to be checked.

CH 1 Auto

Select CH1 input with the *opposite* key.

Adjust the vertical sensitivity to 2 V/div. Three possibilities :

- Vert menu → CH1→ Sensitivity/Coupling : 2 V/div

CH 1 Auto

- Select the channel 1 with the *opposite* key. Adjust the sensitivity on the scroll bar using the mouse.
- Select the channel 1 with the *opposite* key. Adjust the sensitivity with the thumbwheel.

The following symbol ⎓ appears in the CH1 parameters.

T/div. H-Pos.

Set the recording time or the sampling interval (✍ E*xample* : 1 min) by :

- using the *opposite* key, then the thumbwheel.
- Horiz Menu → Horizontal Scale : recording time : 1 min

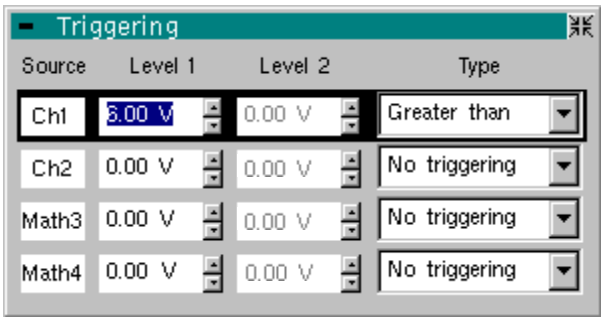
Adjust the trigger parameters : type and threshold level.

✍ *Example* : Upper trigger on CH1 shown by the ⍋1⊤ symbol with a 6 V level. No trigger on other channels.

Handling, two possibilities :

- Press CH1, and then the *opposite* key to select the desired trigger.
- Same operation on each channel.
  To adjust the level, select the ⍋1⊤ symbol using the mouse. Set it to the the desired level. Adjust the value with the scroll bar, in the display of the current value.
- Switch to the trigger menu → Source/Level. Adjust the desired trigger type and trigger level of each channel.

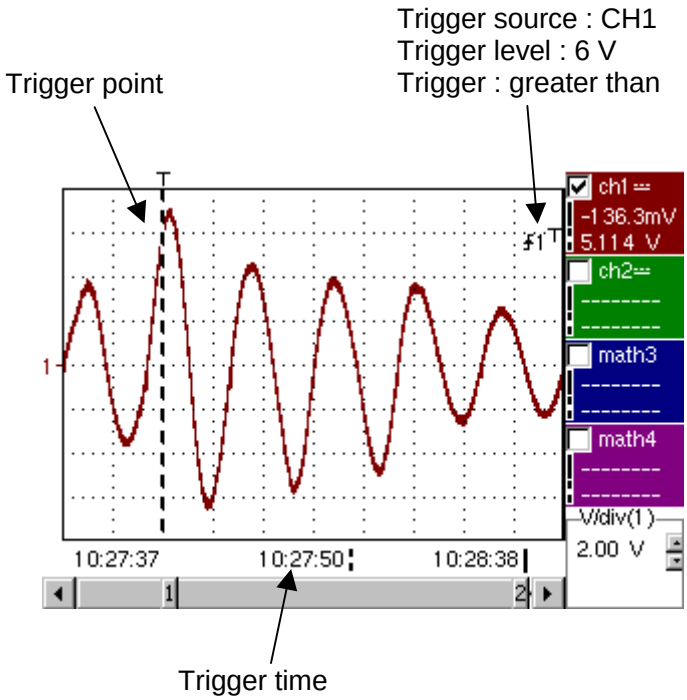
Trigger window after adjustment



- If necessary, set the indicator of CH1 vertical position to 0.00 V.
- Select the level indicator of CH1 using the left key of the mouse. Move it by keeping the key depressed.

Applications *(cont'd)*

- Launch the acquisition using the *opposite* key.



The acquisition stops when the signal overpasses the trigger level.

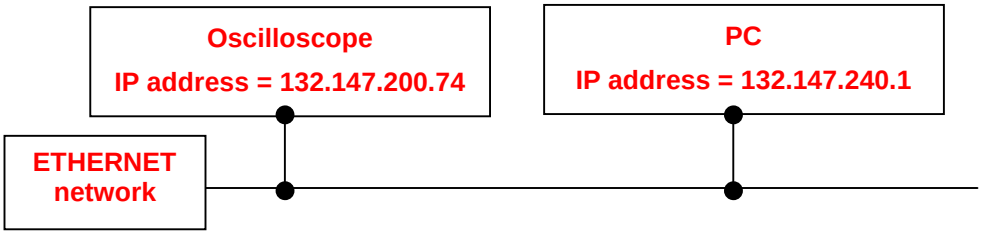
Applications *(cont'd)*

12. ETHERNET network application examples

a) File transfer via the network

The files contained in the oscilloscope's "File management" menu (see "Util" menu) can be transferred onto a PC (or the reverse) via an Ethernet network.

✍ ***Example***



- Use a suitable ETHERNET cable to link the oscilloscope to the network.
- Use a PC connected to this network
- Open the oscilloscope's "Network" menu (see §. “Config Ports I/O” menu → Network).
- Enter the IP address manually or automatically using the icon "supplied by a DHCP server" (if the server is accessible).
- Then validate the information by choosing OK.

✍ *Example* : *132.147.200.74*

- In your browser, type in the URL zone: ftp://132.147.200.74 (our example) 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.

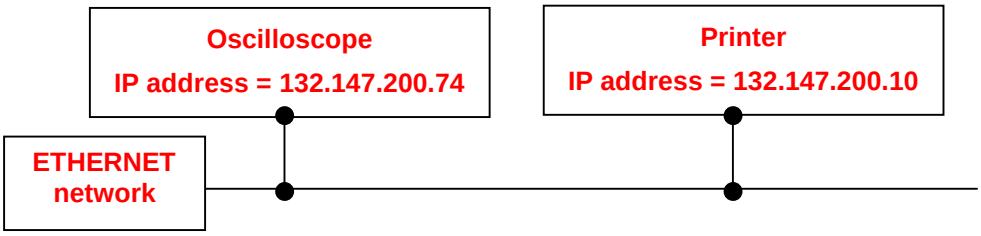
☝ *The SX-METRO software (option) simplifies file transfer via the* ETHERNET *network*.

Applications *(cont'd)*

b) Screen copy via the network

Screen copying can be initiated on a network printer via an Ethernet network.

Example



Use of the FTP protocol to print

- Use a suitable ETHERNET cable to link the oscilloscope to the network.
- Open the oscilloscope's "Network" menu (see §. “Config Ports I/O” menu → Network).
- Enter the IP address manually or automatically using the icon "supplied 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 *opposite* key.

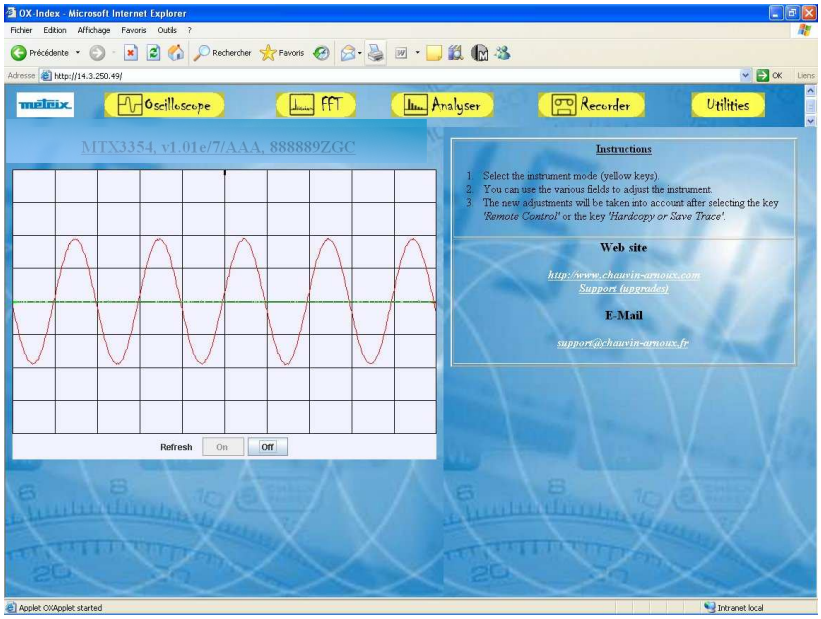
Applications *(cont'd)*

13. Serveur WEB

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

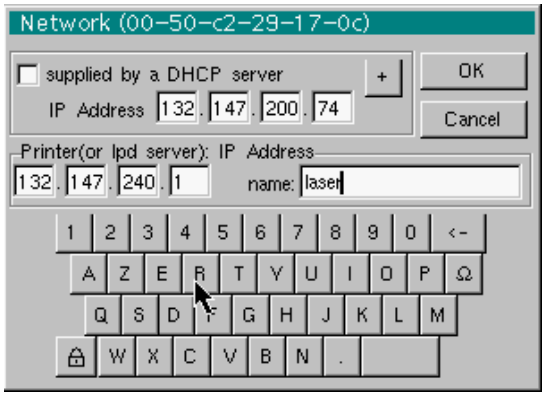
Screens obtained on PC logged on to same network as the instrument.
In the examples that follow, the IP address of the oscilloscope is: 14.3.250.46 (programmed in the UTIL menu → Config I/O Port → Network).

Connection *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.*



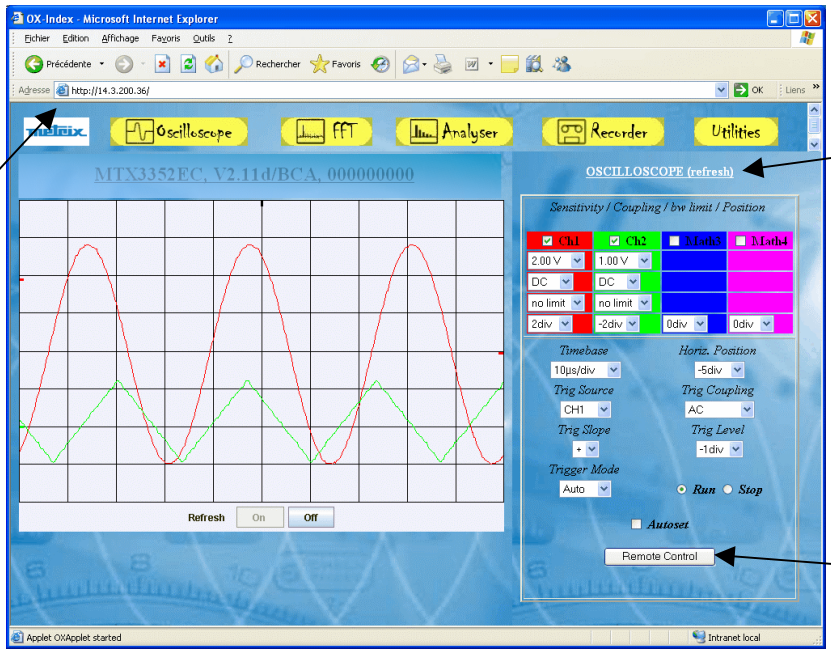
The IP address of the instrument is given in the folowing menu :

UTIL → Config I/O Port → Network



Applications *(cont'd)*

« Oscilloscope » **Mode**

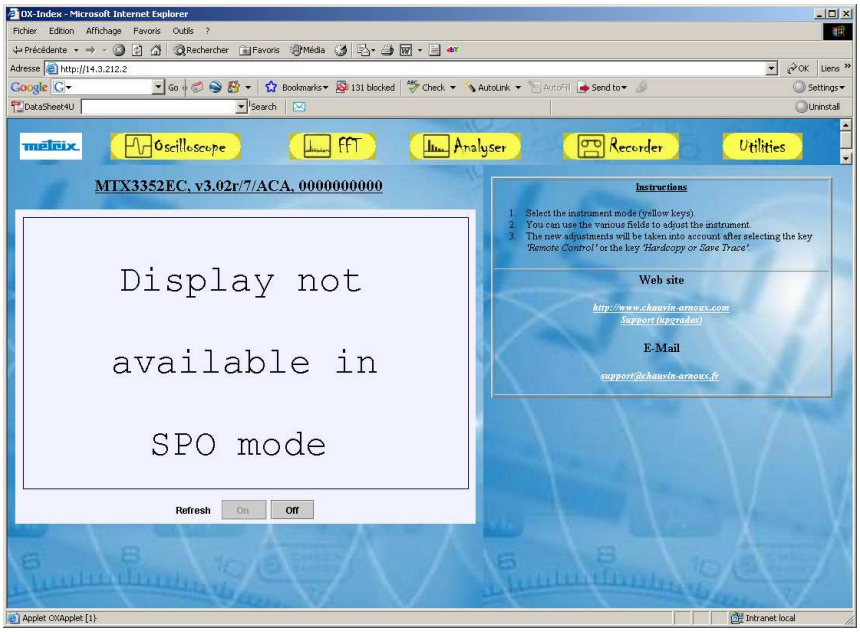


IP address of instrument : see p. 11

One mouse click on window title triggers refreshing

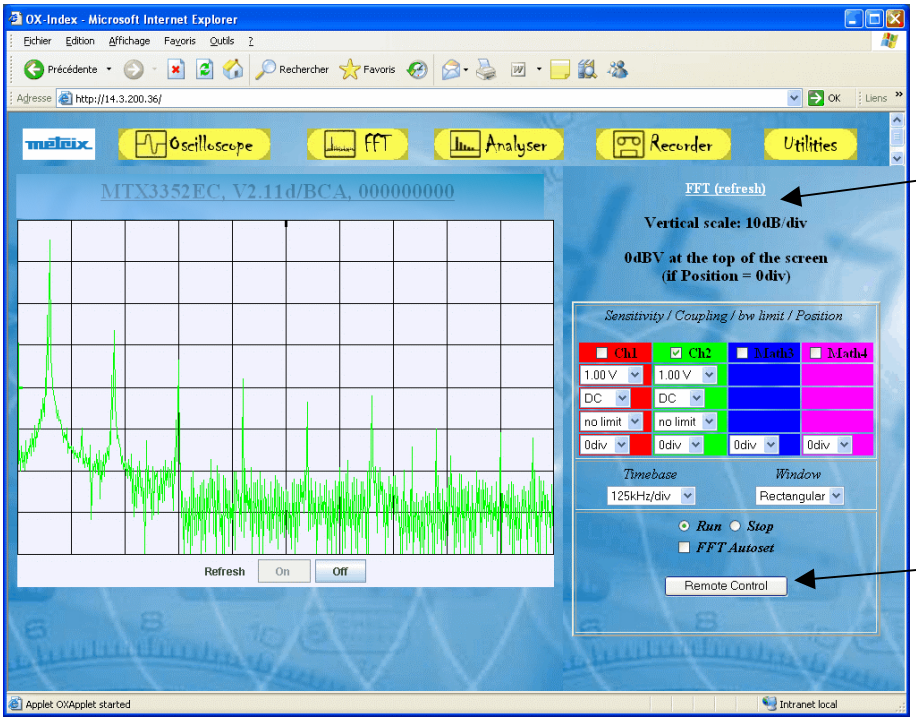
Window adjustments integrated by the scope after a click on "Remote Control".

Attention *If the SPO persistence mode is activated, the traces are not any longer displayed on the screen of the PC and the message « Display not available in SPO mode » appears as shown bellow :*

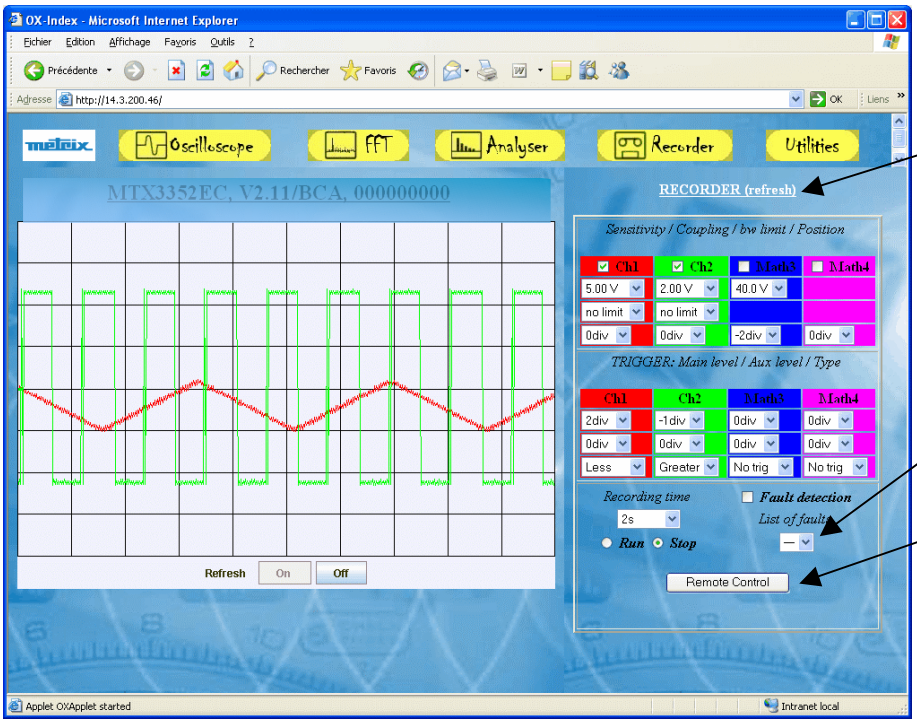


Applications *(cont'd)*

« FFT » Mode



« Recorder » Mode

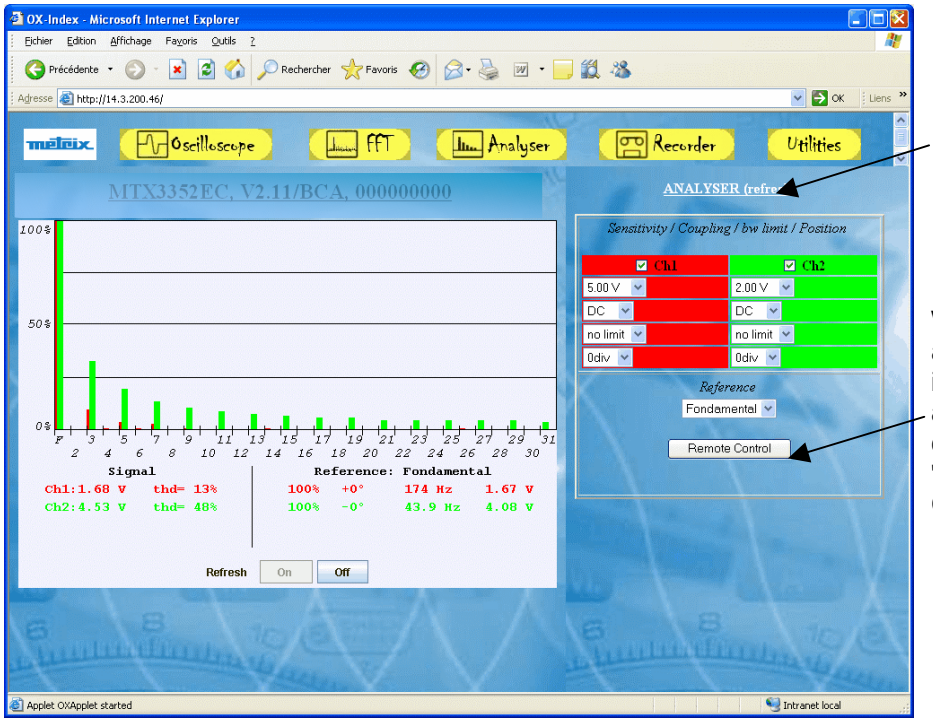


(*) After refreshing window, this list indicates the moment of acquisition of all faults :

- in "standard" mode: a single fault is acquired,
- in "fault capture" mode: 10 faults can be acquired.

Applications *(cont'd)*

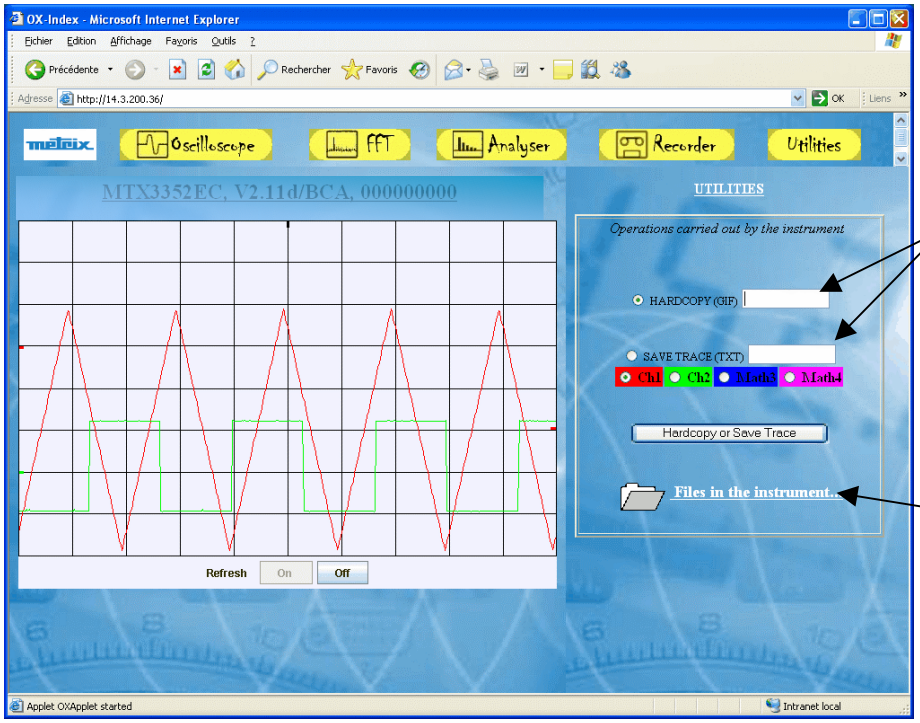
« Harmonic Analyser » Mode



One mouse click on window title triggers refreshing.

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

« Utilities»

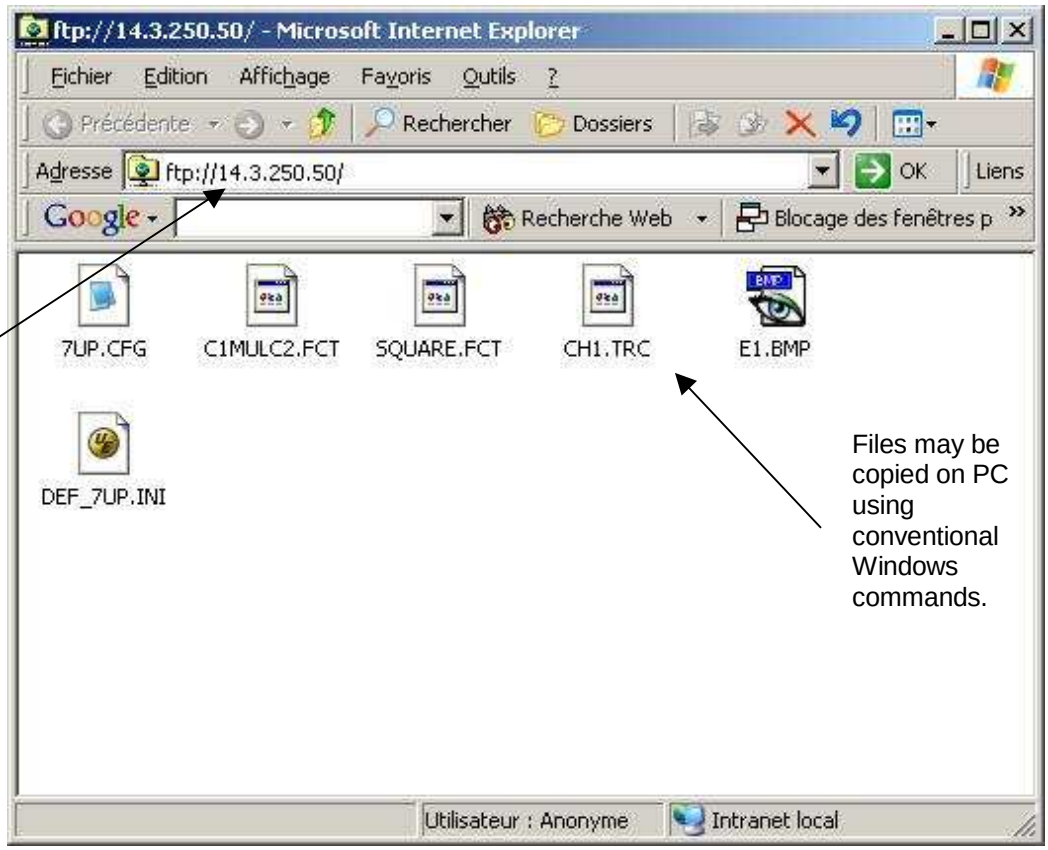


The selection button determines the action: launching of screen copy or file transfer

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

Applications *(cont'd)*

File transfer



IP address of instrument: see p. 11

Files may be copied on PC using conventional Windows commands.

☝ The Webserver does not work in Analyser mode.

Technical Specifications « Oscilloscope » Mode

Vertical deflection	*Only the values assigned with a tolerance or limits are guaranteed values (after half an hour warming-up). Values without a tolerance are given for information only.*	
Characteristics	**Specifications**	**Comments**
Number of **channels**	2 channels: CH1 CH2	
Type of **inputs**	Class 1, common grounds	
Bandwidth at –3dB	> 60 MHz (MTX3252) > 100 MHz (MTX3352) on ranges from 5 mV to 5 V/div. ≥ 20 MHz on ranges from 10 V/div. to 100 V/div. and 2.5 mV/div. ≥ 15 MHz on 2.5 mV /div.	Measured on 50 Ω load with 6 div. amplitude signal
Vertical offset dynamic	± 10 divisions on all ranges	
Input coupling	AC : 10 Hz to 60 MHz (MTX3252) 100 MHz (MTX3352) DC : 0 to 60 MHz (MTX3252) 100 MHz (MTX3352) GND : Reference 0 V	
Bandwidth limit	at 15 MHz, 1.5 MHz, 5 kHz	
Rise time	< 23 ns on all vertical ranges 2.5 mV < 3.5 ns on all vertical ranges 5 mV to 100 V/div.	
Cross-talk between channels	DC at 100 MHz ≥ 30 dB	- for ranges 5 mV to 5 V/div. - same sensitivity on both channels
ESD tolerance	± 2 kV	
Response to rectangular signals 1 kHz and 1 MHz	Overrun < 5 % on rising edge or falling edge Aberration < 5 %	
Vertical **range** accuracy	± 2 %	Sequence of vertical ranges 1 - 2 - 5 Variation in steps
Vertical **resolution**	± 0.4 % of full scale	(no continuously variable coefficient) Vertical resolution 22 points per div.
DC vertical measurement **accuracy**	± [2 % (reading – offset) + precision of vertical offset + (0.05 div.) x (V/div.)]	
Precision of vertical offset	± [0.01 x (offset value) + 4 mV + (0.1 div.) x (V/div.)]	
Probes	Take into consideration attenuation factor of probe in display	*NB: the probe factor must be brought in manually.* *There is no automatic detection of probe presence.*
Vertical **ZOOM** function on acquired or backed up curve	Zoom factors max. 10	
Maximum input **voltage**	420 Vpk (DC + AC peak at 1 kHz) without probes 560 Vpk (DC + AC peak at 1 kHz) with probe 1/10 ref. HX0003	
Electrical **safety**	300 V, CAT II without probe 400 V, CAT II with probes HX0003	
Input **impedance**	1 MΩ ± 1 % approx. 13 pF	
Display modes	ch1, ch2	

« Oscilloscope » Mode Technical Specifications *(cont'd)*

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** rising time falling time positive pulse negative pulse duty cycle period frequency phase counting summon	**Level measurements** DC voltage RMS voltage peak-to-peak voltage amplitude max. voltage min voltage high plateau low plateau overshoot
Resolution of the measurements	9 bits	
☝	*If the « SPO Persistence » is activated, only following measurements are available : **dv**, **dt** manual measurements and phase measurements.*	

Horizontal deflection (time base)

Characteristics	Specifications	Comments
Time base ranges	35 ranges, from 1 ns to 200 s/div.	Sequence 1 - 2 - 5
Time base precision	± 0,5 %	
Single-shot sampling frequency	• 100 MS/s on 2 channels • 200 MS/s on 1 channel (100 MS/s in « SPO »mode) : - one channel among CH1/CH2	Accuracy ± 200 ppm
Time measurement accuracy	± [(0,04 div.) x (time/div.) + 0,005 x (reading) + 1 ns]	
Horizontal **ZOOM**	The available horizontal ZOOM factors range from x 1 to x 200 depending on sequence 1-2-5 (in ZOOM mode, we have the same time base criterion sequence as in normal mode).	*N.B.: The oscilloscope has a recording memory capacity of 50 kpts per channel. Horizontal screen resolution is 250 points for 10 divisions. Vertical Zoom not available in "SPO".*
XY Mode (*not available in "SPO")*	Bandwidth in X and Y identical	
Bandwidth in X and in Y	60 MHz (MTX 3252) 100 MHz (MTX 3352)	
Phase **error**	< 3° at 1 MHz ☝ In XY mode at each moment 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 basic selected time rating.	

Technical Specifications « Oscilloscope » Mode *(cont'd)*

Trigger circuit

Characteristics	Specifications	Comments
Trigger sources	CH1, CH2, EXT, Line	
Trigger **mode**	Automatic Triggered Single shot	
Trigger **coupling** without bandwidth limit	AC : BP 10 Hz to 60 MHz (MTX 3252) 100 MHz (MTX 3352) DC : BP 0 to 60 MHz (MTX 3252) 100 MHz (MTX 3352) HF reject : BP 0 to 10 kHz LF reject : BP 10 kHz to 60 MHz (MTX 3252) 100 MHz (MTX 3352)	
Trigger **slope**	Falling edge or rising edge	
Trigger **sensitivity** Sources CH1 CH2	0.6 div. at 1 kHz (noise rejection mode → inactive) 1.5 div. at 1 kHz (noise rejection mode → active)	
EXT source	50 mVrms at 1 kHz	
Trigger level Variation range	± 8 div.	
Trigger **type**	on edge	
	on pulse width < t ≈ t > t	from 20 ns to 10.5 s
	Trigger after delay of 40 ns to 10.5 s qualifier source: CH1 CH2 trigger source: CH1 CH2	
	Trigger after counting 2 to 16,384 events qualifier source: CH1 CH2 counting source: CH1 CH2 trigger source: qualifier or counting source	
	TV on CH1 CH2: - Selection of line no. and polarity, with 525 lines (PAL) and 625 lines (SECAM) - TV trigger sensitivity: > 1 div.	
Pre-triggering	Adjustable from 0 to 100 %	
Holdoff	Adjustable from 40 ns to 10,5 sec.	

Technical Specifications « Oscilloscope » Mode *(cont'd)*

Acquisition chain

Characteristics	Specifications	Comments
ADC Resolution Maximum **sampling** frequency	9 bits (22 LSB/div.) 100 MS/s	1 converter per channel
Sampling **modes** Real time (Single-shot signals) Equivalent time ETS (repetitive signals)	200 MS/s max. on one channel (100 MS/s in « SPO ») 100 MS/s max. on 2 channels Accuracy ± 200 ppm 100 GS/s max.	
Transient capture Minimum detectable **Glitch** width (min/max acquisition)	≥ 20 ns	Whatever time base used, short-term events (Glitch, ≥ 10 ns) are displayed.
Acquisition memory **dept**	50 Kb	fixed
PRETRIG Function	from 1 kb to 50 kb	
CH1, CH2 channel saving **memories**	Saving of up to 16 files .TRC (200 kb) each containing 50 kpts max.	Files assigned to names
Back-up **memories**	Total size 3.2 Mb for storing: trace, text, config, function, printout, image, etc.	The file names contain 15 characters + suffix
Storage **formats** (file sizes)	Trace (.TRC) (≈ 200 kb) (.TXT) (≈ 500 kb)	Back-up of trace and acquisition parameters
	Configuration (.CFG) (≈ 15 kb)	Back-up of complete equipment configuration
	Hardcopy (.EPS) (.PRN) (.PCL)	Standard printing formats (the size varies according to the format; > 200 kb)
	Hard copy (.BMP) (≈ 40 kb) (.GIF) (≈ 10 kb)	Standard image formats
	File (.FCT) (< 1 kb)	Back-up of a function
« **SPO** » Acquisition	« **SPO** » mode: The acquisition and processing tasks are in parallel. The number of acquisitions per second can be multiplied by 100. The interval between two acquisitions is therefore significantly reduced.	**Normal** Mode: The acquisition, display and processing tasks are sequential.
	N acquisitions = 1 display	*1 acquisition = 1 display*
	Screen representation of 50,000 points acquired, using a smart compression system.	Screen representation of 500 points out of 50,000 points acquired.
	Display of a cloud of points which are not linked together. No interpolation.	Display of a segment to link the points together.

Technical Specifications « Oscilloscope » Mode *(cont'd)*

Display

Characteristics	Specifications	Comments
Display screen	LCD 5.7 STN Color CCFL back-lit	
Contrast	Continuous adjustment	
Resolution	1/4 VGA: i.e.: 320 pixels horizontal x 240 pixels vertical	
Screen saver	Time selectable in Menu Util → Configuration	
LCD zone reserved for **traces**	10 div. (H) x 8 div. (V) i.e. 250 x 176	50 pts/div. (H) x 22 pts/div. (V)
Displayed mode window **Normal**	Complete memory	50 kb
Horizontal **ZOOM**	up to 500 pts from 50 kpts of complete memory	case of max. ZOOM x 100
Display **modes**	Acquired points, interpolated points, variable persistence, averaging	
Vector	The acquired points are attached by a segment.	
Envelope	Min. and max. on each horizontal screen position are displayed.	
Averaging	Factors ranging from 2, 4,16, 64	
Graticule	Complete Axes Borders	
Indications on screen		
Trigger	Trigger level position (with overshoot indicator) Trigger point position on bargraph (with overshoot indicator)	
Traces	Trace identifiers Position, Sensitivity Ground reference Overshoot indicators top and bottom if traces off screen	

Miscellaneous

Calibration **signal**	Form Amplitude Frequency	rectangular 0 - 2.5 V ± 2 % 1 kHz ± 1 %
Autoset		
Search time	< 5 s	
Range of frequency	30 Hz to 150 MHz	
Range of amplitude	40 mVpp to 400 Vpp	
Limits of duty cycle	from 20 to 80 %	

Technical specifications of the "Oscilloscope Mode with SPO"

Acquisition chain

Sampling rate	
Single shot	100 MS/s max.
Equivalent time ETS	25 GS/s max.

Persistence parameters

Settings	Selection in the menu bar (p. 69) or the Display menu (p. 72)
Duration	100 ms, 200 ms, 500 ms, 1 s, 2 s, 5 s, 10 s, infinite
Representation	monochrome or multi-coloured
Storage format	Bitmap (.PER) (≈ 44 kb)

Persistence features

Acquisition speed	50 kWaveform/s max. per channel
Number of samples processed in 1 s	19 MS/s max. per channel

« Harmonic Analysis » Mode Technical Specifications

2-page display of "Harmonics"	Selection of the page in the "Display" menu
Even harmonics	2 to 30
Odd harmonics	3 to 31
1-page display of "Harmonics"	Selection of the page in the "Display" menu
Harmonics	3 to 16
Frequency of the signal analyzed	40 to 5 kHz
Measurement accuracy	
Level of Fundamental	± 2 % ± +10 D
Level of Harmonics	± 3 % ± +10 D
Harmonic Distortion	± 4 %

« Recorder » Mode Technical Specifications

Recording time	from 2 sec. to 31 days
Sampling frequency	from 40 µs to 53.57 s
Fault capture	100 faults in memory 200 faults in files
Trigger	on threshold high and low on threshold high or low
Display	Research minimum and maximum research of fault
Vertical, horizontal accuracy	Specifications identical to « Oscilloscope » mode

☝ Warning !

Error Messages	Autotest :Erreur n°0001 : problème Microprocesseur ou FLASH Autotest :Erreur n°0002 : problème RAM Autotest :Erreur n°0004 : problème FPGA Autotest :Erreur n°0008 : problème SSRAM Autotest :Erreur n°0010 : problème SCALING 1 Autotest :Erreur n°0020 : problème SCALING 2 Autotest :Erreur n°0100 : problème acquisition voie 1 Autotest :Erreur n°0200 : problème acquisition voie 2 Autotest :Erreur n°1000 : problème Ethernet Autotest :Erreur n°2000 : problème Vernier If one of those codes (or addition of several codes) is present when getting started → a default has been detected. In this case, contact your nearest distributor. See §. Maintenance p. 5.

Technical specifications (cont'd)

Communication interfaces

USB type B connector

is used to link the oscilloscope to the PC by an USB cable

Situation	at the back of the oscilloscope
Interface	« USB to RS232 », the configuration of the serial link is automatic at 921 600 bauds, HARD protocol, 8 bits, 1 bit stop, no parity.
Driver	The « USB to RS232 » interface driver is available on the CD_ROM of the user's manual.
PC	The configuration recommended for the downloading via USB to RS232 interface of the embedded software release is : PENTIUM IV, 2 GHz, RAM of 128 Mo.

SUBD 25-pin female connector for RS232C/CENTRONICS interfaces

The RS232C and CENTRONICS interfaces use the same SUBD 25-pin female connector on the back of the unit.

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

Location	on rear of unit
Type	10BASE-T (Twisted Pair)
Connector	RJ 45 8 points
Standard	IEEE 802.3

6-pin **Mini-Din 6** connector

for connecting PS2 mouse.

Location	on rear of unit
Connector	6-pin Mini-Din

Remote program of the instrument by a PC

The oscilloscope can be programmed at a distance with a computer or PC using simple standardized commands and the RS232C interface (or the ETHERNET port, TELNET protocol) for transferring data from or to the recording memory.

The programming instructions comply with the IEEE 488.2 standard, SCPI protocol.

Refer to the remote programming manual for the list of commands.

General Characteristics

Environment

- Reference temperature: 18℃ to 28℃
- Operating temperature range: 0℃ to 40℃
- Storage temperature range: - 20℃ to + 60℃
- Use: indoor
- Altitude: < 2000 m
- Relative humidity: < 80 % at up to 31℃

Mains power supply

- Network voltage: Use nominal range 100 to 240 VAC
- Frequency: from 47 to 63 Hz
- Consumption: < 16 W at 230 VAC, 50 Hz
- Fuse: 2,5 A / 250 V / delayed
- Removable power supply cord

Safety

As per IEC 61010-1 (2001) :

- Insulation: class 1
- Pollution degree: 2
- Power supply overvoltage category: CAT II 240 V
- "Measurement" input overvoltage category: CAT II 300 V

CE

EMC

This equipment is designed to conform to current EMC standards and its compatibility has been tested as per NF Standard EN 61326-1, 2006 :

Immunity	influence magnitude: 2.5 mV in presence of 3 V/m electromagnetic field

Mechanical Characteristics

Case

- Size: Screen shutter open 300 (H) x 270 (l) x 195 (D) in mm
Screen shutter closed 170 (H) x 270 (l) x 195 (D) in mm
- Weight: approximately 3.3 kg
- Materials: ABS VO (self-extinguishing)
- Tightness: IP 30

Packaging

- Size: 308 (l) x 338 (L) x 338 (D) in mm

Supply

Accessories

Supplied with instrument

- Operating and programming manuals on CD ROM
- Mains power supply cord
- Safety probes (x 2)
- PS2 serial mouse
- Mouse mat
- ETHERNET network cord : cross over
- USB cord
- Differential probe acc. to MTX model

Supplied as an option

• Installation set of the « Harmonics Analyser » option	HX0028
• Installation set of the « Recorder » option	HX0029
• Differential probe 30 MHz	MX9003-Z
• Differential probe 30 MHz	MTX1032-B
• Differential probe 50 MHz	MTX1032-C
• Safety probe 1:10 fixed, 250 MHz, CAT II / 1000 V	HX0004
• Safety probe 1:10 fixed, 450 MHz, CAT II / 1000 V	HX0005
• Safety probe 1:100 fixed, 300 MHz, 5 kV Peak	HX0006
• Voltage probe 1:1 1:10 100 MHz CAT II	HX0210
• Voltage probe 1:1 1:10 200 MHz CAT II	HX0220
• Takeoff Tee 1 x BNC male - 2 x BNC female (package of 3 u.)	HA2004-Z
• BNC male / BNC male cord CAT III, 500 V, length 1 m	AG1044
• BNC male / BNC male cord CAT III, 500 V, length 2 m	AG1045
• BNC female - BNC female extender (package of 3 u.)	HA2005
• Safety adapter BNC male / 4 mm socket, CAT III, 500 V (package of 3 u.)	HA2002
• Safety adapter BNC male / 4 mm plug, CAT III, 500 V (package of 3 u.)	HA2003
• Safety adapter BNC male / 4 mm socket, CAT III, 500 V (package of 2 u.)	HA2053
• RS232C – 9-pin male / 25-pin female adapter	AS0204
• RS232C cord – 9-pin male / 25-pin female	X0397A00A
• PS2 mouse	541392
• PC transfer software	SX-METRO
• Labwindows and Labview Drivers (VISA standard) available on the NATIONAL INSTRUMENTS site (www.natinst.com)	
• Carrying bag	AE0189
• Field kit	HX0024

Spares

• 2.5 A, 250 V, T, 5 x 20 mm	AT0090

INDEX