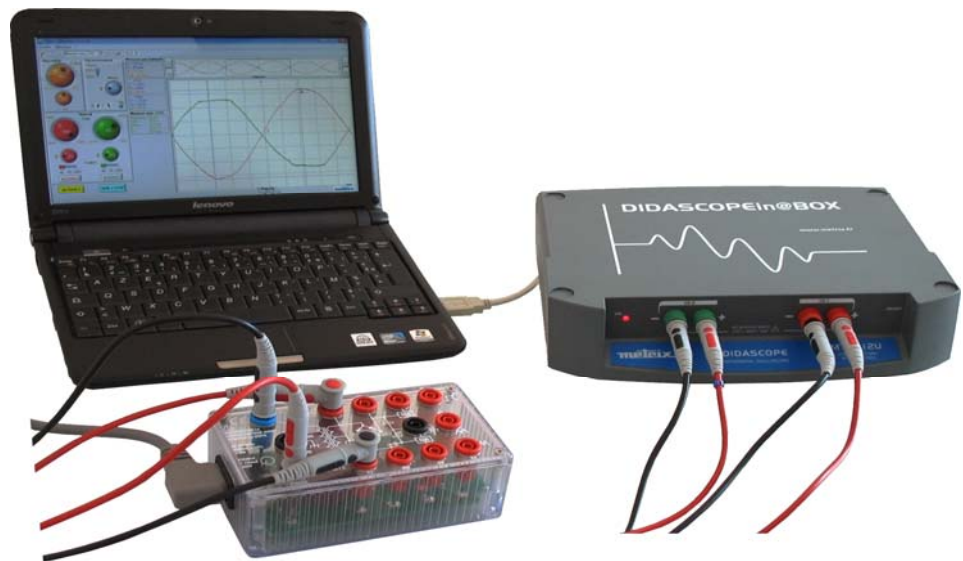


Demonstrator HX0112 "HX DIDAC DIFF MTX"

User's Guide



Getting started

Congratulations!



You have just purchased an HX0112 demonstrator. We thank you for your confidence in our product quality.

The instrument is compliant with safety standard NF EN 61010-1, single insulation.

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

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

Definition

This is a didactic box designed for differential virtual oscilloscopes (MTX112) which highlights different voltage levels.

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

definition of installation 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.


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 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.

Getting started (continued)

during use

- Carefully read all notes prefixed by the  symbol.
- 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.

Mains power supply

The appliance's power supply is designed for a network 230 VAC \pm 10 %. The frequency of this network must be between 50 and 60 Hz.

Symbols on the instrument



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



Earth terminal



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



Frame earth terminal

Cleaning

No interventions inside the appliance are authorised.

- Power off the appliance (disconnect 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 user. All operations must be carried out by skilled and approved personnel.

Contact your closest Chauvin-Arnoux agency or your regional "Manumasure" 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 ("Manumasure" technical centre)
01 44 85 44 85 (Chauvin Arnoux).

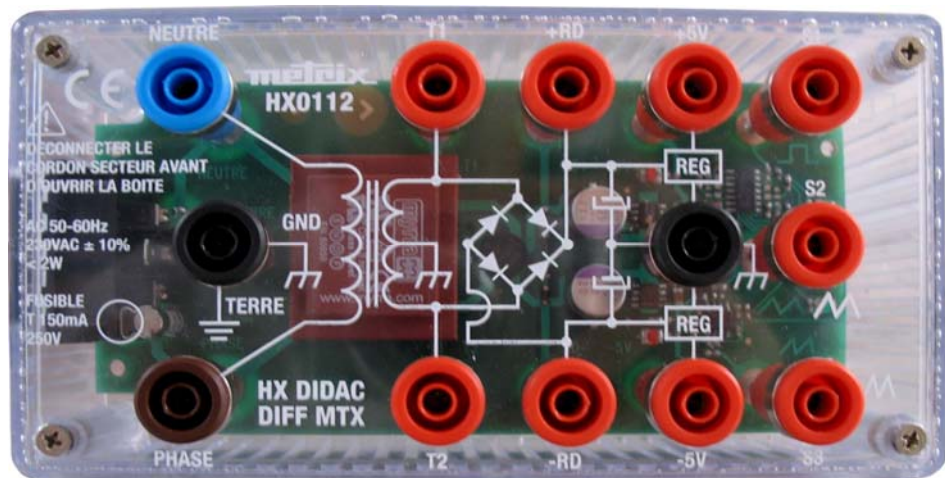
HX0112 "HX DIDAC DIFF MTX" Demonstrator

HX0112 Demonstrator

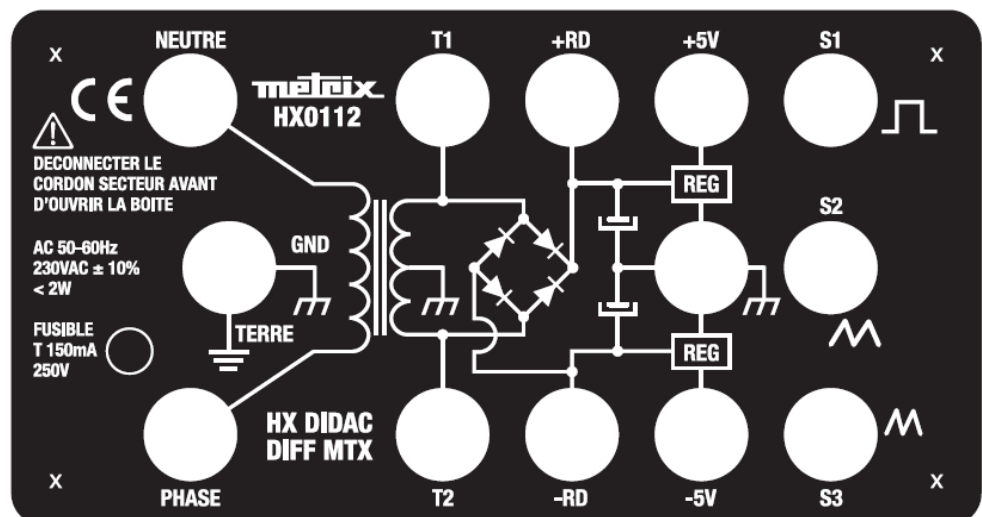
The role of a power supply circuit on an electronic instrument is to transform mains sinusoidal voltage (230 Vrms 50 Hz) into a positive and/or negative continuous voltage compared to the "Earth" reference potential. The HX0112 demonstrator must be powered by a 50 Hz 230 Vrms $\pm 10\%$ mains voltage, the power consumed by the HX0112 is less than 2 W (1 W typically at 230 Vrms 50 Hz). The 50 Hz power supply must imperatively have the 3 wires:

Phase (brown wire)
Neutral (blue)
Earth (green/yellow)

General view



Markings



Study of the signals present in AC-DC power supply using the HX0112 Demonstrator "HX DIDAC DIFF MTX"

The steps required to convert alternating "AC" current to continuous "DC" current are the following:

1) "protection" at the primary transformer level by inserting a fuse on the "Phase".

2) galvanic "insulation and "transformation" of the mains voltage (230 Vrms \pm 10 % 50 Hz) to a sinusoidal low amplitude voltage: this function is carried out by a 50 Hz transformer

The transformer has secondary coils galvanically insulated from the primary coil, the transfer of energy from primary to secondary is by magnetic coupling:

- The primary coil receives the voltage from the mains 50 Hz network
- The secondary coils generate the low voltages

3) rectification and filtering to transform the AC voltage on the transformer secondary to a continuous DC voltage: rectifier diodes and filtering condensers are used

4) regulation is used to remove the residual waves present in the rectified and filtered signal to obtain 2 continuous voltages \pm 5 V.

5) signal generation The 2 ± 5 V regulated voltages supply the logical and analogue circuits on the HX0112 demonstrator to generate 3 signals S1, S2 and S3.


Observation of the signals on the HX0112 demonstrator:

Using the differential oscilloscope we will view and measure the signals during the different steps in the transformation of the sinusoidal signal from the mains network (230 VAC 50 Hz) into 2 continuous voltages of + 5 V and - 5 V.

The \pm 5 V continuous voltages will be used to supply the HX0112 demonstrator's electronic circuits and generate signals S1, S2 and S3.

Using the oscilloscope it will be possible to view and measure the following differential signals:

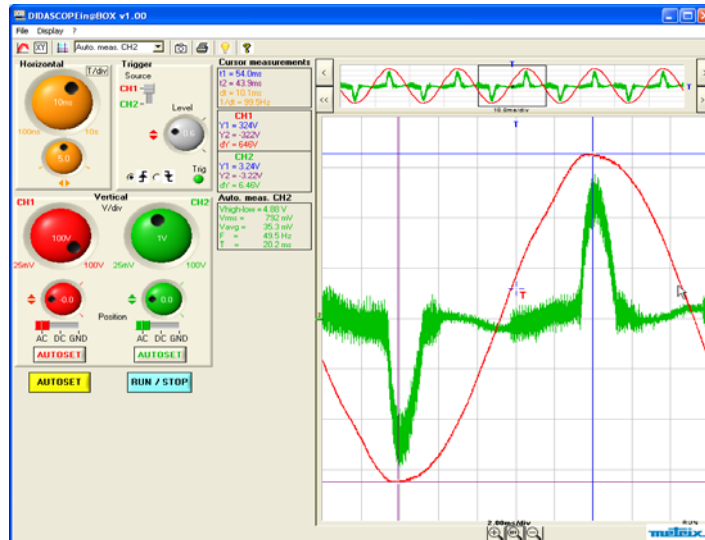
- Differential signal between Phase and Neutral
- Differential signal between Phase and Earth
- Differential signal between Neutral and Earth
- Differential signals on the 50 Hz transformer secondary coils
- Differential signals on the rectifier diode terminals
- Rectified and filtered differential signal

 *The MTX112 is a 2 differential channel oscilloscope; it is used to simultaneously observe 2 differential signals from the 6 listed above.*

Four practical Analysis exercises using the HX0112 "HX DIDAC DIFF MTX" demonstrator

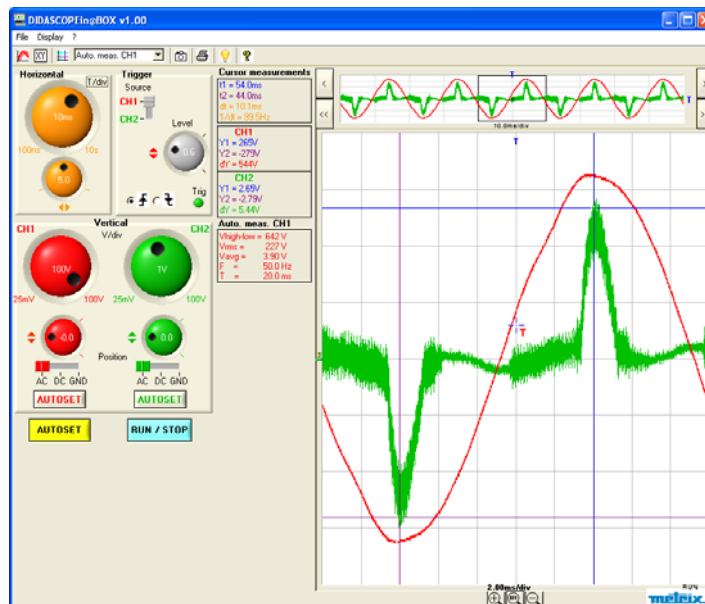
1. Mains Phase and Neutral signal On differential channel **CH1** we viewed the signal between the Phase (socket **CH1+**) and Earth (socket **CH1-**) on our distribution network, it is a sinusoidal signal with frequency **50 Hz**, period **20 ms**, amplitude **642 V** peak to peak and rms voltage **227 Vrms**.

The voltage between the phase and neutral is applied to the transformer primary coil



On channel **CH2** the signal between the neutral and earth: is a signal with frequency **50 Hz**, period **20 ms**, amplitude **4.88 V** peak to peak.

The vertical sensitivity on **CH1** is 100V/div and on **CH2** 1V/div AC coupling



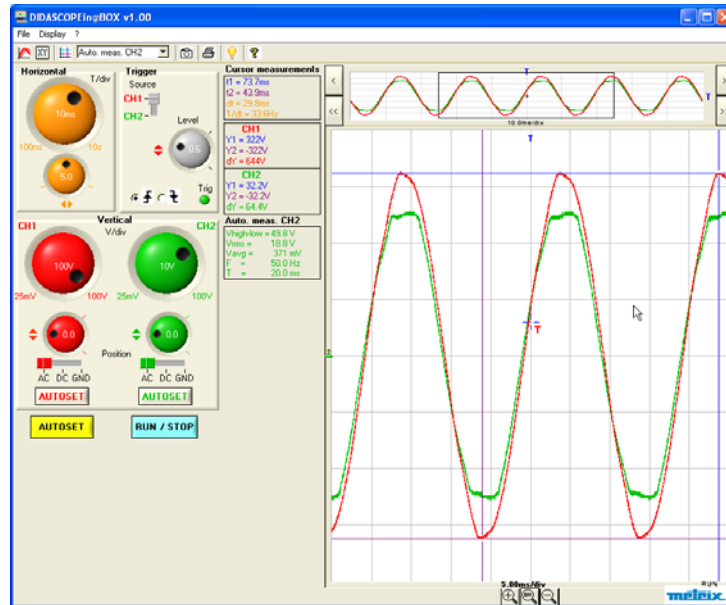
On differential channel **CH1** we viewed the signal between the Phase (socket **CH1+**) and Earth (socket **CH1-**) on our distribution network, it is a sinusoidal signal with frequency **50 Hz**, period **20 ms**, amplitude **642 V** peak to peak and rms voltage **227 Vrms**

Four practical Analysis exercises using the HX0112 "HX DIDAC DIFF MTX" demonstrator (continued)

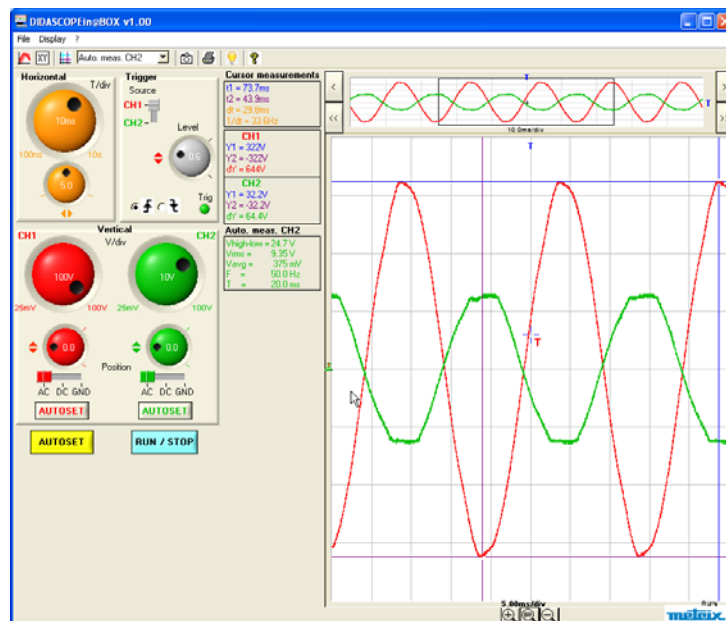
2. Insulation transformation The transformer has 2 secondary coils which supply phase and opposed phase voltage with the mains voltage applied to its primary coil.

We show the signals on the primary (channel CH1) and the secondary (channel CH2) on the transformer:

👉 The vertical sensitivity on CH1 is 100V/div and on CH2 10V/div AC coupling



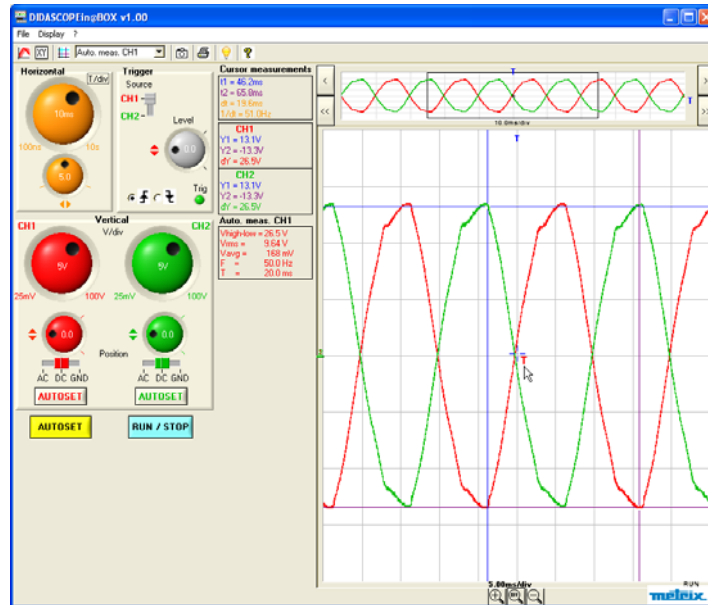
1) Simultaneous viewing of the mains signal 230 Vrms 50 Hz on the transformer primary (CH1+ = Phase CH1- = Neutral) and the signal 18.8 Vrms 50 Hz on the secondaries (CH2+ = T2 and CH2- = T1)



2) Simultaneous viewing of the primary signal (CH1+ = Phase and CH1- = Neutral) and the secondary (CH2+ = T1 and CH2- = Earth)

Four practical Analysis exercises using the HX0112 "HX DIDAC DIFF MTX" demonstrator (continued)

↑ The vertical sensitivity on CH1 and CH2 is 5V/div DC coupling



3) Simultaneous viewing of the signals on the transformer secondaries [CH1+ = T1 CH1- = Earth] and [CH2+ = T2 and CH2- = Earth]

Signal on CH1:

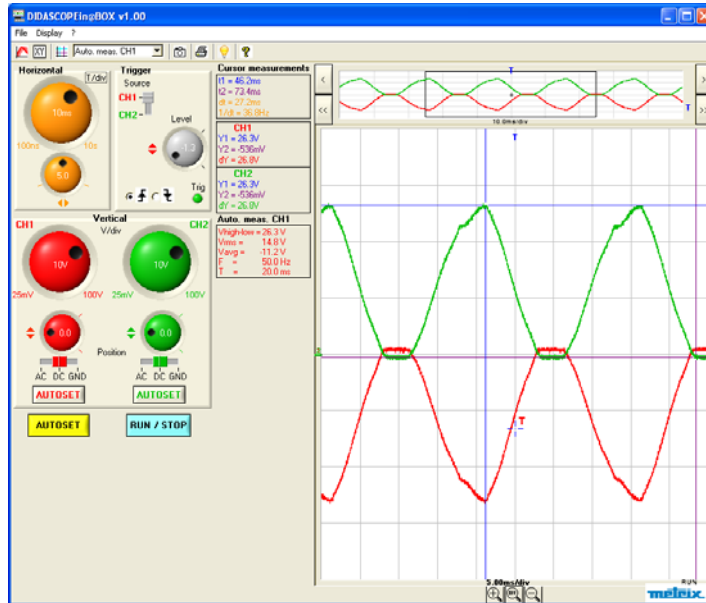
9.64 Vrms 50 Hz

Four practical Analysis exercises using the HX0112 "HX DIDAC DIFF MTX" demonstrator (continued)

3. Rectification filtering

The 2 secondary coils are connected to a rectifier and filtering circuit (composed of rectifier diodes and filtering capacities) to obtain 2 rectified and filtered voltages, one positive compared to the earth viewed on channel CH1 and the other negative compared to the earth viewed on channel CH2.

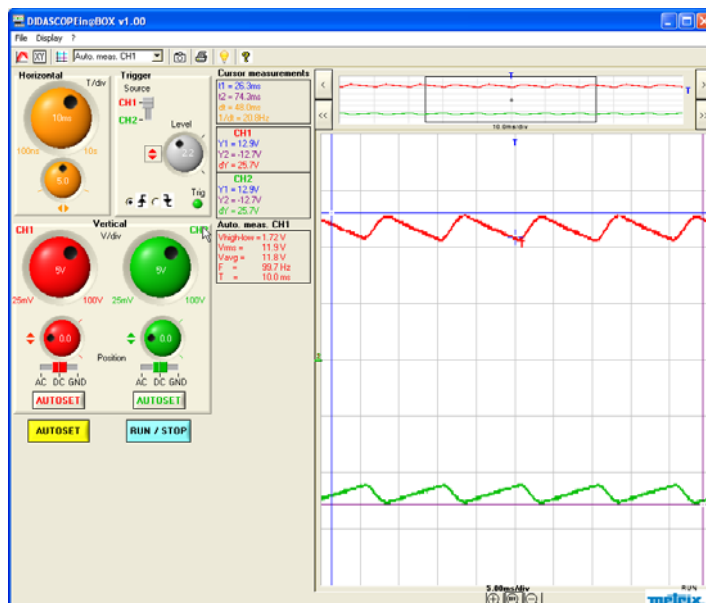
We have selected DC input coupling and a sensitivity of 10V/div to observe the signals with their continuous component



The signals at the rectifier diode terminals [CH1+ = T1 CH1- = +RD] and [CH2+ = T2 CH2- = -RD] are the following (opposite).

Below we show the signals on the 2 filtering condensers, one for positive voltage +RD and the other for negative voltage -RD:

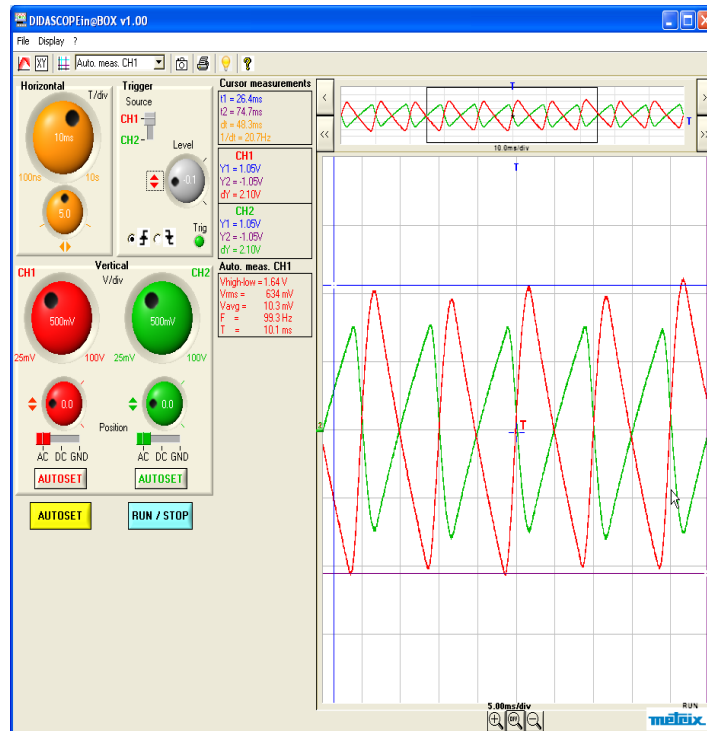
We have selected DC input coupling and vertical sensitivity 5V/div to observe the continuous and variable components of the +RD and -RD signals



We can see that the rectified signal has a continuous component given by V_{avg} of approx. 11.9 V with a residual wave of amplitude 1.72 V peak to peak and a frequency of 100 Hz , because we are using "full wave" type rectification.

Four practical Analysis exercises using the HX0112 "HX DIDAC DIFF MTX" demonstrator (continued)

☞ We have selected AC input coupling and 0.5V/div vertical sensitivity to observe the residual wave on signals +RD and -RD by removing the signal's continuous component



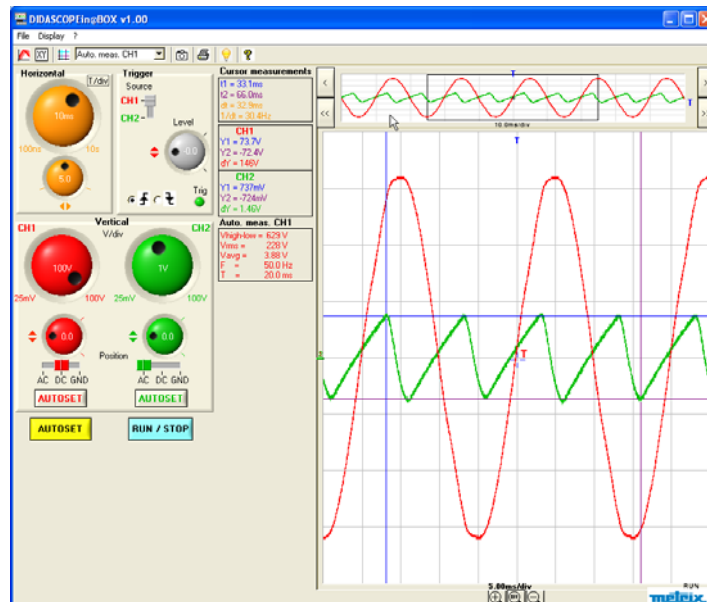
To observe the residual waves more accurately we will switch the input coupling for channels CH1 and CH2 to the AC position and increase vertical sensitivity to 0.5V/div.

Below we show the 50 Hz network voltage on CH1 and on CH2 the residual voltage after - RD filtering:

☞ The residual voltage frequency after "rectification/filtering" is 100Hz, which is typical of a full wave type rectification.

CH1 vertical sensitivity 100V/div DC coupling

CH2 1V/div AC coupling to eliminate the continuous component

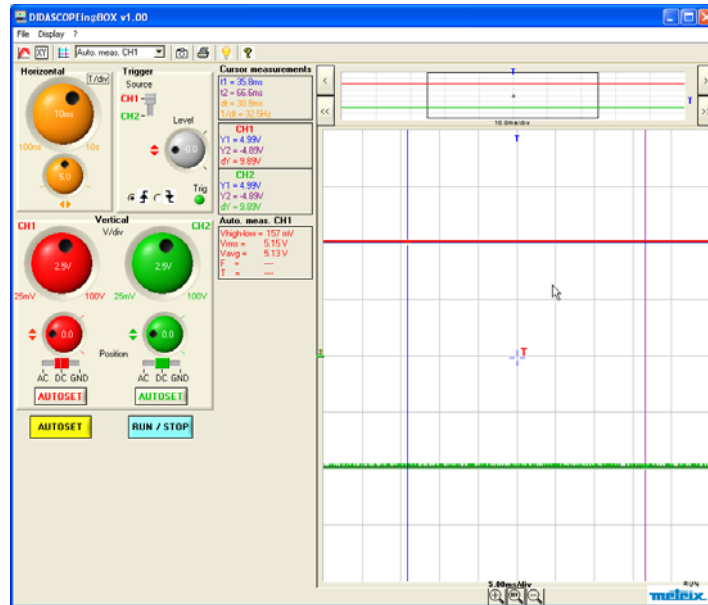


We obtain a residual wave with a peak to peak amplitude of 1.46 V approx.

Four practical Analysis exercises using the HX0112 "HX DIDAC DIFF MTX" demonstrator (continued)

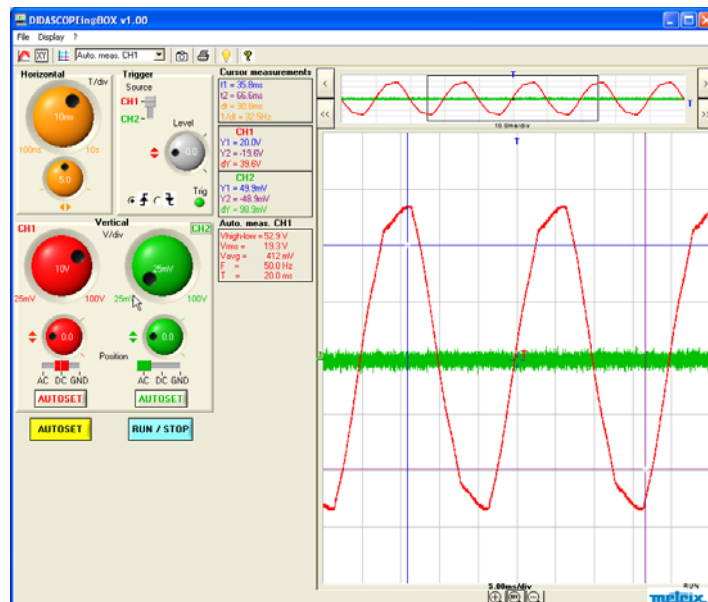
4. Regulation To remove the residual wave on the rectified and filtered signal and to obtain two regulated voltages positive $\approx +5\text{ V}$ and negative $\approx -5\text{ V}$, we inserted 2 voltage regulators.

We have selected DC input coupling and a vertical sensitivity of 2.5V/div to observe the continuous regulated $\pm 5\text{ V}$ voltages



Below we show on CH1 the voltage on the transformer secondaries [CH1+ = T2 and CH1- = T1] and on CH2 the regulated voltage - 5V [CH2+ = -5V and CH2- = Earth], to observe the residual wave after the regulator we switched the input coupling for channel CH2 to AC and selected maximum sensitivity 25 mV/div:

We selected DC input coupling for CH1 and vertical sensitivity 10V/div and AC coupling for CH2 with sensitivity 25mV/div

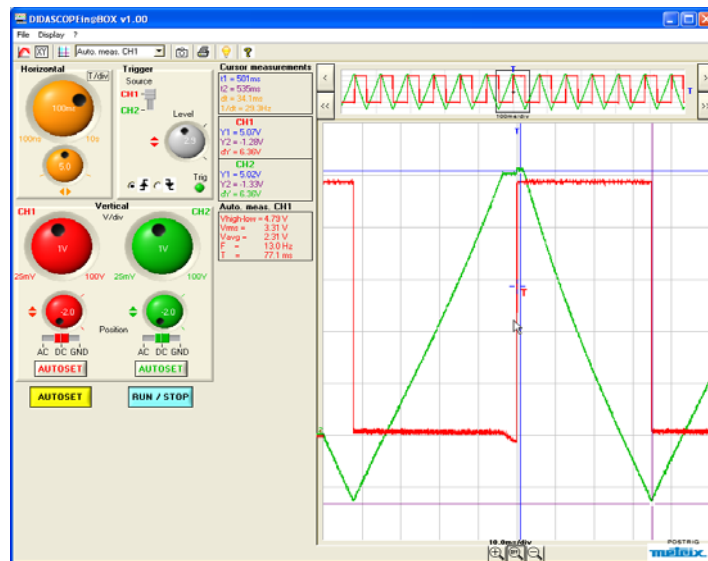


The residual wave on exit from the -5V regulator cannot be measured on the oscilloscope.

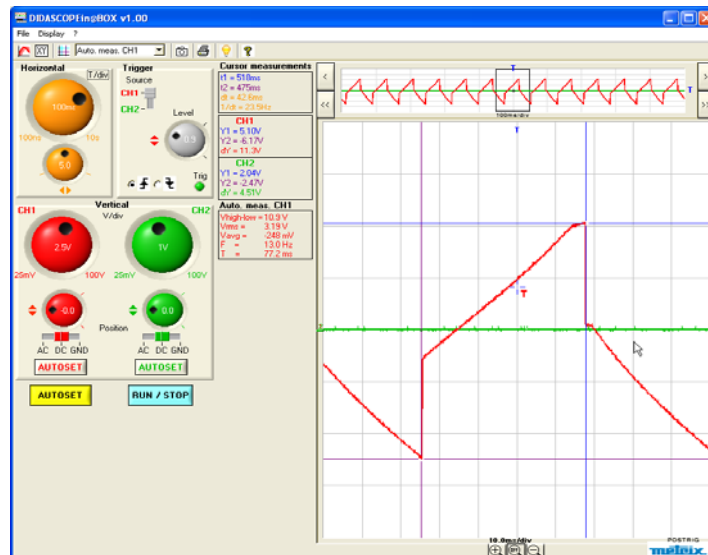
Four practical Analysis exercises using the HX0112 "HX DIDAC DIFF MTX" demonstrator (continued)

To conclude, the HX DIDAC DIFF MTX module can be used to observe the different steps in the transformation of the sinusoidal signal (230V_{AC} 50 Hz) from the mains network into two continuous voltages of + 5 V and - 5 V.

These 2 ± 5 V voltages are used to supply the logical and/or analogue circuits and to generate signals. Below we show 2 signals generated by the "HX DIDAC DIFF MXT" module.



The square signal S1 on channel [CH1+ = S1 and CH1- = Earth] and the sawtooth signal S2 on channel CH2 [CH2+ = S2 and CH2- = Earth]



Opposite we show the differential signal "S2 - S1" on channel CH1:

To do this we inject signal S2 on input CH1+ and signal S1 on input CH1- therefore we show CH1 = S2-S1 [S2 = CH1+ ; S1 = CH1-]

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 230 VAC ± 10 %
- Frequency from 50 to 60 Hz
- Consumption < 2 W at 230 VAC - 50 Hz
- Fuse 0.15 A / 230 V / timed
- Power supply cable removable

Safety

Compliant with NF EN 61010-1:

- Insulation class 1
- Pollution index 2
- Power supply overload category: CAT II 240 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:

Immunity Influence quantity: 5 mV in the presence of a 10 V/m electromagnetic field

Mechanical specifications

Box

- Size 150 x 80 x 46 (in mm)
- Weight 0.366 kg
- Materials ABS VO (auto extinguishing)
- Sealing IP 20

Packaging

- Size 230 x 157 x 65 (in mm)

Parts

Accessories

- Operating instructions on CD ROM
- Power supply cable

- **Option** 2 pairs of Banana safety wires