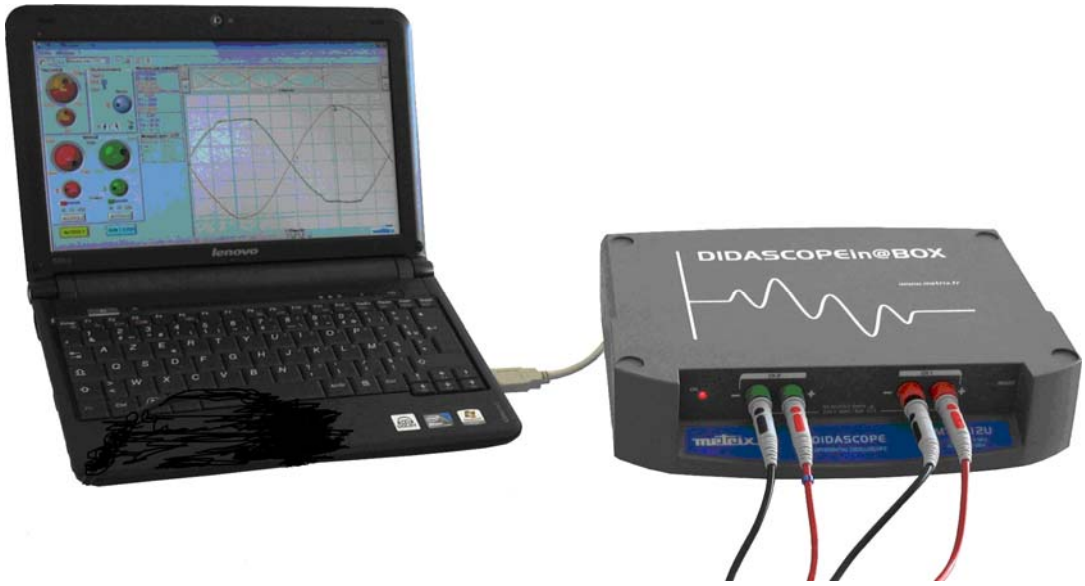
Digital virtual differential
Oscilloscope

Didascope MTX112

2 channel, 10 MHz, FFT, USB

User's Guide



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Contents

Warnings! Before printing this notice think of the impact on the environment.

Getting started

Congratulations!

You have just purchased an ***MTX 112*** oscilloscope. We thank you for your confidence in our product quality.

It is a virtual oscilloscope, 50 Msps, 8 bits, 50 kpts, 25 mV/div to 100 V/div.

The instrument is compliant with safety standards NF EN 61010-1 + NF EN 61010-2-30.

In order to obtain the best results please read this notice carefully and follow the precautions for use.

Failure to respect the warnings and/or usage instructions may damage the appliance and can be dangerous for the user.

Composition

- 10 MHz, 2 channel, **oscilloscope <u>without</u>** own display, USB PLUG and Play operation, differential inputs 600V CATII, universal mains power supply 300V CATII, USB communication interface
- **complete software** called "SCOPEin@BOX_LE" for experienced users.
- **highly simplified didactic software** called "DIDASCOPEin@BOX" for beginners (secondary school pupils).
- a safety sheet and 2 sets of Ø 4 mm measurement cables

Precautions and safety measures

- Indoor use
- Level 2 pollution environment
- Altitude below 2000 m
- Temperature between 0°C and 40°C
- Relative humidity less than 80% up to 31°C
- Measurements on 600V max. CAT II circuits, between 1 terminal and the ground or between 2 terminals, supplied by a 300V max. CAT II network.

definition of measurement categories

CAT II: Test and measurement circuits directly connected to points of use (power outlets and other similar points) on the low voltage network.

E.g. Measurements on circuits on the household appliance, portable tool and other similar appliances network.

CAT III: Test and measurement circuits connected to the installation parts of the building low voltage network.

E.g. Measurements on distribution panels (including secondary meters), the circuit breakers, cabling including cables, busbars, junction boxes, circuit breakers, power outlets in the fixed installation and the industrial use appliances and other equipment such as motors permanently connected to the fixed installation

CAT IV: Test and measurement circuits connected to the source of the installation of the building low voltage network.

E.g. Measurement on equipment installed upstream of the main fuse or building installation cut-off switch.

Warning !

The use of a measurement appliance, a cable or an accessory for a lower voltage reduces the use of the entire unit (appliance + cables + accessories) to the lowest measurement category and/or max. voltage.

Getting started (continued)

Preparing for use

before use

- Respect the environment and storage conditions.
- Check that the accessory protection and insulation is intact.
  All elements of which the insulation is deteriorated (even partially) must be put out of service and disposed of as waste. A change in insulation colour is a sign of deterioration.
- Power supply: make sure that the power supply cable delivered with the appliance is in good condition. It must be connected to the mains (variation from 90 to 264 VAC, 300V max. - CAT II).
- Removable mains power supply cables must be replaced by cables with appropriate rated specifications.
- The instrument earth protection must imperatively be connected to the mains earth.

during use

- Carefully read all notes prefixed by the ⚠ symbol.
- Take care not to obstruct the ventilation.
- As a safety precaution, only use the appropriate cables and accessories shipped with the instrument or approved by the manufacturer, in categories at least equal to the instrument categories, in compliance with NF EN 61010-031.

Power supply

The appliance's power supply is designed for a network that can vary from 90 to 264 V AC (rated use range: 100 to 240 VAC).
The frequency of this network must be between 47 and 63 Hz.

Symbols on the instrument

⚠ Warning: Risk of danger. The operator undertakes to consult the instructions each time this danger symbol is encountered.

In the European Union, this product is the subject of selective waste sorting for the recycling of electric and electronic equipment in in compliance with the Directive WEEE 2002/96/EC: this equipment must not be treated as household waste. The spent batteries and accumulators must not be treated as household waste. Return them to the appropriate collection point for recycling.

Earth terminal

USB

CE The CE marking indicates compliance with the "Low Voltage", "EMC", "WEE" and "RoHS" European Directives.

Getting started (continued)

Maintenance

No interventions inside the appliance are authorised.

- Remove the measurement cables.
- Power off the appliance (remove the power supply cable).
- Clean with a damp cloth and soap.
- Never use abrasive products or solvents.
- Dry quickly using a cloth or pulsed air at 80°C max.

Maintenance and Metrology checks

The appliance has no parts that can be replaced by the operator.
All operations must be carried out by skilled and approved personnel.

Contact your closest Chauvin-Arnoux agency or your regional Manumesure technical centre which will start a return procedure and will communicate the steps you should follow.

Details available on our site:
http ://www.chauvin-arnoux.com or by phone at the following numbers:
02 31 64 51 55 (Manumesure technical centre)
01 44 85 44 85 (Chauvin Arnoux).

Communication interfaces

USB V1.1

It is an interface that connects the instrument directly to a PC USB port. Simple to use, no adjustments are needed for a local application.

Powering up

Before powering up your oscilloscope and connecting it to the host PC:

1. Insert the supplied CD ROM and install the driver software of your choice (see below).
2. Then connect the oscilloscope to the PC by USB using the supplied USB A/B cable.
3. Finally, connect the power supply cable to the power outlet and refer to the following paragraphs.

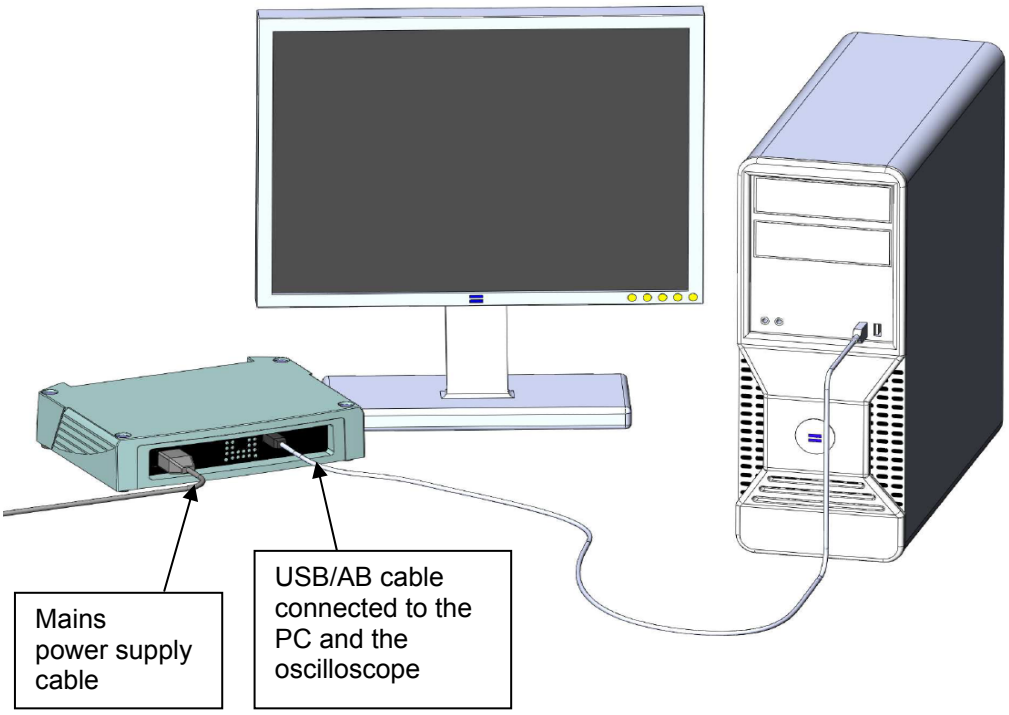
Reminder

The oscilloscope is shipped with 2 items of PC software:

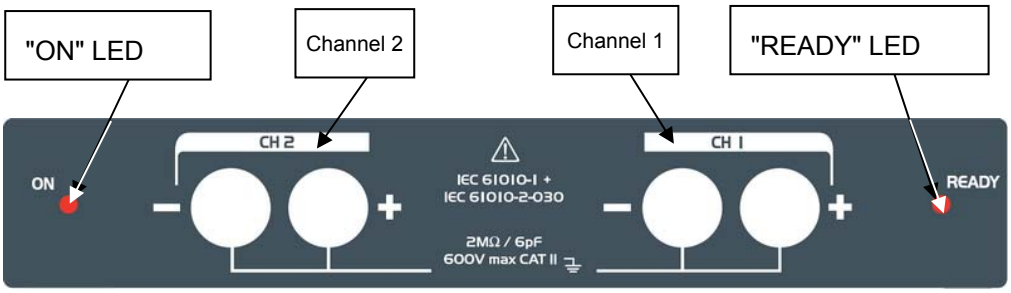
- complete PC software called SCOPEin@BOX_LE and
- simplified didactic software called DIDASCOPEin@BOX.

Getting started (continued)

Connection



- Connect the USB A/B cable to the control PC and the Scope.
- Connect the oscilloscope to the 50 Hz power supply, the "ON" LED on the front face lights to indicate that the appliance is powered on.



- Wait for about ten seconds until the "READY" LED lights indicating that the appliance has completed its initialisation phase.
- When the "READY" LED lights you can launch one of the two PC programmes.

Getting started (continued)

Important !

"READY" LED

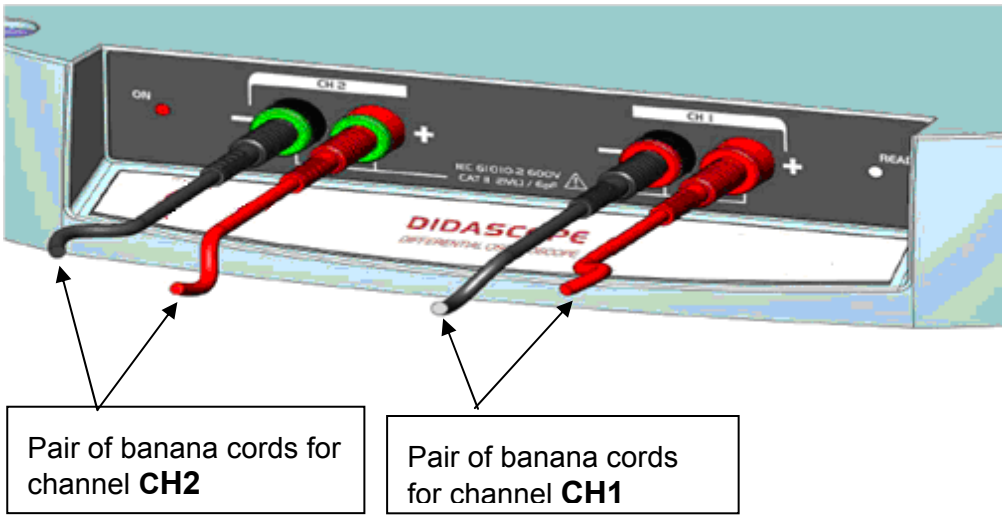
1. When powering on this LED indicates that the appliance has completed its initialisation; the user can then launch either SCOPEin@BOX-LE or DIDASCOPEin@BOX.
2. If the "READY" LED flashes the instrument can be identified and it is possible to check that the PC-Oscilloscope communications are OK.
3. If the "READY" LED is off, the appliance is being used.

Operation of the ON/OFF and READY LEDS on the front face

1. When powering on, the "ON/OFF" LED lights and the "READY" LED is off (the instrument is initialising).
2. When the instrument has completed its initialisation phase, the "READY" LED lights indicating that the SCOPEin@BOX-LE or DIDASCOPEin@BOX software can be launched.
3. When the application is launched, the "READY" LED turns off indicating that the instrument is being used (connected).
4. When exiting the instrument, the "READY" LED lights back on to indicate that the appliance is disconnected and ready for a new work session using SCOPEin@BOX-LE or DIDASCOPEin@BOX.

Connection (cont'd)

Differential signal entry is made using 2 banana safety cords as for a multimeter:



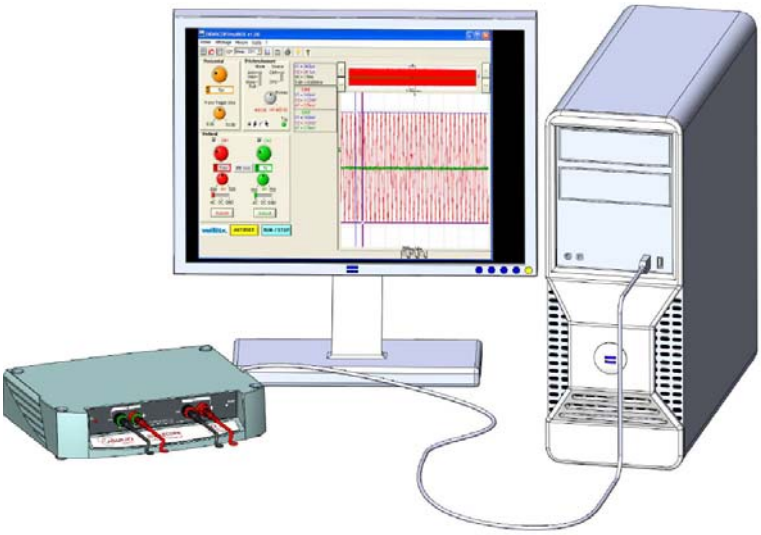
Pair of banana cords for channel **CH2**

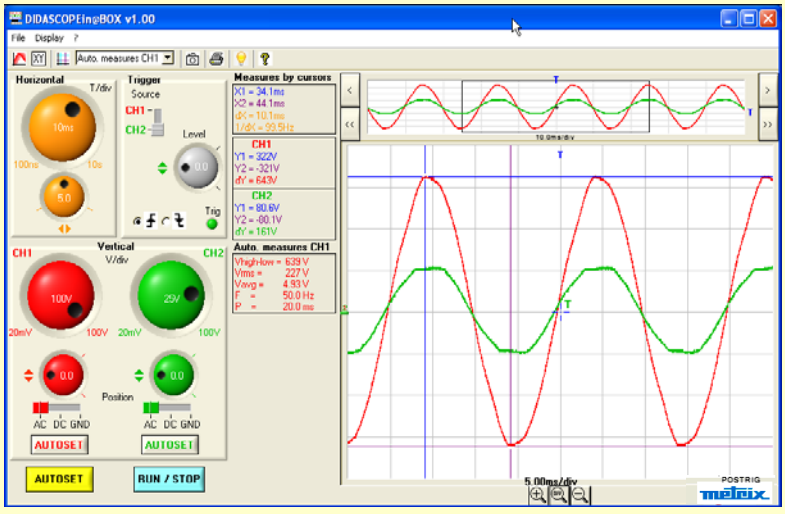
Pair of banana cords for channel **CH1**

Simplified didactic command software DIDASCOPEin@BOX

Starting up

To start up the oscilloscope follow the steps below:

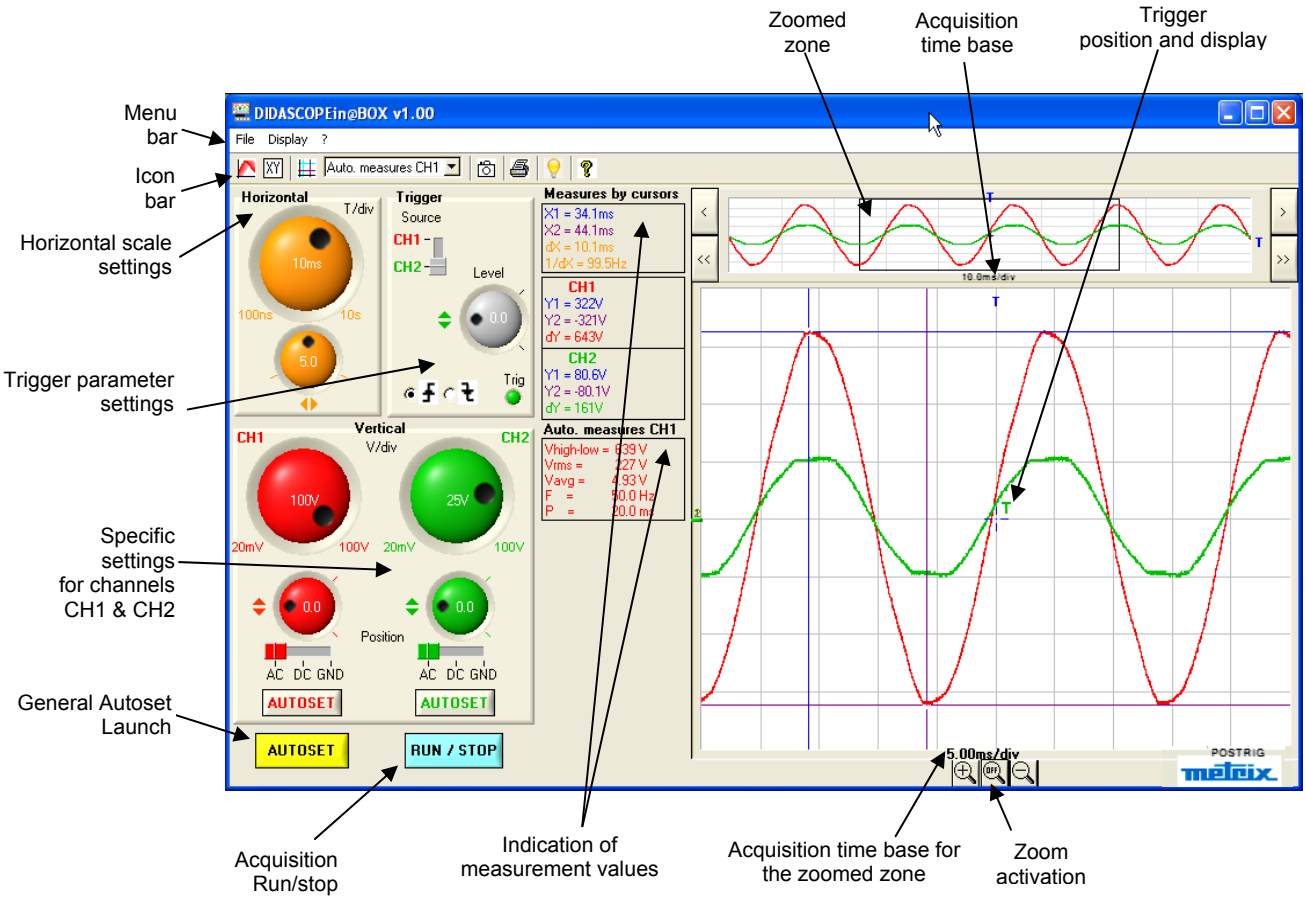


Steps	Action
1.	Power up the control PC.
2.	Connect the oscilloscope to the PC using the USB A/B cable.
3.	Power on the oscilloscope.
4.	Wait for the READY LED to light.
5.	Launch the DIDASCOPEin@BOX PC software
6.	The software will automatically detect oscilloscope presence. 
☝	***On first installation, if the driver is not found, follow the manual search instructions for the driver available on the CD-ROM, Driver USB derectory.***

Command software DIDASCOPEin@BOX

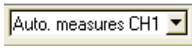
Description of the control screen

The oscilloscope man machine interface is composed of a window showing both the command panel and the trace window:



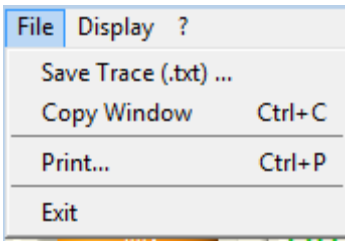
Command software DIDASCOPEin@BOX

a) the Icons

	Persistence display (if activated the icon is displayed below the graphic).
	XY Window display XY → X = CH1, Y = CH2
	Automatic and cursor measurement displays
	Reference channel selection for CH1 and CH2 measurements
	Ref → Traces (screen memory)
	Print
	Keyboard short cut
	Help

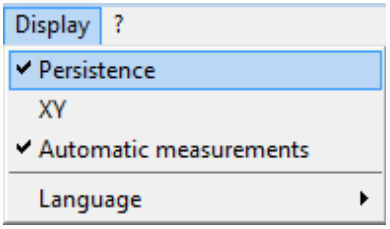
b) the Menus

"File" Menu



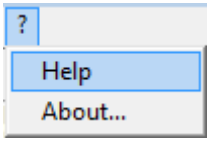
- "Save Trace": saves one of the two traces in .txt format
- "Copy Window": copies the front face and is used to paste it to another document.
- "Print": Initiates printout of the graph with or without the control panel

"Display" Menu



- "Persistene": the accumulation of the different acquisitions on the screen. The most recent acquisition is displayed using the brightest colour.
- "XY": displays a new graph with X = CH1 and Y = CH2
  Each axis has an 8 division graduation.
- "Automatic measurements": displays the cursor measurements and the automatic measurements on the reference channel
- "Language": choice from French, English, German, Italian and Spanish

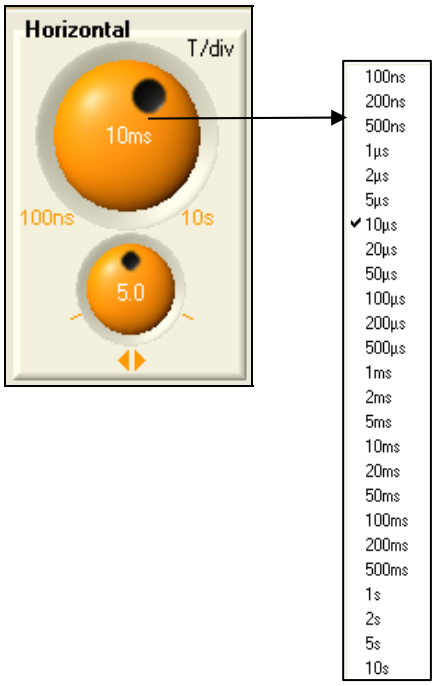
"?" Menu



- "Help" contains this user manual in .pdf format.
- "About … " gives details of:
  - the PC software and onboard software version with the configuration
  - the hardware version
  - the instrument serial number

Command software DIDASCOPEin@BOX

c) "Horizontal" block

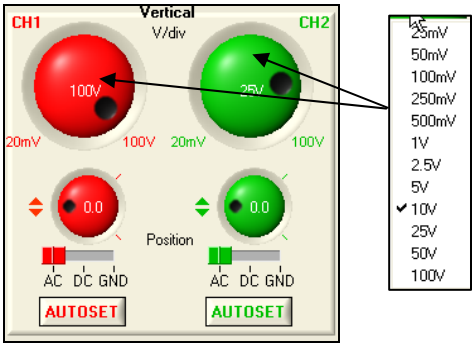


The **Horizontal** block has two rotating orange buttons:

- Selection of the 25 time base calibres, range from 100 ns/div. to 10 s/div. (sweeping coefficient T/div.)
- Horizontal trigger position setting, range from 0 to 10 div.

To display the list of the 25 time base ranges, left click on the T/div. range position displayed on the "time base" button.
Once the list is shown, the sweeping coefficient value can be selected by left clicking the required value.

d) "Vertical" block



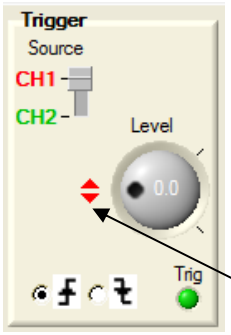
The **Vertical** block contains the essential vertical commands (Red is reserved for channel CH1 commands and green for CH2 commands):

- Vertical sensitivity selection button:
  12 vertical ranges, from 25 mV/div. to 100 V/div.
- Vertical position setting button: range limited to ± 4 div.
- Input coupling selection slider: AC DC GND
- Vertical autoset button for channel CH1 or CH2

To display the list of the 12 vertical ranges, left click on the V/div. range position displayed on the "Sensitivity" button. Once the list is shown, the vertical sensitivity value can be selected by left clicking the required value.

Command software DIDASCOPEin@BOX

e) "Trigger" block



The Trigger block (grey colour) includes:

- the trigger level setting button (positive or negative)
- the trigger source selector, CH1 or CH2
- the trigger slope selector and the green Trig. LED

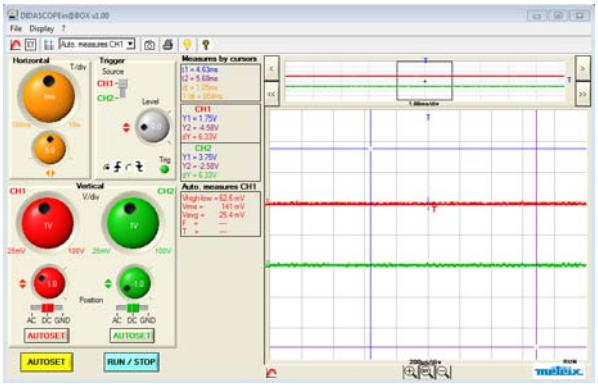
The arrows next to the trigger level setting button are the colour of the active trigger source:

- red for CH1
- green for CH2

With the DIDASCOPE software, the "DC" trigger filter is imposed.

The oscilloscope is programmed for AUTO sweep by default, which will make it possible for the user to quickly find the trace whether or not there is a signal. The "DC" trigger filter is also programmed by default.

f) Trace display



The trace and control panel window cannot be split.

Traces have the specific channel colour:

- Red for channel CH1
- Green for channel CH2

Both channels are active and displayed by default.

The "horizontal EXPANSION" function (or "Zoom") is used to "Zoom" on a 2.5 kpts zone from among the 50 kpts recorded memory.

The maximum expansion factor is 20.

In EXPANSION mode, the contents of the entire recording memory are displayed in the "trace display" window
(50 kpts) as well as the "zoomed" zone (2.5 kpts) both being refreshed in real time.

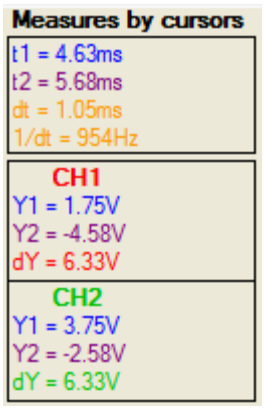
The zoomed part can then be moved within the recorded memory.

Command software DIDASCOPEin@BOX

g) Measurements

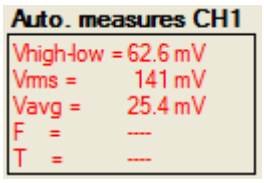
The instrument simultaneously displays two types of measurement which are variable depending on the cursor position:

Manual cursor measurements



For each position of the 2 cursors (t1, Y1) and (t2, Y2) in the trace window, the oscilloscope displays the value in seconds for the difference dT = t1-t2 and the value in Volts for the difference dV = dY = Y1-Y2. It is thus possible to manually measure the amplitude, the period or the frequency of a wave by placing the 2 cursors on the displayed periodic signal.
Blue → cursor 1 (t1, Y1)
Purple →cursor 2 (t2, Y2)

Automatic measurements



For each channel (in the channel colour), the oscilloscope displays the 5 fixed automatic values Vhigh-low, Vrms, Vvg, F and T:

- Vhigh-low: signal peak to peak amplitude
- Vrms: signal rms value
- F: signal frequency
- T: repetitive signal period
- Vavg: average signal voltage

The measured values are displayed using the colour for the reference channel with Red for channel CH1 and Green for channel CH2.

☝ *To increase the accuracy of automatic measurements, the calculation takes into account the entire 50 kpts in the recording memory.*

h) Other command buttons

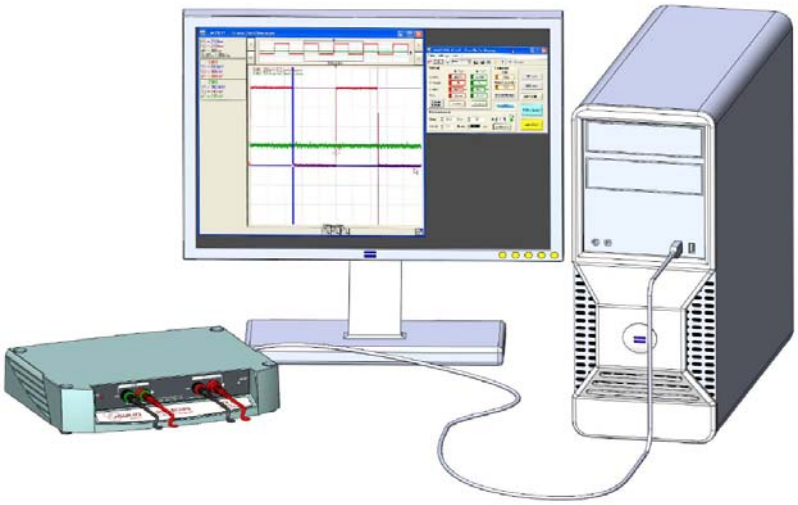
Starts a general oscilloscope Autoset (vertical, horizontal and trigger) by acting on the vertical, horizontal calibres and on the trigger channel.

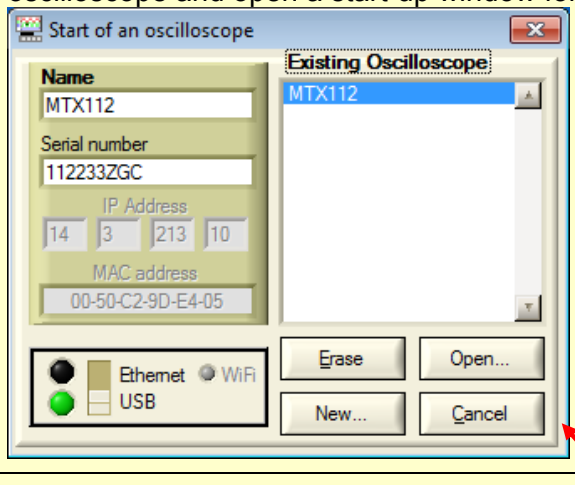
Run / stops acquisitions
RUN / STOP.

Complete command software SCOPEin@BOX-LE

Starting up

To start up the oscilloscope follow the steps below:



Steps	Action
1.	Power up the control PC.
2.	Connect the oscilloscope to the PC using the USB A/B cable.
3.	Power on the oscilloscope.
4.	Wait for the READY LED to light.
5.	Launch the PC software SCOPEin@BOX-LE
6.	The software will automatically detect the presence of the oscilloscope and open a start-up window for the instrument: 
7.	Create a new oscilloscope by clicking on "**New**" or select the oscilloscope to open: in our example, MTX 112.
8.	Click on the "Open" key to launch the application, open a trace display window and a control panel window.

Command software SCOPEin@BOX-LE

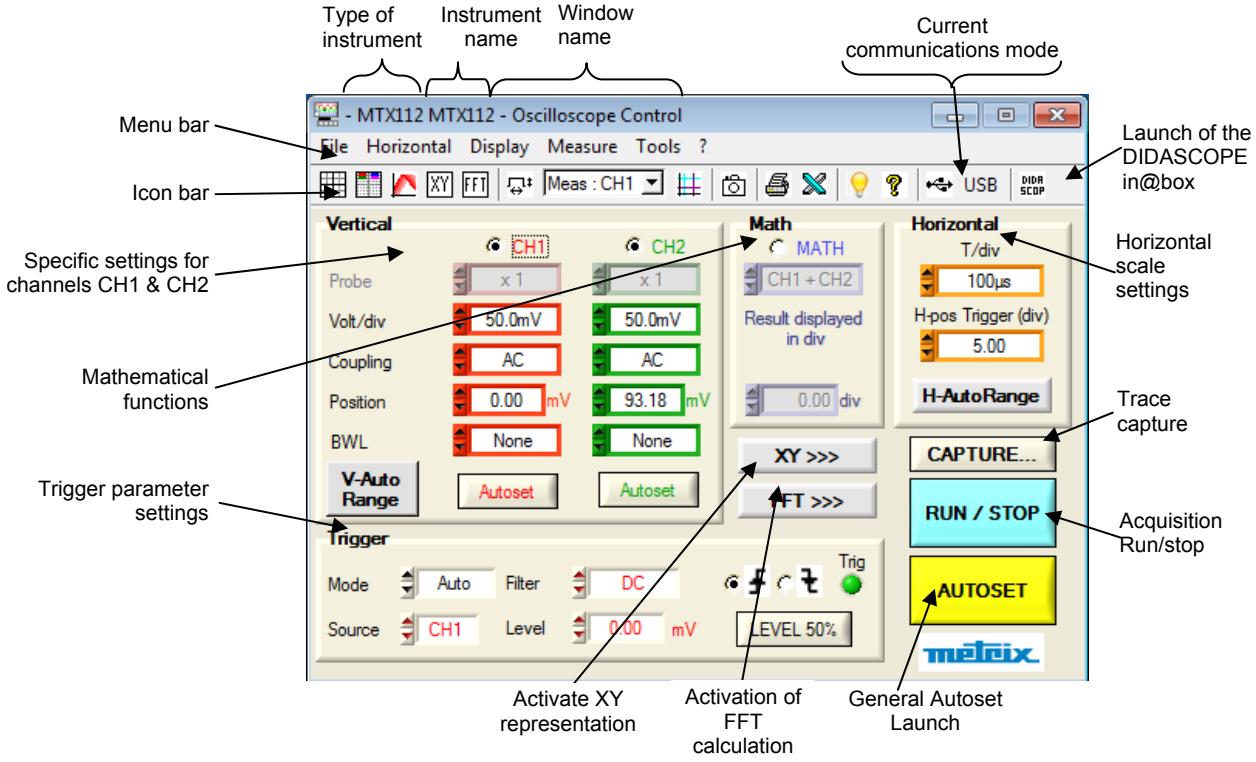
Screen description

The instrument's Man machine interface is composed of:

- an "Oscilloscope Control" window
- an "Oscilloscope Trace" window.

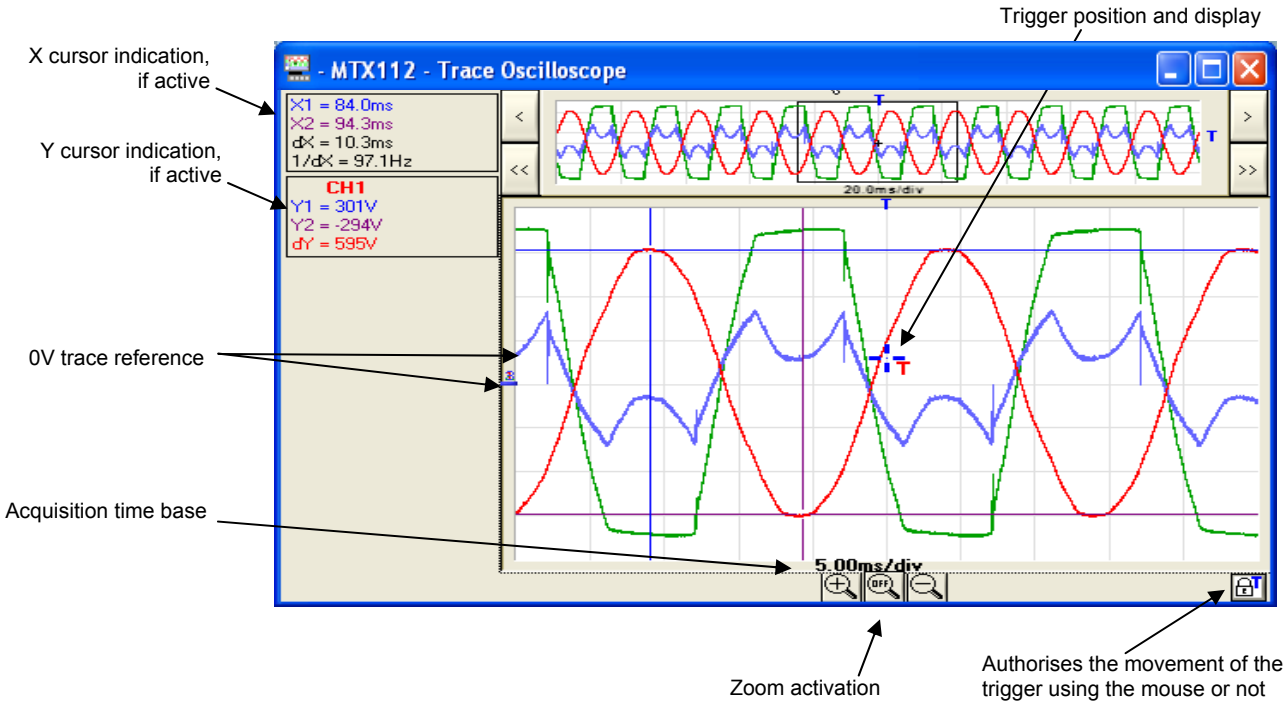
"Oscilloscope Control"

This window contains all the possible settings for the oscilloscope:



"Oscilloscope Trace"

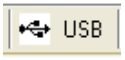
This window contains the graphical representation of the signals:



Command software SCOPEin@BOX-LE

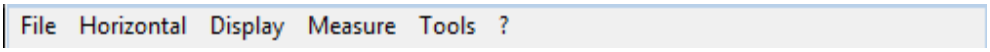
"Oscilloscope Control"

a) the icons

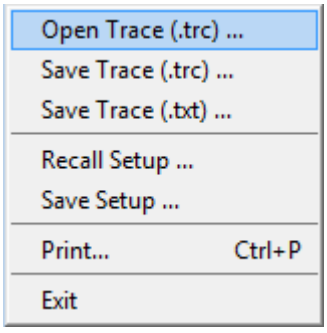
	Grid
	Display of the active channel settings in the oscilloscope trace display window
	Persistent display (if activated the icon is displayed below the graph).
	XY Window display XY → X = CH1, Y = CH2
	FFT display in a new window
	Automatic measurements
	Reference channel selection for CH1 and CH2 measurements
	Manual measurement cursors
	Ref → Traces (screen memory)
	Print
	Export to Excel
	Keyboard short cut
	Help
	USB communications mode
	Launch of the simplified DIDASCOPEin@box software

Command software SCOPEin@BOX-LE

b) the Menus

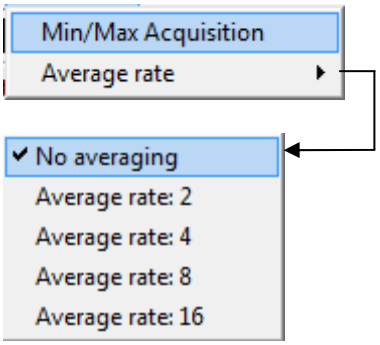


File Menu



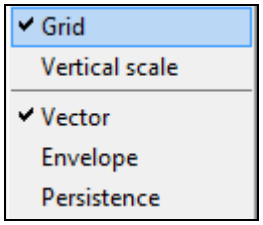
- "Open Trace": displays a previously saved trace with a .trc extension.
- "Save Trace": saves one of the two traces in .txt or .trc format
- "Recall Setup": configures the control screen parameters using a previously saved .cfg file.
- "Print": Initiates printout of the Trace panel and/or Control panel

Horizontal Menu



- "Min/Max Acquisition": the user views the extreme signal values acquired between 2 samples of the acquisition memory.
- "Average rate: 2, 4, 8, 16": calculates an average for the displayed samples. In our example averaging by 2 is activated.

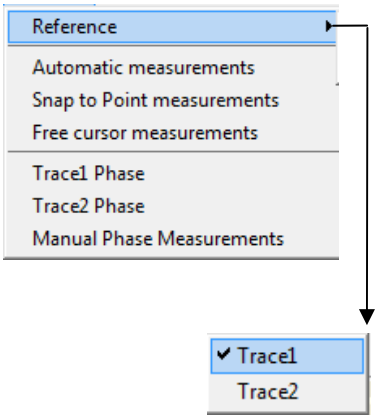
Display Menu



- "Grid": displays/hides the grid
- "Vertical scale": displays the calibre, the coupling, and the bandwidth of the active channels in the Trace window.
- "Vector": a vector is traced between each sample.
- "Envelope": the observed minimum and maximum of each horizontal screen position are displayed.
- "Persistence": the accumulation of the different acquisitions on the screen. The most recent acquisition is displayed using the brightest colour.

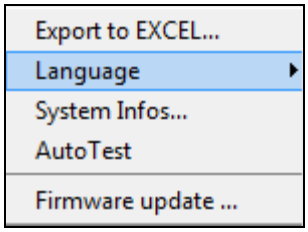
Command software SCOPEin@BOX-LE

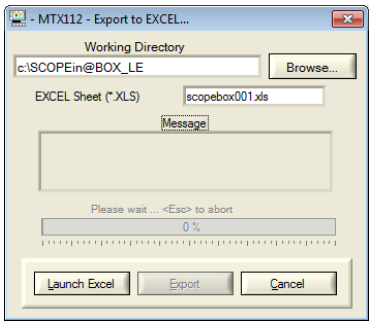
Measurement Menu



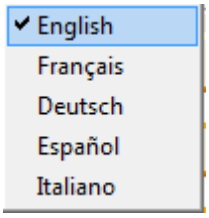
- "Reference": selects the trace on which automatic or manual measurements will be made.
- "Automatic measurements": measurements are made and refreshed in a new window on the selected reference trace. All the possible measurements on this trace are displayed.
- “Attached to Point measurements": the two manual measurement cursors are linked to the reference trace.
- "Free cursor measurements": the two manual measurement cursors are free.
- "Auto Phase Measurement": automatic phase measurement of a trace compared to a reference trace.
- "Manual phase measurements": use cursors 1 and 2 to indicate the offset between two traces.

Tools Menu

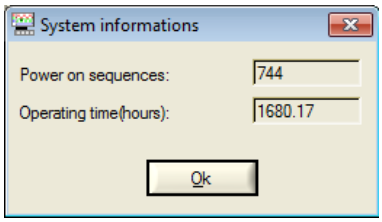




- "Export to Excel": the EXCEL window is used to export a trace for use in EXCEL

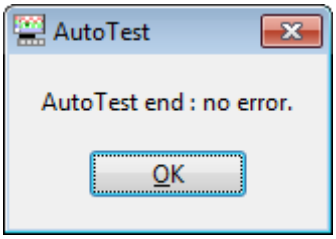


- Language: choice from French, English, German, Italian or Spanish

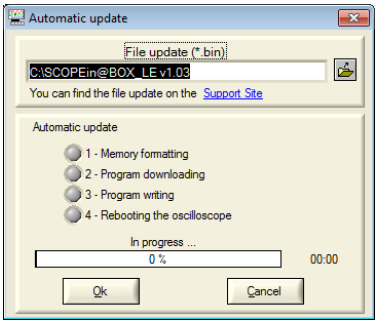


- "System Info": gives details on
  - the number of times power was turned on
  - the number of hours of use

Command software SCOPEin@BOX-LE

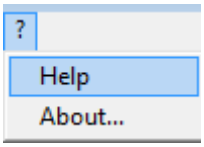


- "Autotest": launches an automatic base board test. If the autotest was successful the message opposite is displayed.



- "Automatic update" of the firmware in 4 steps with automatic reboot of the oscilloscope using the new software version:
  1. internal flash memory preparation,
  2. transfer of the new onboard software,
  3. software saved in flash memory if the transfer was successful,
  4. reboot of the appliance with the new onboard software version.

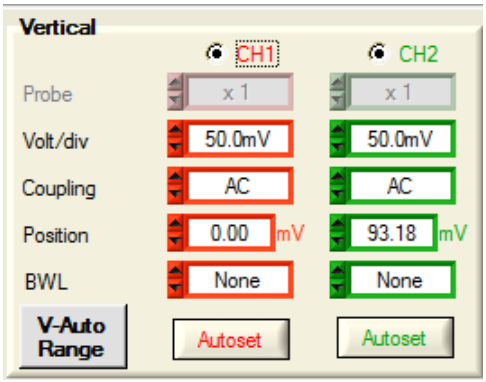
"?" Menu



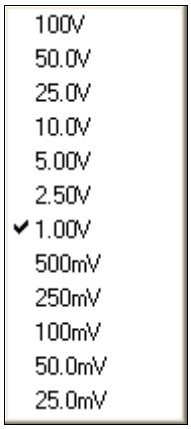
- "Help": contains this user manual in .pdf format.
- "About … " gives details of:
  - the PC software and firmware version with the configuration
  - the hardware version
  - the instrument serial number

Command software SCOPEin@BOX-LE

c) "Vertical" block

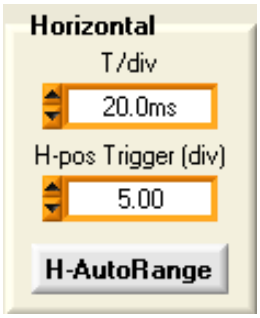


The colour "Red" is associated to channel CH1 and "Green " to CH2, with, for both channels, the possibility of selecting:



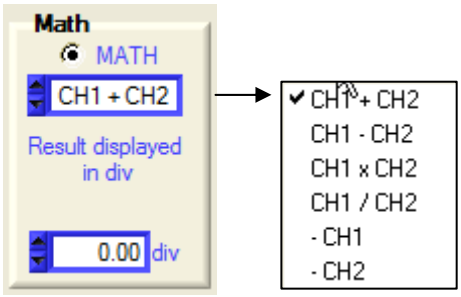
- The vertical ranges Volt/div. :
  12 ranges from 25 mV/div.
  to 100 V/div.
- input coupling:
  AC / DC / GND
- the vertical reference position
- channel bandwidth limitation:
  none, 1.5 MHz, 5 kHz
- the 2 vertical Autoset buttons: one for each channel CH1 CH2
- the vertical Auto range button, which puts both channels into Autorange mode.

d) "Horizontal" block



- the Time Base range :
  29 ranges, from 100 ns/div.
  to 200 s/div.
- the horizontal Trigger position
- The horizontal Autorange button: automatically adjusts the sweep coefficient according to the signal frequency.

e) "MATH" block

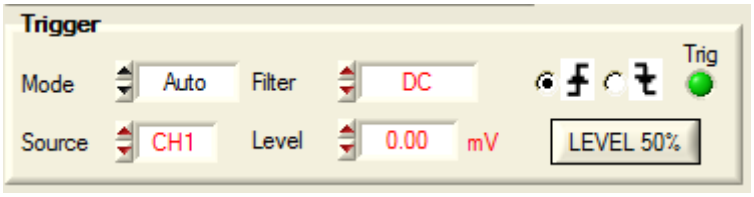


Access to the 6 basic mathematical functions:

- Addition
- Subtraction
- Multiplication
- Division
- CH1 and CH2 Inversion

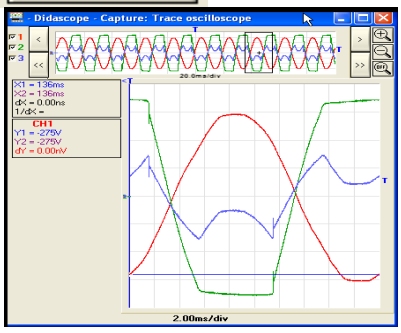
Command software SCOPEin@BOX-LE

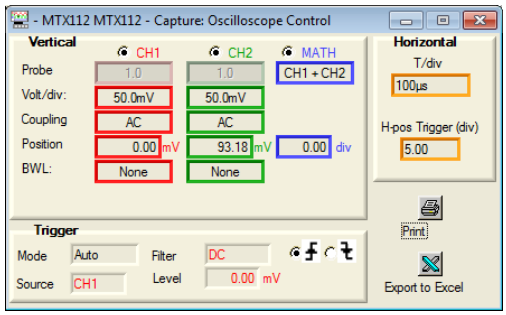
f) "Trigger" block



- Mode: Auto - Triggered - Single - Roll
- Source: CH1 - CH2 - LINE
- Filter: DC - AC - HF Reject - LF Reject
- Level: in V
- Front : positive - negative
- LEVEL 50%: automatically adjusts the trigger level to 50% of the peak amplitude of the triggering source wave.
- Trig: the green LED lights to show that a trigger event has occurred.

g) Other command buttons





Captures current traces (transfers points for each active trace) and displays them in a new window.

The wave "CAPTURE" button opens both a specific "Trace capture" window used to observe the captured wave and the control panel corresponding to the time of capture.

The "CAPTURE" function uses the acquired 50 kpts.

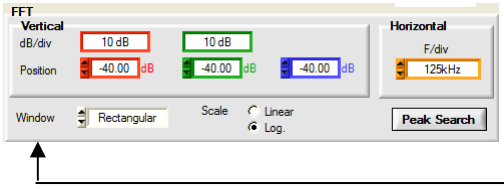
Starts a general oscilloscope autoset (vertical, horizontal and trigger) by acting on the vertical / horizontal calibre and on the trigger channel.

Runs / stops acquisitions RUN / STOP.

activates XY display:
CH1 = X and CH2 = Y.

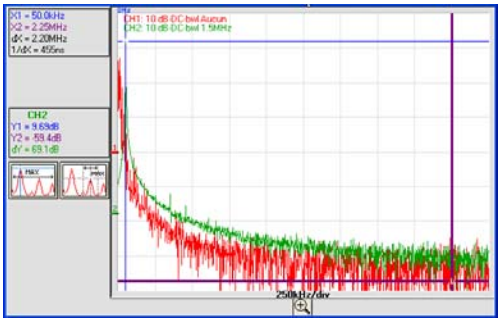
Command software SCOPEin@BOX-LE

activates FFT display, possibility of searching for the max. Peak



By clicking on the "FFT" button a specific FFT trace window and control panel are displayed.

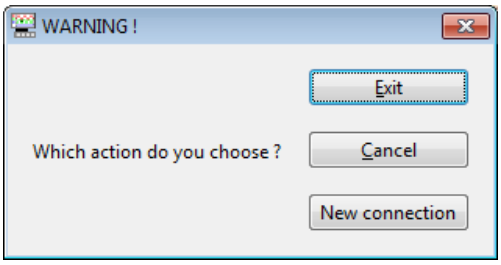
Choice of window type: rectangular, Hamming, Hanning, Blackmann or Flattop



In the FFT block a "Peak Max Search" button is used to display the "Peak max" and "Next Peak Max" search buttons in the FFT trace window.

The PC calculates the FFT on 2.5 kpts.

h) Exit the application or start a new connection



By clicking on:

- "**Exit**": exit from the application SCOPEin@BOX-LE
- "**Cancel**": cancels the operation
- "**New connection**": used to connect to the same instrument or to open a new instrument.

Applications

I - Continuous signal and Periodic Signal

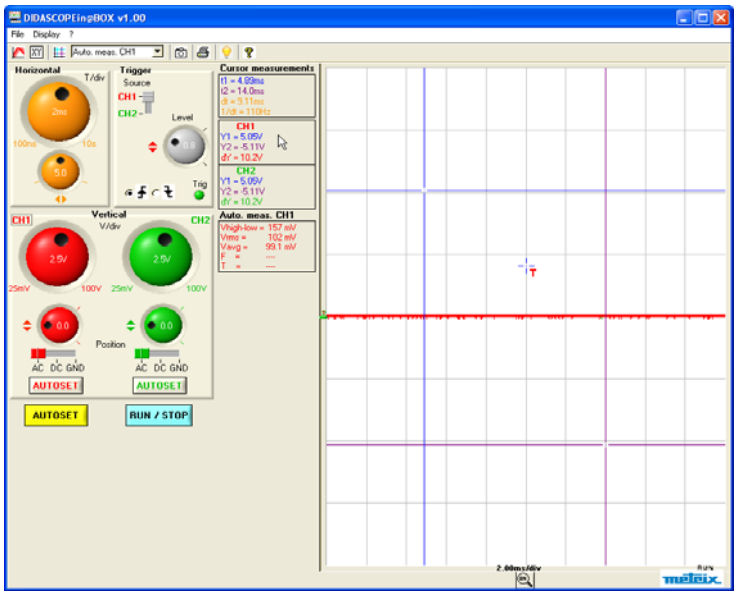
1. Continuous DC signal

Simplified PC software "DIDASCOPEin@BOX"

To observe a continuous current, it is imperative to select DC input coupling.

CH1 2.5V/div AC

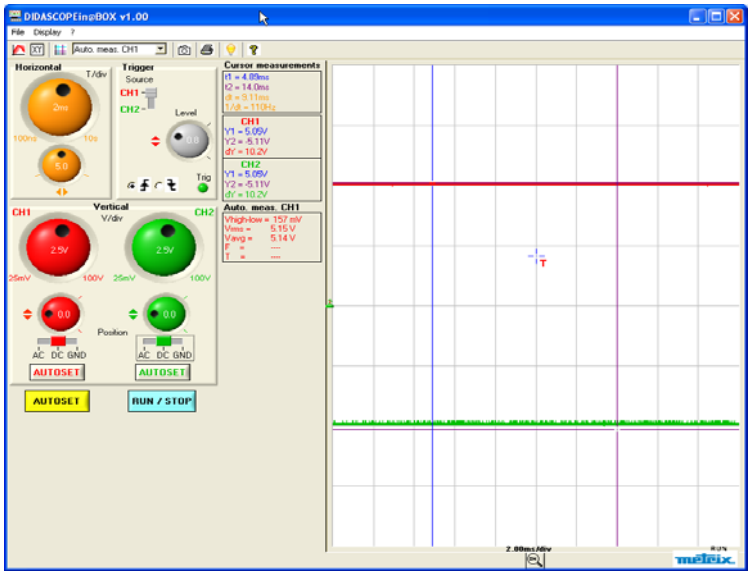
CH2 2.5V/div AC



For example, if a DC voltage of ≈+5V is injected to channel CH1 and ≈ -5V to channel CH2 (vertical calibre 2.5 V/div), we observe, with the AC input coupling, a voltage of 0 V and …

CH1 2.5V/div DC

CH2 2.5V/div DC



… with DC coupling a voltage of ≈+5V on channel CH1 and ≈ -5V on channel CH2. In fact, the role of the AC input coupling is to eliminate the DC component of the input signal.

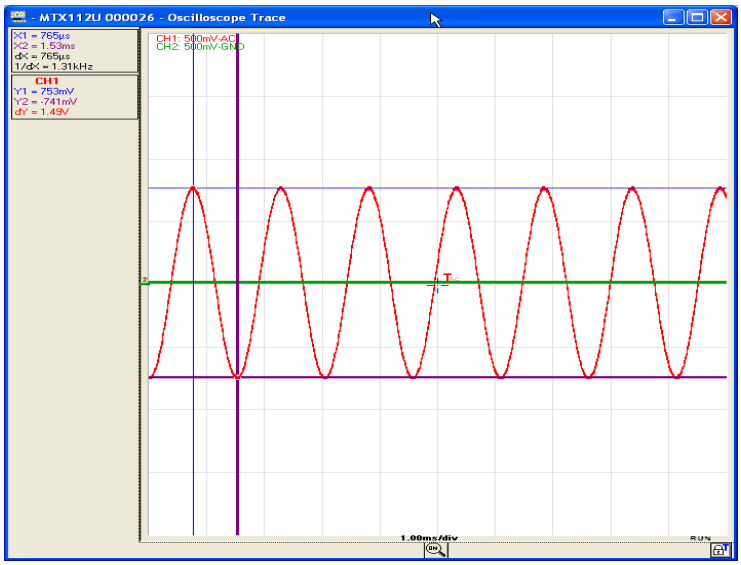
Continuous signal and Periodic signal (continued)

2. Sinusoidal periodic signal with and without continuous component

"SCOPEin@BOX_LE" PC software

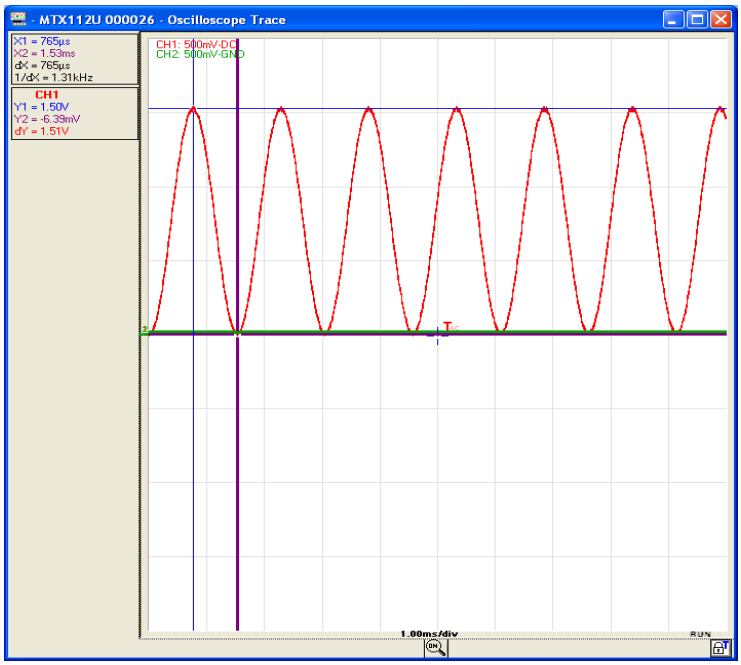
A 1.5 Vpp and F = 0.655 kHz sinusoidal signal is injected to channel CH1 with a continuous component of 0.75 with input AC coupling.

Input AC coupling



With AC coupling we observe the sinusoidal voltage without the continuous component.

Input DC coupling



With input DC coupling,
we observe the sinusoidal voltage with the continuous component.

Continuous signal and Periodic signal (continued)

3. Amplitude, the frequency and period measurement of a sinusoidal signal

To view the table of 19 automatic measurements, launch the PC "SCOPEin@BOX_LE" software (this table is not available with the simplified "DIDASCOPEin@BOX" software):

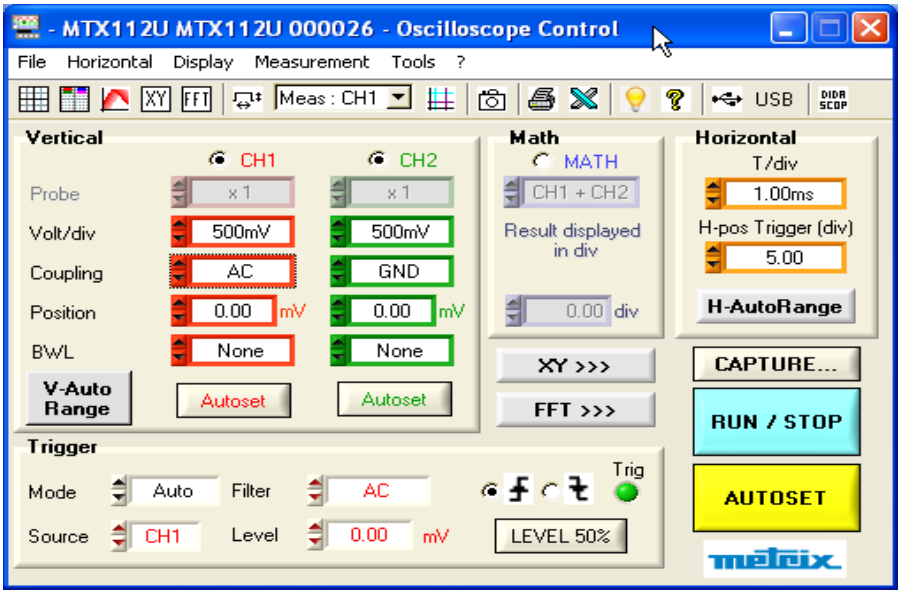
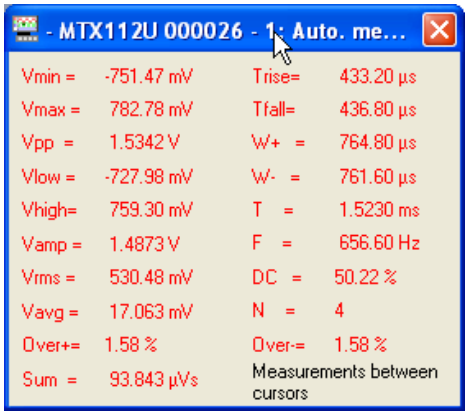


Table of the 19 automatic measurements

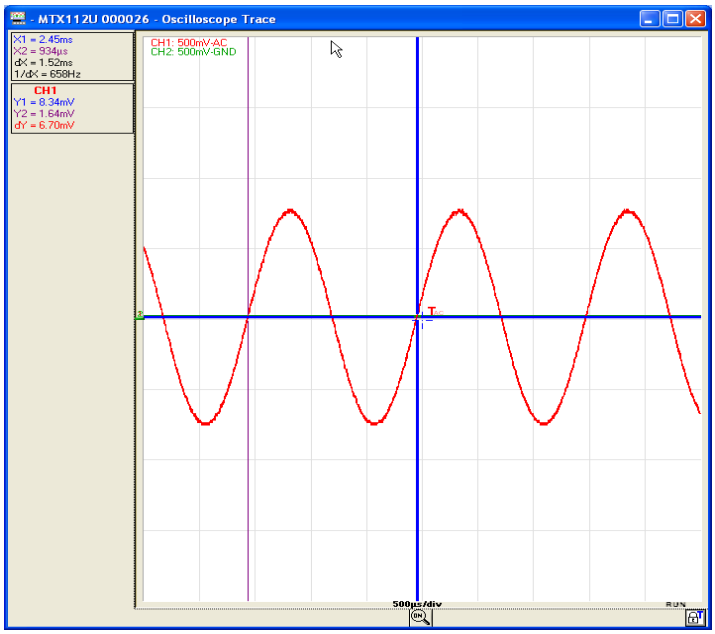
To measure the amplitude, frequency and period of a sinusoidal signal, at least 2 periods must be viewed on the screen:



Frequency measurement using the cursors

Vertical sensitivity CH1 = 500mV/div, AC coupling

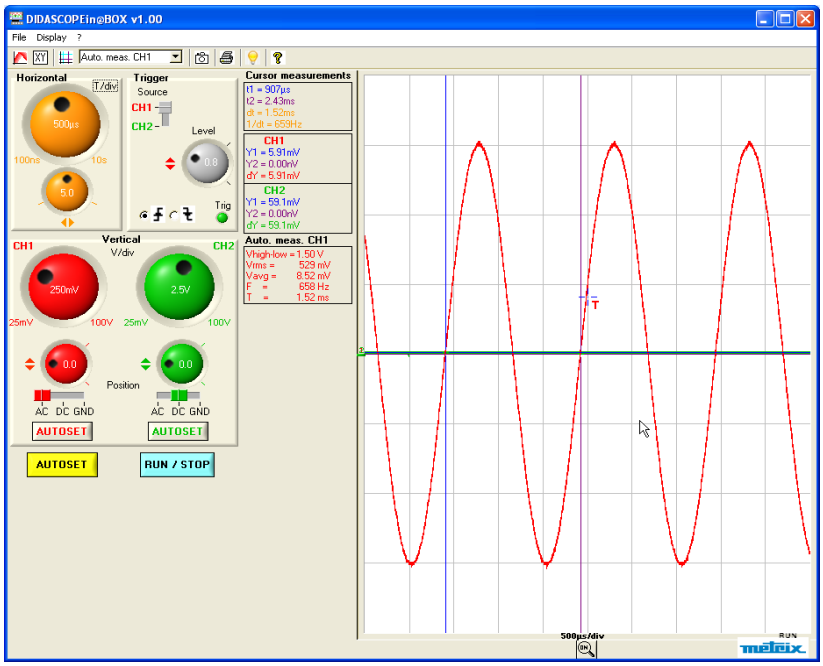
Trigger source CH1



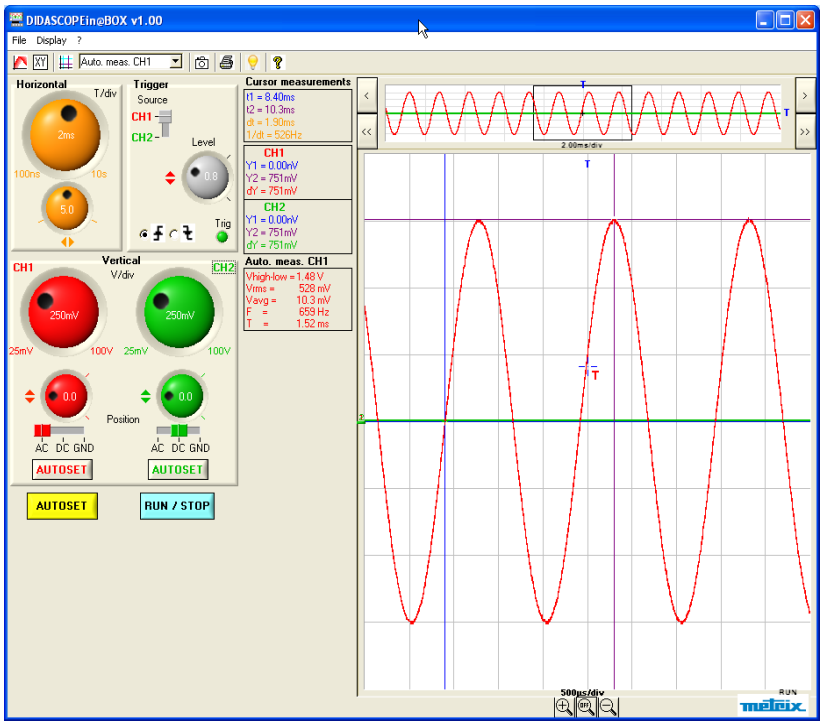
Continuous signal and Periodic signal (continued)

To measure the frequency using the manual cursors, place the 1st cursor (t1, Y1) on the first zero crossover of the signal and the 2nd cursor (T2, Y2) on the following zero crossover with the same slope.

Using the "DIDASCOPEin@BOX" PC software:



The displayed value dt = 1.52ms corresponds to the period T of the sinusoidal signal.
The displayed value 1/dT = 659 Hz corresponds to the frequency F = 1/T of the signal.



To measure the amplitude of the sinusoidal signal, place the cursor (t2, Y2) on the signal maximum.

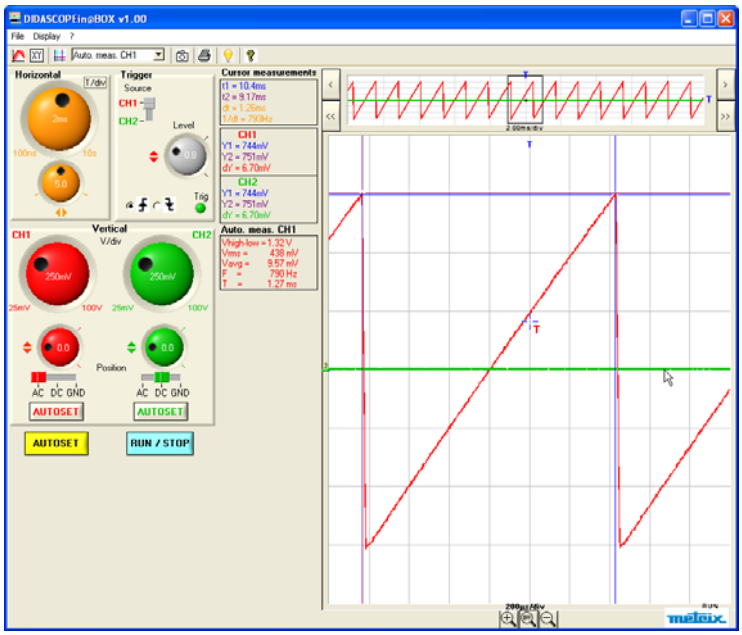
The difference dY = (Y2 - Y1) = 751 mV corresponds to the signal amplitude.

Continuous signal and Periodic signal (continued)

4. Periodic sawtooth signal

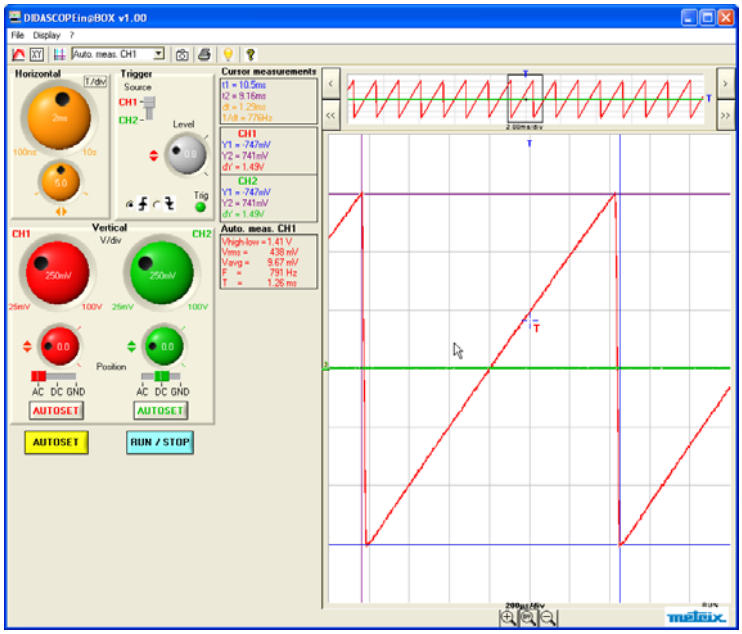
"DIDASCOPEin@BOX" PC software

To measure the sawtooth frequency, place cursors (t1, Y1) and (t2, Y2) on 2 consecutive maximums:



The value dt = (t2 - t1) ≈ 1.26 ms represents the sawtooth period. The value 1/dt = 793 Hz represents the frequency of the "sawtooth".

To measure the "Peak to peak" amplitude of the sawtooth, we place the cursor (T2, Y2) on the signal minimum:



dY = Y2 - Y1 = 1.49 V represents the "peak to peak" amplitude of the sawtooth signal.

Applications (continued)

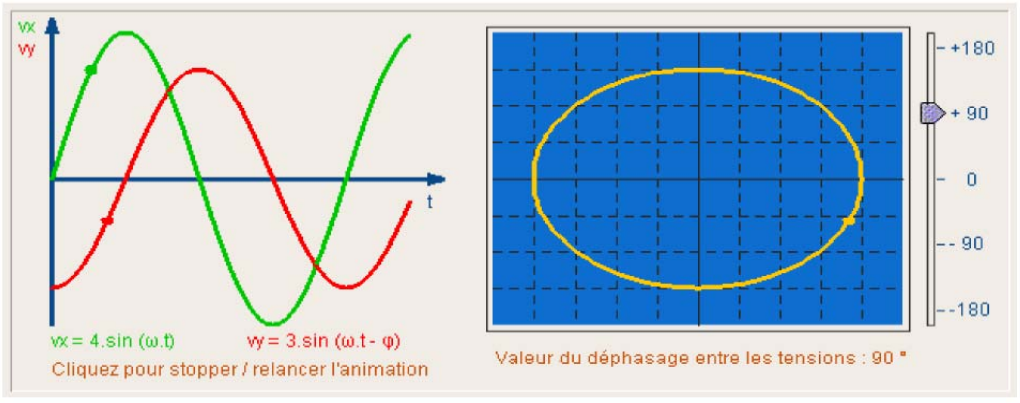
II - Lissajous curve

We will observe the voltage on the terminals of the different components of a few elementary circuits.

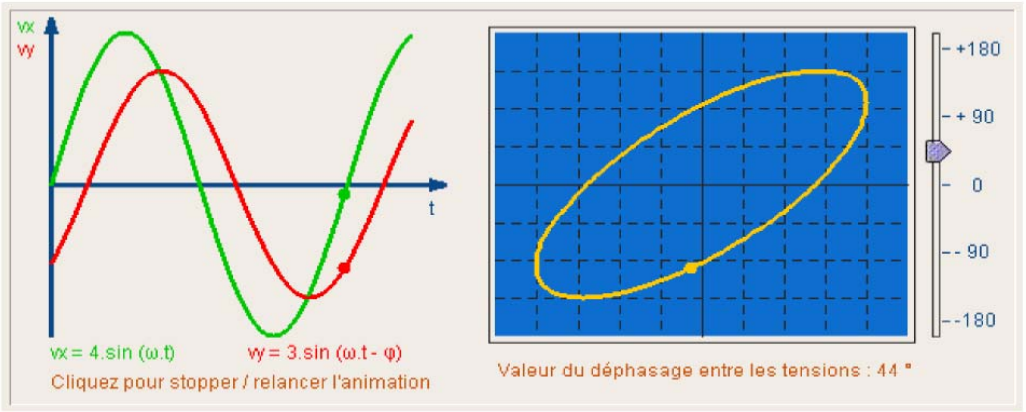
The circuits will have a sinusoidal f(t)=Asin(ωt) power supply

We will use the f(t) representation to observe the voltage forms and the XY mode to obtain the Lissajous curves.

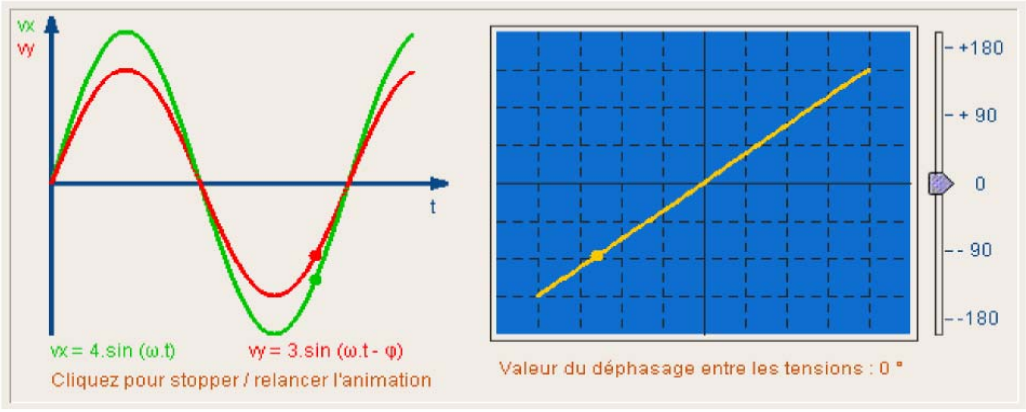
Lissajous with 2 90° dephased sinusoidal signals



Lissajous with 2 45° dephased sinusoidal signals

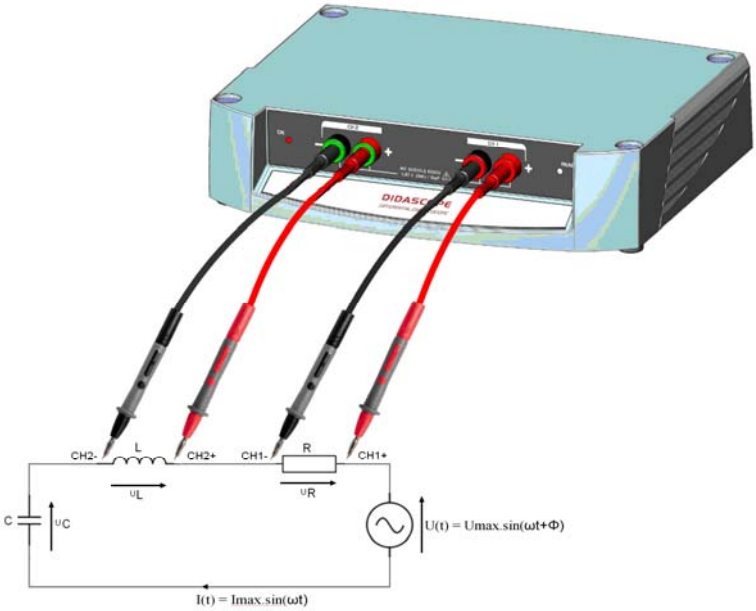


Lissajous with 2 phased sinusoidal signals



II - Lissajous curves (continued)

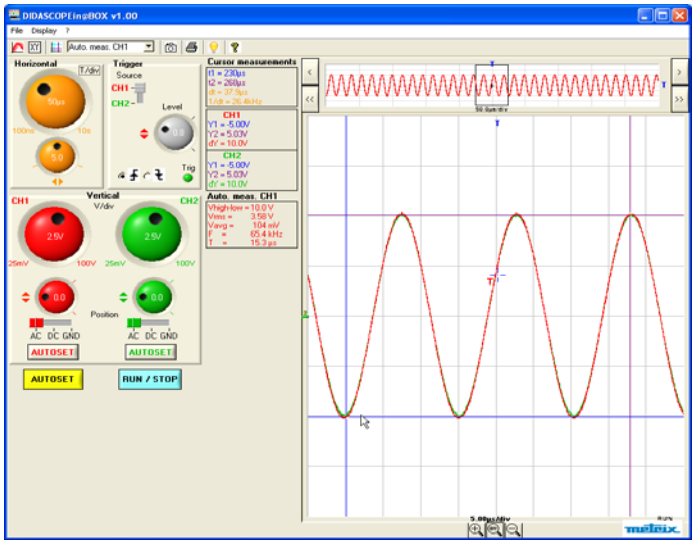
1. RLC Circuit



Values for the RLC circuit in our example R = 130Ω, L = 100µH, C = 60nF: CH1 = U(t) and CH2 = UR

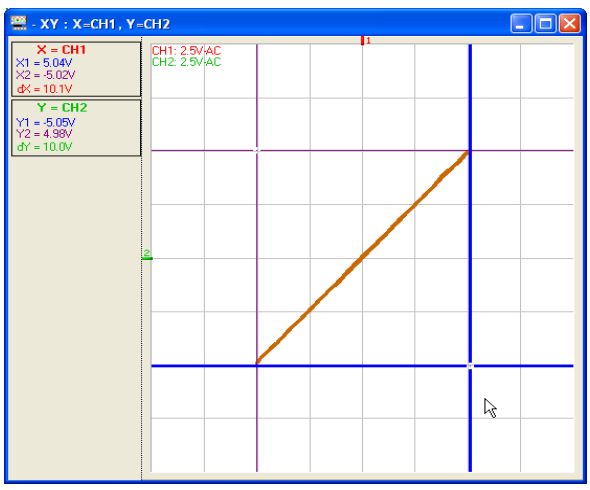
Sinusoidal frequency signal

F = 66 kHz



CH1 2.5V/div

CH2 2.5V/div

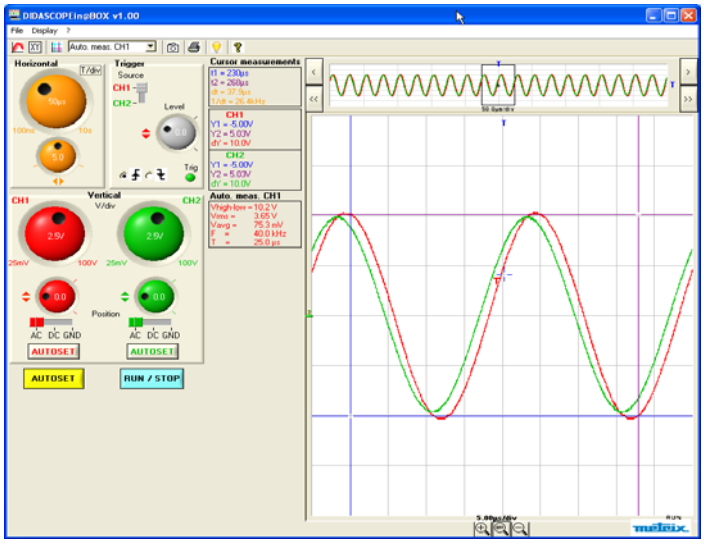


The U(t) and UR voltages are in phase.

II - Lissajous curves (continued)

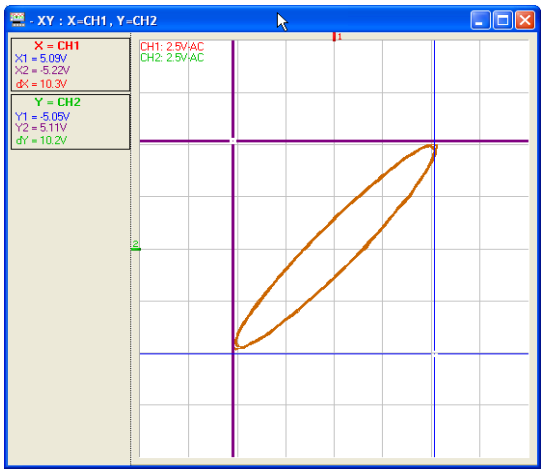
Sinusoidal frequency signal

F = 40 kHz



CH1 2.5V/div AC

CH2 2.5V/div AC

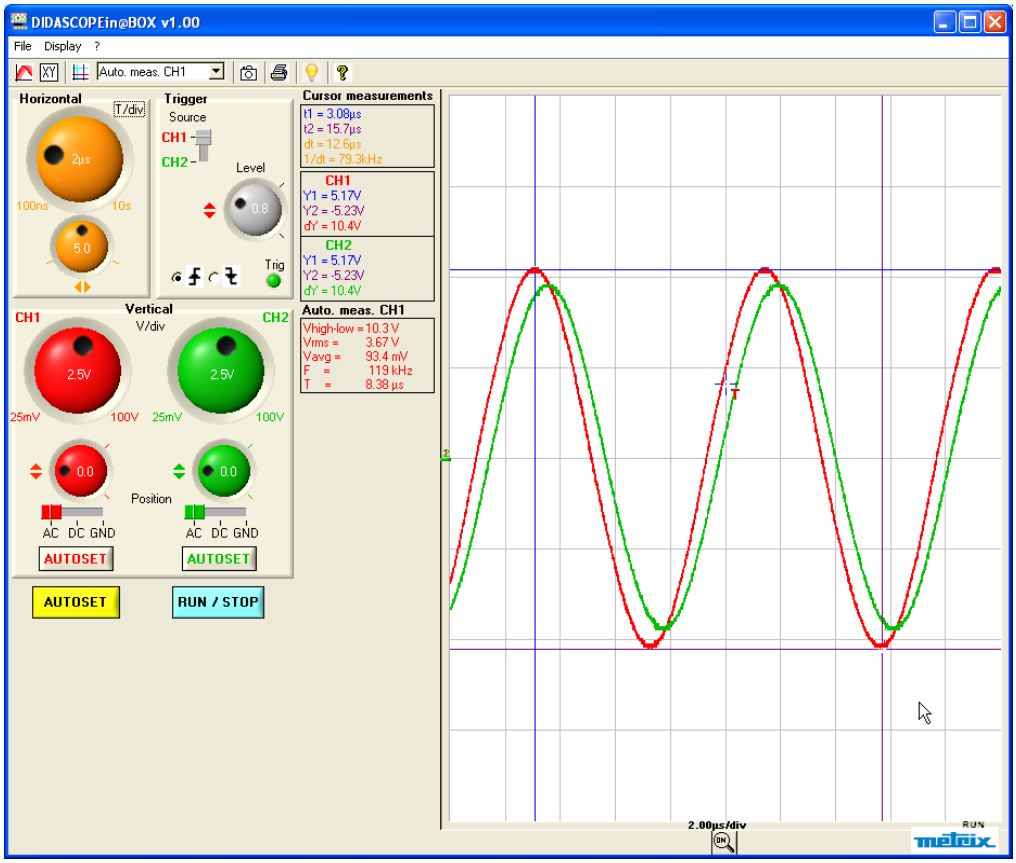


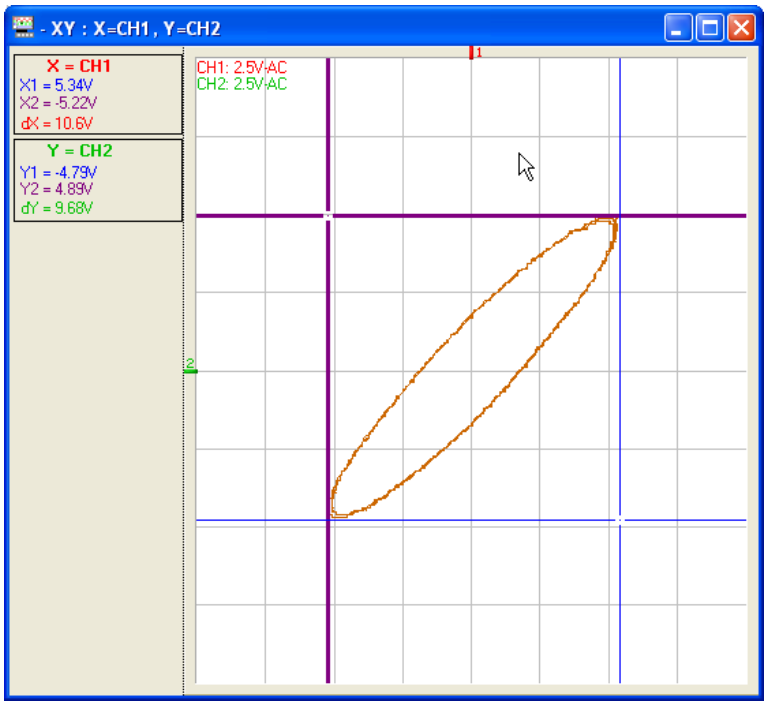
Voltage U(t) (CH1) has a negative phase shift compared to voltage UR (CH2).

II - Lissajous curves (continued)

Sinusoidal frequency signal

F = 119 kHz





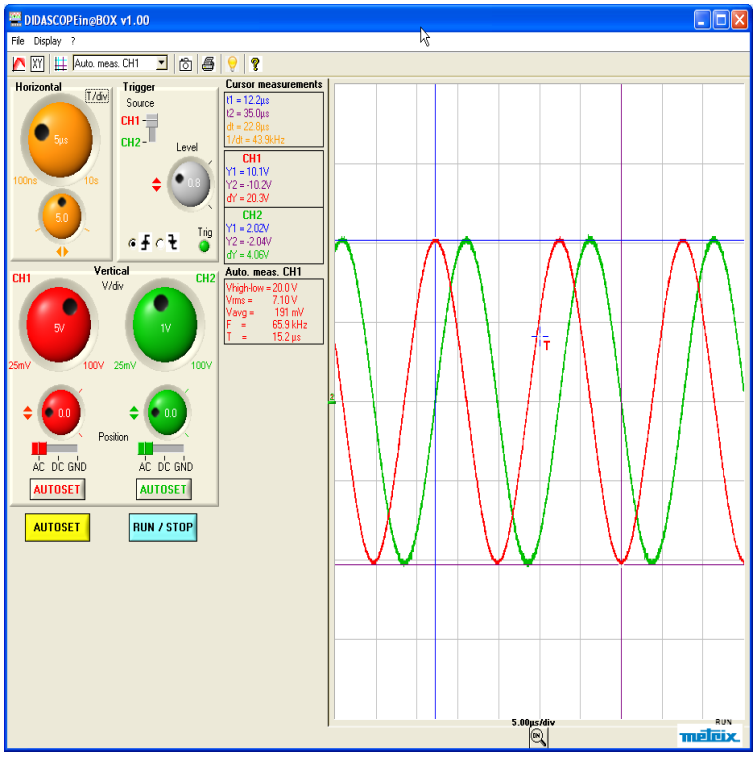
Voltage U(t) (CH1) has a positive phase shift compared to voltage UR (CH2).

II - Lissajous curves (continued)

CH1 = U(t)
and CH2 = Uc

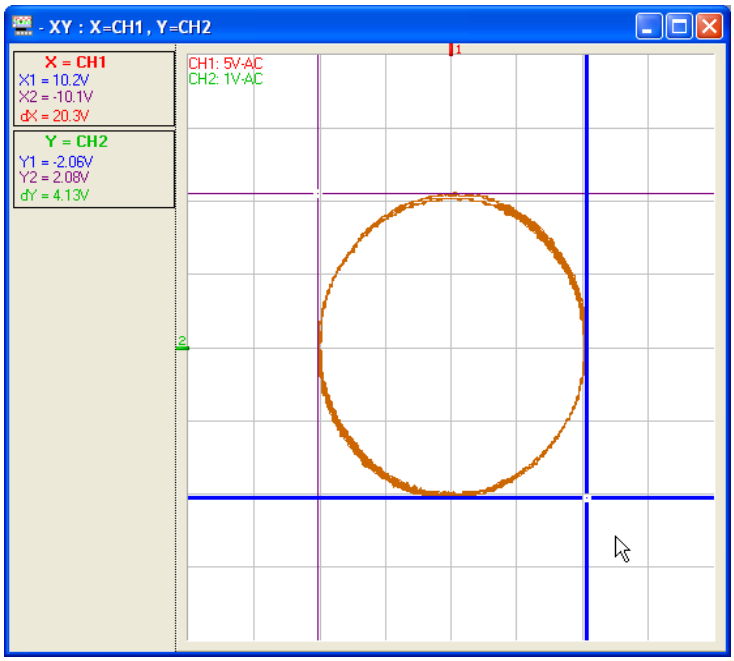
Sinusoidal frequency signal

F = 66kHz



We inject a sinusoidal signal
Vpp = 20 V
F = 66 kHz.

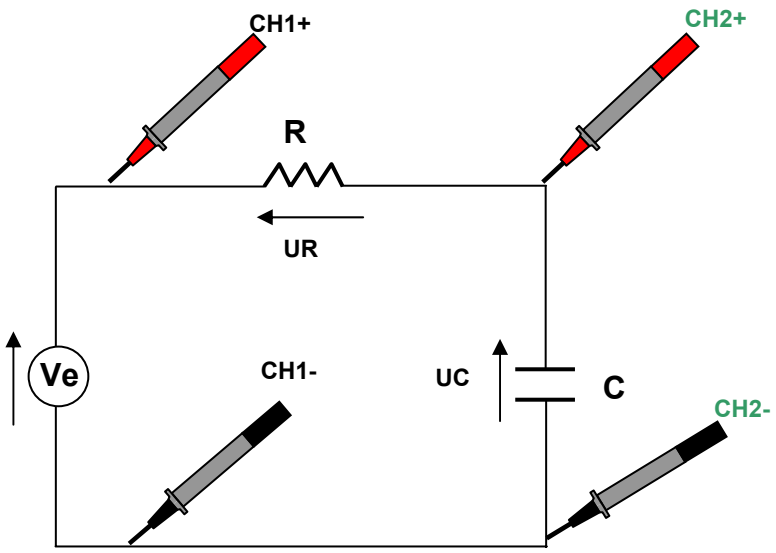
The CH2 = Uc channel signal is shifted by 90° compared to signal CH1 = U(t).



The XY mode curve obtained is almost a circle.

II - Lissajous curves (continued)

2. RC Circuit



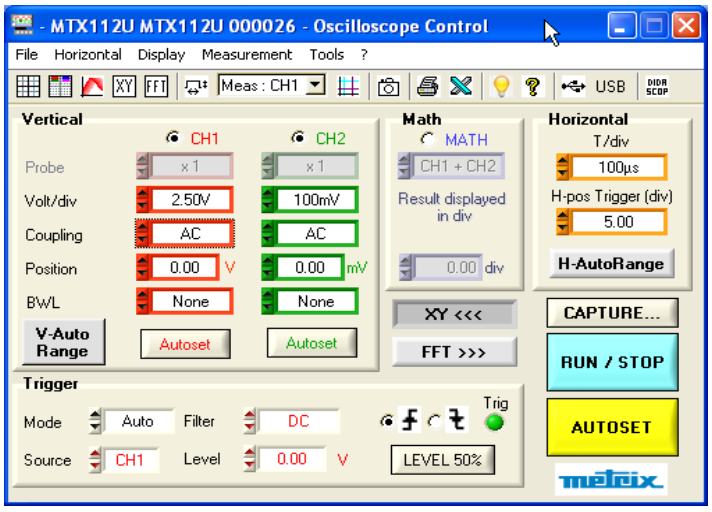
R = 5 kΩ

C = 530 nF

Fc = 60 Hz

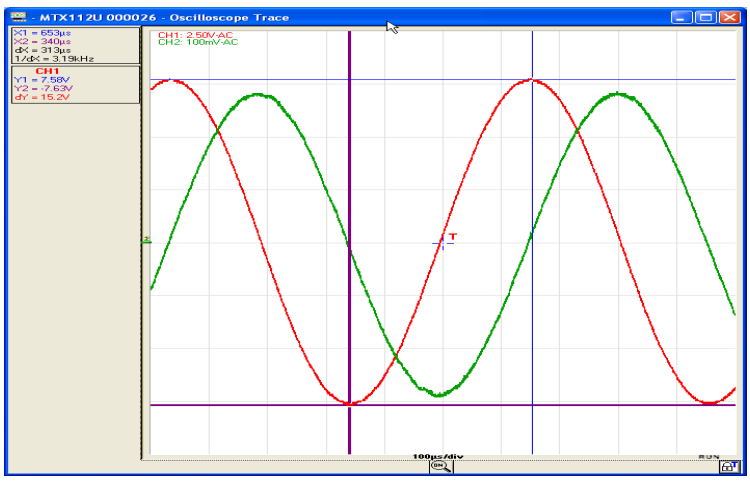
a) Ve = sinusoidal signal Vpp = 15V and F = 1.6 kHz

"SCOPEin@BOX_LE" software



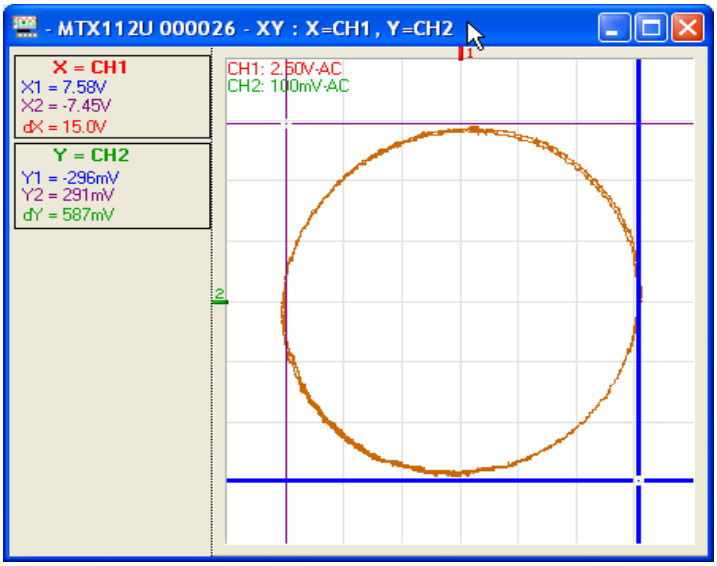
CH1 2.5V/div

CH2 100mV/div



In this case the phase shift between CH1=Ve and CH2=Uc is close to 90° and the CH2 signal is late compared to the CH1 signal.

II - Lissajous curves (continued)

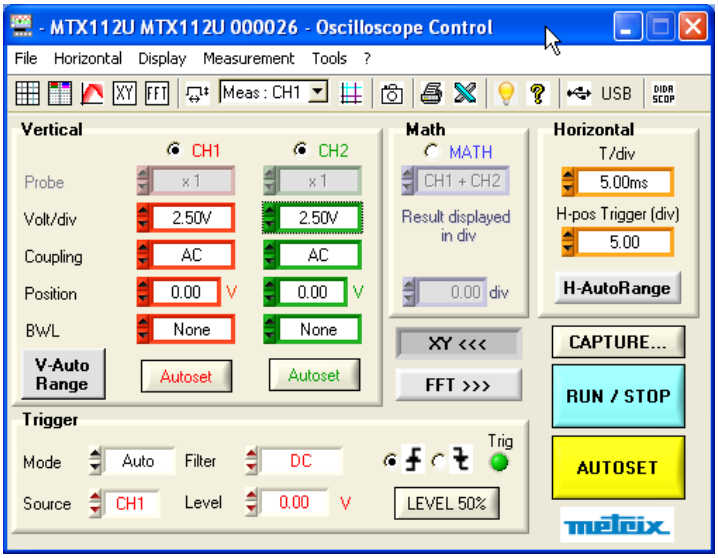


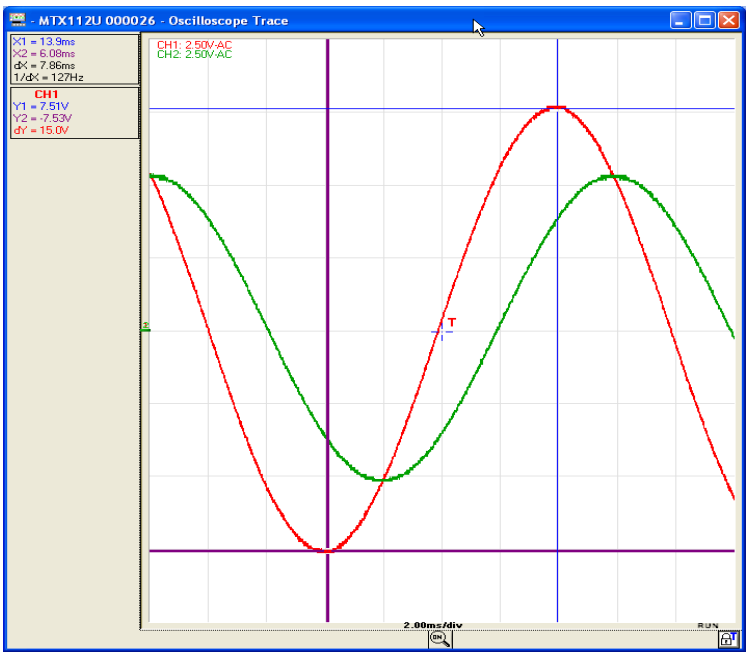
The curve obtained in XY (X=Ve=CH1, Y=Uc=CH2) is close to a circle.

b) Ve = sinusoidal signal Vpp = 15 V and F = 60 Hz

CH1 2.5V/div

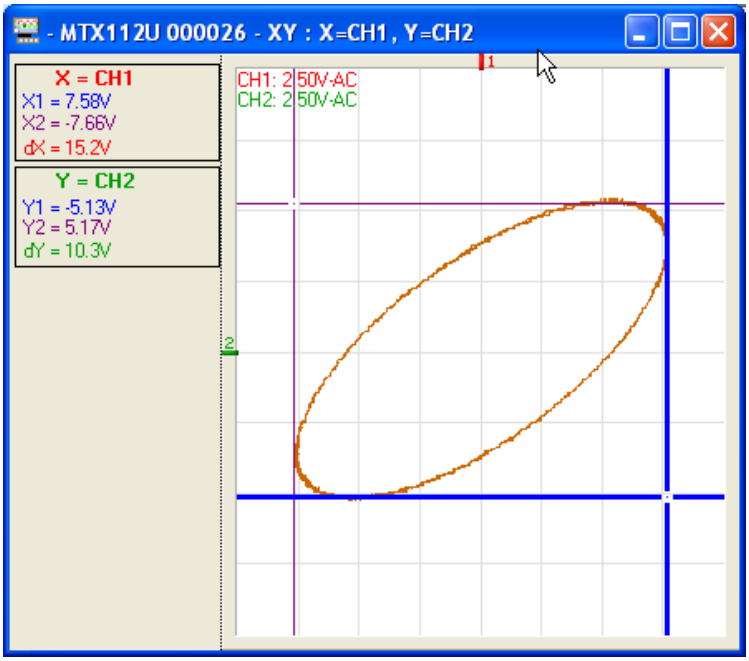
CH2 2.5V/div





In this case the phase shift between CH1 = Ve and CH2 = Uc is close to 45° and the CH2 signal is late compared to CH1.

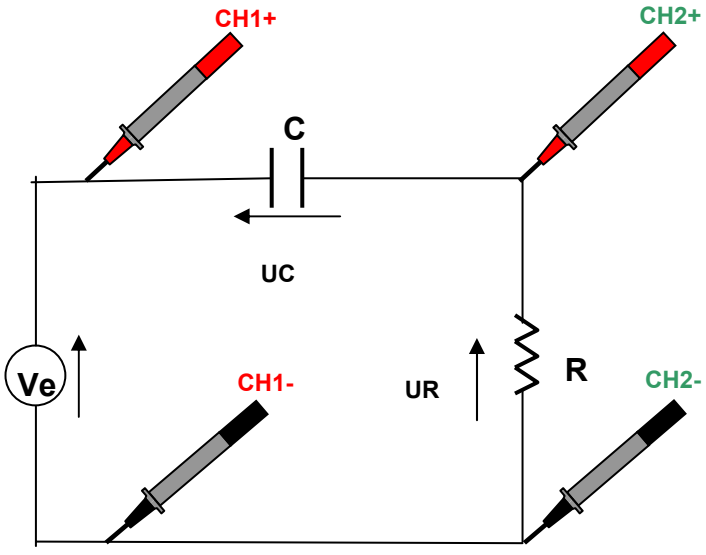
II - Lissajous curves (continued)



The curve obtained in XY (X=Ve=CH1, Y=CH2) is an ellipse.

The angle between the long axis of the ellipse and the horizontal axis is close to 45°

3. CR Circuit



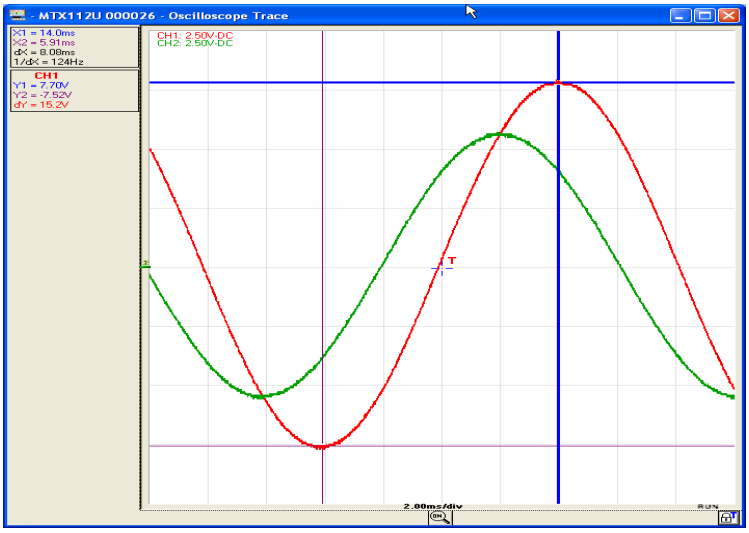
R = 5 kΩ

C = 530 nF

Fc = 60 Hz

1) Ve = sinusoidal signal Vpp = 15V and F = 60Hz

CH1 = Ve and CH2 = UR



The phase shift between the 2 signals is close to 45° and the CH2 signal is early compared to CH1.

CH1 2.5V/div

CH2 2.5V/div

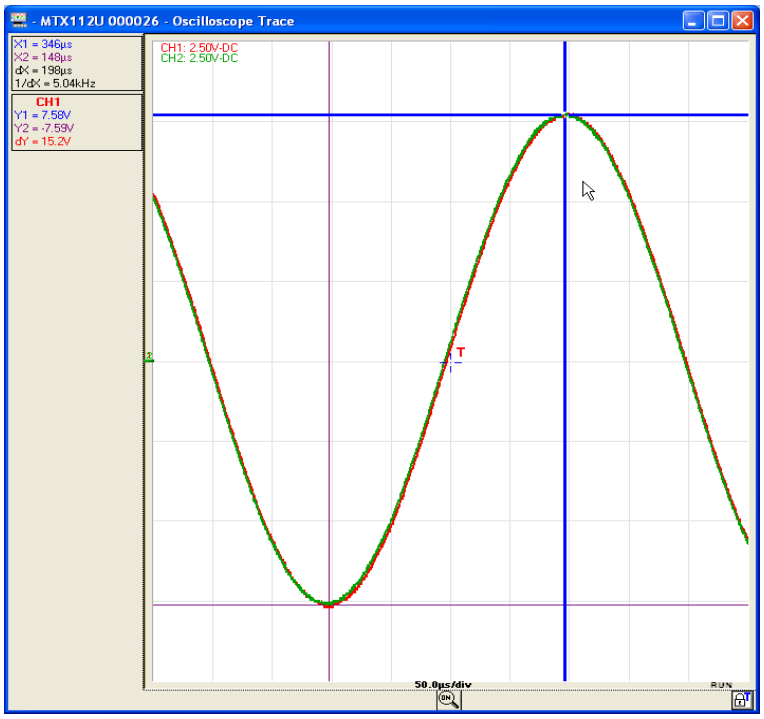
II - Lissajous curves (continued)

2) Ve = sinusoidal signal Vpp = 15 V and F = 2.5 kHz

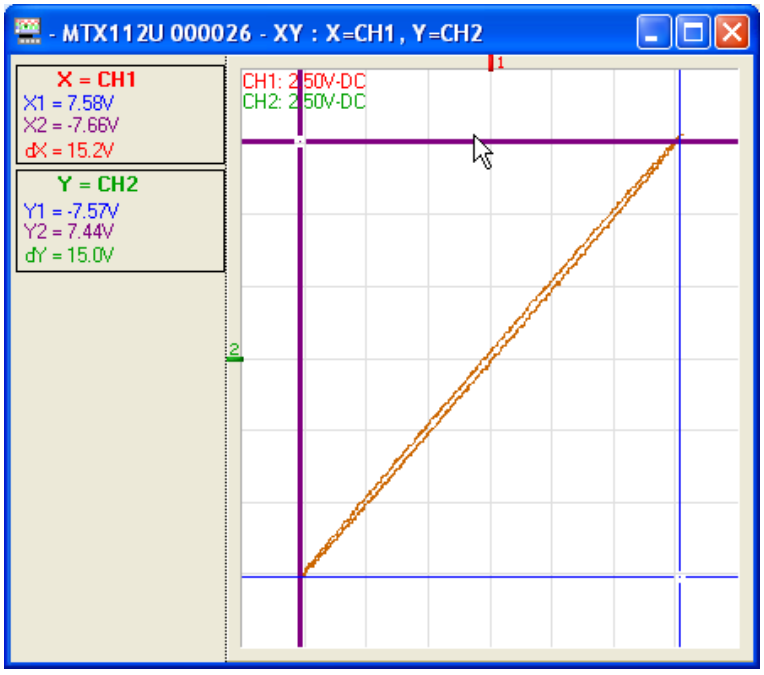
"SCOPEin@BOX_LE" software

CH1 2.5V/div

CH2 2.5V/div



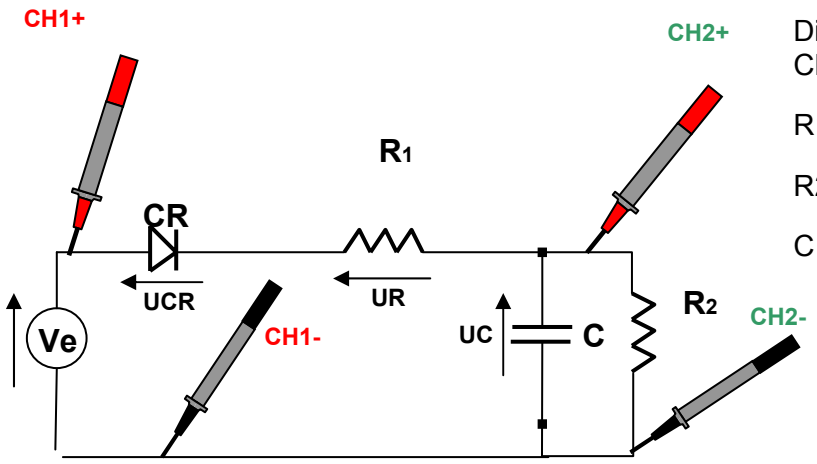
In this case the signals CH1=Ve and CH2=UR are practically in phase.



The XY curve is almost a straight line.

II - Lissajous curves (continued)

4. Rectifier circuit Diode - R - C



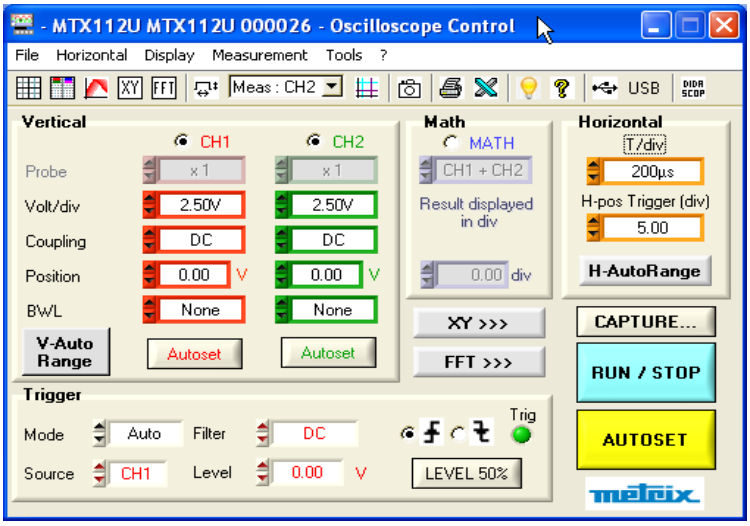
Diode
CR =1N4148

R1 = 100Ω

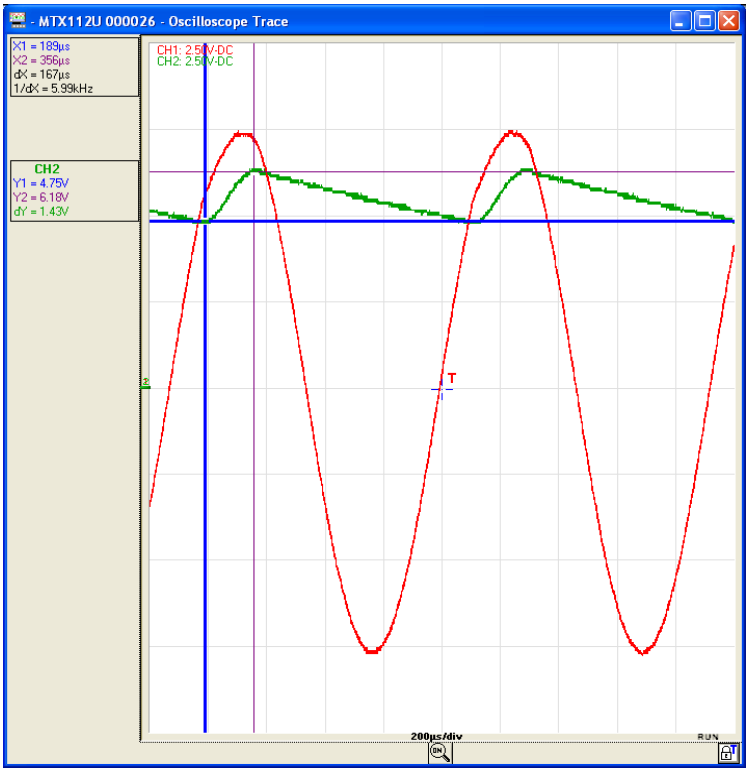
R2 = 5.1kΩ

C = 530nF

Ve = sinusoidal signal 15 Vpp F = 1 kHz



CH1 = Ve and CH2 = Uc



The "CH2 = Uc" voltage has a maximum that corresponds to the "CH1 = Ve" max voltage minus the direct diode voltage. By analysing voltage "CH2 = Uc", we can see that is has a positive slope corresponding to the capacity load (constant ≈ R1C) when the diode passes and a negative slope corresponding to the capacity unload (R2C) when the diode is blocked.

Technical specifications

Vertical offset

Only the assigned tolerance or limit values are guaranteed (after 30 minutes to adapt to temperature).
Values without tolerances are given for information purposes only.

Specifications	Specifications	Observations
Number of **channels**	2 differential channels CH1 and CH2 with 2 Banana safety plugs per channel For each CHi channel, the oscilloscope displays the difference between the signals on the CHi+ and CHi- inputs.	If a sinusoid signal is injected into input CHi+, the displayed signal is in phase with the injected signal. On the other hand, if it is injected into input CHi-, the displayed signal will be opposed to the phase. (BNC inputs on request)
Vertical **calibres**	12 vertical calibres from 25mV/div to 100V/div	
Maximum common mode **voltage**	± 60V calibres 25mV/div. to 500mV/div. ± 600V calibres 1V/div. to 100V/div.	
Common mode **reject** rate	> 35 dB at 1 kHz	
Input type	Differential Banana safety plugs Class 1, common masses	The inputs are connected to ground through a 2 MΩ impedance
Colour of the channel **traces**	Red for CH1 and Green for CH2	Red plugs channel CH1 Green plugs channel CH2
Band width at -3dB Vertical **offset** dynamics	≥ 10 MHz on all vertical calibres from 25 mV to 100 V/div. ± 10 div. on all the calibres	Measured using "load 50 Ω + BNC/Banana adapter" with a 6 division amplitude signal ± 4 divisions with the DIDASCOPEin@BOX software
Input **coupling**	AC, DC, GND	
Bandwidth **Limiter**	at 1.5 MHz and 5 kHz	Each channel has a band limiter.
Ascending time	≤ 35 ns on all the calibres vertical from 25 mV to 100 V/div.	
Crosstalk between channels	DC at 10 MHz ≥ 60 dB	Identical sensitivity on both channels
ESD tolerance	± 2 kV	
Response to the rectangular signals 1 kHz	Overshoot < 3% on all ranges Aberrations < 3% on all ranges	Positive or negative overshoot
Accuracy of the vertical calibres Vertical **resolution** **Accuracy** of vertical measurements **Accuracy** of the vertical offset	± 2 % (on a 8 div. amplitude signal) ± 0.4 % of the full scale ± [2 % (reading - offset) + accuracy of vertical offset + (0.05 div.) x (V/div)] ± [0.01 x value of the offset) + 4 mV + (0.1 div.) x (V/div.)]	Sequence 1 - 2 - 5 Step variation
Maximum input **Voltage**	800 Vpeak (DC + AC peak at 1 kHz)	
Electric **Safety**	600 V CATII	
Impedance of the + and - differential inputs	Calibres 1V/div to 100V/div. : 2 MΩ ± 1 % compared to earth 4 MΩ ± 1 % differential Calibres 25 mV/div to 500 mV/div. : 2.2 MΩ ± 1 % compared to earth 4.4 MΩ ± 1 % differential 5 pF ± 2 pF ± 1 % compared to earth 2,5 pF ± 1pF differential	
Display modes	"Multi-window" type display with the possibility of displaying the f(t) trace, the FFT and the XY mode simultaneously Double time base display, even in real time	Default display: Control window + Trace window same as classic oscilloscopes

Technical specifications (continued)

Time base

Specifications	Specifications	Observations
Time base **calibres**	29 ranges from 100 ns to 200 s/div.	Sequence 1 – 2 - 5 Real time up to 2 µs/div. (if acquisition at 50Msps and 1000pts on the screen)
Time base **accuracy**	± 0.5 %	
Sampling frequency	50 MS/s on all single acquisition channels	20 GS/s in ETS mode
Accuracy of time measurements	± [(0.04 div.) x (time/div.) + 0.005 x (reading) + 1 ns]	
Horizontal **expansion**	Simultaneous display of the 50 Kpts on 2500 points and the 2500 points for the zoomed zone Possibility of offsetting the zoomed zone within the memory	Max expansion: x 20

Technical specifications (continued)

Acquisition

Acquisition memory

The depth of acquisition memory will be 50 kpoints fixed.

On the screen we show 2500 pts.

Multi-windowing makes it possible to simultaneously show:

- The equivalent of a classic oscilloscope double time base:
  - with, in one window, the global signal (shown on 2500 pts by obtaining the Min/Max of the 50 kpts)
  - with the zoomed zone bordered by a rectangle
  - and, in the other window, the zoomed zone shown using 2500 pts in Min/Max mode (zoom factor x 20), the objective being to limit the total number of points to transfer in real time mode.

☝ *The total 50 kpts is only transferred when saving the trace to the PC hard drive or by activating the "CAPTURE" function.*

- The time signal and its FFT calculated using 2.5 kpts
- The time signal and its XY representation

Acquisition management

Simultaneous acquisition on both channels is possible:
CH1 and CH2.

The maximum sampling frequency will be: 50MS/s for simultaneous acquisition on both channels or on 1 channel

Acquisition and screen refresh will be managed by one of the following modes:

AUTO REFRESH

The micro-controller manages AUTO refresh:

If no triggering event related to the signals on the inputs occurs within a time frame of the order of 200 ms (or in the absence of input signals), the micro-controller automatically triggers the refresh of the display.

☝ *In the presence of a triggering event, the screen refresh is managed as in NORMAL REFRESH mode.*

NORMAL REFRESH

In this mode the screen refresh is only triggered in the presence of a triggering event related to the signals present on the oscilloscope inputs (CH1, CH2) or one the LINE sources.

In the absence of a triggering event related to the input signals (or the absence of input signals), the trace is not refreshed.

SINGLE

In this mode a single acquisition set off by the trigger is authorised after having rearmed the trigger circuit.

To authorise a new acquisition, the trigger circuit must be rearmed.

Triggering types

FRONT (Edge):	Main trigger
Holdoff :	on main trigger
Holdoff value :	fixed at 40ns

Technical specifications (continued)

Triggering circuit

Specifications	Specifications	Observations
Trigger S**ources**	Sources CH1, CH2, LINE	
Triggering **mode**	AUTO - NORMAL - SINGLE - ROLL	
Triggering **coupling**	DC: BW 0 at 10 MHz AC: BW 10 Hz to 10 MHz	
Triggering **slope**	Descending wave or Ascending wave	
Triggering **Sensitivity** in normal mode Source channels CHx	 0.5 div.	
Triggering **level** Variation **range**	± 8 divisions	

Acquisition string

Specifications	Specifications	Observations
ADC **Resolution** Max . sampling frequency	8 bits 50 MS/s	an 8 bit converter per channel
Sampling modes - Real time - Equivalent Time Sampling (ETS)	 50 MS/s max Precision ± 200 ppm 20 GS/s max	 Single non repetitive signals Repetitive signals
Transient **capture** Minimum width of detectable **glitches**	> 20 ns	Glitch capture can be activated for all the time base calibres.
Memory **depth** for acquisition	50 kpts	
PRETRIG Function	The trigger point can be positioned using the mouse.	
Backup **memory** for CHx channels	Up to 1500 traces at least can be saved depending on the memory available in the control PC.	These files can be given names and extensions.
Storage formats	"Trace" "TXT"	Backup of the curve and acquisition settings
	"Config"	Backup of the complete instrument configuration

Technical specifications (continued)

Display

Specifications	Specifications	Observations
Viewing **screen**	PC screen	
Number of displayed **points**	2500 Acquired points will be displayed on the PC screen. Possible horizontal zoom x 20	
Viewed window mode **NORMAL** **ZoomH**	 2.5 kpts (representing the Min/Max of the acquired 50 kpts) Horizontal expansion: x 20	 No vertical Zoom
Display modes **Averaging**	Interpolation ***Persistent Display***: This persistence is only managed at the PC display level (not in the FPGA), the last 8 acquired traces will always be displayed, by using 8 shades of the channel colour the brightest colour is assigned to the most recent acquisition and the dullest to the oldest acquisition. **Envelope Mode** Factors from: 2, 4, 8, 16	Automatic measurements are available in this mode and are made using the last acquired trace Indicated on the trace window
Reticle	Complete Axes Borders	
Indications on the **trace view** window Triggering Traces Predefined **mathematical** functions	The horizontal and vertical (level) position of the **Trigger will be shown by the ┼ symbol in the trace window.** "**Identifier + Mass reference**" of the trace colour, "BWL" Bandwidth Limit **Overshoot indicators** High and low if the traces are outside the screen and right left if the T position of the trigger point is not on the screen **Menu bar***:* File - Horizontal - Display - Tools - Help **"Mathematical calculations" active**: FFT **Summary configuration of the instrument** : - Position and vertical sensitivity - Time base calibre - Trigger mode - Trigger source	

Technical specifications (continued)

Mathematical functions

Using the SCOPEin@BOX_LEsoftware, the oscilloscope has the "FFT" function and mathematical functions:

CH1+CH2, CH1-CH2, CH1xCH2, CH1/CH2, -CH1, -CH2

Communications interfaces

USB type B connector — used to connect the scope to the PC using a USB cable.

Location	on the back face of the oscilloscope
Interface	"USB"
Driver	The "USB" interface driver loads automatically when the SCPOPEin@BOX_LE or DIDASCOPEin@BOX software is installed.

Other

Autoset		
Search time	< 5 s	
Frequency range	20 Hz to 10 MHz	
Amplitude range	60 mVpp to 800 Vpp	
Duty cycle limits	from 20 to 80 %	

Warning !

Error messages

Autotest: Error n° 0001: Microprocessor or FLASH problem
Autotest: Error n° 0002: RAM problem
Autotest: Error n° 0004: FPGA problem
Autotest: Error n° 0008: SSRAM problem
Autotest: Error n° 0010: SCALING 1 problem
Autotest: Error n° 0020: SCALING 2 problem
Autotest: Error n° 0040:
Autotest: Error n° 0080:
Autotest: Error n° 0100: channel 1 acquisition problem
Autotest: Error n° 0200: channel 2 acquisition problem
Autotest: Error n° 0400:
Autotest: Error n° 0800:
Autotest: Error n° 2000: Vernier problem

If one of these codes (or the addition of several codes) is present when the appliance starts up → a fault has been detected.

In this case please contact the closest MANUMESURE branch (see §. Maintenance).

General specifications

Environment

- Reference temperature: 18°C to 28°C
- Operating temperature: 0°C to 40°C
- Storage temperature: - 20°C to + 60°C
- Indoor use
- Altitude: < 2000 m
- Relative humidity: < 80% up to 31°C

Mains power supply

- Network voltage: Rated working range 100 to 240 VAC
- Frequency: from 47 to 63 Hz
- Consumption: < 14 W at 230 VAC - 50 Hz
- Fuse: 2.5 A / 230 V / timed
- Power supply cable: removable

Safety

Compliant with NF EN 61010-1 + NF EN 61010-2-030 :

- Insulation: class 1
- Pollution index: 2
- Power supply overload category: CAT II 300 V max.
- "Measurement" input overload category: CAT II 600 V max.

EMC

This appliance has been designed in compliance with the applicable EMC standards and its compatibility has been tested in compliance with standard NF EN 61326-1.

European Directives

CE

The CE marking indicates compliance with the "Low Voltage", "EMC", "DEEE" and "RoHS" European Directives.

Mechanical specifications

Box

- Size: 270 x 213 x 63 (in mm)
- Weight: 1.8 kg
- Materials: ABS VO (auto extinguishing)
- Sealing: IP 20

Packaging

- Size: 300 (W) x 330 (L) x 230 (D) nn mm

Parts

Accessories

shipped

- Operating instructions on CD ROM
- Software "SCOPEin@BOX_LE" on CD ROM
- Software "DIDASCOPEin@BOX" on CD ROM
- Getting started guide for the software on CD ROM
- Safety instructions
- Power supply cable
- 2 pairs of wires Safety Banana connection
- USB A/B Cable

as options

- E6N single calibre current sensor
- Set of 2 BNC/Banana plug adapters (P01102101Z)