cinergia

ePLUS Family units

HUMAN MACHINE INTERFACE

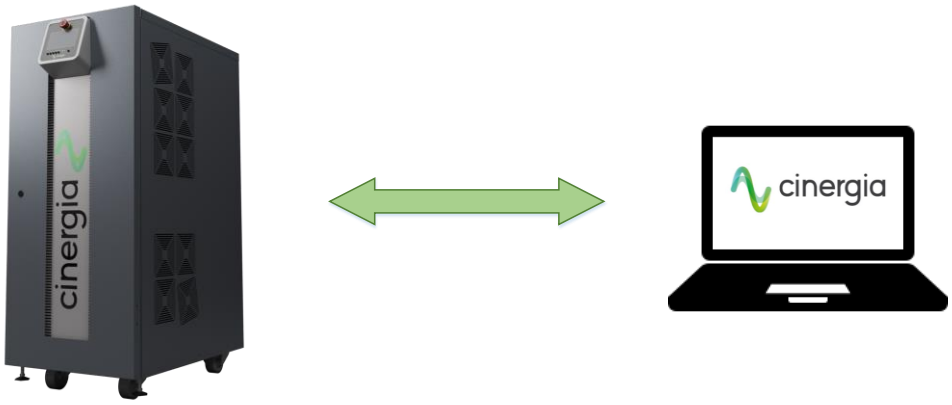
Revision number	Document changes	Date
A00	Creation	June 20
A01	Revision chapter	September 20
A02	Upgrade information and add new chapter	November 20
A03	Solved errors	November 20
A04	Add new chapter	December 20

CONTENT

1. GENERAL

The purpose of this manual is to provide information to use the Cinergia converter with all its different functionalities. It is important for the user to have this manual nearby and familiarize with it to operate efficiently with the converter.
This document tries to be easy to understand, created with schematics and real pictures of the equipment with parts marked with letters and numbers which you can find the explanation just below the picture.

Cinergia is in constant development to deliver always the best service to you, so it is possible to find some discrepancy between this manual and the real converter itself. Don't hesitate to contact us and ask for the latest version of the documentation.



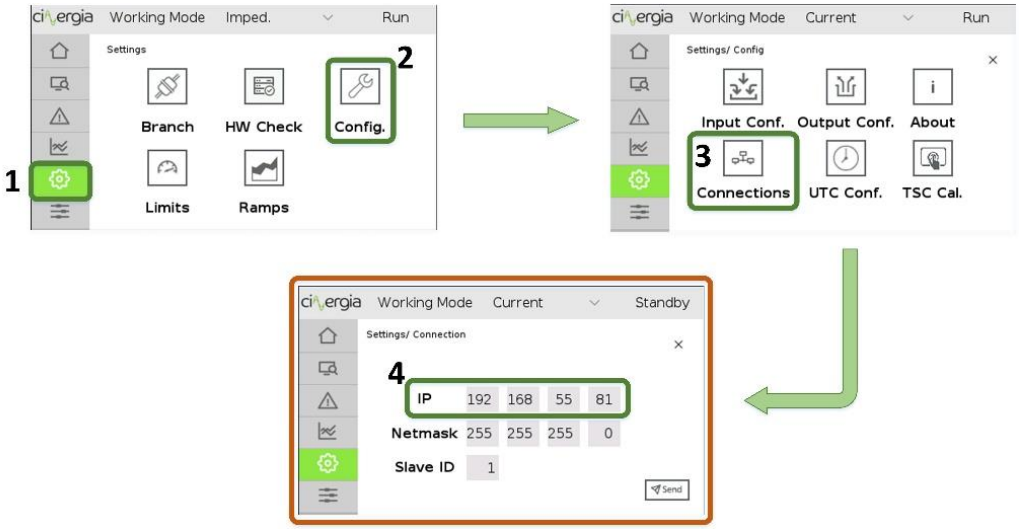
This manual is valid for the following versions of **ePLUS** platform units:

3.07xx, 3,09xx, 3.11xx, 3.10xx, 3.11xx, 3.12xx, 3.13xx, 3,14xx

2. HUMAN MACHINE INTERFACE

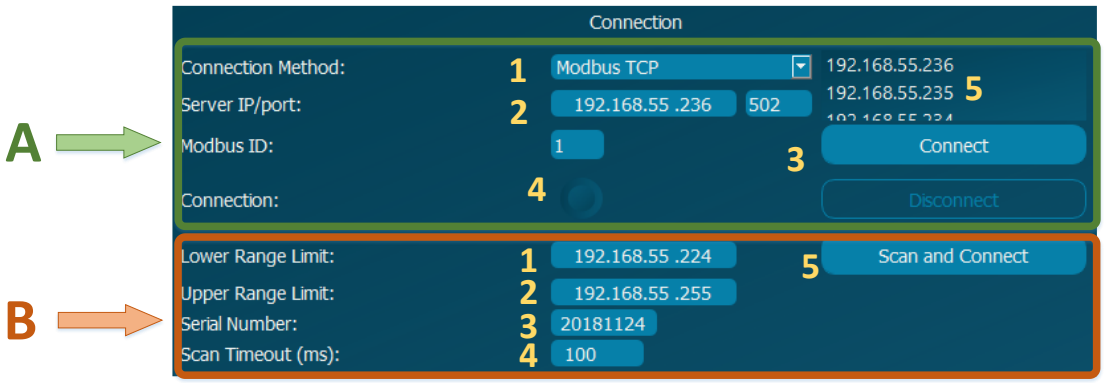
CINERGIA delivers, within the scope of the supply, a Human Machine Interface software[1] that communicates with the equipment using MODBUS protocol. This application is compatible on Windows 10/Windows 7/Windows XP. The software can be installed by executing Setup.exe file in Administrator Mode and following the instructions of the application.
To connect Cinergia units to a PC, follow these steps:

- Connect a standard RJ45 Ethernet cable to terminal X13. The unit can be connected directly either to a computer or to a router (wired or wireless). If the CINERGIA unit is connected through a router, several computers could be connected to the unit at the same time.
- Check the IP address of CINERGIA unit in the LCD Touchscreen following these steps:



[1] *Cinergia's interface and LCD software are based on Open Source Qt. Qt for Application Development is dual-licensed under commercial and open source licenses. Cinergia is developing under the GPL v3 open source licenses, so Cinergia is making a Qt source code copy available for all customers. Please, contact Cinergia if you are interested*

- Check the computer's Ethernet configuration panel and make sure that both the computer and the CINERGIA unit are in the same subnetwork. For instance, if the CINERGIA unit IP address is 192.168.55.81 the computer Ethernet configuration shall be:
  - **a)** Computer IP address: 192.168.55.XXX (XXX can be any address different from 81 and different from any other device in the same network)
  - **b)** Subnet mask: **255.255.255.0** *(Take care about this subnet mask number)*
  - **c)** Gateway and DNS configuration are not needed for a connection with a CINERGIA unit
- Run the graphical user interface delivered by CINERGIA, write the IP address of the unit to be connected and press the Connect button.



There are two different ways to connect the unit to the PC via Modbus TCP:

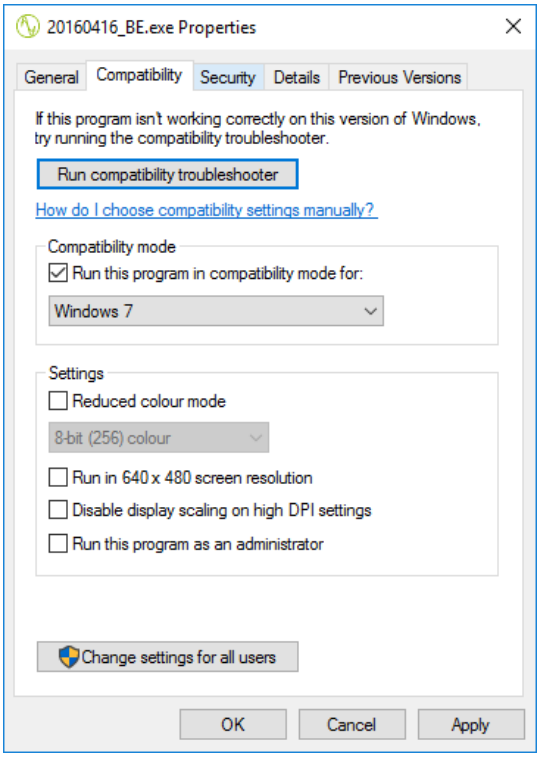
A- Known the IP address of the equipment. This IP address is displayed in the LCD touchscreen as it is explained in the LCD touchscreen schematic displayed above.
- **1-** Define the connection (Modbus TCP)
- **2-** Introduce the IP address
- **3-** Press Connect
- **4-** Once the equipment is connected, the LED will indicate it
- **5-** There is a register of 3 IPs which the interface has connected to the equipment

B- Known the serial number of the equipment and the range of IPs that the equipment is located. The serial number is written in the front of the equipment with the specification data. If the equipment has a serial number such as 20170101-1, the number to introduce must be without the hyphen: 201701011. This method is useful when the user, for example, does not know the exact IP of the equipment but knows that the range of IPs is, for example, from 192.168.55.150 to 192.168.55.250
- **1-** Introduce the lower IP range
- **2-** Introduce the upper IP range
- **3-** Introduce the serial number (without hyphen)
- **4-** Introduce the Scan timeout in ms (default value 100ms)
- **5-** Press *Scan and Connect*. It may last a few seconds to scan all the IPs

If there is an error when trying to run Cinergia application, please check the compatibility mode of your computer. For instance, in a Windows 7 computer, right click CINERGIA application → Properties; go to Compatibility panel and check the box Run this program in compatibility mode; and select the operating system of your computer.

The document PR096 *Connecting CNG+ units to a PC* details how to connect the equipment. Please read this document to make sure that the parameters are introduced properly.

If there is an error when trying to run CINERGIA application, please check the compatibility mode of your computer. For instance, in a Windows 7 computer, right click CINERGIA application → *Properties*; go to *Compatibility* panel and check the box *Run this program in compatibility mode*; and select the operating system of your computer. For instance, for a Windows 7 computer:



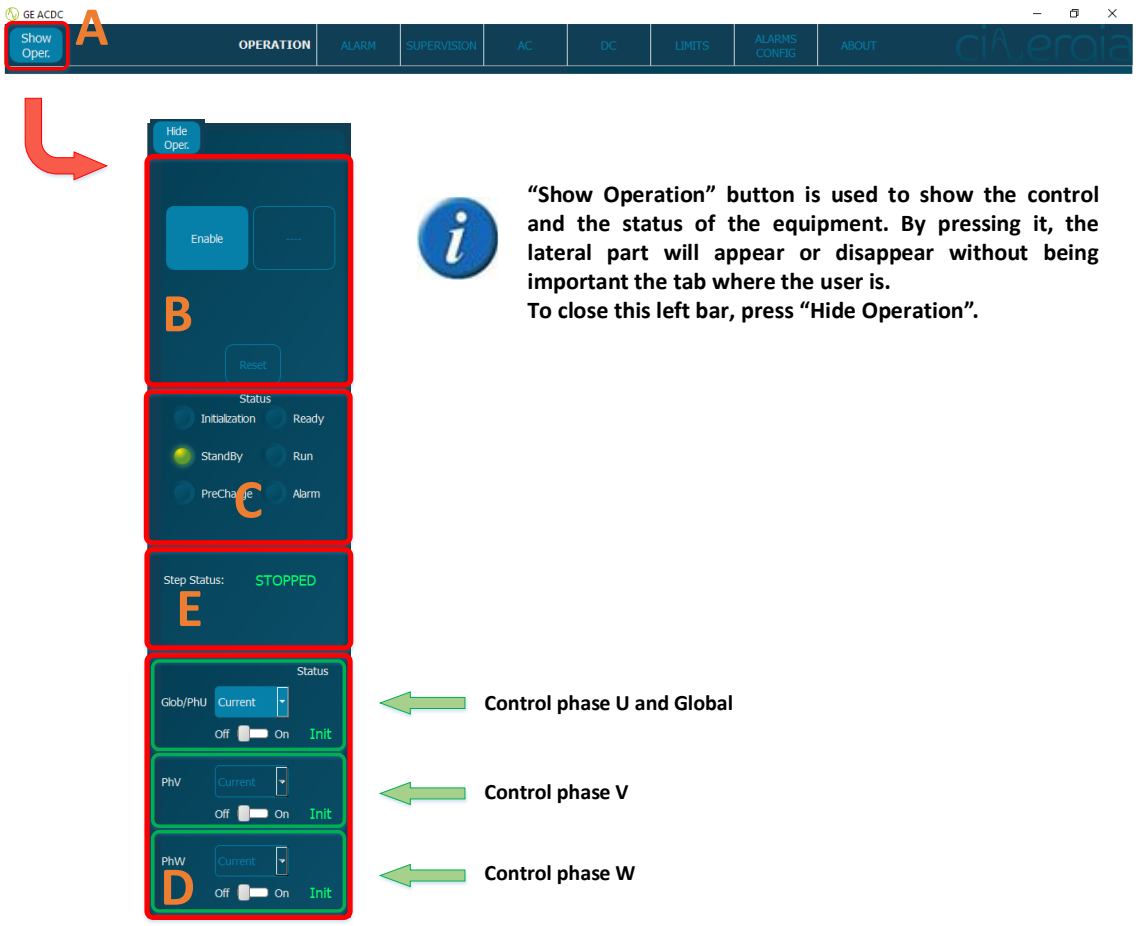
The interface delivered by Cinergia has a correct visualization with screens configured with a minimal resolution of 1366x768 (16:9)

2.1. Optional Communications

There is an optional which is to connect and control the CNG unit using series connection communication (RS485, RS232) or CAN protocol and it has an additional cost. In all cases, please read the specific manual for more information.

Please read the specific manual to learn about these optional communications.

3. SHOW OPERATIONAL BUTTON



"Show Operation" button is used to show the control and the status of the equipment. By pressing it, the lateral part will appear or disappear without being important the tab where the user is.
To close this left bar, press "Hide Operation".

- **A:** "Show Oper." button. It allows the user to see the lateral part of the interface with the control and the status of the converter. It is useful to have a wider view of every tab of the interface.
- **B:** Control the status of the equipment with the buttons:
  - Enable / Disable. *Enable* button turns the equipment into Ready state. *Disable* button turns the equipment into Standby state.
  - Run / Ready. *Run* button turns the equipment into Run state. *Ready* button turns the equipment into Ready state.
  - Reset. *Reset* button turns the equipment into Standby state.

Before going to Run state, please be sure that all the connections between the EUT and the Cinergia equipment are ready.

- **C:** Information about of Active Rectifier and Inverter status:
  - Initialization. The converter control system checks the presence of all internal components and the embedded PC loads the operating system.
  - Standby. Keeps the converter in low power mode until an Enable signal is received. There is no voltage in the DC link and no voltage/current is applied to the output of the converter.

- Precharge. Internal transition state between Standby and Ready. During this state the DC link is gradually charged through resistors until the rated DC link voltage is reached.
- Ready. The converter is ready to operate but no PWM signal is sent to IGBTs. The DC link is charged to the rectified voltage and there is no voltage/current applied to the outputs.
- Run. The converter is completely operational: the inverter starts the control algorithms and PWM. Setpoints can be sent.
  - Warning. The converter is indicated that some phase has an overload. In multichannel or separated channel mode some phase could be in Alarm.
- Alarm. The converter has an alarm and the user can visualize it in the *Alarm* tab. If the unit is in Overload

Button	State transitions
Enable	Standby → Ready
Disable	Ready/Run → Standby
Run	Ready → Run
Ready	Run → Ready
Reset	Alarm → Initialization → Standby

- **D:** Choose the control mode (Voltage, Current, Power or Impedance mode). The converter can change the control mode in any state.
  - In AC:
    - A GE allows voltage control mode.
    - An EL allows current, power and impedance control mode.
  - In DC:
    - A DC source allows voltage, current, power and resistance control mode. If optional are activated the DC source allows working in Battery Emulator, Battery test or PV emulator mode.

The user can unify the control of the channels or can work with them controlling independently by enabling or disabling this option (which is an optional and has an additional cost):
The channels can work Disabling Multichannel or Separated Control Branch (run all phases in the same Run button) or Enabling Multichannel or Separated Control Branch (run each phase with a separate ON/OFF button).

- Separated disabled: once the equipment is in Run status, all three phases are activated. The IGBTs start commuting once the unit is in RUN status. The slider *On/Off* is not used.
- Separated enabled: once the equipment is in Run status, the user can control the phases one by one by activating them with their own slider *Off/On* shown in the picture above. The IGBTs start commuting per each phase once the slider is in ON position. If the slider is in OFF position, the IGBTs is not commuting.

To select the mode Multichannel or Separated Branch Control, please read the chapter **4.1** section **E**.

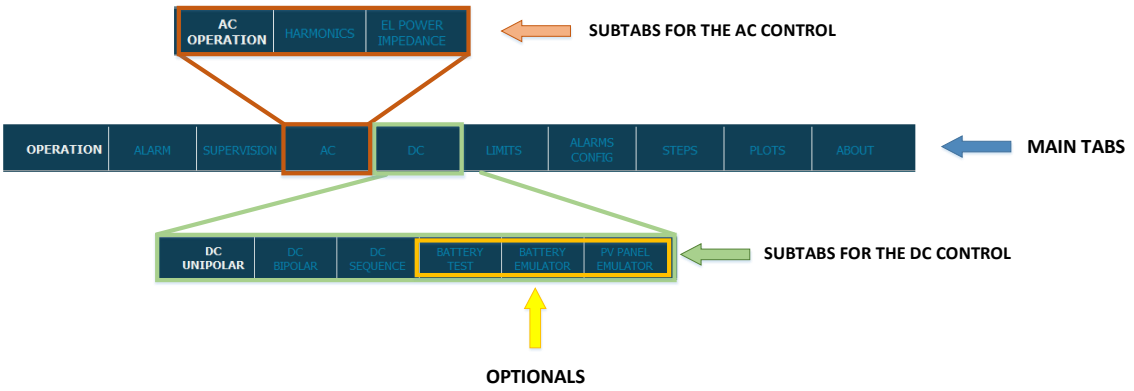
Multichannel or Separated Branch Control mode is optional, and it has an additional cost.

In Current, Power or Impedance mode, the equipment controls current and it requires a voltage source connected at the output side (EUT side) of the Cinergia equipment. The voltage source must be the first to be turned on. Once the Cinergia converter reads the voltage in the inverter, the Run state can be applied.

For more information of this functionality, p*lease read the specific manual, before operating it.*

4. DISTRIBUTION OF THE INTERFACE

To create a friendly navigation of the interface, Cinergia has designed a Tab Dialog distribution, in which each tab has one of the following purposes:



Please note that AC and DC tabs are activated depend on the CNG equipment type. If the unit is an AC only unit, the DC tab will remain frozen with no option to go in and operate. If the unit is a DC only unit, the AC tab will remain frozen with no option to go in and operate.

Please note that the DC subtabs contains 3 OPTIONAL: *Battery Charger*, *Battery Emulator* and *PV Emulator*. These OPTIONAL are an upgrade of the converter and have an additional cost. The subtabs will appear if the option is enabled.
Further information of each kind of tab can be found in the following sections.

If there is any discrepancy between this document and the manual, the information of the present document will prevail.

4.1. Operation

- **A:** Connection mode. Informs about the connection:

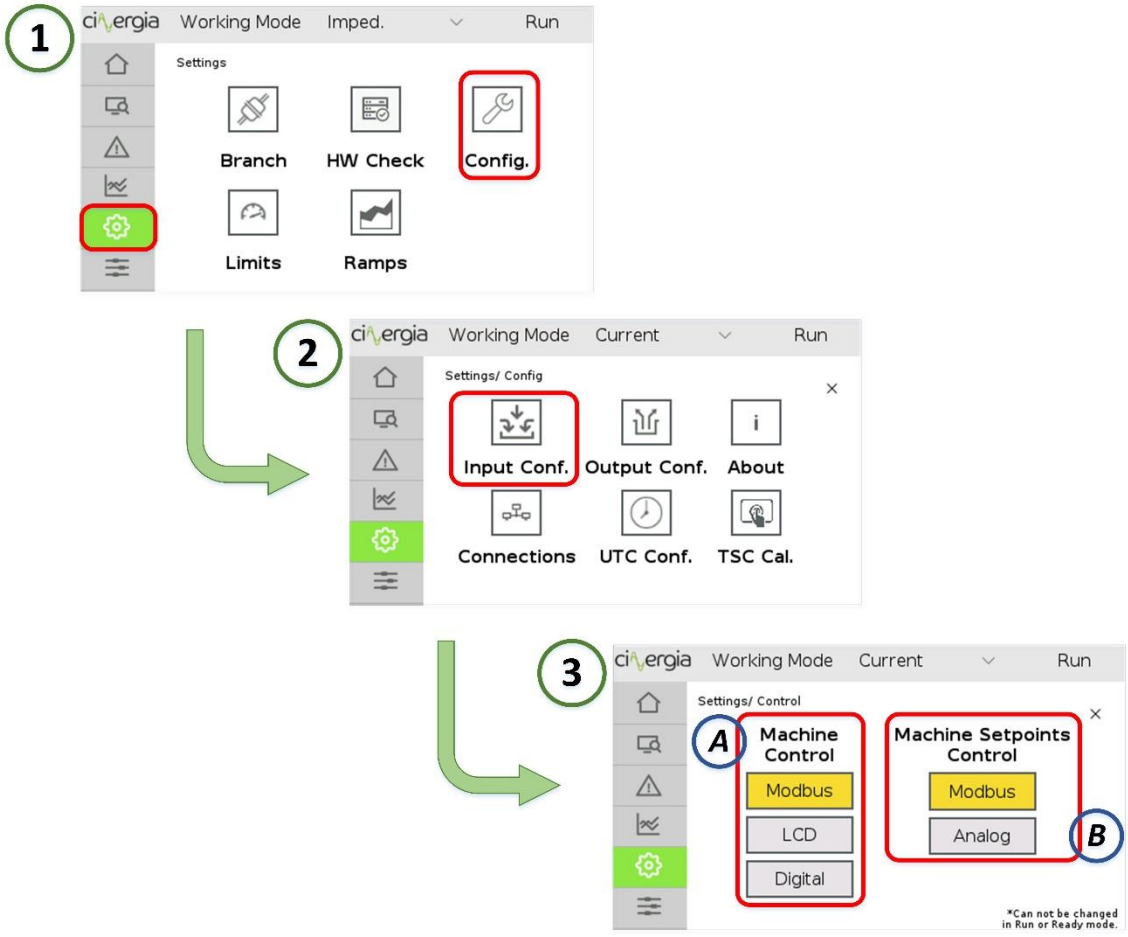
- AC 3 channels/1 channel Bipolar (note that AC unipolar is not allowed)
- DC 3 channels/1 channel Unipolar
- DC 3 channels Bipolar (note that 1 channel bipolar is not allowed)

The connection mode can only be modified by changing the switches in the front panel. Please read the document *Operation Modes* for more information.

- **B:** Informs about which is the equipment's state control:
  - LCD: control from LCD screen.
  - Modbus: control using Modbus Ethernet (IP) or serial port.
  - Digital: control with digital/analogue control.

  The selection of the control mode is set throw the LCD touchscreen (please see figure below)
- **C:** Informs about which is the equipment's setpoint control:
  - Modbus: the setpoint is sent via Modbus (interface)
  - Analogue / Power Amplifier: the setpoint is sent with an analogue signal. There is also the possibility to us the converter as a power amplifier (optional).

  The following figure explains how to change the control mode throw the LCD touchscreen.



Follow the steps **1**, **2** and **3** of the above picture to reach the LCD touchscreen submenu that enables the configuration of the *Machine Control* and *Setpoints Control*. Once the user is in the

third step, **A** part is for the *Machine Control* (*Enable*, *Disable*, *Run*, *Ready* and *Reset*) and **B** part is for the setpoints (the equipment will send the setpoints only in Run state).

Please note that the machine state and the setpoints control are independent.

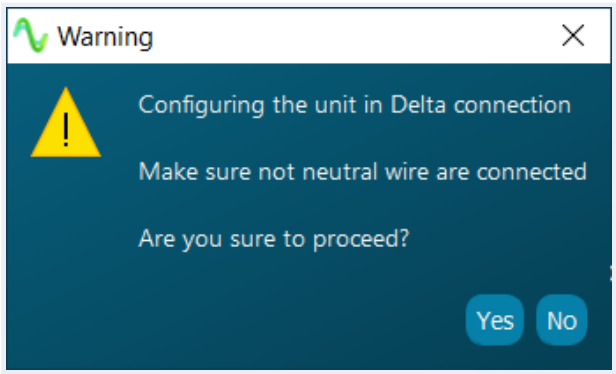
It is not possible to change the control when the equipment is in *RUN* state.

- **D:** Dual range activated (Optional). Only in units with Dual Range Option.
- **E:** Part of the subtab to configure and active/disable different functionalities (*take into account that some of these functionalities are an Optional*):
    - **1:** Independent Branch control (Optional). The user can unify the channels or can work with them independently by enabling or disabling this option (which is an optional and has an additional cost):
      The channels can work Disabling Multichannel or Separated Control Branch (run all phases in the same Run button) or Enabling Multichannel or Separated Control Branch (run each phase with a separate ON/OFF button).
        - Separated disabled: once the equipment is in Run status, all three phases are activated. The IGBTs start commuting once the unit is in RUN status. The slider *On/Off* is not used.
        - Separated enabled: once the equipment is in Run status, the user can control the phases one by one by activating them with their own slider *Off/On* shown in the picture above. The IGBTs start commuting per each phase once the slider is in ON position. If the slider is in OFF position, the IGBTs is not commuting.

For more information of this optional, read chapter *4.1.1 Mutlichannel or Separated channel operation* of this manual.

    - **2:** EL DELTA STAR operation mode. The user can choose working the EL with neutral (STAR) or without neutral (DELTA).
        - STAR mode: xxxx
        - DELTA mode: xxx

      Once the user is selecting a new operation mode, this pop-up will appear, just to be sure that the new configuration is wanted by the user.



Please read the ***PR387 DELTA mode operation in EL ePLUS platform units.pdf*** manual before operating it.

- **3:** 1channel/3channel remote contactor (Optional). The user can control the 1channel/3channel mode by Modbus instead of a switch selector at the front panel of the unit.
- **4:** DC Control Behaviour. The user can select among *standard* DC control behaviour and *fast* DC control behaviour. Depends on the EUT connected at the output of the unit this fast option could generate some instabilities.

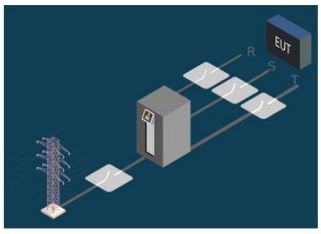
- **F:** Connection settings. The converter can be connected to the interface using the following methods:
  - Modbus TCP. Uses Modbus protocol and the port 502. Connect a RJ45 ethernet cable to the terminal X15.
  - TCP Socket. Uses an internal Cinergia protocol and the port 8989. Connect a RJ45 ethernet cable to the terminal X15.
  - Modbus Serial Port. Uses RS485 or RS232 protocol. Connect a DB9 cable to the terminal X11.

There is another possibility to connect to a Cinergia equipment, which is introduce an IP range and the serial number. This option is useful if there are different units connected to the same subnet. The serial number of the equipment is written in the front panel, opening the door. This number must be introduced in the interface without separate the numbers.

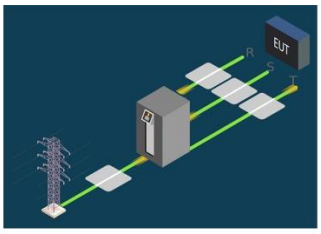
Both *Modbus TCP* and *TCP Socket* can be connected via router or direct to the computer. *Modbus Serial Port* must be connected directly to the computer. For more information please read the document *Connecting CINERGIA units to a PC*.

Once the configuration is selected, press *Connect*.

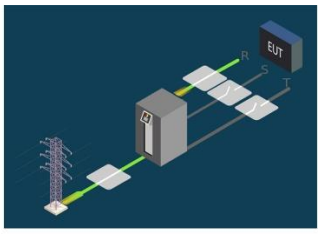
- **G:** Reactive power grid side Setpoint.
- **H:** graphical state of the converter. The figure indicates whereas the equipment is running (and which phase) or not.



EQUIPMENT NOT RUNNING



EQUIPMENT WITH ALL 3 PHASES RUNNING



EQUIPMENT WITH U PHASE RUNNING (only with separate mode)

4.1.1. Multichannel or Separated channel operation (OPTIONAL)

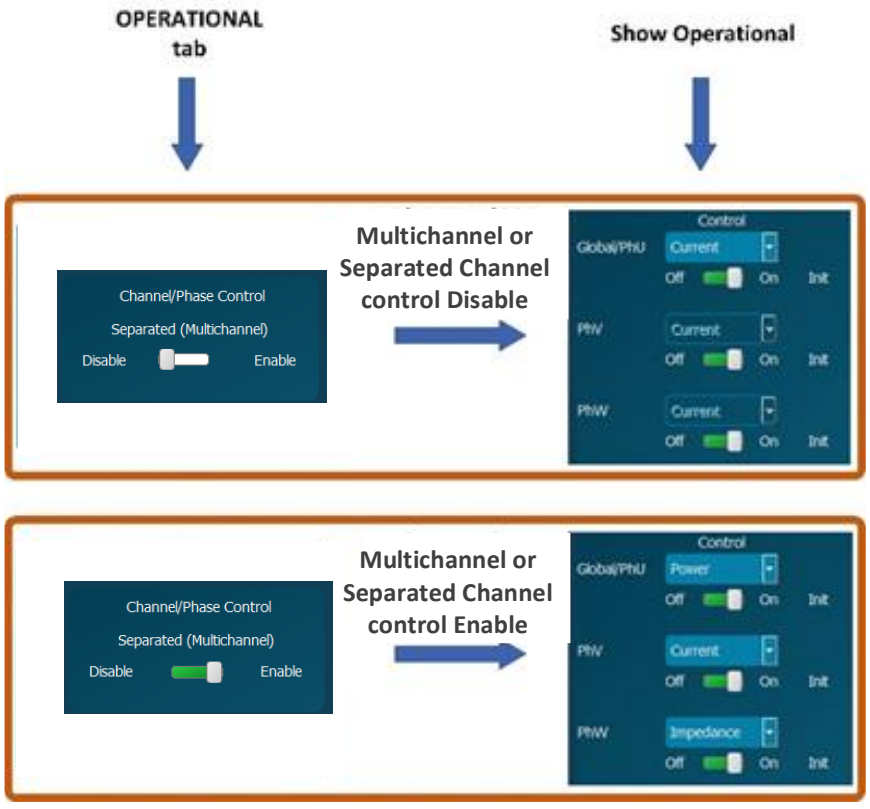
This optional allows the user to control each phase (U, V and W) separately, which means that the phases can be in a different status (*Initialization*, *Running*, *Warning* or *Alarmed*) and a different control mode (*Voltage*, *Current*, *Power* or *Impedance*).

Multichannel or Separated Channel Operation is possible in AC or in DC Cinergia converters in exception of the AC Grid Emulator.

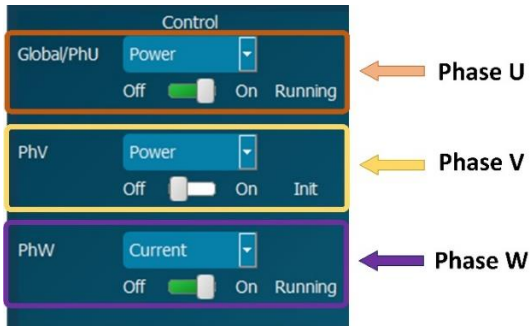
So, this optional allows:

- To start/stop independently each channel. There is a 1-phase output contactor that will be open/closed independently
- To operate each channel in a different mode depending on the type and the version of the unit:
  - AC: Current, Power, Impedance.
  - DC: Voltage, Current, Power, Resistance. With the DC optional enabled, they can be controlled separately for each phase: battery emulator, battery test and PV emulator.
- The three channels will work either in AC or in DC. It's not possible to have one channel in AC and another in DC on a Standard unit (if the user is interested in this possibility, ask Cinergia for this mode).
- An alarm will only stop the channel affected by the alarm; the other channels will continue operating normally. Each channel can be reset individually.
- All models up to and including 60kVA include the separated channel.

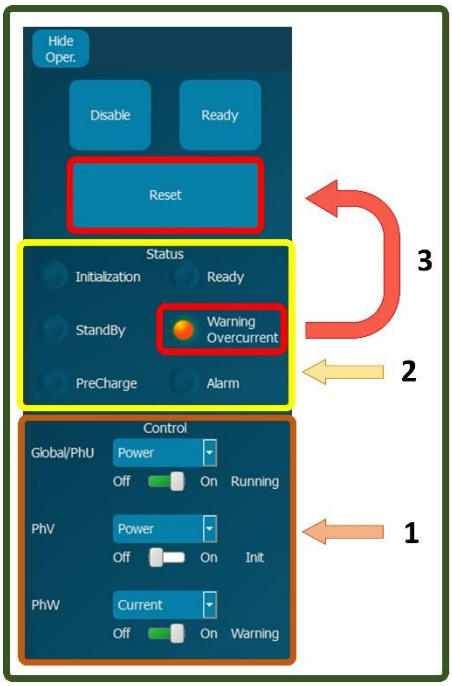
To enable or disable this mode, go to the Operation Tab and select the control with the slider:



Once the mode is activated, the phases will be unfrozen, and the user will be able to control them separately.
The image below illustrates the multichannel or separated channel operation:



Each phase has the selector of the mode and a slider to make the channel go to *Run* or *Initialization* state. In the image above, for example, the only phase that is not in *Run* state is the V.
It is possible to get only one channel alarmed and continue working and it will be indicated in the Status and the Alarm tab of the converter. So, each phase is treated independently, as the following image illustrates:



1- It is visible how the 3 phases are in a different control mode: PhU and PhV are in Power mode whereas PhW is in Current mode. Also, the status per phase is different and it is indicated next to them (Running, Initialization and Warning).

2- As the phase W is in Warning state, the status of the converter indicates that there is an overcurrent

3- The Warning state makes the *Reset* button to be un frozen and the user will be able to press it in case of Alarm.

As an example, there is a sequence below of an equipment that has an overcurrent in phase U:

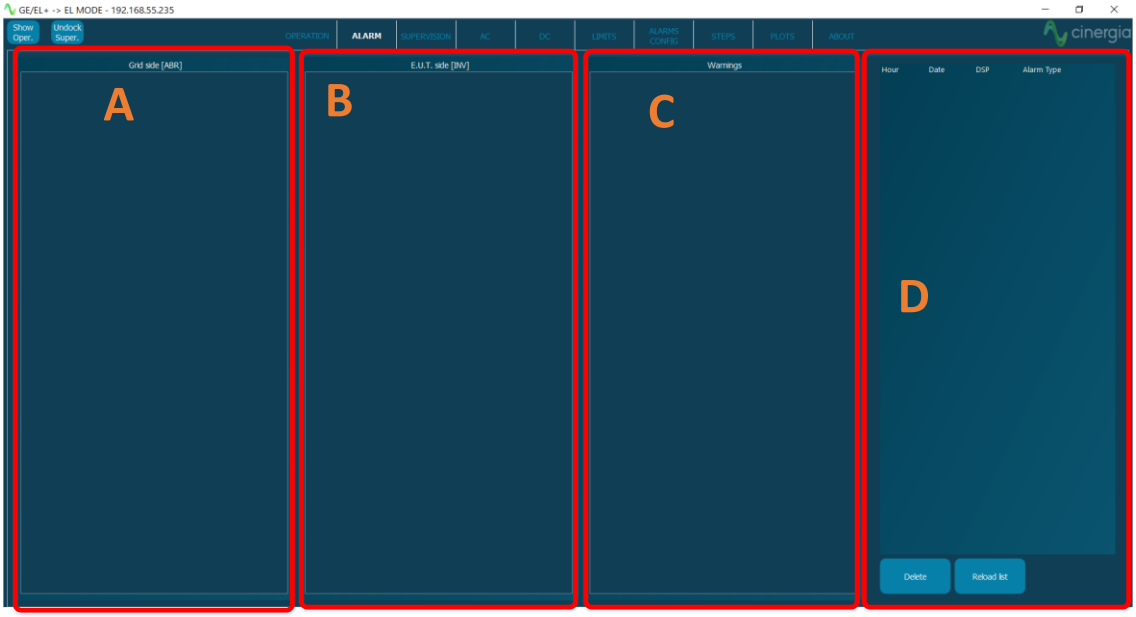
1- The interface notices that phase U is in *Warning* state for some reason.
2- This reason results to be an *Overcurrent*, that is why it appears the Warning LED.
3- In the *Alarm* tab, the *Output OverCurrent* and *Phase U*. Please note that all phases of the converter is still running.
4- Phase U has gone to *Alarm* state, so it is not working. However, the other channels are running.
5- The status indicates that there is some alarm in the inverter.
6- The indicated alarms are *Output OverCurrent* and *Phase U*, but this time the LED is red instead of orange, which means that the output contactor is open, and this phase is not working. The *Reset* button will make this channel to work again.

During all this example, the channels V and W have not stop working.

If the converter has DC OPTIONAL (*Battery Emulator*, *Battery Charger* or *PV Emulator*), each channel can also work as one of these possibilities independently.

4.2. Alarm

In this tab, the alarms of each converter (active rectifier and inverter) are shown. When there is an alarm, the light turns into red.



- **A:** Active Rectifier alarms.
- **B:** Inverter alarms.
- **C:** Unit Warnings.
- **D:** Alarms history. It can be deleted using the Advanced User password after pressing the *Delete* button. Once the list is deleted, please press *Reload list* button to clean.

To reset the equipment, press the *Reset* button using the *Show Slide* button:

1. Press *Show Slide* to see the status of the equipment and the reset button.
2. When the equipment has any alarm, it is reflected in the status. Goes to the Alarm tab just to confirm which has been the alarm. Check that the unit is ready and safe to work again and make a Reset.
3. Press *Reset* to reach the standby state (no alarms).

4.3. Supervision

The supervision is an information tab, where the user can see all the values of the converter from the input side to the output side.

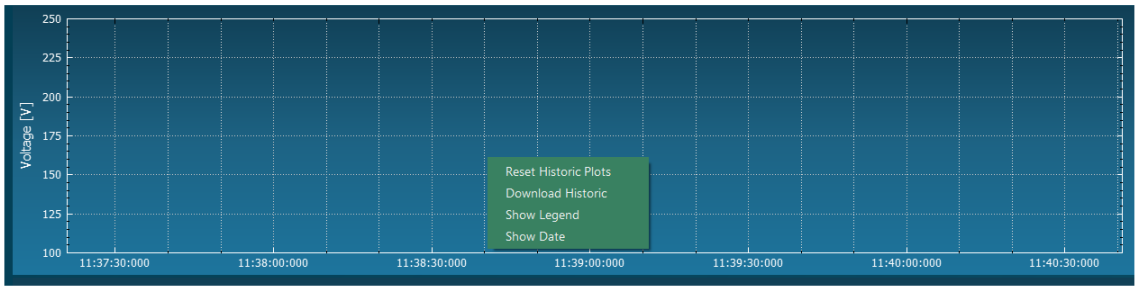
- **A:** Information about the parameters of the input (grid side):
  - *Voltage*
  - *Current*
  - *Active power*
  - *Reactive power*
  - *Frequency*
  - *Temperature*
  - *Voltage DC link*

- **B:** Information about the parameters of the output (EUT side):
  - *Voltage*
  - *Current*
  - *Active power*
  - *Reactive power*
  - *Frequency*
  - *Temperature*
- **C:** Current trend plots:
  - It displays 3 variables per graph. The first one is for voltage, the second one for current and the third for power. Due to a long refreshing time, it is not possible to detect fast current transients of the variables.
    - **1.** The user can set the maximum and the minimum for the vertical axes or can use the Auto Scale, which will adjust the graph with the maximum and minimum displayed at the current time. This configuration is able for all three graphs.
    - **2.** The number of points is all the points that will be displayed in the graphs. If the number is high the time is going to be longer whereas it is going to be

displayed a short period of time with a low number of points. This value is common for all 3 graphs.

- **3.** The user can configure the Acquisition time between samples to represent on graph. The minimum recommended value is 200ms.

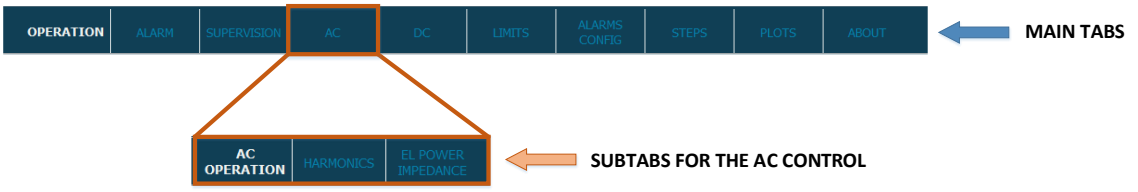
Open the graphic submenu using the right-clicking mouse button above each graphic. The submenu will appear, and the user is allowed to:



- **Reset Historic Plots**: Clear the current Historic Plot. If the interface is going slower than normal the user can clear the plot to free up space.
- **Download Historic**: The user can download the historic plots.
- **Show/Hide Legend**: The user can show or hide the legend of each graphic.
- **Show/Hide Date**: The user can show or hide the date (DD:MM:YYYY format) on the bottom part of each graphic.

4.4. AC

This tab contains all the subtabs concerning the AC mode of all the CNG units: AC Operation, Harmonics and EL Power and Impedance. There is three different units that uses these tabs:

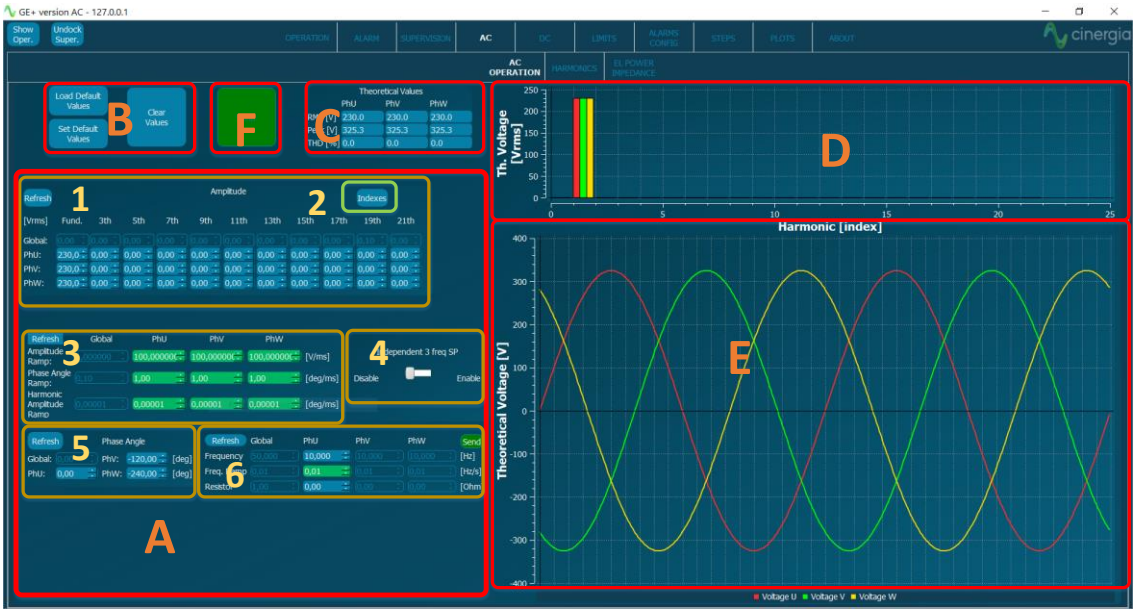


- In case of a **GE_AC (or AC&DC),** the only two first tabs will be used: AC Operation and Harmonics. The El power and Impedance will remain frozen.
- In case of an **EL_AC (or AC&DC),** all three tabs will be used: AC Operation, Harmonics and EL Power and Impedance.
- In case of a **GE&EL_AC (or AC&DC),** depend on the configuration of the unit two (in case of GE) or three tabs (in case of EL) will be activated. If the unit is configured as GE and the user changes to EL, the third tab, EL Power and Impedance, will remain frozen. The user must Close the Cinergia's interface and Open it again.

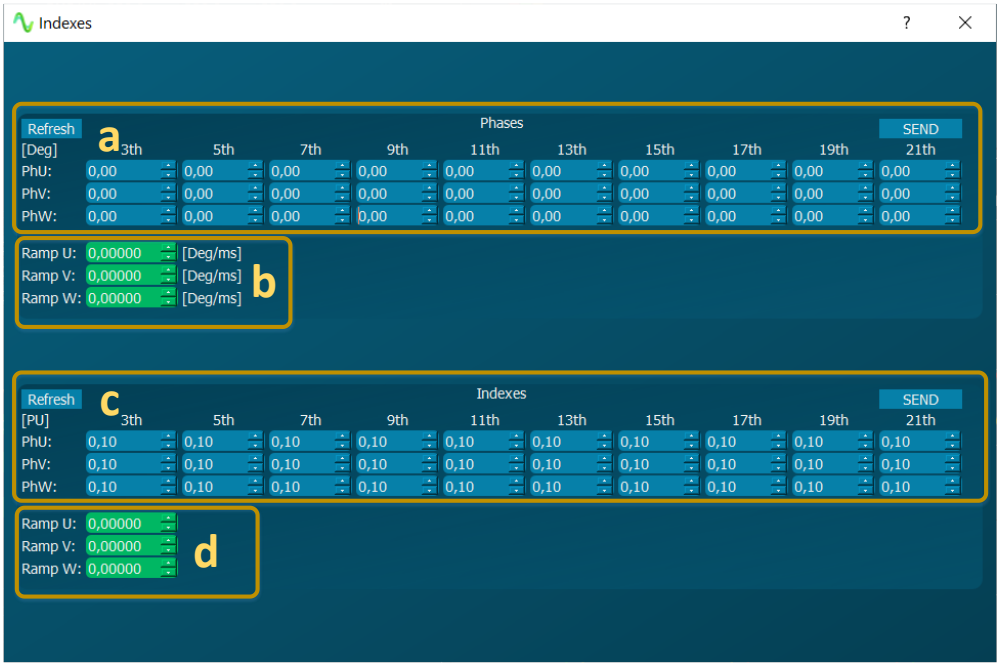
Remember that the *Show Slide* button is available in all the tabs. It is useful to hide the control operation of the converter to have a wider view of the working tab.

4.4.1. AC Operation in Grid Emulator (GE + version AC)

This subtab allows the user to send all the AC parameters to control the Cinergia converter in AC voltage mode: voltage setpoints, harmonics, phase angles, frequency, grid resistance and ramps.



- **A:** Part of the subtab to introduce all the parameters to be sent to the converter.
  - **1.** Set the amplitude of the fundamental voltage setpoint in the first column. The other columns are the harmonics setpoints for each phase. The units for the first column are in rms volts unit, whereas the other columns are a percentage of the first column. From the 3th until the 9th harmonic, the percentage can go from 0% to 100% (0 to ±1), the 11th harmonic can go from 0% to 50% (0 to ±0.5), whereas 13th to 21th can reach 20% (0 to ±0.2).
    If the equipment is in 1 channel mode, the only available setpoints to introduce are in the global row (first row).
  - **2.** Press the *Indexes* button to open all the harmonic configure parameters: Phase angle and indexes of each harmonic.
    - **a.** Phase angle setpoint for the harmonics.
    - **b.** Phase angle ramps for the harmonics.
    - **c.** Setpoint value from the index of the harmonic to generate. It is possible to represent from 0.1 to 50, even interharmonics.
    - **d.** Index ramps for the harmonics.



  - **3.** Ramps section. It controls the softer or faster change of the setpoints of amplitude (fundamental and harmonics) and phase angles. If the equipment is in 1 channel mode, the ramps to be used are Global column.
    Refresh button is for upload the actual values of the converter.
  - **4.** 3 different frequencies or only 1 for the three phases. The user can operate with different value of frequencies and ramp of frequencies per each phase or applying the same frequency and ramp value for the three phases.
  - **5.** Set the phase angle for each phase or for all phases together in case of monophasic output grid (1 channel mode).
    As an *example*, a ***three-phase grid*** is configured with the following angles on this tab: 0º, -120º and -240º.
    If the user introduces 0º, 0º and 0º, the result will be a ***mono-phase grid***.
  - **6.** Introduce the values for the frequency and the grid resistance. The frequency also has a ramp to control the change speed. The grid resistance is used only when a current is flowing throw the equipment. For example, if the resistance is 1Ω

(maximum value) and there are 40A in one phase, there will be a voltage drop of 40V.
Both parameters can be changed in any state of the converter.
The frequency and the grid resistance are the only ones that own a *Send* button only for themselves.

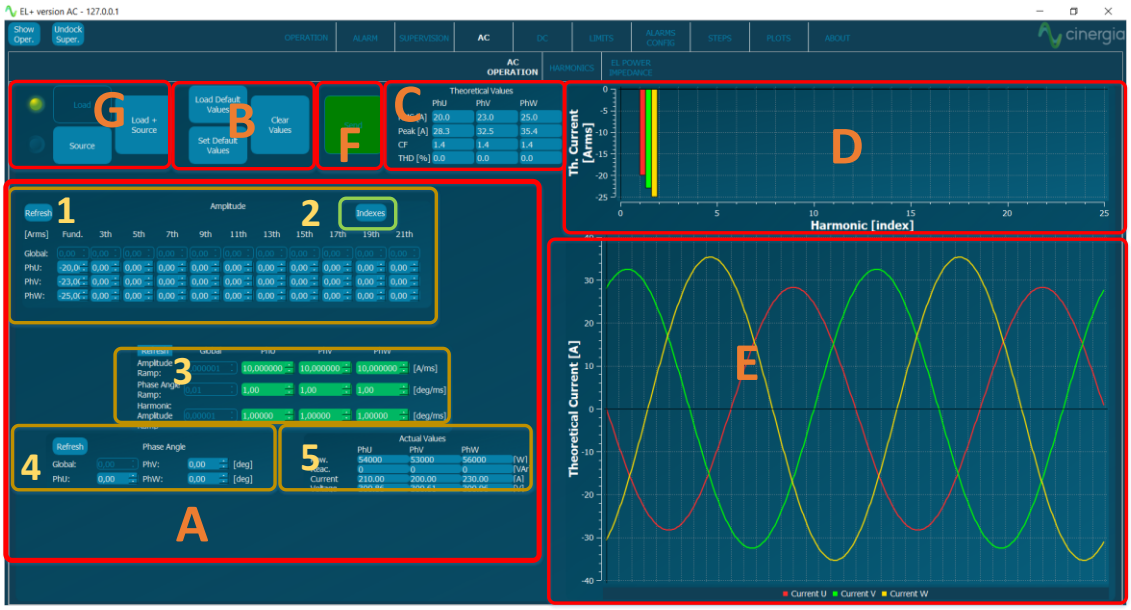
If the user introduces a parameter which is out of the converter limits, the interface will not allow to send it. Please read the manual to know which are the limits of the converter.

- **B:** The 3 buttons are used to help the user saving time by remembering default values of the parts 1, 2 and 4 described above. They can be established by pressing *Set Default Values* and it will save the actual parameters. After pressing this button, the user can use *Load Default values* to refresh them again. *Clear Values* will set to 0 the numbers of the part 1, 0.1 and 0 the H0 index and phase angle of part 2, respectively and 0º, -120º and -240º the numbers of the part 4.
- **C:** Information part. Meanwhile the user is introducing the setpoints, the theoretical values (RMS, maximum, crest factor and the total harmonic distortion) are being calculated and displayed.
- **D:** Information part. Graphs are being drawn meanwhile entering the data in the A part. From left to right, the values of fundamental and harmonic setpoints are being displayed.
- **E:** Information part. Graphs are being drawn meanwhile entering the data in the A part. This is a waveform graph and it is the same that will appear on any oscilloscope connected to the output of the converter in exception of the frequency. It is important to remark that the frequency is not displayed but only the waveform in terms of amplitude.
- **F:** Once all the values of the parts described above are correct, the user must press *Send*. This shall be done in Run state, otherwise the setpoints will not appear in the output.

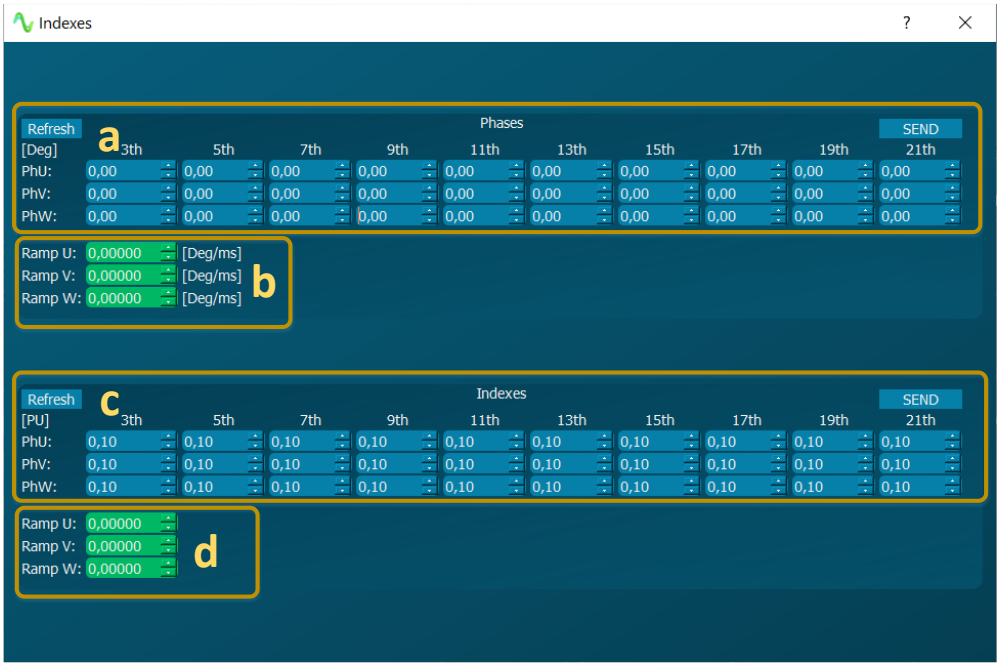
Important: *Take into account that the frequency values and ramps will not be sent pressing this Send button (F). The user must press the button on the marked area A.6 to send it.*

4.4.2. AC Operation in Electronic Load (EL + version AC)

This subtab allows the user to send all the AC parameters to control the Cinergia converter as a current source: current setpoints, harmonics, phase angles and ramps.



- **A:** Part of the subtab to introduce all the parameters to be sent to the converter.
  - **1.** Set the amplitude of the fundamental current setpoint in the first column. The other columns are the harmonics setpoints for each phase. The units for the first column are in rms ampers unit, whereas the other columns are a percentage of the first column. From the 3th until the 9th harmonic, the percentage can go from 0% to 100% (0 to ±1), the 11th harmonic can go from 0% to 50% (0 to ±0.5), whereas 13th to 21th can reach 20% (0 to ±0.2).
  - **2.** Press the *Indexes* button to open all the harmonic configure parameters: Phase angle and indexes of each harmonic.
    - **a.** Phase angle setpoint for the harmonics.
    - **b.** Phase angle ramps for the harmonics.
    - **c.** Setpoint value from the index of the harmonic to generate. It is possible to represent from 0.1 to 50, even interharmonics.
    - **d.** Index ramps for the harmonics.



- **3.** Ramps section. It controls the softer or faster change of the setpoints of amplitude (fundamental and harmonics) and phase angles.
  Refresh button is for upload the actual values of the converter.
- **4.** Set the phase angle for each phase.
  The Electronic Load is synchronizing to the grid per each phase. So, if the user introduces 0º, 0º and 0º, the result will be current in phase with the voltage per phase.
- **5.** Information part. Meanwhile the user is introducing the setpoints and sending to the unit, the actual values at the output (voltage, current, active and reactive power) are being calculated and displayed.

If the user introduces a parameter which is out of the converter limits, the interface will not allow to send it. Please read the manual to know which are the limits of the converter.

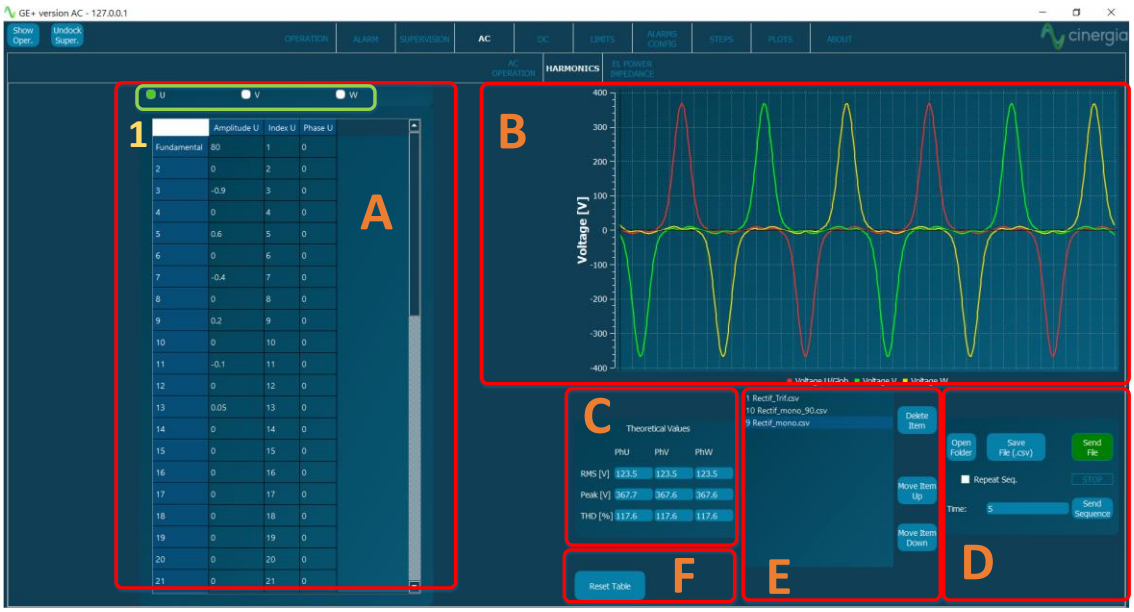
- **B:** The 3 buttons are used to help the user saving time by remembering default values of the parts 1, 2 and 4 described above. They can be established by pressing *Set Default Values* and it will save the actual parameters. After pressing this button, the user can use *Load Default values* to refresh them again. *Clear Values* will set to 0 the numbers of the part 1, 0.1 and 0 the H0 index and phase angle of part 2, respectively and 0º, -120º and -240º the numbers of the part 4.
- **C:** Information part. Meanwhile the user is introducing the setpoints, the theoretical values (RMS, maximum, crest factor and the total harmonic distortion) are being calculated and displayed.
- **D:** Information part. Graphs are being drawn meanwhile entering the data in the A part. From left to right, the values of fundamental and harmonic setpoints are being displayed.
- **E:** Information part. Graphs are being drawn meanwhile entering the data in the A part. This is a waveform graph and it is the same that will appear on any oscilloscope connected to the output of the converter in exception of the frequency. It is important

to remark that the frequency is not displayed but only the waveform in terms of amplitude.

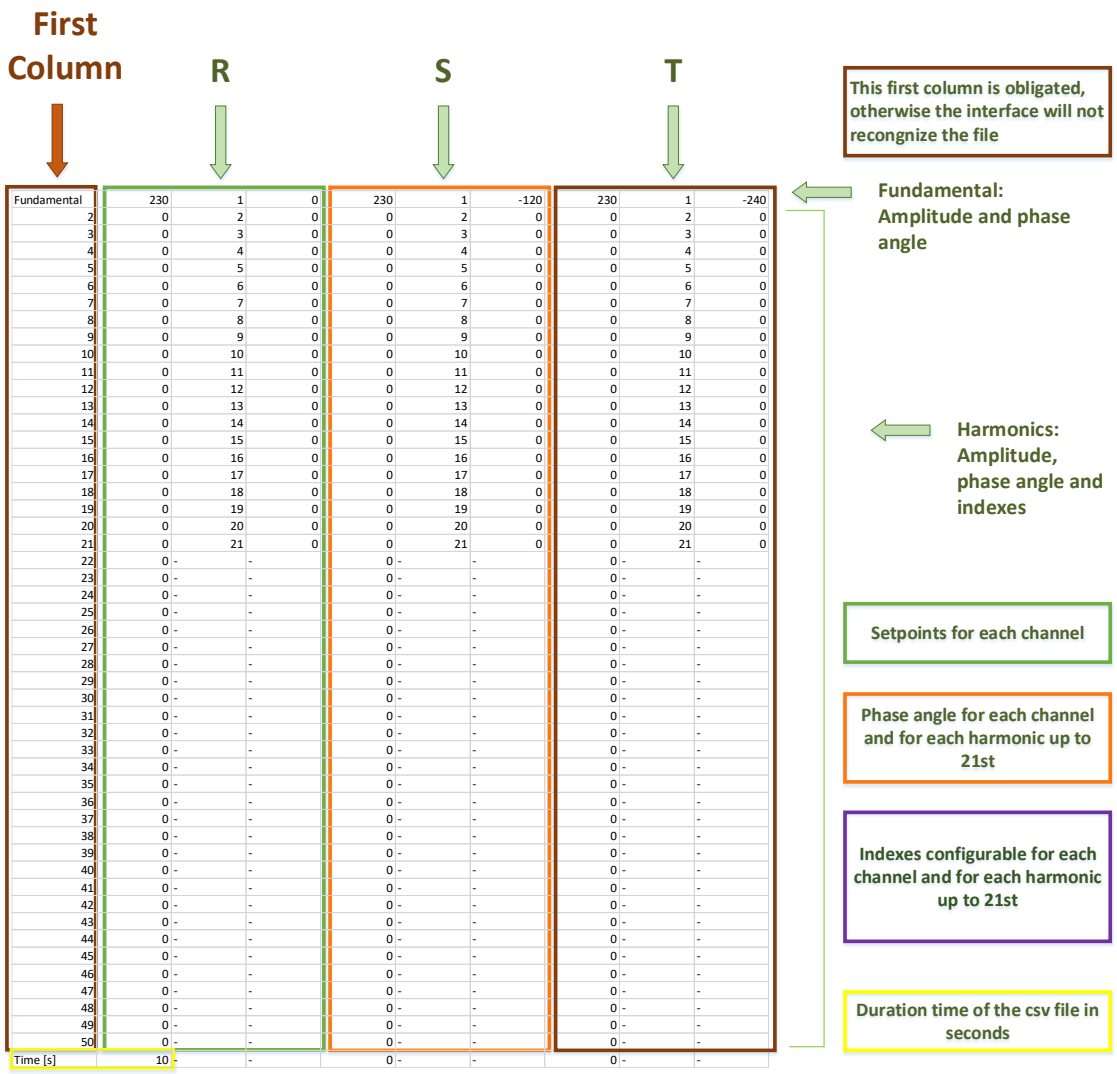
- **F:** Once all the values of the parts described above are correct, the user must press *Send*. This shall be done in Run state, otherwise the setpoints will not appear in the output.
- **G:** *Load* or *Source* operation mode or both. Define if the converter must behave as a ***load*** or as a ***source***. When it is in *Load* mode (absorbing current), the only available setpoints are negative whereas when the converter is in *Source* mode (delivering current), the setpoints must be positive.

4.4.3. Harmonics in Grid Emulator (GE+ version AC)

The *Harmonics* tab allows the user to send *.csv* (coma separated value) files. The *.csv* files can be created and saved, loaded or modified and saved by the interface.
All the files can be executed as a sequence.



- **A:** This table shows all the values that refer to the configuration of the harmonics and it is distributed in the following way:



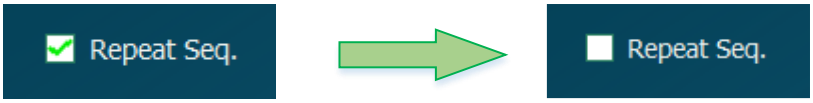
	R			S			T		
Fundamental	230	1	0	230	1	-120	230	1	-240
2	0	2	0	0	2	0	0	2	0
3	0	3	0	0	3	0	0	3	0
4	0	4	0	0	4	0	0	4	0
5	0	5	0	0	5	0	0	5	0
6	0	6	0	0	6	0	0	6	0
7	0	7	0	0	7	0	0	7	0
8	0	8	0	0	8	0	0	8	0
9	0	9	0	0	9	0	0	9	0
10	0	10	0	0	10	0	0	10	0
11	0	11	0	0	11	0	0	11	0
12	0	12	0	0	12	0	0	12	0
13	0	13	0	0	13	0	0	13	0
14	0	14	0	0	14	0	0	14	0
15	0	15	0	0	15	0	0	15	0
16	0	16	0	0	16	0	0	16	0
17	0	17	0	0	17	0	0	17	0
18	0	18	0	0	18	0	0	18	0
19	0	19	0	0	19	0	0	19	0
20	0	20	0	0	20	0	0	20	0
21	0	21	0	0	21	0	0	21	0
22	0	-	-	0	-	-	0	-	-
23	0	-	-	0	-	-	0	-	-
24	0	-	-	0	-	-	0	-	-
25	0	-	-	0	-	-	0	-	-
26	0	-	-	0	-	-	0	-	-
27	0	-	-	0	-	-	0	-	-
28	0	-	-	0	-	-	0	-	-
29	0	-	-	0	-	-	0	-	-
30	0	-	-	0	-	-	0	-	-
31	0	-	-	0	-	-	0	-	-
32	0	-	-	0	-	-	0	-	-
33	0	-	-	0	-	-	0	-	-
34	0	-	-	0	-	-	0	-	-
35	0	-	-	0	-	-	0	-	-
36	0	-	-	0	-	-	0	-	-
37	0	-	-	0	-	-	0	-	-
38	0	-	-	0	-	-	0	-	-
39	0	-	-	0	-	-	0	-	-
40	0	-	-	0	-	-	0	-	-
41	0	-	-	0	-	-	0	-	-
42	0	-	-	0	-	-	0	-	-
43	0	-	-	0	-	-	0	-	-
44	0	-	-	0	-	-	0	-	-
45	0	-	-	0	-	-	0	-	-
46	0	-	-	0	-	-	0	-	-
47	0	-	-	0	-	-	0	-	-
48	0	-	-	0	-	-	0	-	-
49	0	-	-	0	-	-	0	-	-
50	0	-	-	0	-	-	0	-	-
Time [s]	10	-	-	0	-	-	0	-	-

The user can write the desired values on this table of the interface to create a harmonic file to be sent or saved as it is explained in the point E of this chapter.

- **1.** Only one phase harmonic values are shown at a time. The user can look each phase pressing over each name. The phase activated is the one marked with the green circle.

- **B:** Meanwhile the user is introducing the values for the harmonics in table A, it draws the waveform showing how the harmonics will look like when the user uses an oscilloscope in the output (EUT side).
- **C:** Theoretical values are very useful to know which is the maximum output voltage, as well as the peak, the crest factor and the total harmonic distortion (THD).
- **D:** Open, save or send *.csv* files with the following buttons
  - *Open Folder*. Open a folder of the computer with *.csv* files in it. The files will be shown in window E.
  - *Save File (.csv)*. This button allows to save a created harmonic in A window (all phases) or to modify an existing opened file.
  - *Send File*. The created file in A or the opened and selected file in E will be sent by pressing this button. The sent file will be the one shown in A, B and D.
  - *Send Sequence*. The user can send a sequence instead of a unique file. The file sequence to execute will be the one with the harmonic files in E window that the user has opened.

- *Repeat Sequence*. By pressing this button, the LED right beside it will be illuminated and it will indicate that the sequence is going to start again when it is finished.



- *Time*. It shows the time in seconds that the actual file will last until it goes to the next file.
- *STOP*. The user can stop the sequence any time, but the equipment will stay in the actual file. This button is not a button to stop the converter but the sequence.

- **E:** This window will show the name and the location of the file that the user opens from the button *Open Folder* of part E. it is possible to select (double click) one file and the characteristics of it will be shown in windows A, B, C and D. To create the order of the sequence, click the file and move it up or down with the buttons *Move Item Up* and *Move Item Down*.
- **F:** *Reset Table* button. The user can make a reset of all the current table shown on A. Pressing this button, the values will go to default.

When the user creates a .csv file with excel or a text editor, it is important to write in the first column first row, as in the example above, '*Fundamental*' and in the first column row 51 '*Time [s]*'.

Each file is a test so, to create a sequence, different files must be created and saved in the same folder. From the interface, the user can visualize all the files of this folder, send each file into the unit, or perform the sequence.

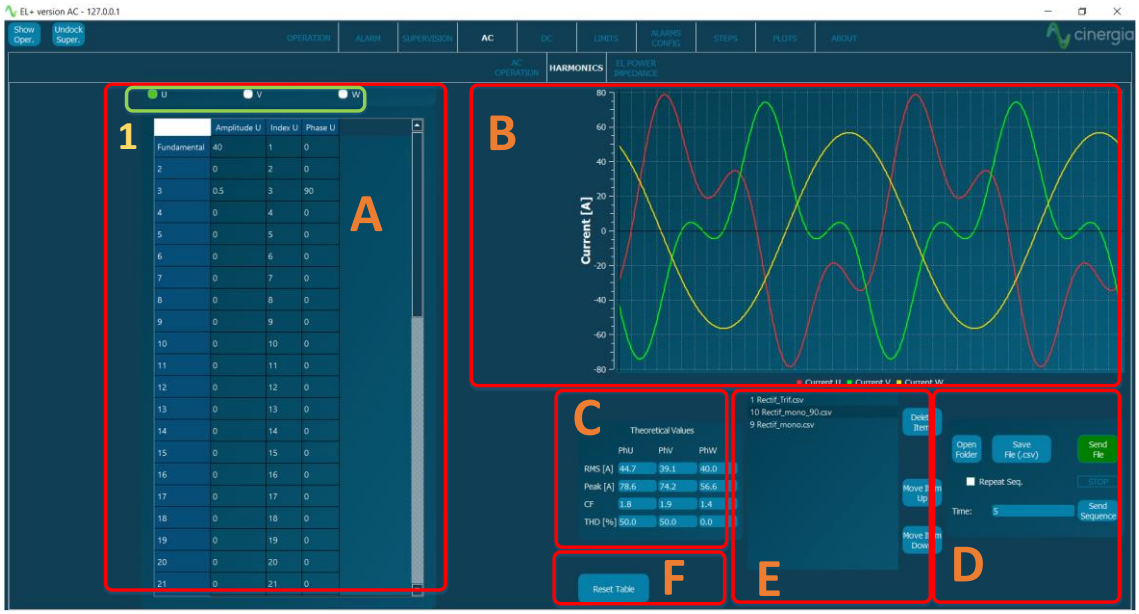
The same example of *csv* file explained above with *excel* is shown in the following image with a text editor. Please note that the columns are separated with comas and the decimal points are points. Please note that the indexes and phase angle variables from 22nd to 50th harmonics need a '-' signal.

A **.csv file* as an example is shown:

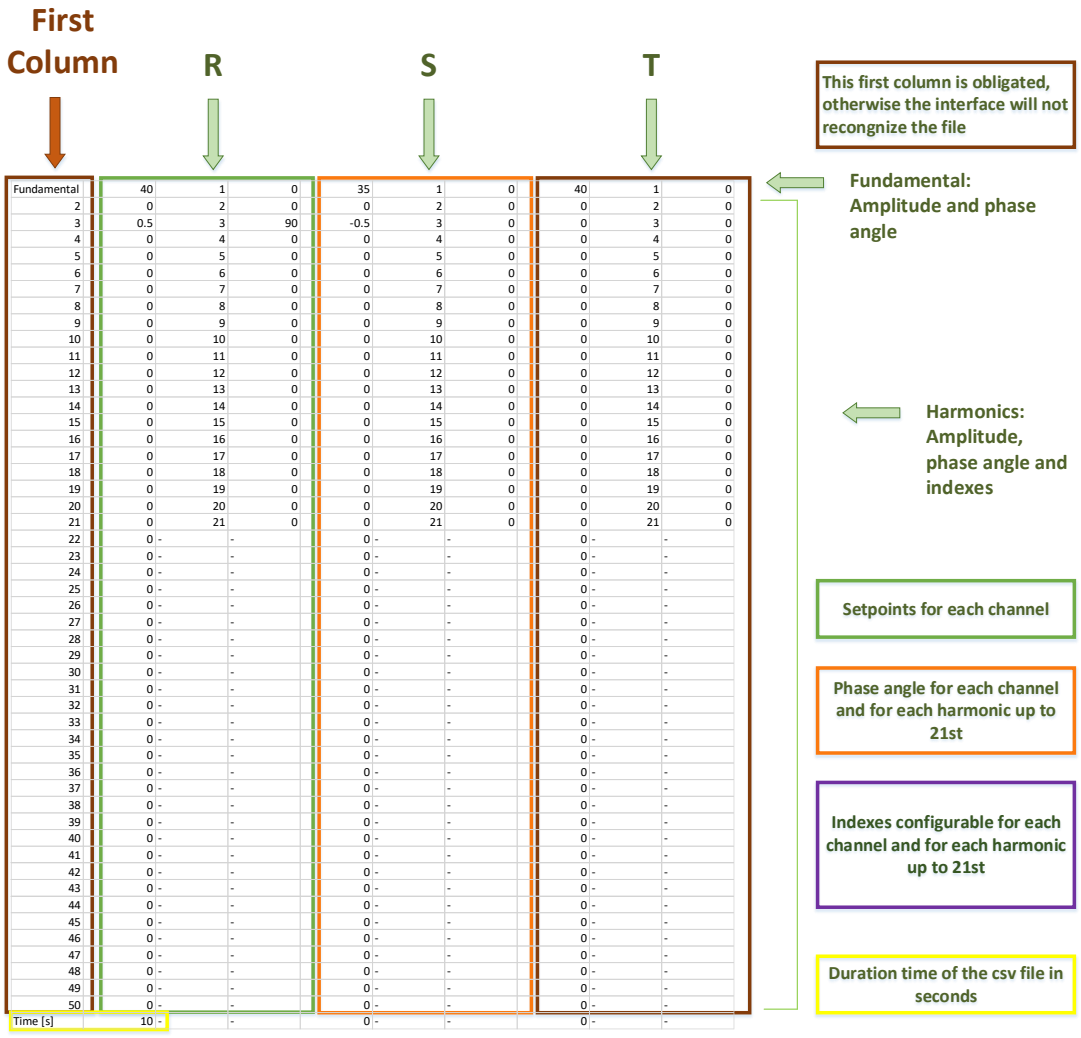
```
Fundamental, 230.5,1,0, 115.5,1,0, 230,1,0,
2, 0,2,0, 0,2,0, 0,2,0,
3, 0.5,3,0, -0.5,3,0, 0,3,0,
4, 0,4,0, 0,4,0, 0,4,0,
5, 0,5,0, 0,5,0, 0,5,0,
6, 0,6,0, 0,6,0, 0,6,0,
7, 0,7,0, 0,7,0, 0,7,0,
8, 0,8,0, 0,8,0, 0,8,0,
9, 0,9,0, 0,9,0, 0,9,0,
10, 0,10,0, 0,10,0, 0,10,0,
11, 0,11,0, 0,11,0, 0,11,0,
12, 0,12,0, 0,12,0, 0,12,0,
13, 0,13,0, 0,13,0, 0,13,0,
14, 0,14,0, 0,14,0, 0,14,0,
15, 0,15,0, 0,15,0, 0,15,0,
16, 0,16,0, 0,16,0, 0,16,0,
17, 0,17,0, 0,17,0, 0,17,0,
18, 0,18,0, 0,18,0, 0,18,0,
19, 0,19,0, 0,19,0, 0,19,0,
20, 0,20,0, 0,20,0, 0,20,0,
21, 0,21,0, 0,21,0, 0,21,0,
22, 0,-,-, 0,-,-, 0,-,-,
23, 0,-,-, 0,-,-, 0,-,-,
24, 0,-,-, 0,-,-, 0,-,-,
25, 0,-,-, 0,-,-, 0,-,-,
26, 0,-,-, 0,-,-, 0,-,-,
27, 0,-,-, 0,-,-, 0,-,-,
28, 0,-,-, 0,-,-, 0,-,-,
29, 0,-,-, 0,-,-, 0,-,-,
30, 0,-,-, 0,-,-, 0,-,-,
31, 0,-,-, 0,-,-, 0,-,-,
32, 0,-,-, 0,-,-, 0,-,-,
33, 0,-,-, 0,-,-, 0,-,-,
34, 0,-,-, 0,-,-, 0,-,-,
35, 0,-,-, 0,-,-, 0,-,-,
36, 0,-,-, 0,-,-, 0,-,-,
37, 0,-,-, 0,-,-, 0,-,-,
38, 0,-,-, 0,-,-, 0,-,-,
39, 0,-,-, 0,-,-, 0,-,-,
40, 0,-,-, 0,-,-, 0,-,-,
41, 0,-,-, 0,-,-, 0,-,-,
42, 0,-,-, 0,-,-, 0,-,-,
43, 0,-,-, 0,-,-, 0,-,-,
44, 0,-,-, 0,-,-, 0,-,-,
45, 0,-,-, 0,-,-, 0,-,-,
46, 0,-,-, 0,-,-, 0,-,-,
47, 0,-,-, 0,-,-, 0,-,-,
48, 0,-,-, 0,-,-, 0,-,-,
49, 0,-,-, 0,-,-, 0,-,-,
50, 0,-,-, 0,-,-, 0,-,-,
Time [s], 10,-,-, 0,-,-, 0,-,-,
```

4.4.4. Harmonics in Electronic Load (EL+ version AC)

The *Harmonics* tab allows the user to send *.csv* (coma separated value) files. The *.csv* files can be created and saved, loaded or modified and saved by the interface.
All the files can be executed as a sequence.



- **A:** This table shows all the values that refer to the configuration of the harmonics and it is distributed in the following way:



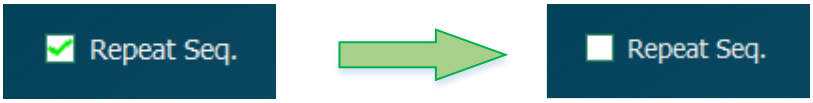
Fundamental	40	1	0	35	1	0	40	1	0
2	0	2	0	0	2	0	0	2	0
3	0.5	3	90	-0.5	3	0	0	3	0
4	0	4	0	0	4	0	0	4	0
5	0	5	0	0	5	0	0	5	0
6	0	6	0	0	6	0	0	6	0
7	0	7	0	0	7	0	0	7	0
8	0	8	0	0	8	0	0	8	0
9	0	9	0	0	9	0	0	9	0
10	0	10	0	0	10	0	0	10	0
11	0	11	0	0	11	0	0	11	0
12	0	12	0	0	12	0	0	12	0
13	0	13	0	0	13	0	0	13	0
14	0	14	0	0	14	0	0	14	0
15	0	15	0	0	15	0	0	15	0
16	0	16	0	0	16	0	0	16	0
17	0	17	0	0	17	0	0	17	0
18	0	18	0	0	18	0	0	18	0
19	0	19	0	0	19	0	0	19	0
20	0	20	0	0	20	0	0	20	0
21	0	21	0	0	21	0	0	21	0
22	0	-	-	0	-	-	0	-	-
23	0	-	-	0	-	-	0	-	-
24	0	-	-	0	-	-	0	-	-
25	0	-	-	0	-	-	0	-	-
26	0	-	-	0	-	-	0	-	-
27	0	-	-	0	-	-	0	-	-
28	0	-	-	0	-	-	0	-	-
29	0	-	-	0	-	-	0	-	-
30	0	-	-	0	-	-	0	-	-
31	0	-	-	0	-	-	0	-	-
32	0	-	-	0	-	-	0	-	-
33	0	-	-	0	-	-	0	-	-
34	0	-	-	0	-	-	0	-	-
35	0	-	-	0	-	-	0	-	-
36	0	-	-	0	-	-	0	-	-
37	0	-	-	0	-	-	0	-	-
38	0	-	-	0	-	-	0	-	-
39	0	-	-	0	-	-	0	-	-
40	0	-	-	0	-	-	0	-	-
41	0	-	-	0	-	-	0	-	-
42	0	-	-	0	-	-	0	-	-
43	0	-	-	0	-	-	0	-	-
44	0	-	-	0	-	-	0	-	-
45	0	-	-	0	-	-	0	-	-
46	0	-	-	0	-	-	0	-	-
47	0	-	-	0	-	-	0	-	-
48	0	-	-	0	-	-	0	-	-
49	0	-	-	0	-	-	0	-	-
50	0	-	-	0	-	-	0	-	-
Time [s]	10	-	-	0	-	-	0	-	-

The user can write the desired values on this table of the interface to create a harmonic file to be sent or saved as it is explained in the point E of this chapter.

- **1.** Only one phase harmonic values are shown at a time. The user can look each phase pressing over each name. The phase activated is the one marked with the green circle.

- **B:** Meanwhile the user is introducing the values for the harmonics in table A, it draws the waveform showing how the harmonics will look like when the user uses an oscilloscope in the output (EUT side).
- **C:** Theoretical values are very useful to know which is the maximum output voltage, as well as the peak, the crest factor and the total harmonic distortion (THD).
- **D:** Open, save or send *.csv* files with the following buttons
  - *Open Folder*. Open a folder of the computer with *.csv* files in it. The files will be shown in window E.
  - *Save File (.csv)*. This button allows to save a created harmonic in A window (all phases) or to modify an existing opened file.
  - *Send File*. The created file in A or the opened and selected file in E will be sent by pressing this button. The sent file will be the one shown in A, B and D.
  - *Send Sequence*. The user can send a sequence instead of a unique file. The file sequence to execute will be the one with the harmonic files in E window that the user has opened.

- *Repeat Sequence*. By pressing this button, the LED right beside it will be illuminated and it will indicate that the sequence is going to start again when it is finished.



- *Time*. It shows the time in seconds that the actual file will last until it goes to the next file.
- *STOP*. The user can stop the sequence any time, but the equipment will stay in the actual file. This button is not a button to stop the converter but the sequence.

- **E:** This window will show the name and the location of the file that the user opens from the button *Open Folder* of part E. it is possible to select (double click) one file and the characteristics of it will be shown in windows A, B, C and D. To create the order of the sequence, click the file and move it up or down with the buttons *Move Item Up* and *Move Item Down*.
- **F:** *Reset Table* button. The user can make a reset of all the current table shown on A. Pressing this button, the values will go to default.

When the user creates a .csv file with excel or a text editor, it is important to write in the first column first row, as in the example above, '*Fundamental*' and in the first column row 51 '*Time [s]*'.

Each file is a test so, to create a sequence, different files must be created and saved in the same folder. From the interface, the user can visualize all the files of this folder, send each file into the unit, or perform the sequence.

The same example of *csv* file explained above with *excel* is shown in the following image with a text editor. Please note that the columns are separated with comas and the decimal points are points. Please note that the indexes and phase angle variables from 22nd to 50th harmonics need a '-' signal.

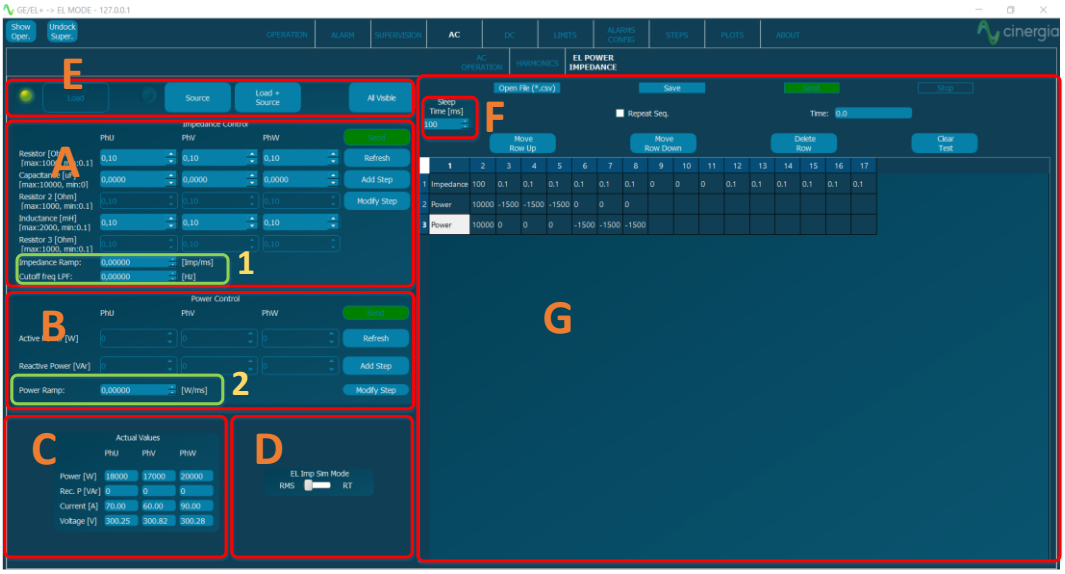
A **.csv file* as an example is shown:

```
Fundamental, 40,1,0, 35,1,0, 40,1,0,
2, 0,2,0, 0,2,0, 0,2,0,
3, 0.5,3,90, -0.5,3,0, 0,3,0,
4, 0,4,0, 0,4,0, 0,4,0,
5, 0,5,0, 0,5,0, 0,5,0,
6, 0,6,0, 0,6,0, 0,6,0,
7, 0,7,0, 0,7,0, 0,7,0,
8, 0,8,0, 0,8,0, 0,8,0,
9, 0,9,0, 0,9,0, 0,9,0,
10, 0,10,0, 0,10,0, 0,10,0,
11, 0,11,0, 0,11,0, 0,11,0,
12, 0,12,0, 0,12,0, 0,12,0,
13, 0,13,0, 0,13,0, 0,13,0,
14, 0,14,0, 0,14,0, 0,14,0,
15, 0,15,0, 0,15,0, 0,15,0,
16, 0,16,0, 0,16,0, 0,16,0,
17, 0,17,0, 0,17,0, 0,17,0,
18, 0,18,0, 0,18,0, 0,18,0,
19, 0,19,0, 0,19,0, 0,19,0,
20, 0,20,0, 0,20,0, 0,20,0,
21, 0,21,0, 0,21,0, 0,21,0,
22, 0,-,-, 0,-,-, 0,-,-,
23, 0,-,-, 0,-,-, 0,-,-,
24, 0,-,-, 0,-,-, 0,-,-,
25, 0,-,-, 0,-,-, 0,-,-,
26, 0,-,-, 0,-,-, 0,-,-,
27, 0,-,-, 0,-,-, 0,-,-,
28, 0,-,-, 0,-,-, 0,-,-,
29, 0,-,-, 0,-,-, 0,-,-,
30, 0,-,-, 0,-,-, 0,-,-,
31, 0,-,-, 0,-,-, 0,-,-,
32, 0,-,-, 0,-,-, 0,-,-,
33, 0,-,-, 0,-,-, 0,-,-,
34, 0,-,-, 0,-,-, 0,-,-,
35, 0,-,-, 0,-,-, 0,-,-,
36, 0,-,-, 0,-,-, 0,-,-,
37, 0,-,-, 0,-,-, 0,-,-,
38, 0,-,-, 0,-,-, 0,-,-,
39, 0,-,-, 0,-,-, 0,-,-,
40, 0,-,-, 0,-,-, 0,-,-,
41, 0,-,-, 0,-,-, 0,-,-,
42, 0,-,-, 0,-,-, 0,-,-,
43, 0,-,-, 0,-,-, 0,-,-,
44, 0,-,-, 0,-,-, 0,-,-,
45, 0,-,-, 0,-,-, 0,-,-,
46, 0,-,-, 0,-,-, 0,-,-,
47, 0,-,-, 0,-,-, 0,-,-,
48, 0,-,-, 0,-,-, 0,-,-,
49, 0,-,-, 0,-,-, 0,-,-,
50, 0,-,-, 0,-,-, 0,-,-,
Time [s], 10,-,-, 0,-,-, 0,-,-,
```

4.4.5. EL Power Impedance (EL+ version AC)

On this subtab, the user can set the setpoints values for impedance and power. As it is an AC current source, the impedance is composed by resistance, inductance and capacitance and the power by active and reactive. This tab also allows to create sequence with combinations of these two working modes.

The 2 buttons *Load* and *Source* described in the following chapter is used only for helping the user to understand whereas the equipment is delivering or injecting current. It can be important, for example, if the EUT connected at the output is not bidirectional so only allows one way current (injected or delivered). These buttons do not make changes in the Cinergia equipment but only on the interface. If the button pressed is *Load*, for example, the interface will allow negative power setpoints. Please note that in Impedance mode, the only mode that make sense is working as a *Load*.



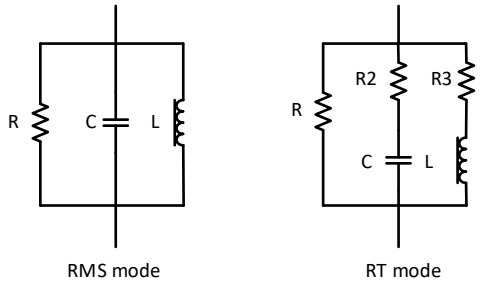
- **A:** Impedance control. When the equipment is in impedance mode (the mode is selected in the button *Show Operation* explained in the chapter 3 part D of this manual) this part will be illuminated, and the user will be able to introduce the impedance setpoints. Each column is for each phase and the rows are for the resistor, resistor 2 and resistor 3, inductance and capacitance setpoints, respectively. Once the parameters are ready, press *Send*. If the converter is in impedance mode and configured as a source, the equipment will not send the setpoints, so it is important that the converter is in load state (windows **E**) when it is in impedance mode. The values from Resistor 2 and Resistor 3 will be available only when the RT simulation EL mode is activated (window **D**). In other case, these parameters will remain frozen.
  The button *Refresh* will make appear the internal values of the equipment in that moment. *Add Step* and *Modify Step* are explained in the part **G** of this chapter.
  - **1**: there is also two more parameters for this mode:
    - *Impedance Ramp*. This value is applied in all impedance parameters at the same time per each unit (in ohms, uF and mH).

- *Cutoff LPF*. As the unit in RT mode could be instability the user can control the lowpassfilter bandwidth.

- **B:** Power control. When the equipment is in power mode (the mode is selected in the button *Show Operation* explained in the chapter **¡Error! No se encuentra el origen de la referencia.** part D of this manual) this part will be illuminated, and the user will be able to introduce the power setpoints. Each column is for each phase and the rows are for the active and reactive power setpoints respectively. Once the parameters are ready, press *Send*.
  The button *Refresh* will make appear the internal values of the equipment in that moment. *Add Step* and *Modify Step* are explained in the part **G** of this chapter.
  - **2**: there is also one more parameter for this mode:
    - *Power Ramp*. This value is applied in active and reactive in W/ms.

If the user introduces a parameter which is out of the converter limits, the interface will not allow to send it. Please read the manual to know which are the limits of the converter.

- **C:** Information part. Meanwhile the user is introducing the setpoints and sending to the unit, the actual values at the output (voltage, current, active and reactive power) are being calculated and displayed.
- **D:** EL simulation mode. The user can choose the Impedance simulation mode to reproduce with an EL_AC between RMS or Realtime:
  - RMS simulation mode
  - Real time simulation mode



RMS mode RT mode

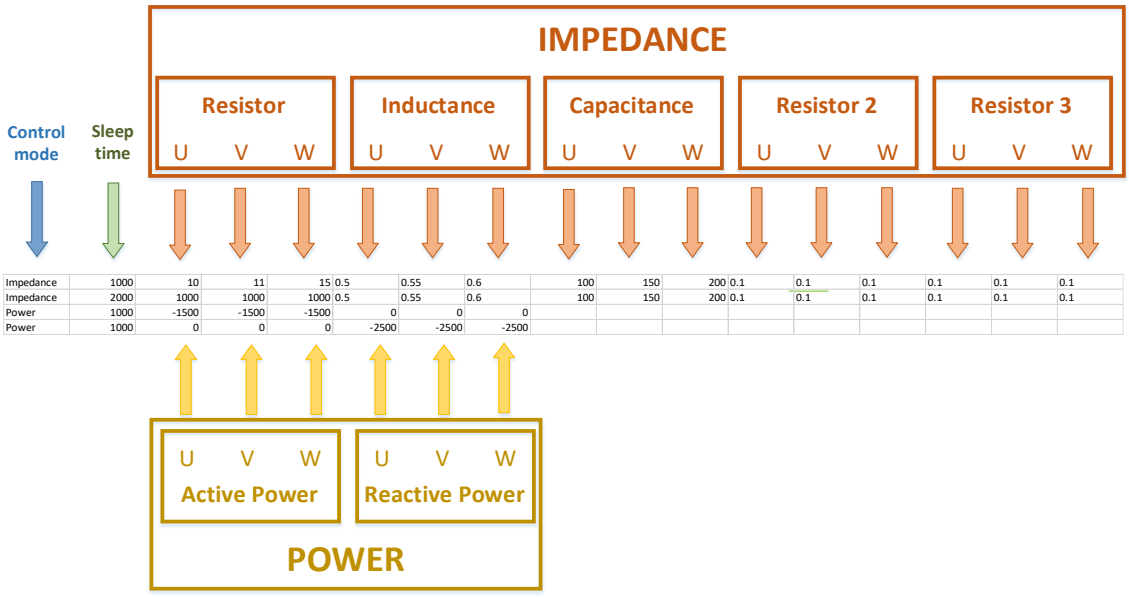
For more information of this functionality, p*lease read the specific manual, before operating it.*

- **E:** Define if the converter must behave as a load or as a source. When it is in Load mode (absorbing current), the only setpoints available are negative whereas when the converter is in Source mode (delivering current), the setpoints must be positive. The button *All Visible* allows the user to see and write the parameters of parts **A**, **B** and **C**. It is useful to create the sequences explained in the following part **G**.
- **F:** The Sleep Time is the configurable time that the sequence will use to remain in a row of setpoints. It is explained in the part **G**.

In windows **A** and **B** there are the buttons "*Add Step*" and "*Modify Step*". They are used to add or modify points in the sequence created in the window **G**:

- **G:** Create or load an impedance and/or power sequence. Each row contains the parameters of the setpoint and to add them it is necessary to introduce the desired values to the windows **A** or **B** and press *Add Step*. To modify a row, proceed exactly the same as if introducing another row but instead of *Add Step* press *Modify Step*. It is important to select the row that the user want to modify before pressing the button.
  Once the sequence is ready, press *Send* and there is the possibility of repeating it by pressing *Repeat Sequence*. The button *Stop* allows to stop the execution in any moment. The user can also open a created sequence using the button *Open File (*.csv)*. It is also possible to save the test created in the interface by pressing *Save*, and it is important to save it as a *.csv* file.
  Pressing the *Clear Test* button, the current sequence created and shown on the tab will be deleted.
  Selecting one row and pressing the *Move Row Up* or *Move Row Down* button, the user can move the selected row inside the sequence created. Pressing *Delete Row*, the user will delete the selected row.

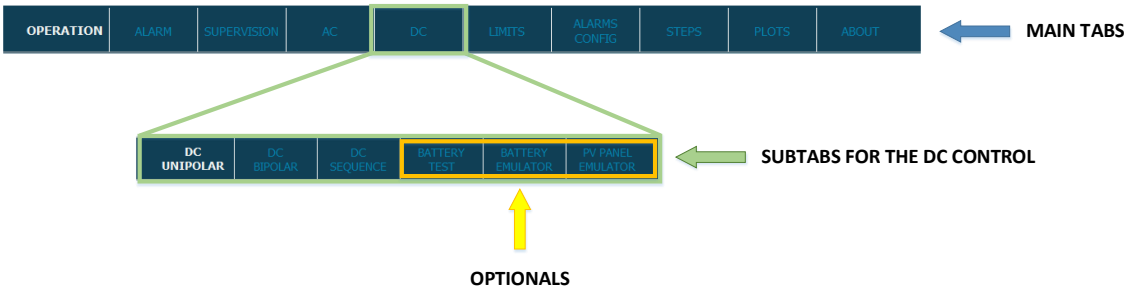
The resulting *.csv* file after saving the sequence can be modified in a program (such as Excel). The user can also create the sequence from the beginning. This file must follow this pattern and can be as long as the user desires:



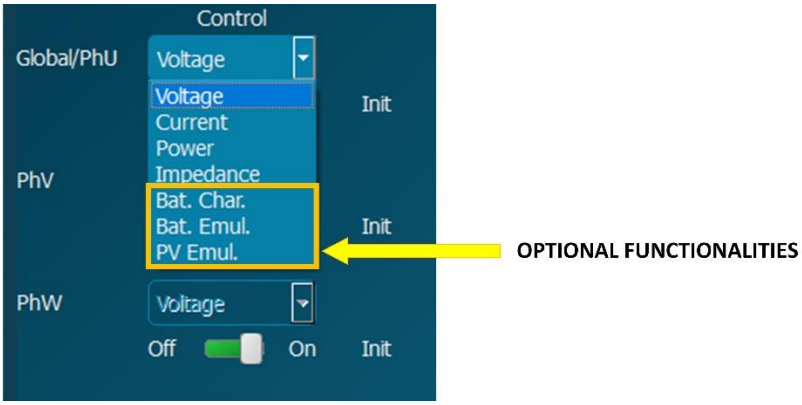
Please note that each row is a test of the sequence.

4.5. DC

This tab contains all the subtabs concerning the DC mode: DC Unipolar, DC Bipolar and DC Sequence.



Apart from the standard functionalities of the equipment, there are 3 DC OPTIONAL in the converter: *Battery Charger*, *Battery Emulator* and *PV Emulator*. These tab functions will appear when the optional is activated, as well as the new functionalities in the *Show Operational* part:



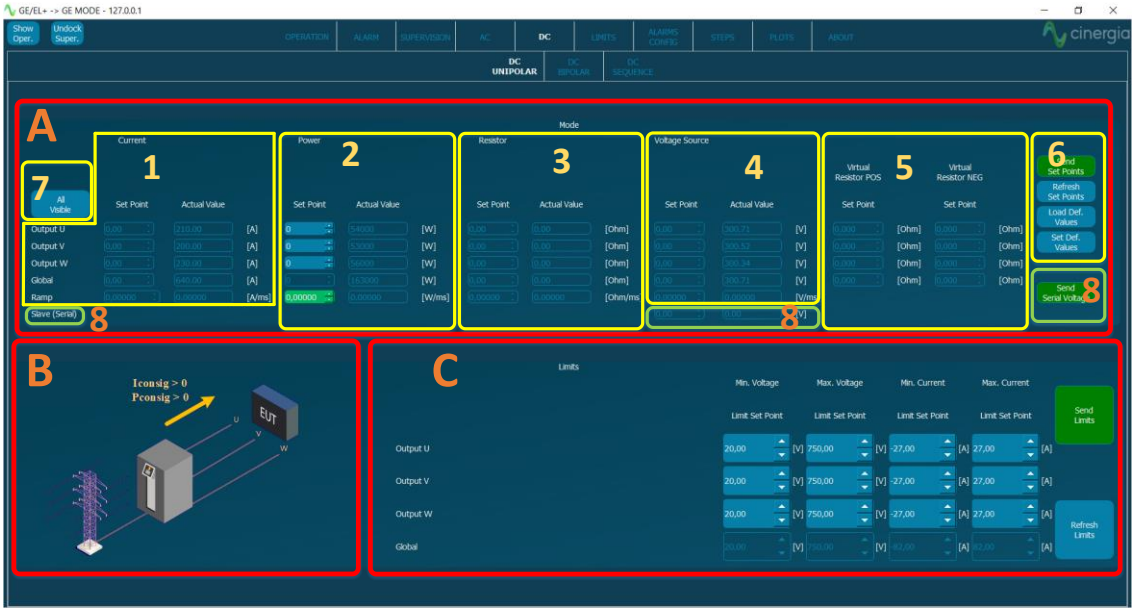
These 3 functionalities require an upgrade and has an additional cost.

Remember that the *Show Slide* button is available in all the tabs. It is useful to hide the control operation of the converter to have a wider view of the working tab.

4.5.1. DC Unipolar

This subtab allows the user to send all the DC parameters to control the Cinergia converter in unipolar connection: current, power, impedance, voltage setpoints, virtual resistances and limits.

Please read the *Operation Modes* document to know more about how to connect the equipment in unipolar.



- **A:** Part of the subtab to introduce all the setpoints to be sent to the converter. The interface will illuminate the parts where the values can be introduced depending on the connection mode (independent or parallel) and the control mode (current, power, impedance or voltage).
  - **1:** Set the current setpoints to be sent and its ramp. The allowed maximum and minimum values are ± *rated current* and the ramps go from 0 to 1000A/ms.
  - **2:** Set the power setpoints to be sent and its ramp. The allowed maximum and minimum values are ± *rated power* and the ramps go from 0 to 1000W/ms.
  - **3:** Set the resistance setpoints to be sent and its ramp. The allowed maximum and minimum values are 1000 and 0.8 Ω, but the minimum value in the global case (parallel) is 0.26Ω. The ramps go from 0 to 1000 Ω /ms. The user must calculate the appropriate value or resistance to get the desired current.
  - **4:** Set the voltage setpoints to be sent and its ramp. The allowed maximum and minimum values are 750 and 20V. The ramps go from 0 to 1000V/ms.

    All setpoints windows have the actual value right beside them. In this way, the user can know it without being necessary the supervision tab.

  - **5:** Set the virtual resistance value to create a voltage drop. It is configurable for each channel and for 3 channels and 1 channel mode. The difference between the positive (POS) resistance and the negative (NEG) resistance is that each one will work depending on the sign of the flowing current. The maximum and minimum values are from 1 to 0Ω.

    Please note that it is a virtual resistance. It means that there is no physical resistance introduced in the output of the equipment.
  - **6:** Once all the setpoints are ready, the user must press *Send Set Points* button and it will send only the setpoints of the actual control mode (the illuminated part).

    For example, if the equipment is in voltage mode, when the voltage setpoints are ready and the user press *Send Set Points*, the voltage values are sent whereas the current, power and impedance values are not sent.

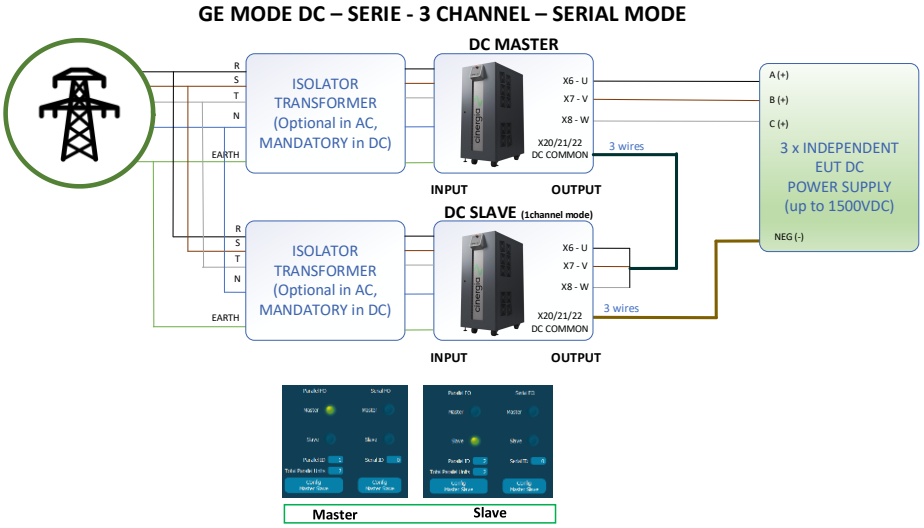
    The other buttons are useful to save time when typing setpoints:
    - **a.** *Refresh Set Points*: it will refresh the setpoints with the actual value of setpoints showed in the *actual value* windows (beside the setpoints). But if

the equipment is controlling power, for example, the *actual value* of power is not being sent to the *set point* on the left.

b. *Load Default Values*: the interface saves values as default and the user can set which are this default numbers in the following button *Set Default Values.*

c. *Set Default Values*: introduce the desired values and press this button. Then these values are going to appear again by pressing the button *Load Default Values*.

- **7:** *All Visible* button unfreeze all setpoints windows whatever it is the control mode. In this situation, if it is sent by pressing *Send Set Points*, for example, a power setpoint being in current mode, the equipment will not set this power setpoints. This button is useful to set the default setpoints of the equipment.
- **8:** Slave voltage setpoint (Serial). This parameter is only used when the user is controlling units in **serial connection mode** (please see the diagram below) to increase the voltage up to 1500VDC. In any other case, this parameter is not used.
  If the user has a setup with two units in serial mode connected, it is needed to fix the DC voltage from the slave unit first. In this case, the user must send the DC voltage setpoint from the slave unit and after that send the full setpoint voltage that the unit must apply at the output.



For example, the user wants to apply a DC voltage setpoint of 1000VDC, 1200VDC and 1400VDC. The user could send a slave DC voltage setpoint of 700VDC first. So, the slave unit will apply 700VDC and the master unit will apply 300VDC, 400VDC and 700VDC, respectively. Of course, there are a lot of combination available and there are a lot of setpoints that can not be performed.

For more information of this functionality, p*lease read the specific manual, before operating it.*

- **B:** The graph explains which is the direction of the current and power according to the setpoints.
- **C:** The equipment has its rated values and limits itself, but the user can set another limit (lower than the factory ones). The factory limits are the followings:

	Minimum	Maximum
Voltage	0V	750V
Current	- (rated value + 10%)	rated value + 10%)

These limits above are default values and will be the ones initialized when turning on the equipment, but they can be modified, and another limit can be chosen as default. Please read the chapter *4.6. Limits* for more information.
The interface will freeze and unfreeze the available part to write limits depending on the connection mode (3 channels or 1 channel).

Remember that the limits introduced by the user must be lower than the factory ones. If a higher or lower limit is sent, the interface will show and send the maximum or minimum of the equipment

Once the limits are ready, press *Send Limits*. The button *Refresh Limits* will show in the windows the limits that the equipment has in that moment.
When the converter is switched off and on again, these limits will be erased and substituted for the factory ones. It is possible to save limits in the equipment in the EEPROM memory, but an Advanced User password is required (explained in the chapter *1.6. Limits* of this manual).

4.5.2. DC Bipolar

This subtab allows the user to send all the DC parameters to control the Cinergia converter in bipolar connection: current, power, impedance, voltage setpoints, virtual resistances and limits.

Please read the *Operation Modes* document to know more about how to connect the equipment in bipolar.

- **A:** Part of the subtab to introduce all the setpoints to be sent to the converter. The interface will illuminate the parts where the values can be introduced depending on the control mode (current, power, resistance or voltage).
  1. Set the current setpoints to be sent and its ramp. The allowed maximum and minimum values are ± 1.1 x *rated current* and the ramps go from 0 to 1000A/ms.
  2. Set the power setpoints to be sent and its ramp. The allowed maximum and minimum values are ± 2 x *rated power* and the ramps go from 0 to 1000W/ms.
  3. Set the impedance setpoints to be sent and its ramp. The allowed maximum and minimum values are 1000 and 0.8 Ω. The ramps go from 0 to 1000 Ω /ms. The user must calculate the appropriate value or resistance to get the desired current.

     The converter is controlling channels U and W and both are referred to channel V. If the current setpoints of phases U and W add up to the limits of V channel, the equipment will go to alarm. In the supervision tab, the user can see which is the current and the power flowing through V phase.

  4. Set the voltage setpoints to be sent and its ramp. The allowed maximum and minimum values are 750 and 20V. The ramps go from 0 to 1000V/ms.

     All setpoints windows have the actual value right beside them. In this way, the user can know it without being necessary the supervision tab.

  5. Set the resistance value to create a voltage drop. It is configurable for each channel. The difference between the positive (POS) resistance and the negative (NEG) resistance is that each one will work depending on the sign of the flowing current. The maximum and minimum values are from 1 to 0Ω.
     Please note that it is a virtual resistance. It means that there is no physical resistance introduced in the output of the equipment.

  6. Once all the setpoints are ready, the user must press *Send Set Points* button and it will send only the setpoints of the actual control mode (the illuminated part).
     For example, if the equipment is in voltage mode, when the voltage setpoints are ready and the user press *Send Set Points*, the voltage values are sent whereas the current, power and impedance values are not sent.
     The other buttons are useful to save time when typing setpoints:
     - **a.** *Refresh Set Points*: it will refresh the setpoints with the actual value of setpoints showed in the *actual value* windows (beside the setpoints). But if the equipment is controlling power, for example, the *actual value* of power is not being sent to the *set point* on the left.
     - **b.** *Load Default Values*: the interface saves values as default and the user can set which are this default numbers in the following button *Set Default Values.*
     - **c.** *Set Default Values*: introduce the desired values and press this button. Then these values are going to appear again by pressing the button *Load Default Values*.

- **B:** The graph explains which is the direction of the current and power according to the setpoints.

- **C:** The equipment has its rated values and limits itself, but the user can set another limit (lower than the factory ones). The factory limits are the followings:

	Minimum	Maximum
Voltage	-350V	350V
Current	- (rated value + 10%)	rated value + 10%)

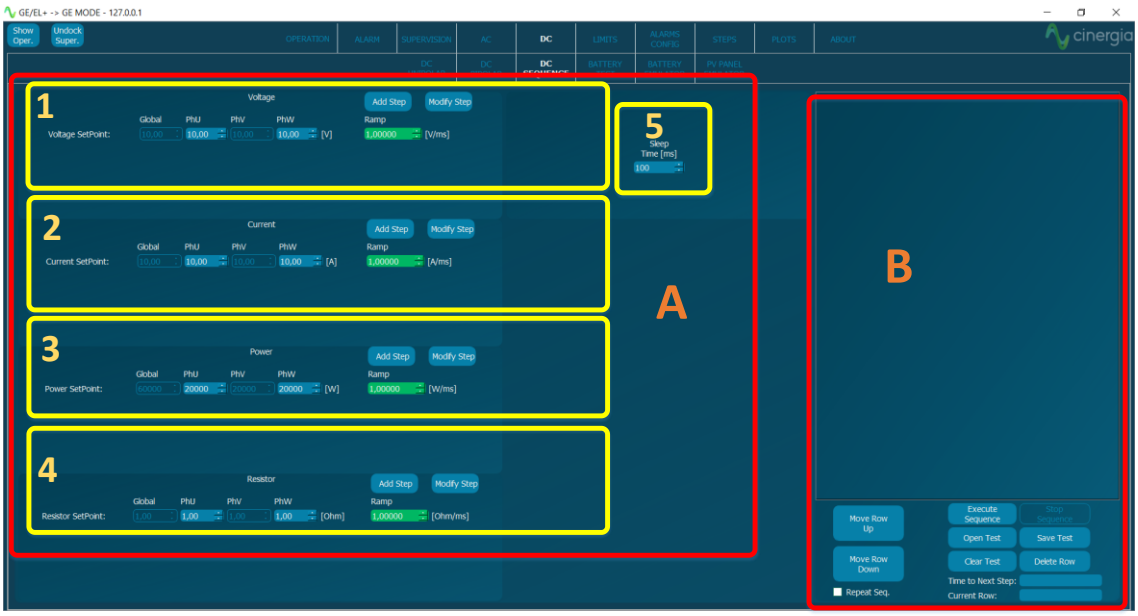
These limits above are default values and will be the ones initialized when turning on the equipment, but they can be modified, and another limit can be chosen as default. Please read the chapter *4.6. Limits* for more information.

Remember that the limits introduced by the user must be lower than the factory ones. If a higher or lower limit is sent, the interface will show and send the maximum or minimum of the equipment

Once the limits are ready, press *Send Limits*. The button *Refresh Limits* will show in the windows the limits that the equipment has in that moment.
When the converter is switched off and on again, these limits will be erased and substituted for the factory ones. It is possible to save limits in the equipment in the EEPROM memory, but an Advanced User Password is required (explained in the chapter *1.6. Limits* of this manual).

4.5.3. DC Sequence

The converter can execute sequences created by the user. These sequences can be made in the interface or in an external program and saved as a *CSV* (Coma Separated Values) file. This chapter explains how to create this file/sequence through the interface.



- **A:** Part of the subtab to introduce all the values that will conform the sequence. This can be multiple, which means that the equipment can be in voltage, current, power or impedance mode in the same sequence.

When the equipment is in current, power or impedance mode is controlling current, which means that a voltage source is required. The logical DC sequence is the one with the same type of control: voltage or current. It is recommended to create two types of DC sequences: one with voltage mode and one with current, power and impedance mode.

The sequence is configured with rows and each row is one step of the sequence.
The parts **1**, **2**, **3** and **4** of **A** contain two buttons: *Add Step* and *Modify Step*. They are used to add or modify rows in the sequence.

1. Voltage setpoints configuration where the user can introduce values for the global configuration (1 channel), channel U, V and W and the ramp.
2. Current setpoints configuration where the user can introduce values for the global configuration (1 channel), channel U, V and W and the ramp.
3. Power setpoints configuration where the user can introduce values for the global configuration (1 channel), channel U, V and W and the ramp.
4. Impedance setpoints configuration where the user can introduce values for the global configuration (1 channel), channel U, V and W and the ramp.
5. Pauses. It is necessary to add a *Sleep* in between rows. This will determinate the duration of the setpoints. When configuring the parts 1, 2, 3 and 4, it is also necessary to determinate the time that this row will last using this *Sleep Time*. When an *Add Step* or a *Modify Step* button is pressed, the *Sleep Time* will be added on the row. Please note that it is configured in milliseconds.

The minimum recommended value for a *Sleep* is 200ms.

The maximum and minimum values to be introduced in the parts **1**, **2**, **3** and **4** depend on the rated values of the equipment or the limits introduced by the user (chapter *4.6. Limits*).

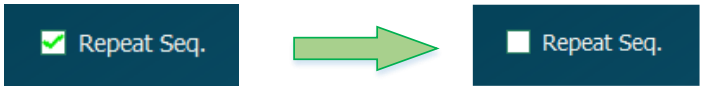
To add or modify a row of the sequence follow the steps:

- *Add Step*: press this button once the parameters are introduced and the values will appear the row in window **B**.
- *Modify Step*: if there is any row of windows **B** that the user needs to modify, double click directly to it in **B** and the values of that row will appear in the corresponding part of **A**. For example, if the user makes a double click in a row of **B** which is of power mode, the values of that row will appear in the part **A3**. Then, the values can be modified in **A3** and when the correct parameters are introduced press *Modify Step*. It will change the values of that selected row in **B** with the new parameters introduced in **A3**.

- **B:** This part shows all the rows that configure the sequence. It allows to operate with the rows, but no with the values of them. This window contains the following buttons:
  - *Move Row Up/Down*. Select a row and press these buttons to move a row up or down.
  - *Execute Sequence*. Once the sequence is ready, press this button and the converter will start the sequence.
  - *Open test*. Another way to create a sequence instead of using the interface is building it with an external programme and save it as a *CSV* file. This button

allows to open one of these files. The explanation of how to create this *CSV* file is in the manual of the equipment.

- *Clear test*. This button will erase all the rows to begin a new sequence.
- *Stop sequence*. When the sequence is running, and the user needs it to be stopped, this button will do it and the setpoints will remain in the row of the actual sequence.
- *Save test*. There is the possibility to save the created sequence. By pressing this button, the user will save the existent sequence in the B window in a *CSV* file in the desired location and name.
- *Delete row*. If the user requires to delete a row, click to it and press this button. It will disappear from the sequence.
- *Repeat test*. The sequence can be repeated by pressing the LED showed in the following figure:



When the LED is illuminated the sequence will start again when it arrives at the last row.

- *Time to Next Step*. This indicator will show how many seconds the actual row will last and start the next one.
- *Current Row*. This indicator will show the number of the actual row.

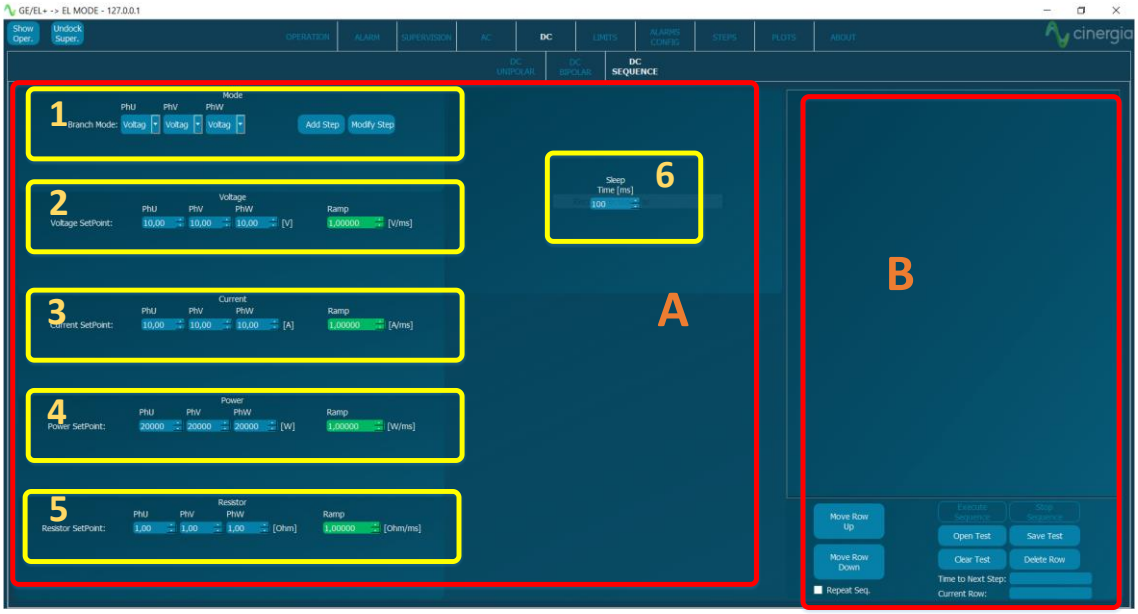
The resulting *.csv* file after saving the sequence can be modified in a program (such as Excel). The user can also create the sequence from the beginning. This file must follow this pattern and can be as long as the user desires:

Control mode	Sleep Time	Setpoint Global	Setpoint U	Setpoint V	Setpoint W	Ramp
Voltage	100	50	100	150	200	1
Current	1500	-10	5	10	15	0.01
Power	2000	60000	20000	-20000	3000	3
Impedance	3000	50	60	70	80	4

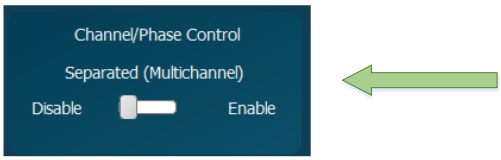
4.5.4. DC Sequence in multichannel or separated channel control

Equipment with multichannel or separated channel operation enabled can create another type of DC Sequence due to the more possibilities that the converter has.

Remember that multichannel or separated channel operation is an optional and has an additional cost.



To enable the multichannel or separated channel operation, go to the Operation tab and move the corresponding slider:



Enable/Disable Multichannel or Separated Phase Control

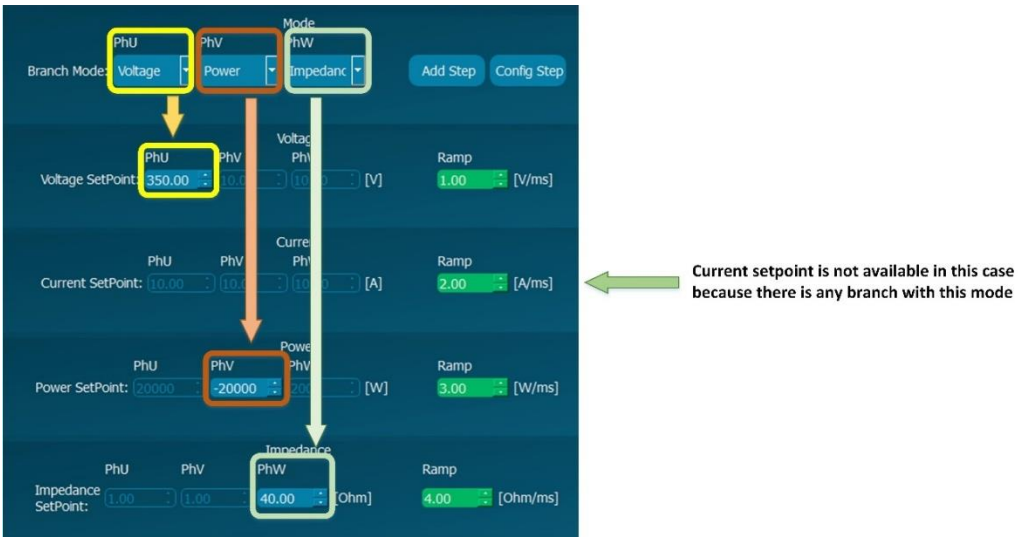
It is possible to configurate the outputs with different modes, but it is known that two voltage sources together in 1 channel are not compatible.

For more information about the multichannel or separated control branch, please read the chapter *0. Multichannel or separated Branch Control* of this manual

- **A:** Part of the subtab to introduce all the values that will conform the sequence. This can be multiple, which means that the equipment can be in voltage, current, power or impedance mode in the same sequence.

  The sequence is configured with rows and each row is one step of the sequence.

  1. Define the control mode of each branch and by selecting the modes, the corresponding parts of **2, 3**, **4** and **5** will be illuminated.
     As an example, the screenshot above has the branches configured as Voltage (phU), Power (phU) and Impedance (phW) and the setpoints must be introduced in the corresponding part:



This part also contains two buttons: *Add Step* and *Modify Step*. They are used to add or modify rows in the sequence.

2. Voltage setpoints configuration where the user can introduce values for the global configuration (1 channel), channel U, V and W and the ramp.
3. Current setpoints configuration where the user can introduce values for the global configuration (1 channel), channel U, V and W and the ramp.
4. Power setpoints configuration where the user can introduce values for the global configuration (1 channel), channel U, V and W and the ramp.
5. Impedance setpoints configuration where the user can introduce values for the global configuration (1 channel), channel U, V and W and the ramp.
6. Pauses. It is necessary to add a *Sleep* in between rows. This will determinate the duration of the setpoints. When configuring the parts 1, 2, 3 and 4, it is also necessary to determinate the time that this row will last using this *Sleep Time*. When an *Add Step* or a *Modify Step* button is pressed, the *Sleep Time* will be added on the row. Please note that it is configured in milliseconds.

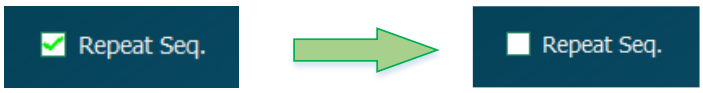
The minimum recommended value for a *Sleep* is 200ms.

The maximum and minimum values to be introduced in the parts **2**, **3**, **45** and **5** depend on the rated values of the equipment or the limits introduced by the user (chapter *4.6. Limits*).

To add or modify a row of the sequence follow the steps:

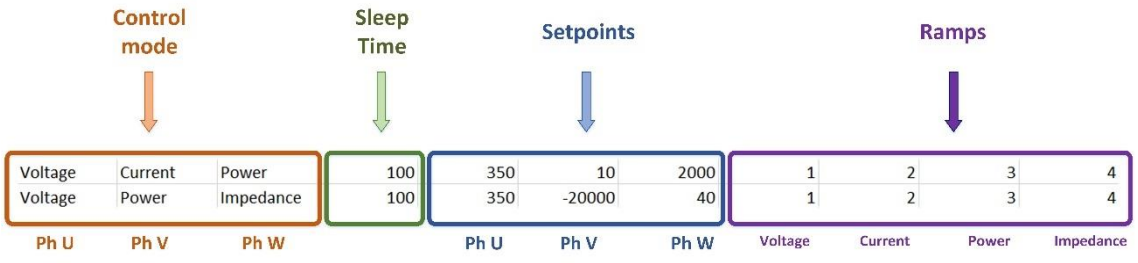
- *Add Step*: press this button once the parameters are introduced and the values will appear the row in window B.
- *Modify Step*: if there is any row of windows B that the user needs to modify, double click directly to it in B and the values of that row will appear in the corresponding part of A. For example, if the user makes a double click in a row of B which is of current mode, the values of that row will appear in the part A3. Then, the values can be modified in A3 and when the correct parameters are introduced press *Modify Step*. It will change the values of that selected row in B with the new parameters introduced in A3.

- **B:** This part shows all the rows that configure the sequence. It allows to operate with the rows, but no with the values of them. This window contains the following buttons:
  - *Move Row Up/Down*. Select a row and press these buttons to move a row up or down.
  - *Execute Sequence*. Once the sequence is ready, press this button and the converter will start the sequence.
  - *Open test*. Another way to create a sequence instead of using the interface is building it with an external programme and save it as a *CSV* file. This button allows to open one of these files. The explanation of how to create this *CSV* file is in the manual of the equipment.
  - *Clear test*. This button will erase all the rows to begin a new sequence.
  - *Stop sequence*. When the sequence is running, and the user needs it to be stopped, this button will do it and the setpoints will remain in the row of the actual sequence.
  - *Save test*. There is the possibility to save the created sequence. By pressing this button, the user will save the existent sequence in the B window in a *CSV* file in the desired location and name.
  - *Delete row*. If the user requires to delete a row, click to it and press this button. It will disappear from the sequence.
  - *Repeat test*. The sequence can be repeated by pressing the LED showed in the following figure:



    When the LED is illuminated the sequence will start again when it arrives at the last row.
  - *Time to Next Step*. This indicator will show how many seconds the actual row will last and start the next one.
  - *Current Row*. This indicator will show the number of the actual row.

The DC sequence with multichannel or separated channel operation is possible such as the sequence without multichannel explained in the chapter before. But there are differences between one *.csv* file and another. The pattern to follow when creating a *.csv* file with the multichannel or separated control branch is the following:



Please note that in the first row, for example, the impedance is not used, and it means that the ramp that affects this parameter makes no effect to this row (the “4” at the end of the row). Whereas in the second row, the current does not appear, so the value “2” of the ramp at the end of the row is not used.

4.5.5. Battery Test (OPTIONAL)

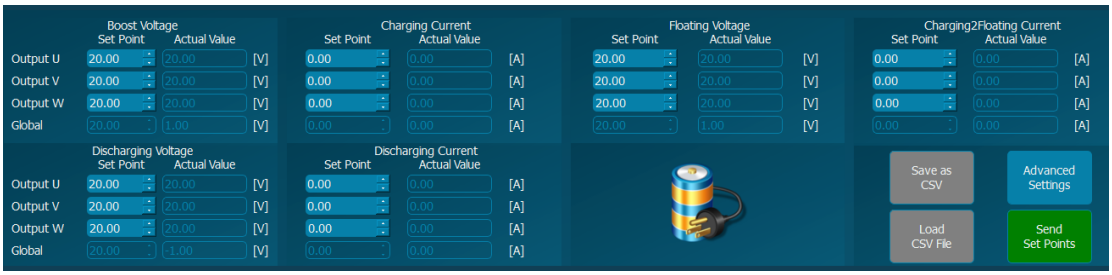
The equipment is prepared to charge and discharge batteries and create cycles to test them. The user must introduce the basic parameters (maximum and minimum voltage and current of the battery…) and the converter will start charging, discharging or both. Remember that it is possible to work with 3 independent power supplies (3 channels unipolar connection) or 1 power supply (1 channel unipolar connection).

Please, read the *PR0114A06 Battery test optional document* before using this mode. There are more Information.

To activate this optional, contact Cinergia to get the upgrade code (only in units with DC mode). Upgrading it has an additional cost.

Please be sure that the battery to be charged and discharged fills in the voltage and current limits of the Cinergia converter.

Before the *Run* of the Cinergia converter, all the parameters must be configured and sent to the converter, otherwise, the equipment will start with the default values. These default values are the ones represented in the following picture:



These parameters can be modified in any state of the equipment, even in *Run*. Be sure, before sending any parameter, that the EUT and the Cinergia converter will accept the changes.

Depending on the connection of the equipment (3 channels or 1 channel), the windows setpoints and parameters to be introduced will be frozen or not showing only the ones where the user can introduce values.

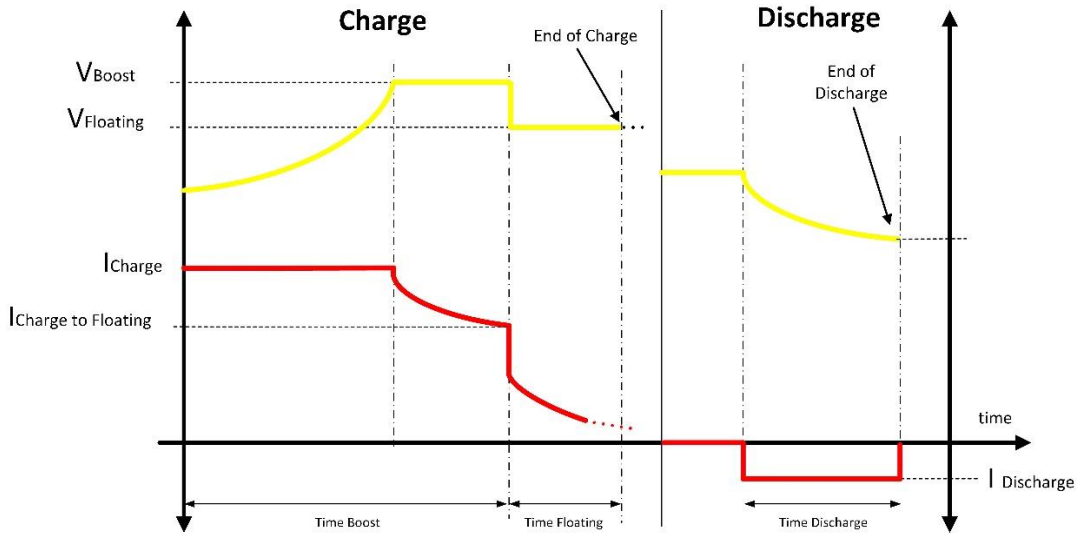
In this function mode, the power converter is working as a battery charger, so it charges, discharges, or applies cycles to any battery.

Please, read the *Battery test optional* document for more Information.

- **A:** Window where all the battery parameters can be introduced.
  1. *Boost Voltage*. Maximum voltage of the battery. The equipment will charge the battery until it reaches this voltage.
  2. *Charging Current*. Maximum accepted input current of the battery. The higher the current is, the faster will be charged the EUT, but be sure that this parameter is lower than the maximum current accepted of the battery.
  3. *Floating Voltage*. Once the battery has reached the boosting voltage (the maximum voltage), the converter will make the EUT to remain in the floating voltage which is lower than the *boost voltage*.
  4. *Charging to Floating Current*. To make the battery remain in the *floating voltage* some current must flow inside the it, otherwise it would lose voltage. Once this current reaches the introduced value, the equipment will start discharging the battery.
  5. *Discharging Voltage*. It is the minimum voltage where the converter will make the battery reach. A lower voltage than the one accepted for the EUT would make it irreversible damages in the battery.
  6. *Discharging Current*. The Cinergia equipment will discharge the battery until the *discharging voltage* with this current. It is the only parameter that must be negative. If the user introduces a value which is higher than the one accepted for the EUT, it would make irreversible damages in the battery.

Please be sure that all parameters are appropriate for the battery where the Cinergia converter is connected. For example, an over current or voltage can make irreversible damages to the EUT.

There is a figure in the part **B** that illustrates all that parts above mentioned:



7. *Control buttons*:

a. *Save to CSV*. All the introduced parameters above (from **1** to **6**) can be saved and named in a *.csv* file so it won't be necessary to remember and reintroduce the parameters of a test.

b. *Load CSV file*. To load the parameters saved before, press this button and look for the file in the computer. It is important that this file is saved in *.csv* format.

This csv file can be created using the interface with the button Save to CSV or with another program such as Excel, but it must have the following format:

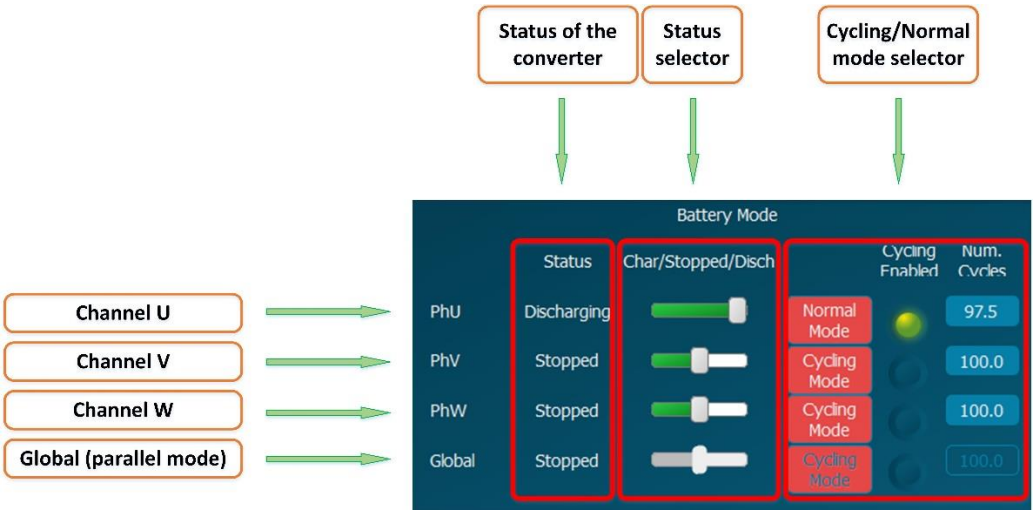
First Column	U	V	W	Global
Boost Voltage	110	110	110	10
Charging Current	20	20	20	0
Floating Voltage	109	109	109	9
Charging to Floating Current	8	8	8	0
Discharging Voltage	106	106	106	6
Discharging Current	-20	-20	-20	0
Boost Time	3600	600	600	600
Floating Time	5	0	0	0
Time Transition	5	0	0	0
Time Discharge	3600	600	600	600
Ah Stop Charge	1000	0	0	0
Ah Stop Discharge	-1000	1000	1000	1000

c. *Advanced Settings*. Apart from these basic settings described above, the converter can control the battery with some other parameters which make

the regulation of the EUT much more realistic. **For more information, please read the specific manual.**

d. *Send Set Points*. This button will introduce the parameters of the parts **1** to **6** inside the Cinergia equipment, but it won't start charging or discharging the equipment until it is in *Run* state.

- **B:** As it is explained before, this figure shows all the parameters of **A**.
- **C:** This window controls the status of the converter. The allowed status is *Charging*, *Discharging* and *Stopped*. The detail of this window is in the following image:



- *Status of the converter*. It is an indicator that shows the status in the actual moment.
- *Status selector*. The user must select the status by moving the slider right or left (right goes to discharge and left to charge. The slider in the middle means Stop). If the status is *Stopped*, the equipment won't start charging nor discharging. If the connected battery is discharged and the user select *Disch*, the Cinergia equipment will go to alarm state. It happens the same when the battery is charged and the user select to charge it.
- *Cycling selector*. In this part of the window, the user can enable the cycling mode of the equipment. If the cycling mode is selected, the corresponding LED is illuminated. To go back to normal mode, press again the red button *Normal Mode*.

  It is also possible to determinate the number of cycles that the equipment will make to the EUT. To introduce the number of cycle, write it directly in the blue space of this window and press *Intro*. Once all the cycles are completed, the equipment will stop automatically.

All these operations can be done for each channel as the figure shows. The first row is for the U channel, the second for the V, the third for the W and the last for the 1 channel mode (global).

- **D:** This window contains indicators of the voltage and current for each channel. It also has another parameter to be introduced in the converter: the amps per hour of the battery. This value must be negative and is the value that indicates the capacity of the battery. For example, if the battery has a capacity of 100Ah, it means that can deliver 10A during 10h or 1A during 100h and so on. To introduce this parameter, write it to the

corresponding blue window depending on the channel to be introduced and press intro in the keyboard.

To make the equipment work with a battery, the user must follow this order: with the equipment in *Ready* state, introduce and send all the parameters (from 1 to 6 described above and the send button of 7). Once the parameters are sent, *run* the Cinergia converter and it will start charging or discharging the battery depending on the selected mode chose in windows C (for each channel). If the selected mode is *Stop*, the converter will not start sending any current.

Please, read the Battery test optional document for more Information.

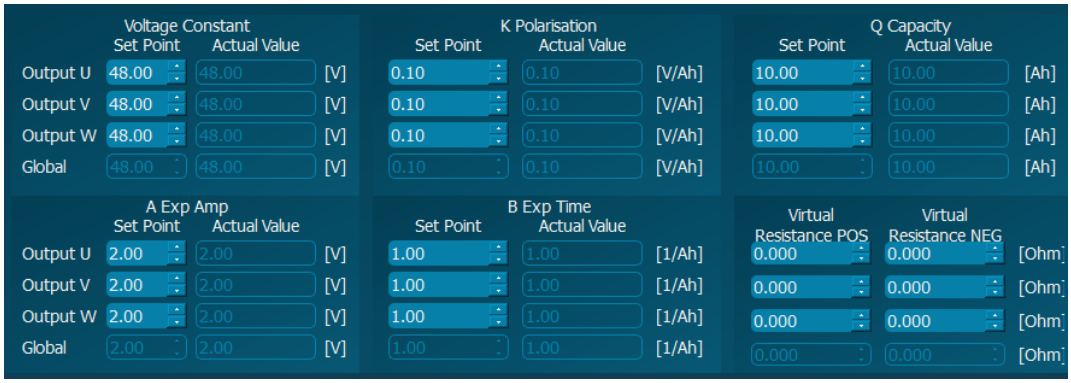
4.5.6. Battery emulator (OPTIONAL)

The equipment is prepared to emulate any kind of battery. Remember that it is possible to work with 3 independent power supplies (3 channels unipolar connection) or 1 power supply (1 channel unipolar connection).

Please, read the *PR0113A07 Battery Emulator optional document* before using this mode. There are more Information.

To activate this optional, contact Cinergia to get the upgrade code (only in units with DC mode). Upgrading it has an additional cost.

Before the *Run* of the Cinergia converter, all the parameters must be configured and sent to the converter, otherwise, the equipment will start with the default values. These default values are the ones represented in the following picture:

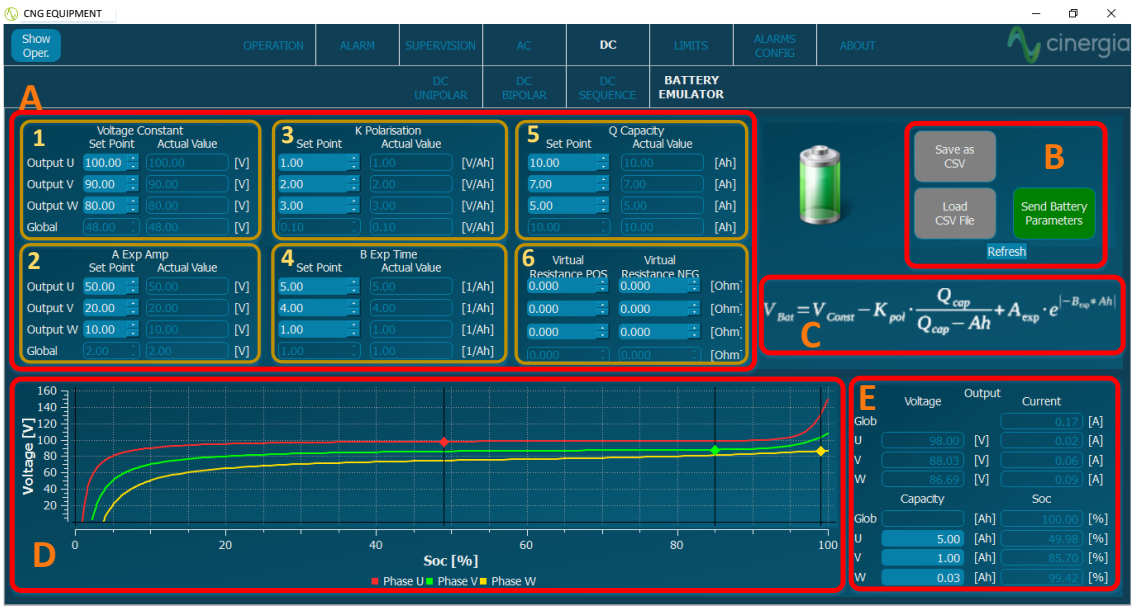


Please be sure that the battery to be emulated fills in the voltage and current limits of the Cinergia converter.

These parameters can be modified in any state of the equipment, even in *Run*. Be sure, before sending any parameter, that the EUT and the Cinergia converter will accept the changes.

Depending on the connection of the equipment (3 channels or 1 channel), the windows setpoints and parameters to be introduced will be frozen or not showing only the ones where the user can introduce values.

The following image details the parts of the interface with the parameters of the Battery with the corresponding description below:



A: In this part there are all the parameters to be introduced in the equipment that will describe its behaviour as a battery.

1. **Voltage Constant.** This voltage is normally given by the manufacturer of the battery. It is where the two exponentials are found in the graph, so it is, approximately, the voltage in the middle of the graph.
2. **A Exp Amp.** It is the voltage that will be increased from the *Voltage Constant* depending on the technology of the battery. If the *Ah* (explained in part E) is 0, which means that the battery is fully charged, the maximum voltage will be *Voltage Constant + A Exp Amp*. This parameter describes the slope of the right in the graph (the one that makes the voltage go to the maximum).
3. **K Polarisation.** This parameter describes the slope of the left (the one that makes the voltage go to 0).
4. **B Exp Time.** It describes how long will be the horizontal part of the line in the graph.

5. **Q Capacity.** Capacity of the battery in *Ah*.
6. **Virtual Resistance.** This resistance is also delivered by the manufacturer of the battery, and it is the parameter that sets the voltage drop depending on the current flowing through each channel. So, for example, if the voltage is 100V, the resistance is 1Ω and the current is 10A, the voltage drop will be of 10V, so the voltage in the output will be of 90V instead of 100V. When the current is positive, the virtual resistance that will affect is the positive one, whereas if the current is negative, the virtual resistance will be the negative.

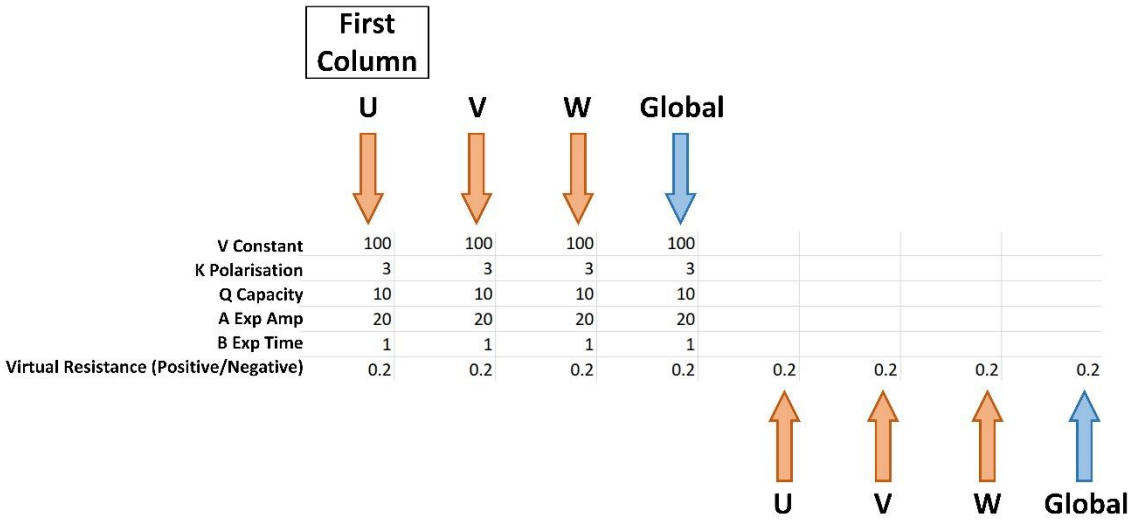
If these virtual resistance (*POS* and *NEG*) are 0, it can introduce resonances in the system.

From **1** to **5**, there are 2 columns: the first one is the set point to be introduced and the second is the actual value that the equipment has and is applying.

B: these 3 buttons are used to operate with the parameters described above:

- **Save as CSV:** all the parameters in **A** are saved in a csv file in the folder that the user selects.
- **Load CSV file:** to recover parameters from a csv file and introduce them to the converter, press this button and search the csv where the parameters are saved.
- **Refresh:** this button shows the current values on the Cinergia unit.
- **Send Battery Parameters:** it is always necessary to send the parameters. If the user loads a csv file and does not press this send button, the parameters will not be introduced to the converter. To know if the parameters are introduced properly, compare in **A** if the setpoints and the actual values are the same.

This csv file that can be saved and loaded can also be created by the user with a program such as Excel and loaded in the converter, but it must have the following structure:



This csv file can only contain numbers.

C: The formula that the equipment uses to calculate the output voltage is the following:

$$V_{Bat} = V_{const} - K_{pol} \cdot \frac{Q_{cap}}{Q_{cap} - Ah} + A_{exp} \cdot e^{(-B_{exp} \cdot Ah)}$$

D: The graph Voltage-SOC represents in real time the state of the battery for each channel. There is a point represented in each line that shows the exact point of the charge.

E: The output parameters show the values in the output of the converter such as voltage and current. The *SOC [%]* also shows in real time the state of the battery and it can be seen in the graph in **D**.
In this part there is also the *Capacity [Ah]* which can be modified online while the converter is in Run state. It will be useful to make a battery go to any part of the line and do not have to wait until it reaches the desired part. So, for example, if the capacity (*Q Capacity*) of the battery (introduced in part **A5**) is 10Ah and the user sets a *Capacity* of 5Ah in the **E** part, the *SOC* of the battery will go to 50%.

Please, read the *Battery emulator optional document* for more Information.

4.5.7. PV emulator (OPTIONAL)

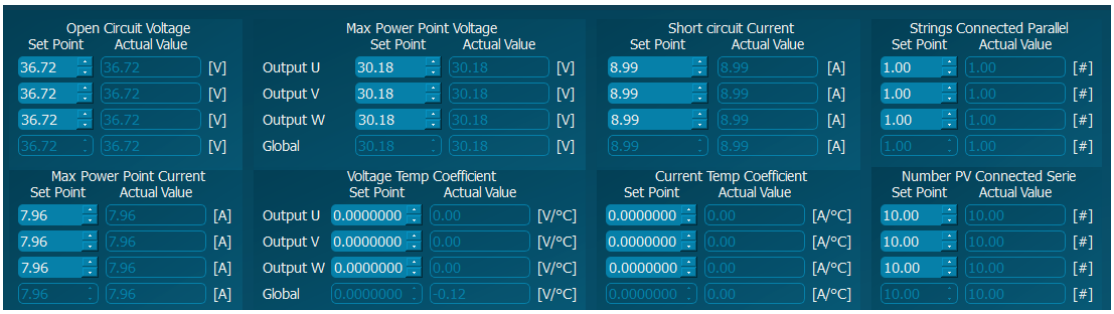
The equipment is prepared to work as a photovoltaic Solar panel. The user can also create a sequence with different setpoints of temperatures and radiation.

Please, read the *PR0118A06 PV emulator optional document* before using this mode. There are more Information.

To activate this optional, contact Cinergia to get the upgrade code (only in units with DC mode). Upgrading it has an additional cost.

Please be sure that the battery to be charged and discharged fills in the voltage and current limits of the Cinergia converter.

Before the *Run* of the Cinergia converter, all the parameters must be configured and sent to the converter, otherwise, the equipment will start with the default values. These default values are the ones represented in the following picture:



These parameters can be modified in any state of the equipment, even in *Run*. Be sure, before sending any parameter, that the EUT and the Cinergia converter will accept the changes.

Depending on the connection of the equipment (3 channels or 1 channel), the windows setpoints and parameters to be introduced will be frozen or not showing only the ones where the user can introduce values.

The following image details the parts of the interface with the parameters of the Battery with the corresponding description below:

A: In this part there are all the parameters to be introduced in the equipment that will describe its behaviour as a photovoltaic panel. All of them are normally given by the manufacturer.

7. **Open Circuit Voltage.** It is the output voltage of one panel when there is no voltage from the Equipment Under Test (EUT). If there are several panels in series, this voltage will be multiplied by the number of panels (configurable in **B**).
8. **Max Power Point Current.** It is the current that makes the maximum power. Please see example below the description of this tab.

9. **Max Power Point Voltage.** It is the voltage that makes the maximum power. Please see example below the description of this tab.
10. **Short Circuit Current.** Current that the converter will reach with voltage zero (short circuit).
11. **Voltage Temperature Coefficient.** Datasheet parameter. It is negative.
12. **Current Temperature Coefficient.** Datasheet parameter.

B: These two parameters are the multipliers because they simulate how many panels are in series or in parallel. So, the *Strings Connected Parallel* is the multiplier of the current and the *Number PV Connected Serie*.

C: Using these buttons, the user will save or load the parameters of **A** and **B**, making it easier to work with one standardized photovoltaic panel:

- **Save as CSV:** all the parameters in **A** and **B** are saved in a csv file in the folder that the user selects.
- **Load CSV file:** to recover parameters from a csv file and introduce them to the converter, press this button and search the csv where the parameters are saved.
- **Send PV Parameters:** it is always necessary to send the parameters. If the user loads a csv file and does not press this send button, the parameters will not be introduced to the converter. To know if the parameters are introduced properly, compare in **A** and **B** if the setpoints and the actual values are the same.
- **Runtime View:** this button shows a table where the user will be able to introduce the parameters to create an evolution simulation of temperature and radiation. **For more information, please read the specific manual.**
- **Refresh:** this button shows the current values on the Cinergia unit.

The csv file that can be saved and loaded can also be created by the user with a program such as Excel and loaded in the converter, but it must have the following structure:

First Column	U	V	W	Global
Open Circuit Voltage	36.72	36.72	36.72	36.72
Max Power Point Voltage	30.18	30.18	30.18	30.18
Short circuit Current	8.99	8.99	8.99	8.99
Max Power Point Current	5	7	8	7.96
Voltage Temperature Coefficient	0.01	0.02	0	0
Current Temperature Coefficient	0.004	0.005	0	0
Number PV Connected Serie	10	10	10	10
Strings Connected Parallel	1	2	2	1

This csv file can only contain numbers.

D: The curves display the behave of the photovoltaic panels of each channel showing which is the real-time point where the voltage-current is. Please note that these graphs are for a single panel and the multipliers explained in **B** are the responsible to adjust the calculations.

E: These output real-time values show the voltage and current, but also the *Temperature* and the *Irradiance*, which these two lasts are modifiable on-line.
The first column is for temperature and the second for irradiance, whereas the rows are for global (parallel mode), phase U, V and W and the last for the temperature and the irradiance standard.

Please, read the *PV emulator optional* document for more Information.

4.6. Limits AC and DC

The user can define the limits of the operation of the equipment in this tab. The converter has its own factory limits, but it is possible to introduce new ones.

The condition for these new limits is that they must be lower (in case of maximum limits) or higher (in case of minimum limits) than the factory ones, otherwise the equipment will introduce the factory limits.

Depending on the connection mode of the equipment (AC or DC), this tab will automatically change and the parameters that will appear will be the ones according to the mode.

4.6.1. AC Limits

- **A:** AC Limits: peak voltage minimum and maximum voltage and minimum and maximum current and power. The user can set the maximum and minimum limits for each phase. Once the limits are ready, press *Send Power Limits*. By pressing *Refresh Limits*, the converter will deliver the actual limit values.

If the user introduces limit values higher the accepted ones, the converter will set the maximum allowed values. By pressing *Refresh Limits*, the user will know which are the values of the converter in that moment.

1. Voltage peak limits. The user can set the maximum voltage peak allowed at the output for each phase.
2. Voltage limits. The user can set the maximum and minimum limits for each phase.
3. Current limits. The user can set the maximum and minimum limits for each phase. These current limits are used in current mode (positive and negative) and in power mode (positive but not negative).

The minimum and maximum upper and lower current limits are, respectively, 1A and -1A

4. Power limits. The user can set the maximum and minimum limits for each phase.
5. Set the limits for the frequency parameters: Cutoff frequency to configure the Bandwidth of the resonator control; Max VFreq curve; and the maximum and minimum frequency allowed all these parameters are applied for all phases.
6. Once the limits are ready, press *Send AC Limits*. When the user presses *Refresh Limits*, the converter will return the actual limit values. This last button is useful to realise if the introduced limits are higher that the allowed ones.

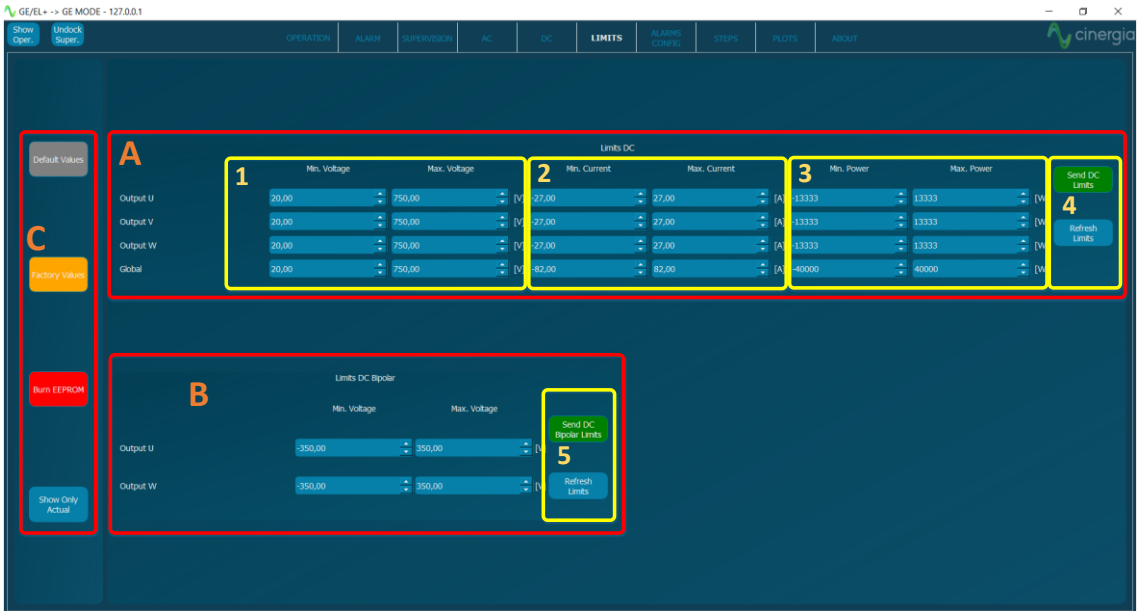
If the equipment is in RUN mode with a value that is outside the range of the new introduced limits, it will change the actual setpoint. For example, if the converter is in current mode with a value of 20A and the user introduces (and sends) a limit of 15A, the equipment will go to 15A and remain there. If the limit is only introduced in one channel, it is going to be that channel the one which go to that limit.

- **B:** These buttons allow the user to operate with the values of the limits.
  - *Default Values.* The user can define default values that will remember the equipment as long as it is switched on and lower than the *Factory Values*.
  - *Factory Values.* The equipment has its own factory values depending on the rated power. This button will make these parameters appear in the visible windows.
  - *Burn EEPROM.* To save the sent values to the equipment and make it remember them even it is switched off, the EEPROM can be burnt. This step requires a password.
  - *All Visible.* This button unfreeze all the windows so that the user can set the *Default Values*. Remember that the limits are not introduced to the equipment until *Send Limits* buttons of each window (A and B) are pressed.

When the converter is switched off and on again, these limits will be erased and substituted for the factory ones. It is possible to save limits in the equipment in the EEPROM memory, but an Advanced User Password is required

Please, read the *PR105A07_Human Machine Interface Advanced User document* before using this mode. There are more Information.

4.6.2. DC Limits



The interface will freeze or unfreeze (illuminate) the available parts where the user can introduce the parameters depending on the connection mode (1 channel or 3 channel).

- **A: UNIPOLAR SECTION LIMITS:** Voltage, current and Power limits.
  1. Voltage limits. The user can set the maximum and minimum limits for each phase (3 channels connection) or for the global (1 channel connection). Please note that the maximum voltage is the same if the equipment is in 1 channel or 3 channels.
  2. Current limits. The user can set the maximum and minimum limits for each phase (3 channels connection) or for the global (1 channel connection). The current in 1 channel mode is 3 times the current for each channel in 3 channels connection.

     The minimum and maximum upper and lower current limits are, respectively, 1A and -1A

  3. Power limits. The user can set the maximum and minimum limits for each phase (3 channels connection) or for the global (1 channel connection). The power in 1 channel mode is 3 times the power for each channel in 3 channels connection.
  4. Send and refresh button for this section parameters.
     Each part (**A** and **B**) has two different buttons explained in the following lines. It is important that, for example, voltage unipolar limits must be sent, the buttons to use are the ones in the **A** part.
     a. *Send DC Limits*. Once all the limits are introduced in the corresponding part, press this button and the parameters will be sent to the converter.
     b. *Refresh Limits*. This button will show the limits values that are in the converter in that moment.

- **B: BIPOLAR SECTION LIMITS**. This part of the tab will be illuminated when the equipment is in bipolar connection. The maximum voltage in unipolar is 750V whereas

that in bipolar is ±350V. This is the reason that bipolar connection is required a new part to send voltage limits (current and power limits are the same than in unipolar). The user can introduce new voltage limits as long as they are lower, in case of maximum limits, or higher, in case of minimum limits, than the factory one.

5. Send and refresh button for this section parameters.
   Each part (**A** and **B**) has two different buttons explained in the following lines. It is important that, for example, voltage bipolar limits must be sent, the buttons to use are the ones in the **B** part.
   a. *Send DC Limits*. Once all the limits are introduced in the corresponding part, press this button and the parameters will be sent to the converter.
   b. *Refresh Limits*. This button will show the limits values that are in the converter in that moment.

If the equipment is in RUN mode with a value that is outside the new introduced limits, it will change the actual setpoint. For example, if the converter is in voltage mode with a value of 500V and the user introduces (and sends) a limit of 300V, the equipment will go to 300V and remain there. If the limit is only introduced in one channel, it is going to be that channel the one which go to that limit.

- **C:** These buttons allow the user to operate with the values of the limits.
  - *Default Values.* The user can define default values that will remember the equipment as long as it is switched on and lower than the *Factory Values*.
  - *All Visible.* This button unfreezes all the windows so that the user can set the *Default Values*. Remember that the limits are not introduced to the equipment until *Send Limits* buttons on each window (A, B and C) are pressed.
  - *Factory Values.* The equipment has its own factory values depending on the rated power. This button will make these parameters appear in the visible windows.
  - *Burn EEPROM.* To save the sent values to the equipment and make it remember them even it is switched off, the EEPROM can be burnt. This step requires a password.

When the converter is switched off and on again, these limits will be erased and substituted for the factory ones. It is possible to save limits in the equipment in the EEPROM memory, but an Advanced User Password is required

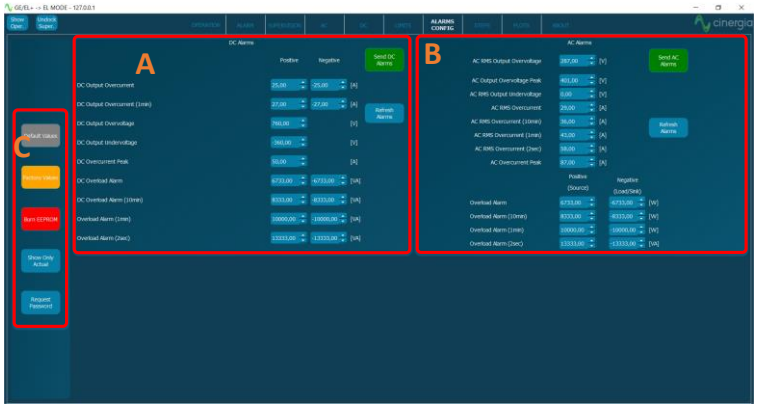
Please, read the *PR105A07_Human Machine Interface Advanced User document* before using this mode. There are more Information.

4.7. Alarms Tab Configuration

This tab sets the alarms of the equipment. The difference between *Limit* and *Alarm* is that the equipment can work during a certain time above the limits, but if there is some value that goes further than the alarm parameter, the equipment will go to alarm status.
Please, **take into account that the Alarms for the AC and DC mode**s are completely different, even the power or current parameters. The user must confirm all this values before operating with the unit.

Depending on the connection mode of the equipment (AC or DC), this tab will automatically change and the parameters that will appear will be the ones according to the mode.

The minimum and maximum upper and lower current alarms are, respectively, 2A and -2A



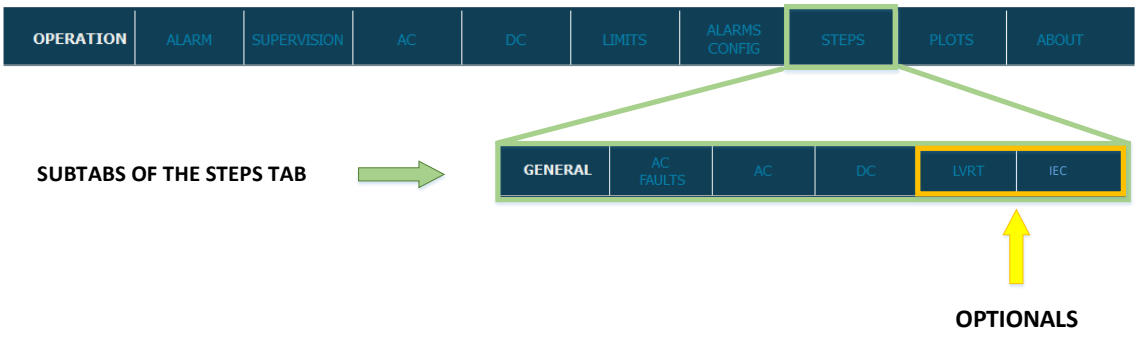
- **A: DC Alarms section.** The user can configure all the DC alarms of the converter. Note that the alarms are for all phases at the same time. Set the DC alarms and once the values are ready press *Send DC Alarms* button. If the user presses *Refresh Alarms*, the parameters that the converter has in that moment will appear in the window.
- **B: AC Alarms section.** The user can configure all the AC alarms of the converter. Note that the alarms are for all phases at the same time. Set the DC alarms and once the values are ready press *Send AC Alarms* button. If the user presses *Refresh Alarms*, the parameters that the converter has in that moment will appear in the window.
- **C:** These buttons allow the user to operate with the values of the limits.
  - *Default Values.* The user can define default values that will remember the equipment as long as it is switched on and lower than the *Factory Values*.
  - *Factory Values.* The equipment has its own factory values depending on the rated power. This button will make these parameters appear in the visible windows.
  - *Burn EEPROM.* To save the sent values to the equipment and make it remember them even it is switched off, the EEPROM can be burnt. This step requires a password.
  - *Ask Password.* A popup message will appear asking the Advanced User Password. This allows to burn EEPROM with the parameters send it.

Please, read the *PR105A07_Human Machine Interface Advanced User document* before using this mode. There are more Information.

4.8. STEPS Tab Operation

This tab provides to the user running some automatic tests after performed with the CINERGIA interface provided with the unit. Once the test is defined and implemented, the user can upload it to the unit and execute it. A deterministic behaviour is guaranteed.

This tab contains all the subtabs concerning the STEPS will need and some predefined tests LVRT and IEC (Optional).



Before analysing in detail this functionality, let us define what a "STEP" is:

STEP is an input which charges three configurable parameters in a specific time (as long as it has been previously ACTIVATED). It is necessary to activate the desired step previous its execution. As the Step File is fully sent to the unit, the step guarantees a deterministic behaviour.

CINERGIA's equipment can execute a group of Steps whose information is stored in a specific CSV format file, with a limited number of **40 steps** per file or test. If the user creates a CSV steps file with more than 40 steps, the unit will not report any alarm, but the full test will not be performed by the unit. Some malfunction could appear.

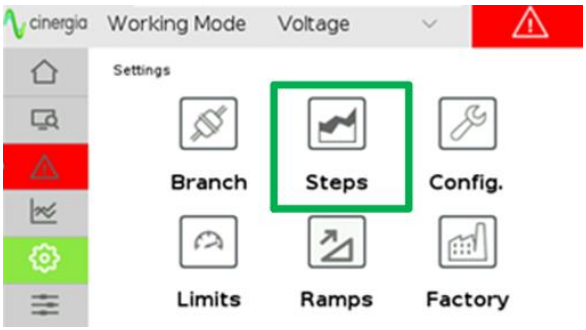
The maximum number of STEPS per execution test or file is 40.

CINERGIA's equipment can also save multiple files, therefore, their information is not lost after the unit shuts down.

A group of files can be saved (upload to) in the unit, but only ONE can be activated at a time. The user need to active which test would want to execute.

The user can access to this functionality via STEPS tab on Cinergia Interface:

But it is also possible to access to STEPS functionality using the LCD touchscreen: CONFIG> Steps, as it can be seen in the following image.



The creation of the STEPS files is ONLY allowed using the CINERGIA's Interface. Through the LCD, the user can operate it and controlling its execution.

4.8.1. Activating and Controlling the STEPS by LCD

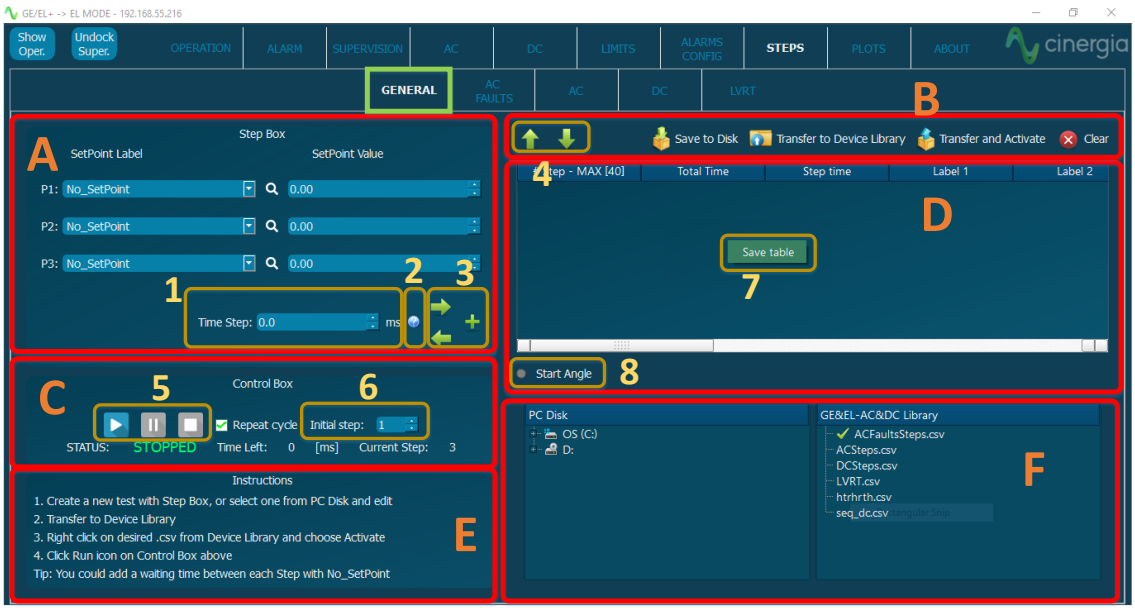
As mentioned before, using the LCD, the user is not ALLOWED to create or modify any step files. Using the LCD, the user can activate and execute any of the files previous uploaded to the unit.

Please, read the *PR100A02_Local Touchscreen+ Manual* for more information about this Step operation.

4.8.2. Activating and Controlling the STEPS by Interface

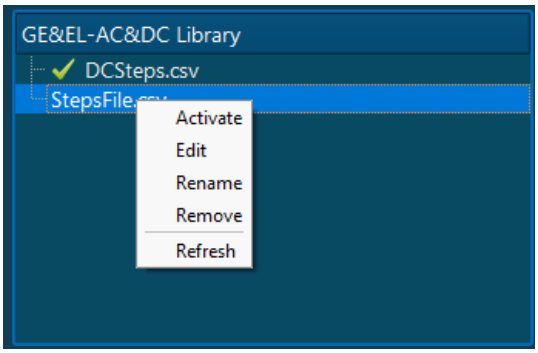
In this section, we are showing how to proceed to activate and execute any step file with the Interface provided by CINERGIA. In this case, the user should go to the STEPS tab and remain in the GENERAL subtab.

Please, go to chapter *4.8.8 GENERAL subtab* for more information of this *GENERAL subtab*.



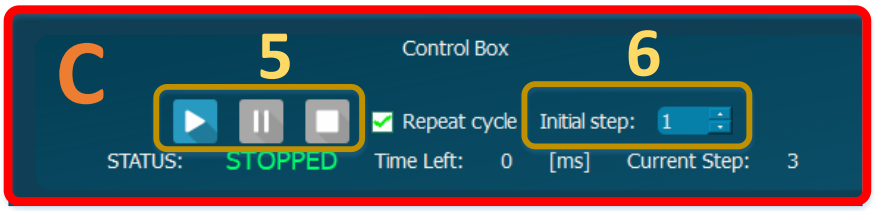
To Activate steps test, the user must go to **section D** on the previous image, go to the UNIT Library (right side), where contains all the step files that are saved in the unit. One of these must be selected by right-clicking on it and choosing "Activate" option.

Right-Click on one of the listed files from the unit Library and choose "Activate" to activate the steps. The file can be Removed, Refreshed and Renamed by using this similar methodology.



Take into account, when the information of the activated steps file is changed or updated on the interface by the user, this modified file must be upload and re-activated to notify the unit of all the changes.

Once a steps file is activated, the user can control the execution via the Control Box located on **section C** of the previous General subtab picture. On this part of the subtab, the user can:



- **C: Control Box**. The user can control the execution of the activated step file.
  - *5.* ***Control buttons****.* The user can **Run**, **Pause** or **Stop** the activated step file.
  - *6.* ***Initial Steps***. The user can configure the first step to execute from the entire test file.
  - *Other parts*:
    - *Status. The unit is informing the status of the steps test: Stopped, Paused, Init, Running.*
    - *Time Left.* It is the remaining time for the steps to be finished
    - *Current step.* It indicates which step is being executed.
    - *Repeat Cycle.* Checkbox that indicates what to do once the execution has finished: stopped or repeat the same test file.

4.8.3. Creating a new STEPS file

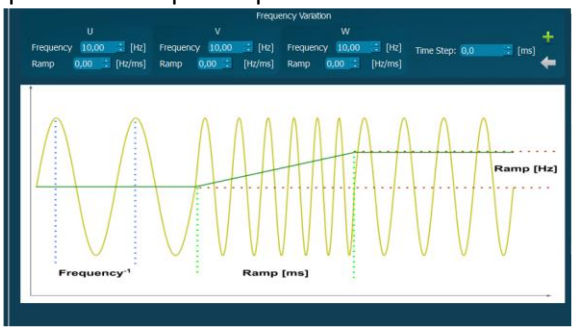
Once learnt how to control and activate steps, it is time to create new Steps file. To do that it is recommended to start playing with the specific subtab *AC Faults* subtab.

4.8.4. AC faults subtab

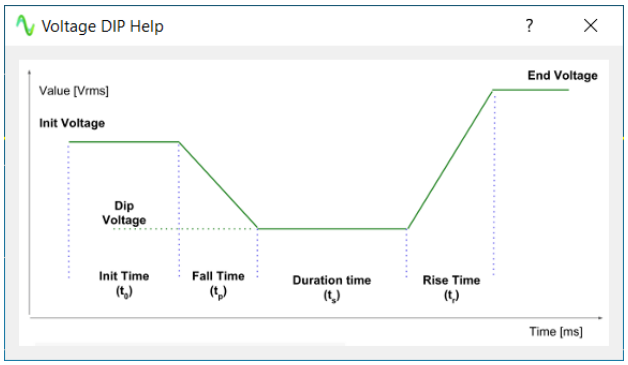
Once the user enters the AC Faults subtab (in the STEPS tab), a similar page to the following one is shown. On this subtab the user can create different types of predefined AC Faults such as Voltage Dip, Frequency Variation and Flicker.

For further information about any parameter please click on button (B.1), or Right-Click the Plot (section B).

- **A: Define the AC fault to configure.** The user can create three different kind of AC faults predefined by the interface as user friendly. The user needs to choose the desire AC fault to configure and execute.
- **B: Graphical and data configuration per each AC fault defined.** Depends on the AC fault selected different data configuration will appear. The user can configure all the parameters to reproduce the desired AC fault to execute on.
  - **Voltage Dip, Frequency Variation and Flicker** are the predefined options that the user can implement. Each option has its specific parameters.



  - *1. Information mark.* The user can press this button to obtain more information about any parameter of each AC fault. Pressing the information mark this pop-up will appear.



- *2. Moving elements.*
  - button: Add the configured values to the table.
  - button: Recovering the information from the table to the Graphical and data configuration. The user can replace the current values with the table ones.

- **C: Transferring information.** On this part of the subtab, the user can upload and activate the new steps file to the unit.
  - *Multifaults? Checkbox*. The user can configure two AC faults consecutives on the same steps file if this checkbox is checked. Once it is checked, a *Pause time* appears to add time between faults.

  - *Save to disk*. Save the current table on the local PC where the Cineina interface is executing.
  - *Transfer and Activate.* Loads and activates the current table to the unit.
  - *Edit from Device.* The Step file related on this subtab (in this case *ACFaultsSteps*.csv), is downloaded to the PC on the table subtab and the user can modified it. Once the file is modified, the user must Transfer to the unit again to update.
  - *Clear.* The current table will be erased from the Steps file information. The steps file remains to the unit if the user uploaded on a time.
- **D: Steps file information**. Once the user is configuring some steps, using the ADD button, all the information will appear on this table.
- **E: Control Box**. The user can control the execution of the activated step file.
  - ***Control buttons***. The user can **Run**, **Pause** or **Stop** the activated step file.
  - ***Initial Steps***. The user can configure the first step to execute from the entire test file.
  - *Other parts*:
    - *Status. The unit is informing the status of the steps test: Stopped, Paused, Init, Running.*
    - *Time Left.* It is the remaining time for the steps to be finished
    - *Current step.* It indicates which step is being executed.
    - *Repeat Cycle.* Checkbox that indicates what to do once the execution has finished: stopped or repeat the same test file.

4.8.4.1. Working and example of usage

In this section the workflow of the execution of an AC Fault test is explained. It is valid for all of them because they have the same options. For this manual, the explanation would be with the Voltage Dip.

If the user want to run any of these tests, the user must follow the **next 5 STEPS** defined below:

STEP 1: All this predefined test requires that the unit must be in **Run** mode. Otherwise, the step will not be executed. The user must choose the desired test **(section A).**

STEP 2: Configuration of the AC fault to execute. Once the user has configured correctly the values corresponding to the desired behaviour (**Section B**), it is time to add the values to the table by clicking the + button present on **section B**.

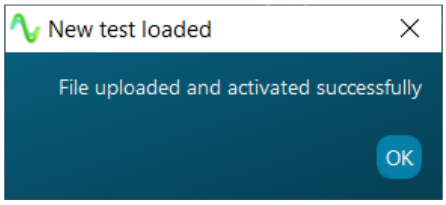
If the user accidentally changes the values of the section B but wants to recover the information given by the table, he can press the ← button to replace the current values with the table ones.

To configure two AC Faults at the same time, the *Multifaults?* checkbox must be checked (which is located in the C section) and then the + button must be pressed again.

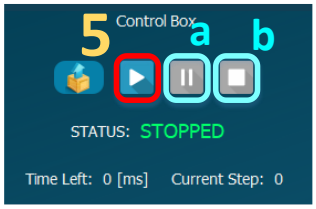
Without *Multifaults?* checked, the functionality of + button is to replace the information of the table with a new one.

STEP 3: Load and **activate** the steps file **(section C)**. Once filled the table **(section D),** the user can upload the steps file to the unit by clicking *Transfer & Activate* icon and waiting until a pop-up appears with a satisfactory image.

STEP 4: Waiting for the confirmation of the unit. It will not be fully uploaded until the dialog "*New test loaded*" of success appears on the interface, as following:



STEP 5: **Run** the loaded sequence through Control Box (**section E**). You can do it with the "**Play**" button next to the Load and Activate sequence. You will see that some elements will have changed. Also you can take two actions in this state:



a. **Pause** the sequence: This will reestablish the sequence to the base values (those specified in "Frequency" and "Nominal", on the left of Send Manual Values). Once there, you can Play the sequence to restart from the point that was

paused, or you can stop it, so it will end there and values will be also restored to the “Frequency” and “Nominal”.

b. **Stop** the sequence. This stops the test and also restores the values to the specified in “Frequency” and “Nominal”.

The STEP 5 can be done also on the GENERAL subtab, activating the ACFaultsSteps.csv steps file, and executing using the Control Box of this subtab.

It is important to know the capabilities of the equipment in order to understand why some input setpoints are enabled (working) or disabled (not working).

Please get in mind that, in case of not changing the name of the transferred file, ACFaultsSteps.csv will be replaced with the new file (which has got the same name) once clicked “Transfer & Activate” button of AC Faults page.

It is possible to add a Frequency Variation or Flicker effect after the Voltage Dip, just by configuring it in each option, and Adding it to the table when *Multifaults?* is checked.

Please remember to add the values to the table and transfer it clicking “Transfer & Activate” icon if you want to activate the steps file.

Ask Cinergia for example file steps to use on your unit.

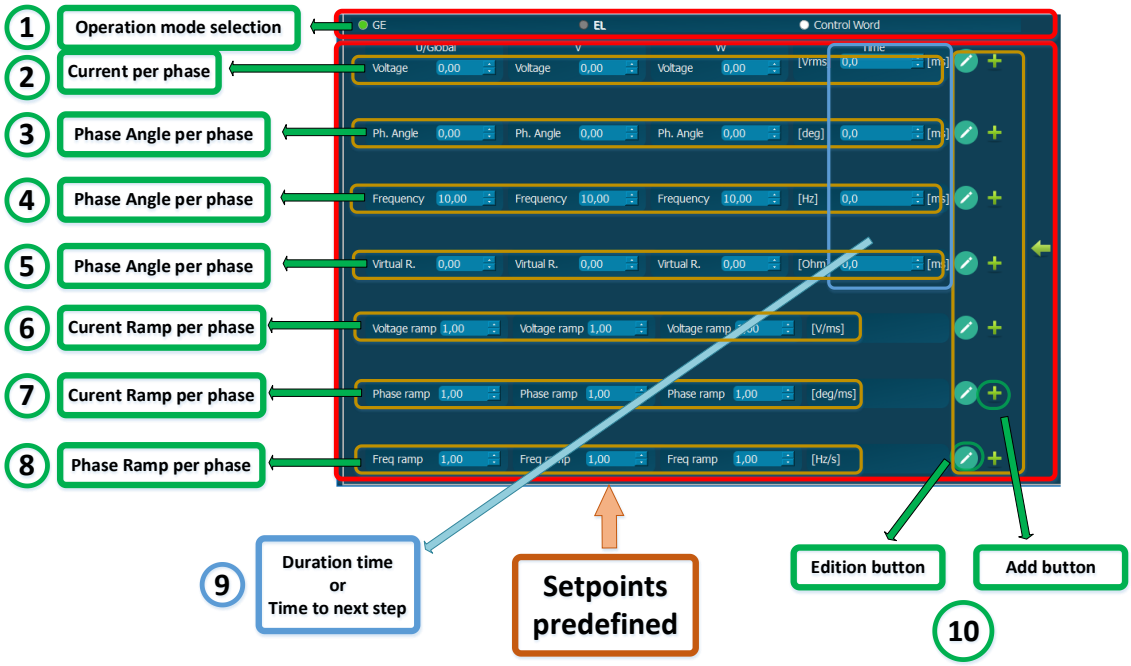
4.8.5. AC subtab

The functionality of AC subtab is basically the same as DC subtab; the only difference is in the setpoints values. The Cinergia interface has create these two subtabs to help the user to create any sequence in AC and DC operation mode. On this subtab the user will find the setpoint to use.

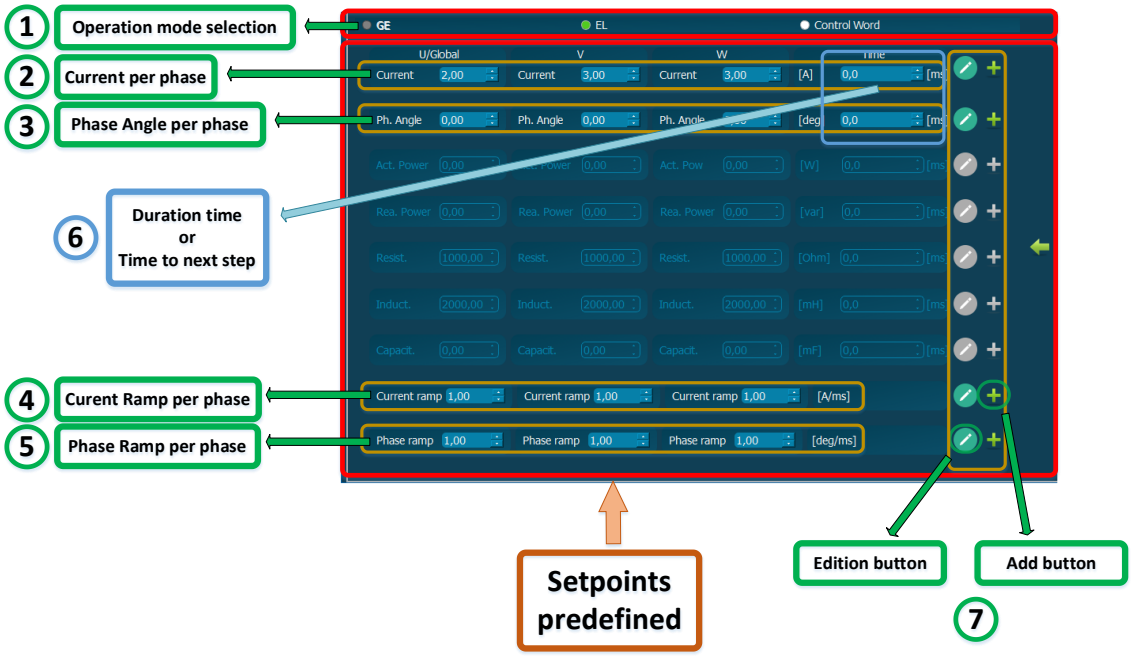
Let´s have a look at the parts of the AC steps subtab and see how we can create a table, transfer it to the unit and activate it.

Take into account that the section C, D and E are the same as mentioned on the AC Faults subtab.

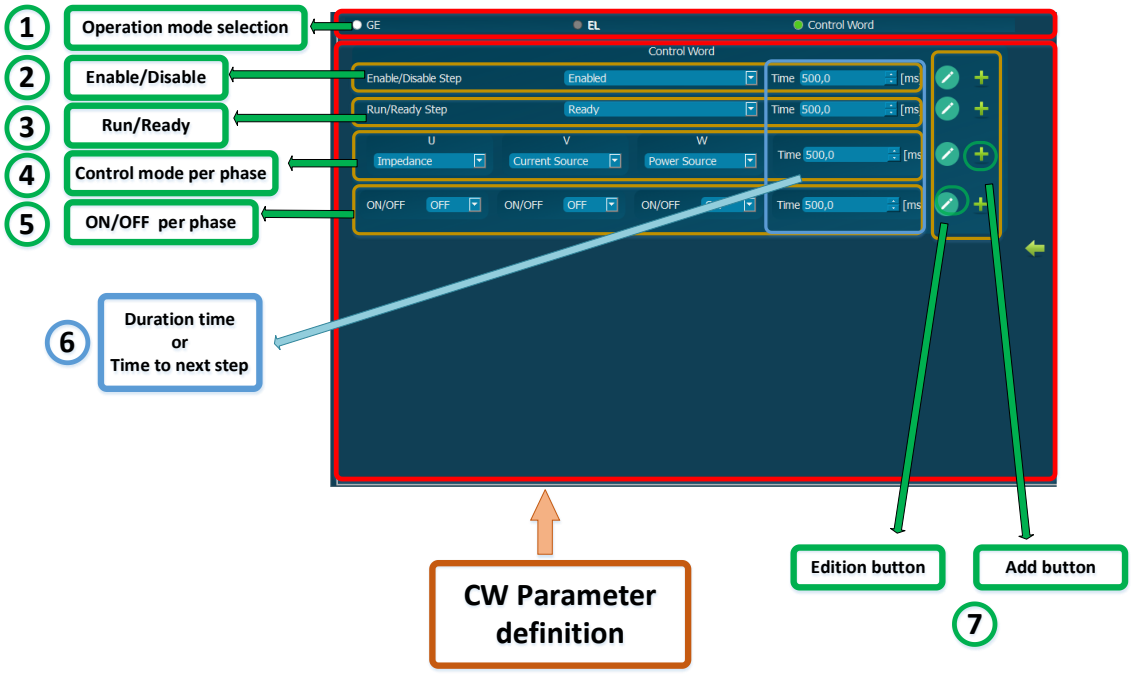
- **A: Define the operation mode.** The user can create three different kind of AC predefined steps using the interface more user friendly. The user needs to choose the desire AC depends on the unit to use.
  - **GE mode:** once this option is marked, on the Section B all the required parameter to configure the output from a GE will appear
  - **EL mode:** once this option is marked, on the Section B all the required parameter to configure the output from a EL will appear
  - **Control Word**: on this option, the user can control the unit, enabling, running and stopping using any CW parameters.
- **B: Data configuration parameter per each AC option.** Depends on the AC mode selected different configuration parameter will appear. The user can configure all the parameters to reproduce the desired AC output and execute on it.
  - **GE mode:** the user can configure the voltage, phase angle, frequency, virtual resistor, ... and time to apply it.



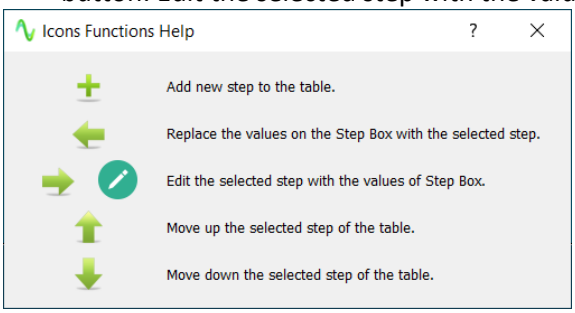
- **EL mode:** the user can configure the current, phase angle and ramps and time to apply it.



- **Control Word:** are the predefined options



- *1 and 2. Moving elements.*
  - button: Add the configured values to the table.
  - button: Recovering the information from the table to the Graphical and data configuration. The user can replace the current values with the table ones.
  - button: Edit the selected step with the values of the Step Box.



- **C: Transferring information.** On this part of the subtab, the user can upload and activate the new steps file to the unit.
  - *Moving elements*. Move up or Down the selected step.
  - *Save to disk*. Save the current table on the local PC where the Cineina interface is executing.
  - *Transfer and Activate.* Loads and activates the current table to the unit.
  - *Edit from Device.* The Step file related on this subtab (in this case *ACSteps.csv*), is downloaded to the PC on the table subtab and the user can modified it. Once the file is modified, the user must Transfer to the unit again to update.
  - *Clear.* The current table will be erased from the Steps file information. The steps file remains to the unit if the user uploaded on a time.
- **D: Steps file information**. Once the user is configuring some steps, using the ADD button, all the information will appear on this table.
- **E: Control Box**. The user can control the execution of the activated step file.

- ***Control buttons***. The user can **Run**, **Pause** or **Stop** the activated step file.
- ***Initial Steps***. The user can configure the first step to execute from the entire test file.
- *Other parts*:
  - *Status. The unit is informing the status of the steps test: Stopped, Paused, Init, Running.*
  - *Time Left.* It is the remaining time for the steps to be finished
  - *Current step.* It indicates which step is being executed.
  - *Repeat Cycle.* Checkbox that indicates what to do once the execution has finished: stopped or repeat the same test file.

4.8.5.1. Working and example of usage

In this section the workflow of the execution of an AC test is explained. It is valid for all of them because they have the same options. For this manual, the explanation would be with the EL_AC selected mode.

If the user want to run any of these tests, the user must follow the **next 5 STEPS** defined below:

STEP 1: As on this mode the user can operate the unit it is not necessary that the unit is in RUN. Otherwise, if the test is only using setpoints, the unit must be in RUN to reproduce it. The user must choose the desired test to perform depend on the unit used **(section A).**

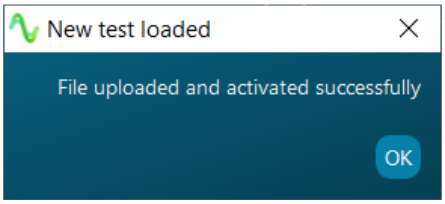
STEP 2: Configuration of the AC to execute. Once the user has configured correctly the values corresponding to the desired behaviour (**Section B**), it is time to add the values to the table by clicking the + button present on **section B**. The user can construct the table with flexibility, always according to the options that the unit permits. For example, in this case of using a EL, the GE option is disabled because CINEINA is connected to an EL device. In addition, only Current setpoints are enabled because the unit is working in Current mode.

The user can replace one specific step from the table with another one, just by selecting the row which wants to replace, and clicking the button.

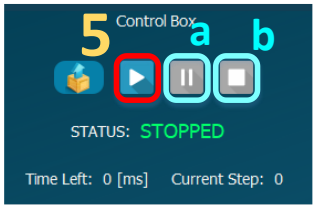
Finally, to know which is the setpoint corresponding to a specific row from the table, it is necessary just to Double-Click on the row in question or selecting the row and pressing the button. At this point, the corresponding Setpoint from the table will be shown on the corresponding setpoint from the **B section** table.

STEP 3: Load and **activate** the steps file **(section C)**. Once filled the table **(section D),** the user can upload the steps file to the unit by clicking *Transfer & Activate* icon and waiting until a pop-up appears with a satisfactory image.

STEP 4: Waiting for the confirmation of the unit. It will not be fully uploaded until the dialog "*New test loaded*" of success appears on the interface, as following:



STEP 5: **Run** the loaded sequence through Control Box (**section E**). You can do it with the "**Play**" button next to the Load and Activate sequence. You will see that some elements will have changed. Also, you can take two actions in this state:



a. **Pause** the sequence: This will reestablish the sequence to the base values (those specified in "Frequency" and "Nominal", on the left of Send Manual Values). Once there, you can Play the sequence to restart from the point that was paused, or you can stop it, so it will end there and values will be also restored to the "Frequency" and "Nominal".

b. **Stop** the sequence. This stops the test and also restores the values to the specified in "Frequency" and "Nominal".

The STEP 5 can be done also on the GENERAL subtab, activating the *ACSteps.csv* steps file, and executing using the Control Box of this subtab.

It is important to know the capabilities of the equipment in order to understand why some input setpoints are enabled (working) or disabled (not working).

Please get in mind that, in case of not changing the name of the transferred file, ACSteps.csv will be replaced with the new file (which has got the same name) once clicked "Transfer & Activate" button of AC subtab.

Please remember to add the values to the table and transfer it clicking "Transfer & Activate" icon if you want to activate the steps file.

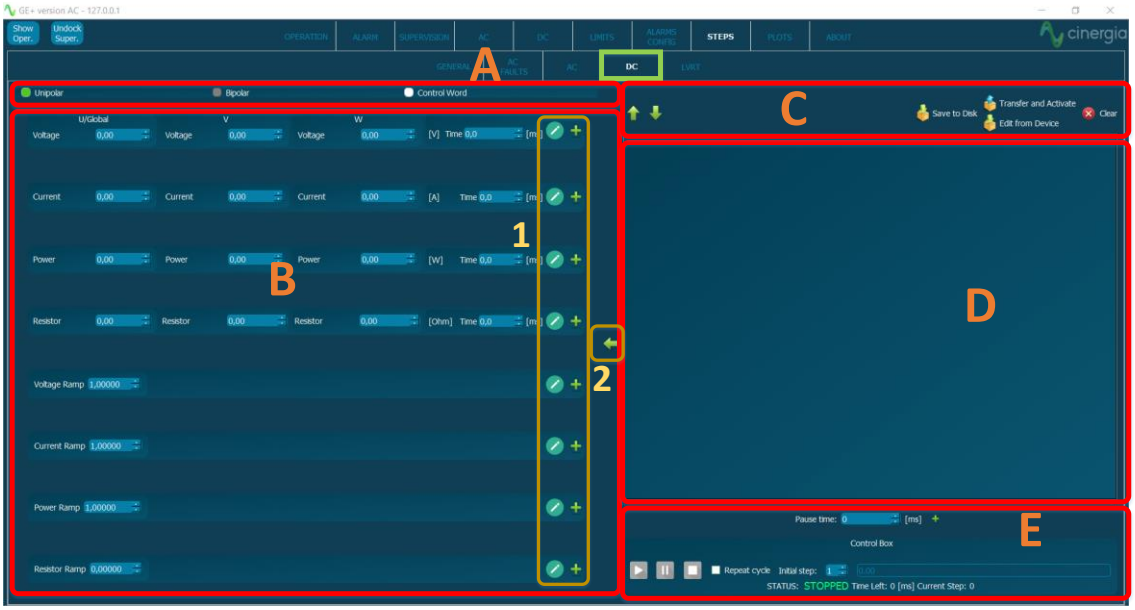
Ask Cinergia for example file steps to use on your unit.

4.8.6. DC subtab

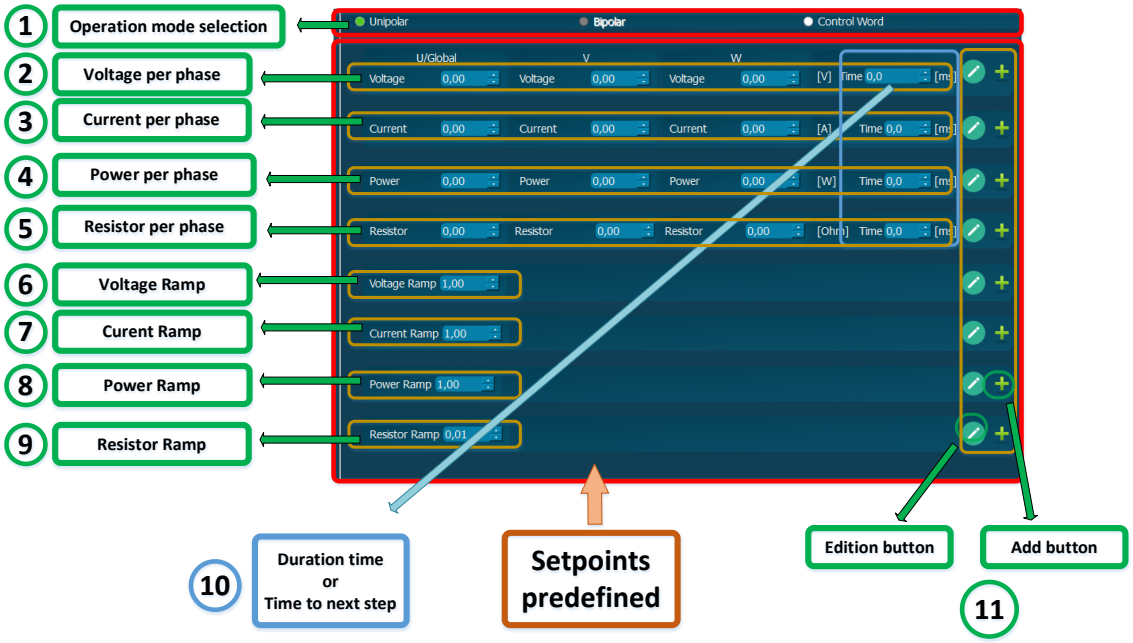
The functionality of DC subtab is basically the same as AC subtab; the only difference is in the setpoints values. The Cinergia interface has create these two subtabs to help the user to create any sequence in AC and DC operation mode. On this subtab the user will find the setpoint to use.

Let´s have a look at the parts of the DC steps subtab and see how we can create a table, transfer it to the unit and activate it.

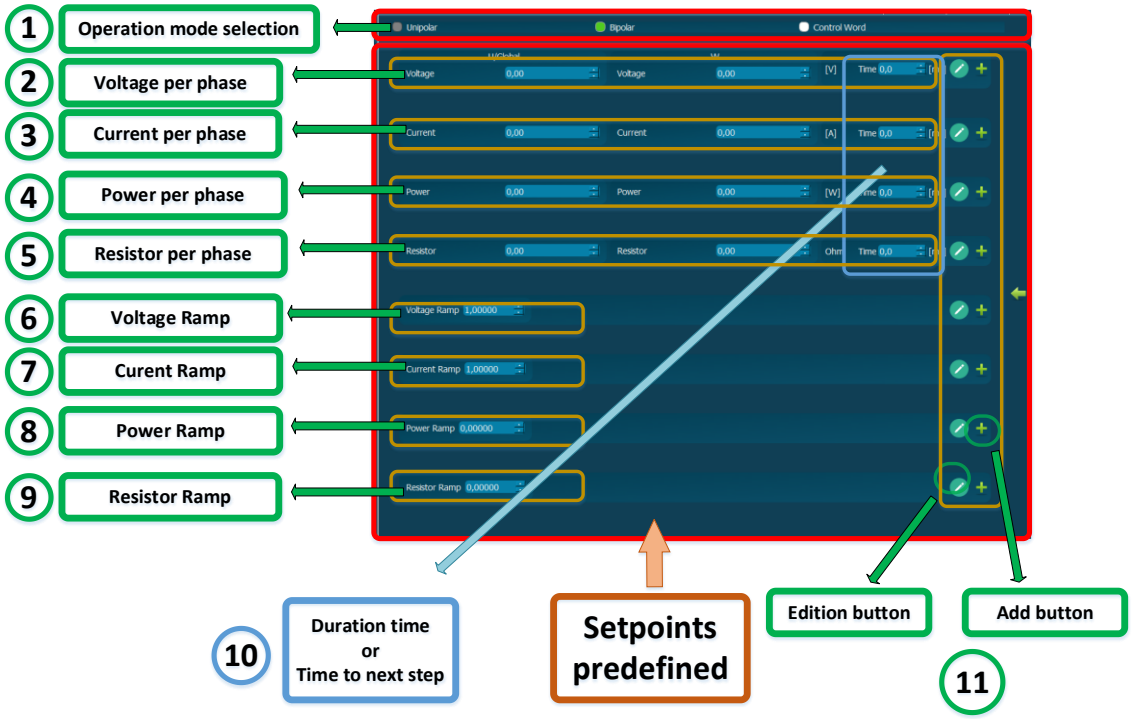
Take into account that the section C, D and E are the same as mentioned on the AC Faults and AC subtab.



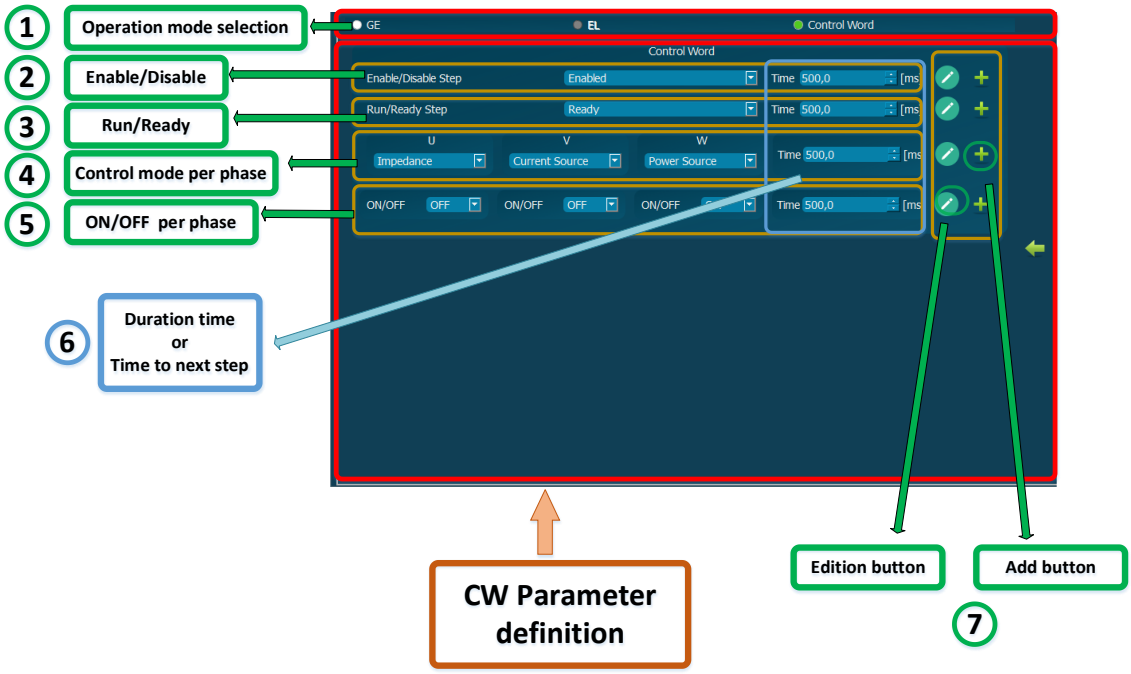
- **A: Define the operation mode.** The user can create three different kind of AC predefined steps using the interface more user friendly. The user needs to choose the desire AC depends on the unit to use.
  - **Unipolar mode:** once this option is marked, on the Section B all the required parameter to configure the output from a DC Unipolar will appear
  - **Bipolar mode:** once this option is marked, on the Section B all the required parameter to configure the output from a DC Bipolar will appear
  - **Control Word**: on this option, the user can control the unit, enabling, running and stopping using any CW parameters.
- **B: Data configuration parameter per each DC option.** Depends on the DC mode selected different configuration parameter will appear. The user can configure all the parameters to reproduce the desired DC output and execute on it.
  - **Unipolar mode:** the user can configure all the DC unipolar setpoints and the ramps values ... and time to apply it.



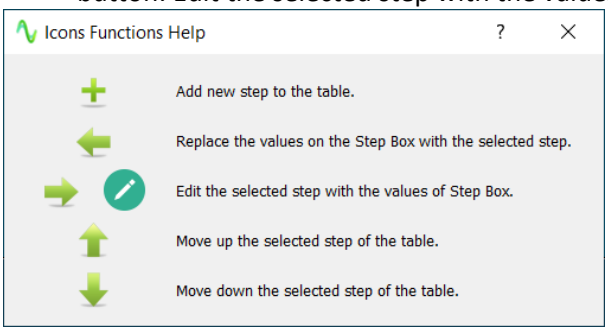
- **Bipolar mode:** the user can configure all the DC bipolar setpoints and the ramps values ... and time to apply it.



- **Control Word:** are the predefined options



- *1 and 2. Moving elements.*
  - button: Add the configured values to the table.
  - button: Recovering the information from the table to the Graphical and data configuration. The user can replace the current values with the table ones.
  - button: Edit the selected step with the values of the Step Box.



- **C: Transferring information.** On this part of the subtab, the user can upload and activate the new steps file to the unit.
  - *Moving elements*. Move up or Down the selected step.
  - *Save to disk*. Save the current table on the local PC where the Cineina interface is executing.
  - *Transfer and Activate.* Loads and activates the current table to the unit.
  - *Edit from Device.* The Step file related on this subtab (in this case *DCSteps.csv*), is downloaded to the PC on the table subtab and the user can modified it. Once the file is modified, the user must Transfer to the unit again to update.
  - *Clear.* The current table will be erased from the Steps file information. The steps file remains to the unit if the user uploaded on a time.
- **D: Steps file information**. Once the user is configuring some steps, using the ADD button, all the information will appear on this table.
- **E: Control Box**. The user can control the execution of the activated step file.

- ***Control buttons***. The user can **Run**, **Pause** or **Stop** the activated step file.
- ***Initial Steps***. The user can configure the first step to execute from the entire test file.
- *Other parts*:
  - *Status. The unit is informing the status of the steps test: Stopped, Paused, Init, Running.*
  - *Time Left.* It is the remaining time for the steps to be finished
  - *Current step.* It indicates which step is being executed.
  - *Repeat Cycle.* Checkbox that indicates what to do once the execution has finished: stopped or repeat the same test file.

4.8.6.1. Working and example of usage

In this section the workflow of the execution of an DC test is explained. It is valid for all of them because they have the same options. For this manual, the explanation would be with the unipolar DC selected mode.

If the user want to run any of these tests, the user must follow the **next 5 STEPS** defined below:

STEP 1: As on this mode the user can operate the unit it is not necessary that the unit is in RUN. Otherwise, if the test is only using setpoints, the unit must be in RUN to reproduce it. The user must choose the desired test to perform depend on the unit used **(section A).**

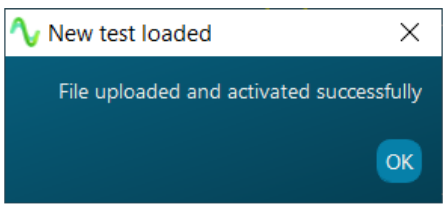
STEP 2: Configuration of the DC to execute. Once the user has configured correctly the values corresponding to the desired behaviour (**Section B**), it is time to add the values to the table by clicking the + button present on **section B**. The user can construct the table with flexibility, always according to the options that the unit permits.

The user can replace one specific step from the table with another one, just by selecting the row which wants to replace, and clicking the button.

Finally, to know which is the setpoint corresponding to a specific row from the table, it is necessary just to Double-Click on the row in question or selecting the row and pressing the button. At this point, the corresponding Setpoint from the table will be shown on the corresponding setpoint from the **B section** table.

STEP 3: Load and **activate** the steps file **(section C)**. Once filled the table **(section D),** the user can upload the steps file to the unit by clicking *Transfer & Activate* icon and waiting until a pop-up appears with a satisfactory image.

STEP 4: Waiting for the confirmation of the unit. It will not be fully uploaded until the dialog "*New test loaded*" of success appears on the interface, as following:



STEP 5: **Run** the loaded sequence through Control Box (**section E**). You can do it with the "**Play**" button next to the Load and Activate sequence. You will see that some elements will have changed. Also you can take two actions in this state:

c. **Pause** the sequence: This will reestablish the sequence to the base values (those specified in "Frequency" and "Nominal", on the left of Send Manual Values). Once there, you can Play the sequence to restart from the point that was paused, or you can stop it, so it will end there and values will be also restored to the "Frequency" and "Nominal".

d. **Stop** the sequence. This stops the test and also restores the values to the specified in "Frequency" and "Nominal".

The STEP 5 can be done also on the GENERAL subtab, activating the *DCSteps.csv* steps file, and executing using the Control Box of this subtab.

It is important to know the capabilities of the equipment in order to understand why some input setpoints are enabled (working) or disabled (not working).

Please get in mind that, in case of not changing the name of the transferred file, DCSteps.csv will be replaced with the new file (which has got the same name) once clicked "Transfer & Activate" button of DC subtab.

Please remember to add the values to the table and transfer it clicking "Transfer & Activate" icon if you want to activate the steps file.

Ask Cinergia for example file steps to use on your unit.

4.8.7. LVRT (Optional)

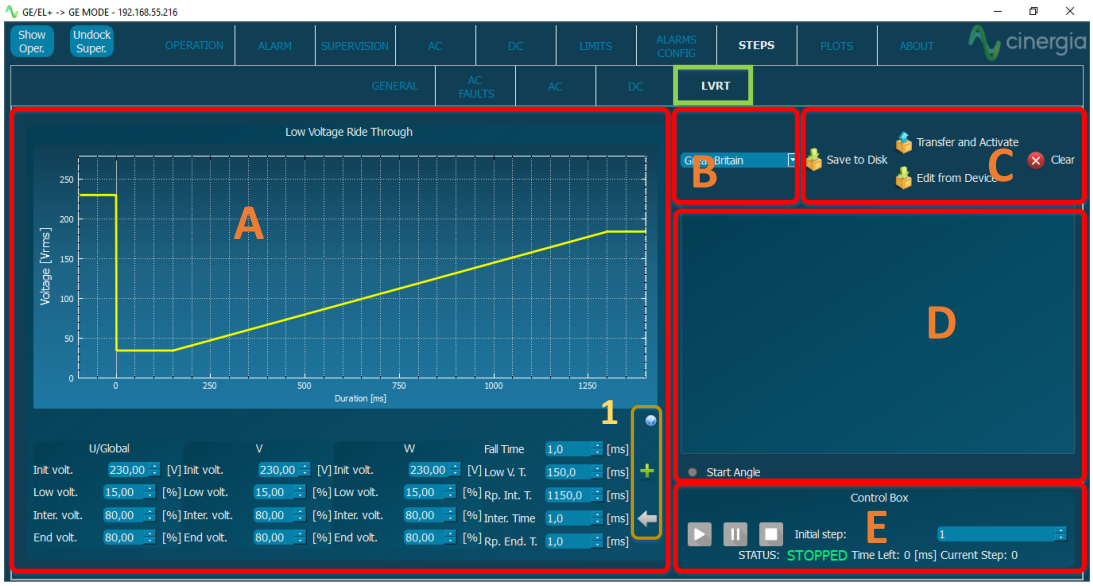
As mentioned before the LVRT is an *optional*. Please, if you are interested on this optional, contact with Cinergia.

Let´s have a look at the parts of the LVRT steps subtab and see how we can create a table, transfer it to the unit and activate it.

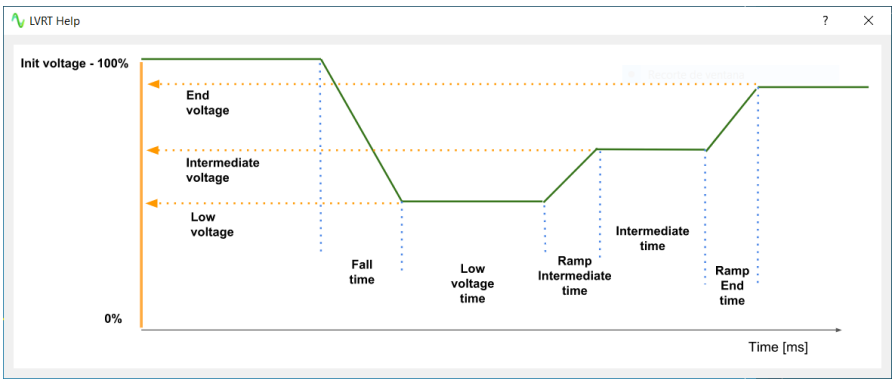
Take into account that the section C, D and E are the same as mentioned on the AC Faults and AC subtab.

To activate this optional, contact Cinergia to activate it. Upgrading it has an additional cost.

The LVRT STEPS activated gives to the user the possibility of executing and simulating the behavior of Low Voltage Ride Through effects. Cinergia provides some pre-set LVRT tests (**Section B**).



- **A: Data configuration parameter and graphical information of the LVRT configured.** The user can use different country LVRT test predefined choosing it on the list on **Section B.** The user also can create a new LVRT test or modify any of the predefined tests.
  - *1. Moving elements.*
    - button: Add the configured values to the table.
    - button: Recovering the information from the table to the Graphical and data configuration. The user can replace the current values with the table ones.
    - button. A pop-up will appear with more information about the parameter to configure on LVRT test.



- **B: Configuration predefined LVRT country test.** Depends on the country selected a defined test will be upload to the **section A**.
- **C: Transferring information.** On this part of the subtab, the user can upload and activate the new steps file to the unit.
  - *Save to disk*. Save the current table on the local PC where the Cineina interface is executing.
  - *Transfer and Activate.* Loads and activates the current table to the unit.
  - *Edit from Device.* The Step file related on this subtab (in this case *LVRT.csv*), is downloaded to the PC on the table subtab and the user can modified it. Once the file is modified, the user must Transfer to the unit again to update.
  - *Clear.* The current table will be erased from the Steps file information. The steps file remains to the unit if the user uploaded on a time.
- **D: Steps file information**. Once the user is configuring some steps, using the ADD button, all the information will appear on this table.
- **E: Control Box***.* The user can control the execution of the activated step file.
  - ***Control buttons****.* The user can **Run**, **Pause** or **Stop** the activated step file.
  - ***Initial Steps***. The user can configure the first step to execute from the entire test file.
  - *Other parts*:
    - *Status. The unit is informing the status of the steps test: Stopped, Paused, Init, Running.*
    - *Time Left.* It is the remaining time for the steps to be finished
    - *Current step.* It indicates which step is being executed.

4.8.7.1. Working and example of usage

In this section the workflow of the execution of an LVRT test is explained.

If the user want to run any of these tests, the user must follow the **next 5 STEPS** defined below:

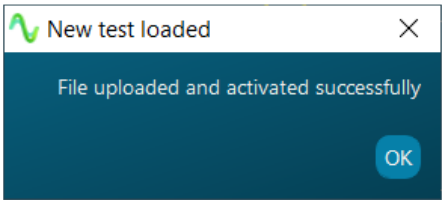
STEP 1: All this predefined test requires that the unit must be in **Run** mode. Otherwise, the step will not be executed.

STEP 2: Configuration of the LVRT test to execute. Once the user has configured correctly the parameters corresponding to the desired behaviour using the list (**Section B**) or creating a new one, it is time to add the values to the table by clicking the  button present on **section A**. It must be noticed that  button will replace the contains of the table with the new ones.

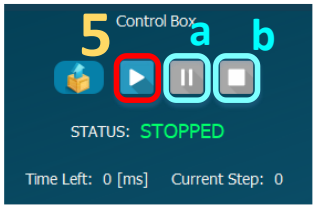
The user can click  button to replace the input values with the values from the table.

STEP 3: Load and **activate** the LVRT file **(section C)**. Once filled the table **(section D),** the user can upload the steps file to the unit by clicking *Transfer & Activate* icon and waiting until a pop-up appears with a satisfactory image.

STEP 4: Waiting for the confirmation of the unit. It will not be fully uploaded until the dialog "*New test loaded*" of success appears on the interface, as following:



STEP 5: **Run** the loaded sequence through Control Box (**section E**). You can do it with the "**Play**" button next to the Load and Activate sequence. You will see that some elements will have changed. Also you can take two actions in this state:



e. **Pause** the sequence: This will reestablish the sequence to the base values (those specified in "Frequency" and "Nominal", on the left of Send Manual Values). Once there, you can Play the sequence to restart from the point that was paused, or you can stop it, so it will end there and values will be also restored to the "Frequency" and "Nominal".

f. **Stop** the sequence. This stops the test and also restores the values to the specified in "Frequency" and "Nominal".

The STEP 5 can be done also on the GENERAL subtab, activating the *DCSteps.csv* steps file, and executing using the Control Box of this subtab.

It is important to know the capabilities of the equipment in order to understand why some input setpoints are enabled (working) or disabled (not working).

Please get in mind that, in case of not changing the name of the transferred file, LVRT.csv will be replaced with the new file (which has got the same name) once clicked "Transfer & Activate" button of DC subtab.

Please remember to add the values to the table and transfer it clicking "Transfer & Activate" icon if you want to activate the steps file.

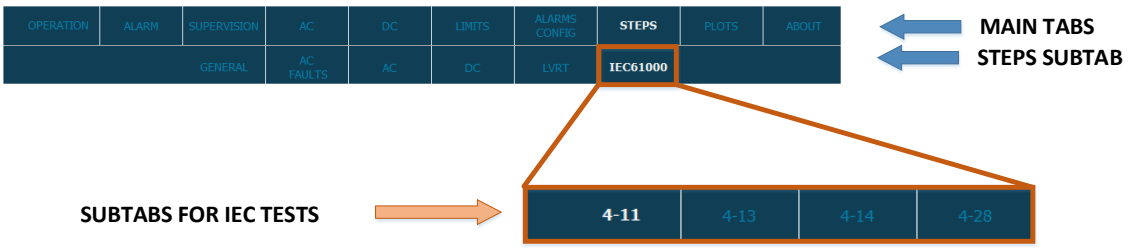
4.8.8. IEC61000 Subtab (Optional)

The STEPS functionality gives to the user the possibility of executing and simulating a predefined STEPS that the IEC regulation defines.

The IEC is an optional. Please, if you are interested on this optional, contact with Cinergia.

To activate this optional, contact Cinergia to get the upgrade code. Upgrading it has an additional cost.

This subtab contains other subtabs concerning the IEC specific predefined tests.



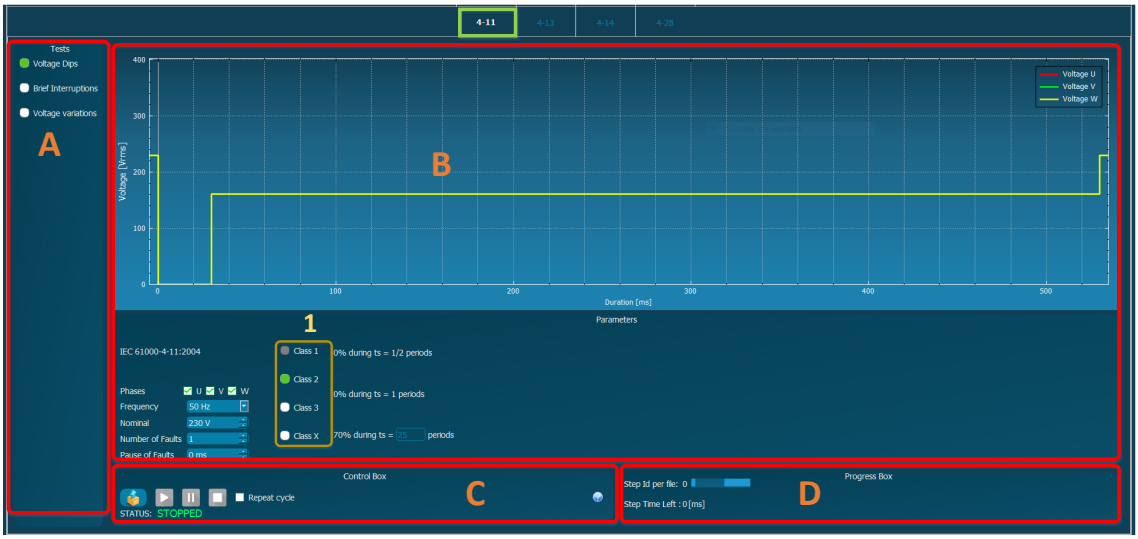
Remember that the *Show Slide* button is available in all the tabs. It is useful to hide the control operation of the converter to have a wider view of the working tab.

The IEC6100 tab contains four subtabs related with the IEC61000 test.

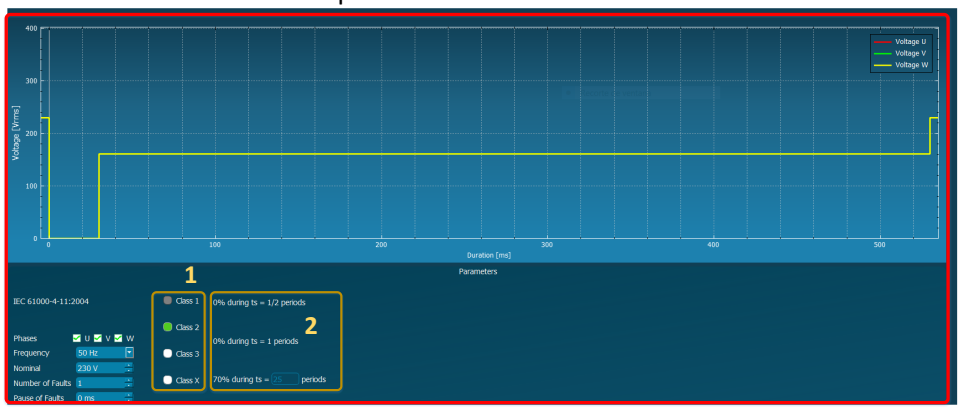
- **4-11:** There are three types of tests: voltage dips, brief Interruptions and Voltage variations. For each type of test there are different predefined classes (2, 3 and X[2]) to choose.
- **4-13:** There are four types of tests: Harmonic combinations, sweep in frequency, individual and interhamornics and Meister curve. For each type of test there are different predefined classes (1, 2, 3 and X[3]) to choose.
- **4-14:** There is only one type of tests: Voltage fluctuation test. In this case, three classes (2, 3 and X[3]) could be chosen.
- **4-28:** There is only one type of tests: Variation of Power Frequency. In this case, one class (2) ad four levels (2, 3 4, and X[3]) could be chosen.

[2] *X means that the customer can configure its own test based on the IEC regulation test.*

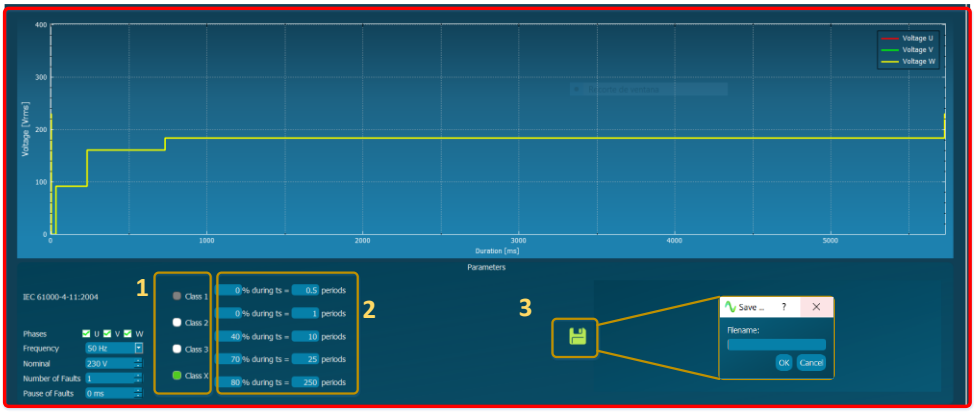
4.8.8.1. 4-11 Subtab



- **A: Predefined IEC 4-11 tests selection.** Depends on the user needs, once must be selected. Depend on the test selected the graphic and the parameters on B will change according to its needs.
- **B: Data configuration parameter and graphical information of the IEC test selected.** The user can use different type of test predefined choosing it on the list on **Section A.** The user also can create a new IEC 4-11 test or modify any of the predefined tests.
    - **Voltage Dips**
        - *1.* The user can also choose between different types of test selecting each Classes. The *Class 1, 2, 3* have predefined values configured. On *Class X*[3] the user can implement each own specific test.
          See picture above for more information.
        - *2*. The parameter of the test selected. These parameters are locked, when a predefined test is selected, the user cannot change the value of these parameters. If the user selects the *Class X*[4], all the parameters related on the test are unlocked ant the user can modify all the parameter values. The graphical representation will change according to the new parameters.

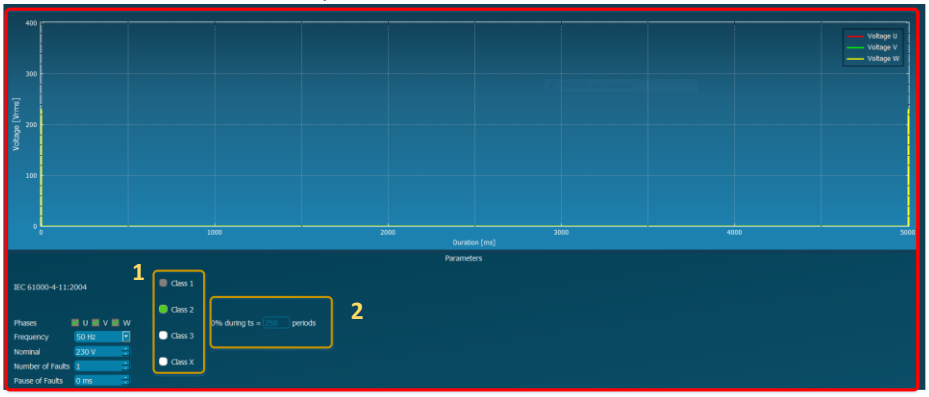


[3] *X means that the customer can configure its own test based on the IEC regulation test.*

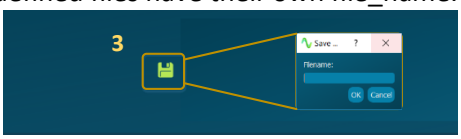


- *3*. **Save** the new test. In case of Cass X[4], a floppy disk appears on the window. If the user clicks on it, a pop-up Save a new file. All the predefined files have their own *file_name*.

- **Brief Interruptions**
  - *1*. The user can also choose between different types of test selecting each Classes. The *Class 1, 2, 3* have predefined values configured. On *Class X* the user can implement each own specific test.
  - *2*. The parameter of the test selected. These parameters are locked, when a predefined test is selected, the user can not change the value of these parameters. If the user selects the *Class X*, all the parameters related on the test are unlocked ant the user can modify all the parameter values. The graphical representation will change according to the new parameters.

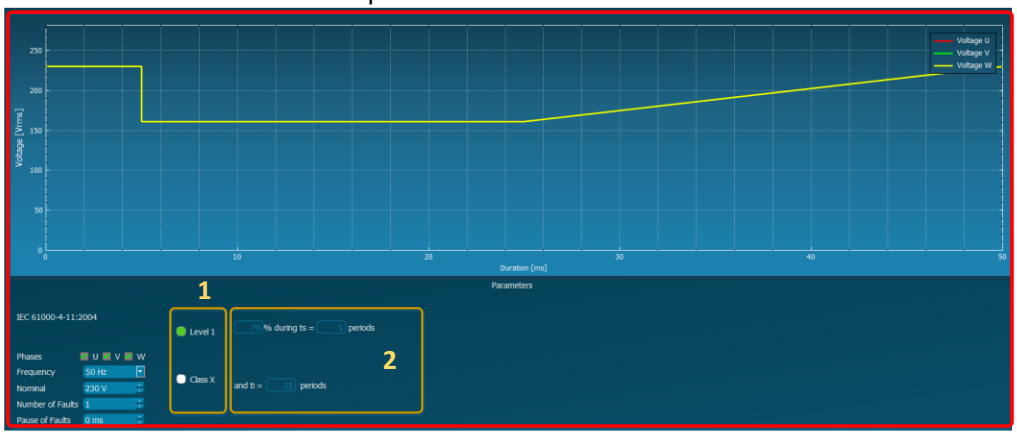


  - *3*. **Save** the new test. In case of Cass X, a floppy disk appears on the window. If the user clicks on it, a pop-up Save a new file. All the predefined files have their own file_name.

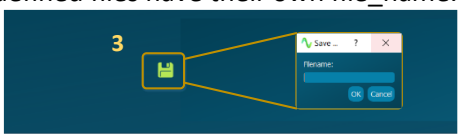


- **Voltage variation**
  - *1*. The user can also choose between different types of test selecting each Classes. The *Level 1* has predefined values configured. On *Class X* the user can implement each own specific test.
  - *2*. The parameter of the test selected. These parameters are locked, when a predefined test is selected, the user cannot change the value of these parameters. If the user selects the *Class X*, all the parameters related on the test are unlocked ant the user can modify all the

parameter values. The graphical representation will change according to the new parameters.

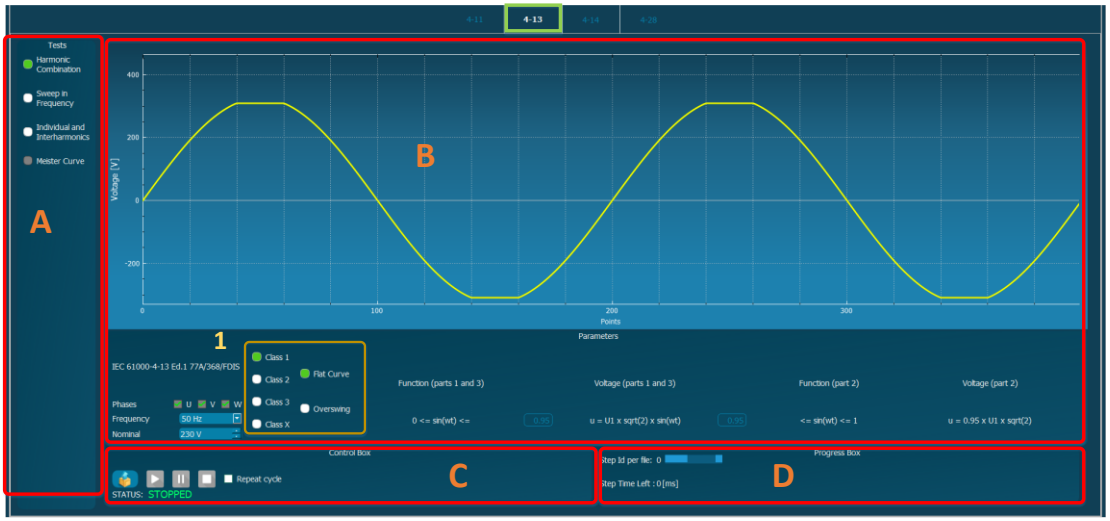


- *3*. **Save** the new test. In case of Cass X, a floppy disk appears on the window. If the user clicks on it, a pop-up Save a new file. All the predefined files have their own file_name.

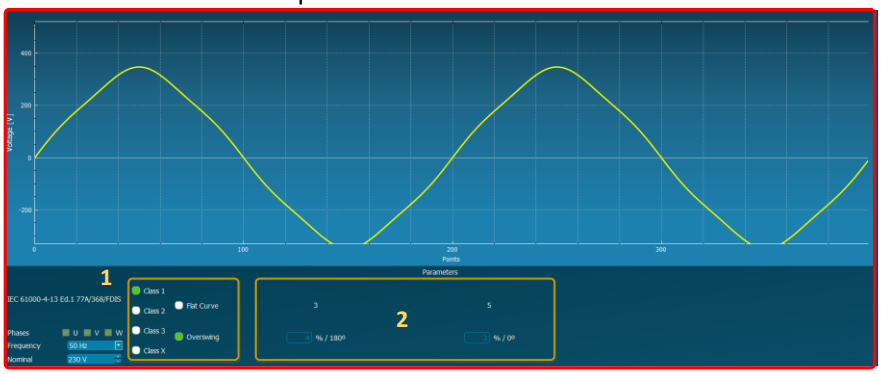


- **C: Control Box**. The user can control the execution of the activated step file.
  - **Load sequence button**: Loads and activates the current test.
  - ***Control buttons***. The user can **Run**, **Pause** or **Stop** the activated step file.
  - *Other parts*:
    - *Status. The unit is informing the status of the steps test: Stopped, Paused, Init, Running.*
    - *Repeat Cycle.* Checkbox that indicates what to do once the execution has finished: stopped or repeat the same test file.
- **D: Progress box information**. Once the user is configuring some steps, using the ADD button, all the information will appear on this table.
  - *Time Left.* It is the remaining time for the steps to be finished
  - *Current step.* It indicates which step is being executed.

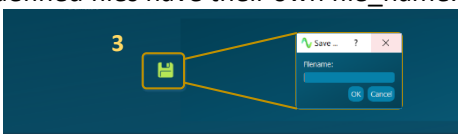
4.8.8.2. 4-13 Subtab



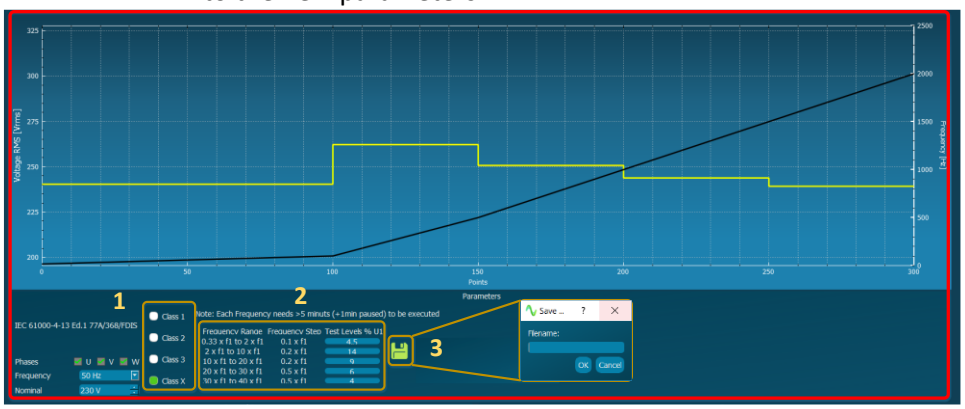
- **A: Predefined IEC 4-13 tests selection.** Depends on the user needs, once must be selected. Depend on the test selected the graphic and the parameters on B will change according to its needs.
- **B: Data configuration parameter and graphical information of the IEC test selected.** The user can use different type of test predefined choosing it on the list on **Section A.** The user also can create a new IEC 4-13 test or modify any of the predefined tests.
  - **Harmonic combination**
    - *1.* The user can also choose between different types of test selecting each Classes. The *Class 1, 2, 3* have predefined values configured. On *Class X* the user can implement each own specific test.
      See picture above for more information.
      The user can also choose between *Flat Curve* or *Overswing*.
    - *2*. The parameter of the test selected. These parameters are locked, when a predefined test is selected, the user cannot change the value of these parameters. If the user selects the *Class X*, all the parameters related on the test are unlocked ant the user can modify all the parameter values. The graphical representation will change according to the new parameters.



- *3*. **Save** the new test. In case of Cass X, a floppy disk appears on the window. If the user clicks on it, a pop-up Save a new file. All the predefined files have their own file_name.



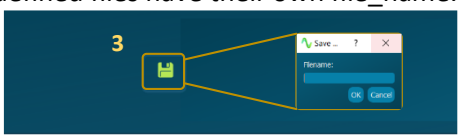
- **Sweep in Frequency**
  - *1*. The user can also choose between different types of test selecting each Classes. The *Class 1, 2, 3* have predefined values configured. On *Class X* the user can implement each own specific test.
  - *2*. The parameter of the test selected. These parameters are locked, when a predefined test is selected, the user cannot change the value of these parameters. If the user selects the *Class X*, all the parameters related on the test are unlocked ant the user can modify all the parameter values. The graphical representation will change according to the new parameters.



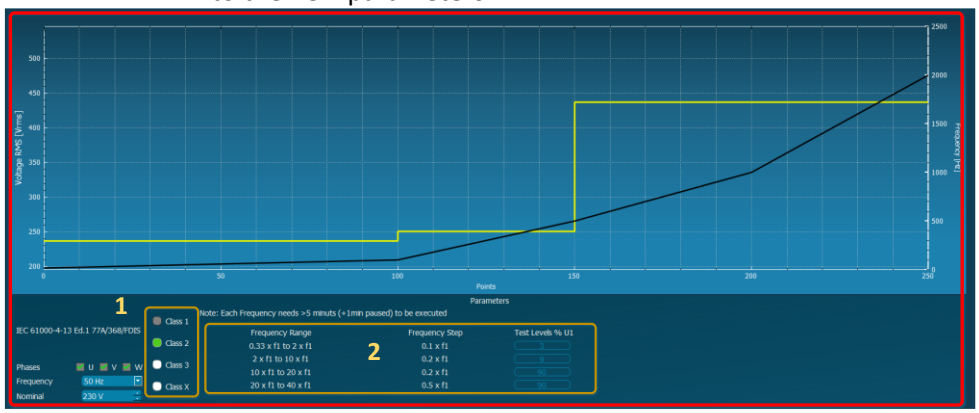
  - *3*. **Save** the new test. In case of Cass X, a floppy disk appears on the window. If the user clicks on it, a pop-up Save a new file. All the predefined files have their own file_name.

- **Individual and Interharmonics**
  - *1*. The user can also choose between different types of test selecting each Classes. The *Class 1, 2, 3* have predefined values configured. On *Class X* the user can implement each own specific test.
    The user can also choose between *Individual* and *Interharmonics*.
  - *2*. The parameter of the test selected. These parameters are locked, when a predefined test is selected, the user cannot change the value of these parameters. If the user selects the *Class X*, all the parameters related on the test are unlocked ant the user can modify all the parameter values. The graphical representation will change according to the new parameters.

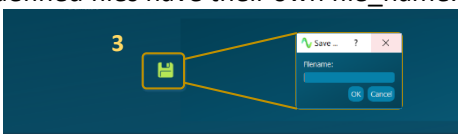
- *3*. **Save** the new test. In case of Cass X, a floppy disk appears on the window. If the user clicks on it, a pop-up Save a new file. All the predefined files have their own file_name.



- **Meister Curve**
  - *1*. The user can also choose between different types of test selecting each Classes. The *Class 1, 2, 3* have predefined values configured. On *Class X* the user can implement each own specific test.
  - *2*. The parameter of the test selected. These parameters are locked, when a predefined test is selected, the user cannot change the value of these parameters. If the user selects the *Class X*, all the parameters related on the test are unlocked ant the user can modify all the parameter values. The graphical representation will change according to the new parameters.



- *3*. **Save** the new test. In case of Cass X, a floppy disk appears on the window. If the user clicks on it, a pop-up Save a new file. All the predefined files have their own file_name.



- **C: Control Box**. The user can control the execution of the activated step file.
  - **Load sequence button**: Loads and activates the current test.
  - ***Control buttons***. The user can **Run**, **Pause** or **Stop** the activated step file.
  - *Other parts*:
    - *Status. The unit is informing the status of the steps test: Stopped, Paused, Init, Running.*
    - *Repeat Cycle.* Checkbox that indicates what to do once the execution has finished: stopped or repeat the same test file.
- **D: Progress box information**. Once the user is configuring some steps, using the ADD button, all the information will appear on this table.
  - *Time Left.* It is the remaining time for the steps to be finished
  - *Current step.* It indicates which step is being executed.

4.8.8.3. 4-14 Subtab

- **A: Predefined IEC 4-14 tests selection.** Depends on the user needs, once must be selected. Depend on the test selected the graphic and the parameters on B will change according to its needs.
- **B: Data configuration parameter and graphical information of the IEC test selected.** The user can use different type of test predefined choosing it on the list on **Section A.** The user also can create a new IEC 4-14 test or modify any of the predefined tests.
  - **Voltage Fluctuation Test**
    - *1.* The user can also choose between different types of test selecting each Classes. The *Class 2, 3* have predefined values configured. On *Class X* the user can implement each own specific test.
      See picture above for more information.
    - *2.* The parameter of the test selected. These parameters are locked, when a predefined test is selected, the user cannot change the value of these parameters. If the user selects the *Class X*, all the parameters related on the test are unlocked ant the user can modify all the parameter values. The graphical representation will change according to the new parameters.

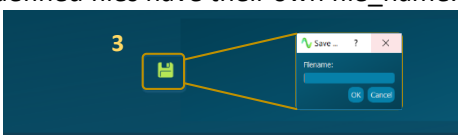
- *3.* **Save** the new test. In case of Cass X, a floppy disk appears on the window. If the user clicks on it, a pop-up Save a new file. All the predefined files have their own file_name.

- **C: Control Box**. The user can control the execution of the activated step file.
  - **Load sequence button**: Loads and activates the current test.
  - ***Control buttons***. The user can **Run**, **Pause** or **Stop** the activated step file.
  - *Other parts*:
    - *Status. The unit is informing the status of the steps test: Stopped, Paused, Init, Running.*
    - *Repeat Cycle.* Checkbox that indicates what to do once the execution has finished: stopped or repeat the same test file.
- **D: Progress box information**. Once the user is configuring some steps, using the ADD button, all the information will appear on this table.
  - *Time Left.* It is the remaining time for the steps to be finished
  - *Current step.* It indicates which step is being executed.

4.8.8.4. 4-28 Subtab

- **A: Predefined IEC 4-28 tests selection.** Depends on the user needs, once must be selected. Depend on the test selected the graphic and the parameters on B will change according to its needs.
- **B: Data configuration parameter and graphical information of the IEC test selected.** The user can use different type of test predefined choosing it on the list on **Section A.** The user also can create a new IEC 4-28 test or modify any of the predefined tests.
  - **Voltage Fluctuation Test**
    - *1.* The user can also choose between different types of test selecting each Classes. The *Class 2, 3* have predefined values configured. On *Class X* the user can implement each own specific test.
      See picture above for more information.
    - *2*. The parameter of the test selected. These parameters are locked, when a predefined test is selected, the user cannot change the value of these parameters. If the user selects the *Class X*, all the parameters related on the test are unlocked ant the user can modify all the parameter values. The graphical representation will change according to the new parameters.

- *3*. **Save** the new test. In case of Cass X, a floppy disk appears on the window. If the user clicks on it, a pop-up Save a new file. All the predefined files have their own file_name.

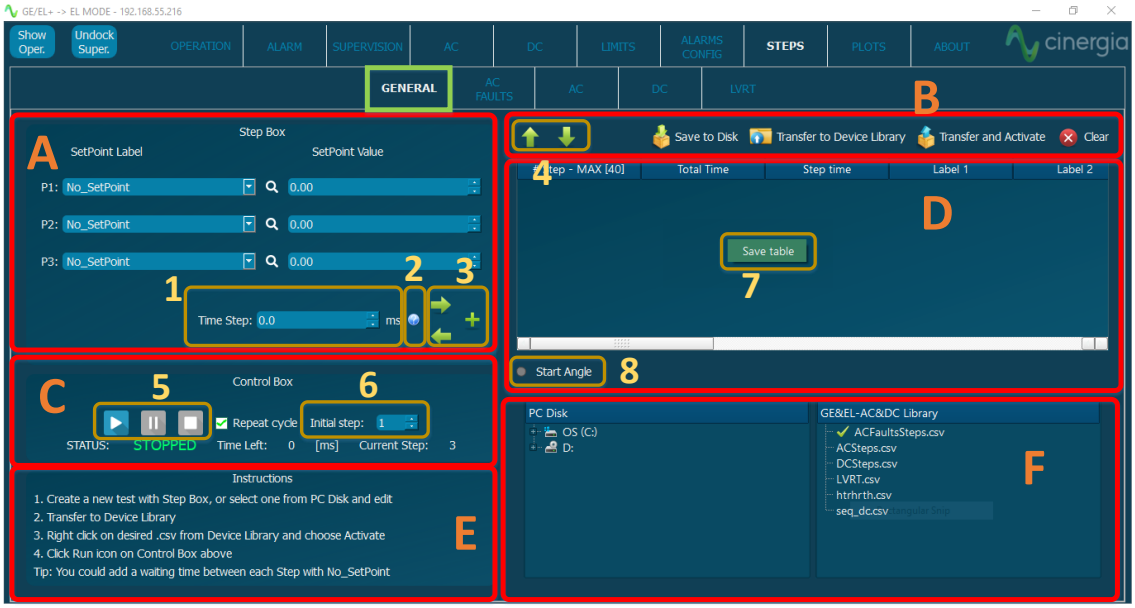


- **C: Control Box**. The user can control the execution of the activated step file.
  - **Load sequence button**: Loads and activates the current test.
  - ***Control buttons***. The user can **Run**, **Pause** or **Stop** the activated step file.
  - *Other parts*:
    - *Status. The unit is informing the status of the steps test: Stopped, Paused, Init, Running.*
    - *Repeat Cycle.* Checkbox that indicates what to do once the execution has finished: stopped or repeat the same test file.
- **D: Progress box information**. Once the user is configuring some steps, using the ADD button, all the information will appear on this table.
  - *Time Left.* It is the remaining time for the steps to be finished
  - *Current step.* It indicates which step is being executed.

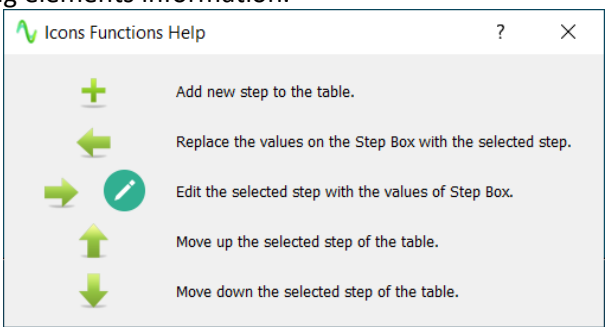
4.8.9. GENERAL Subtab

The GENERAL subtab allows the user to create any kind of behaviour that the equipment permits. On previous chapters on this manual, it is shown how a user can create, activate, and control new Steps with each of the previously mentioned subtabs. However, each of the subtabs in question has been limited to specific options of Setpoints, to make it more user friendly.

With the General tab it can be created any kind of behaviour that the equipment permits. It is the most flexible but also the most complicated to use subtab from STEPS.



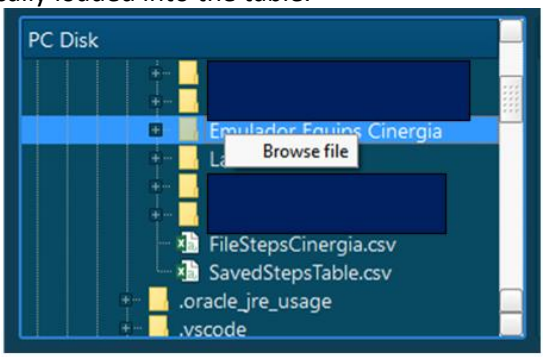
- **A: Data configuration parameter.** The user can find any parameter from the unit defined on the list pressing the arrow or the magnifier icon. There are three parameters to configure per each step. So, the user is invited to select three parameters (or setpoints) and a time (Time Steps value) to create a specific step. Once the values have been chosen and properly configured, it can be added to the table by clicking + button.
  - 1. *Time Steps* (*ms*): duration time of the step configured.
  - *2. Information mark*: A pop-up will appear with more information about the moving elements information.



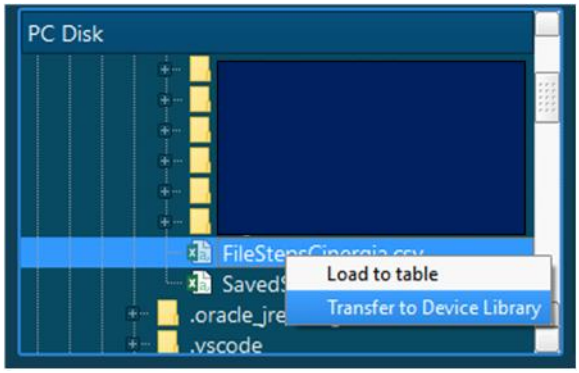
  - *3. Moving elements.*
    - + button: Add the configured values to the table (section **D**).
    - button: Recovering the information from the table to the Graphical and data configuration. The user can replace the current values with the table ones.

- button: Edit the selected step with the information of the Step Box.

- **B: Transferring information.** On this part of the subtab, the user can upload and activate the new steps file to the unit.
  - *Save to disk*. Save the current table on the local PC where the Cineina interface is executing.
  - *Transfer and Activate.* Loads and activates the current table to the unit.
  - *Transfer to Device Library.* Transferring and save the current step file to the unit without the need to Activate it. It is used for storing purposes.
  - *Clear.* The current table will be erased from the Steps file information. The steps file remains to the unit if the user uploaded on a time.
  - *4. Moving elements.* Move up or Down the selected step.
- **C: Control Box**. The user can control the execution of the activated step file.
  - *5.* ***Control buttons****.* The user can **Run**, **Pause** or **Stop** the activated step file.
  - *6.* ***Initial Steps***. The user can configure the first step to execute from the entire test file.
  - *Other parts*:
    - *Status. The unit is informing the status of the steps test: Stopped, Paused, Init, Running.*
    - *Time Left.* It is the remaining time for the steps to be finished
    - *Current step.* It indicates which step is being executed.
    - *Repeat Cycle.* Checkbox that indicates what to do once the execution has finished: stopped or repeat the same test file.
- **D: Steps file information**. Group of steps that are going to be transferred to the device or saved locally. Once the user is configuring some steps, using the add button, all the information will appear on this table.
  - *7.* ***Save.*** Right clicking the parameter's table, the user can save the current steps file.
  - *8.* ***Start Angle.*** The user can configure the start angle per each step file.
- **E: General Steps Instruction.** Reminder of the steps system operation.
- **F: PC Disk** and **Unit Device Library**: Browser Window to search for located saved steps files and the list of steps files saved on the equipment. It also indicated which group of steps file is activated.
  In this **section F – PC Disk**, the user can search for steps files that are saved and located in the PC. The desired file can be searched by either navigating along the proposed tree or Right Clicking a folder (then a File Explorer will pop-up). Once selected a CSV file, it will be automatically loaded into the table.

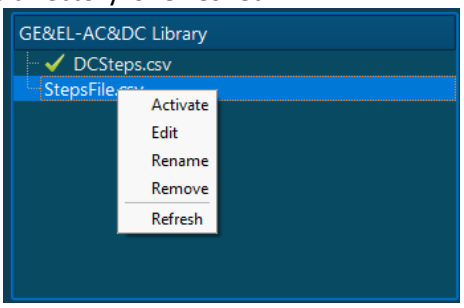


In case of finding the desired file in the tree view, it can be directly transferred to the unit, (with the same name).



In this **section F – Unit Device Library**, all step files saved in the converter are listed in this section. When Right-Clicking a file from the list, the user can choose to carry out one of the following actions:

- *Active:* The selected group of steps will be activated.
- *Edit:* The information from the CSV file will be loaded into the table.
- *Rename:* The filename is modified. Please, note that an activated file cannot be renamed.
- *Remove:* The selected steps file is deleted.
- *Refresh*: The directory is refreshed.



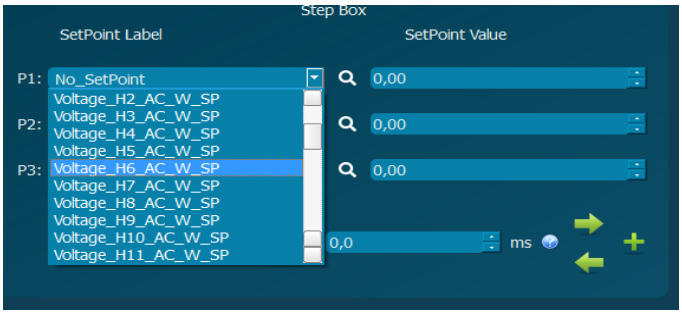
4.8.9.1. Working and example of usage

In this section the workflow of the execution of a GENERAL steps test is explained.

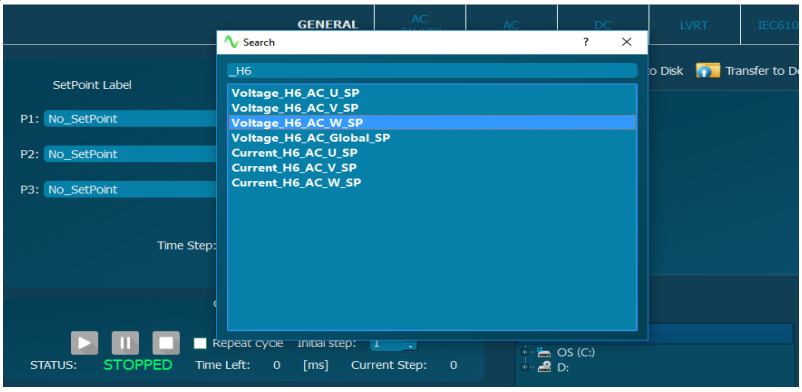
If the user want to configure and run any of these tests, the user must follow the **next 5 STEPS** defined below:

STEP 1: As on this mode the user can operate the unit it is not necessary that the unit is in RUN. Otherwise, if the test is only using setpoints, the unit must be in RUN to reproduce it. The user must choose the desired parameters to perform the test to execute (section **A**). There are three different ways to introduce the configured parameters listed below:

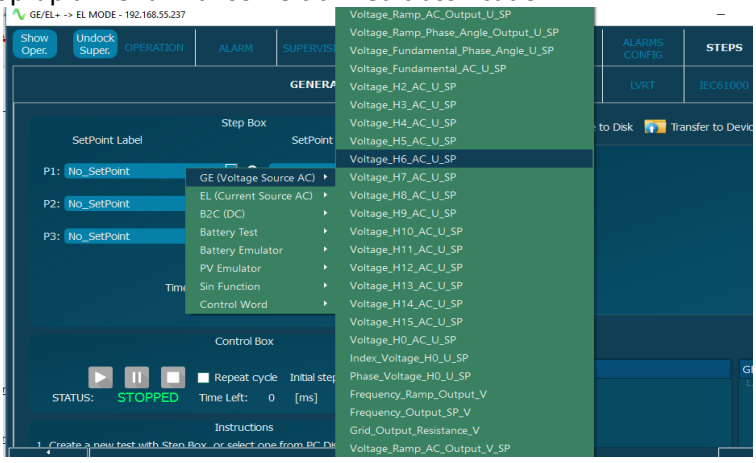
- **1: Choosing the desired Setpoint from the list**. To access to it, click on the down arrow  of the object.



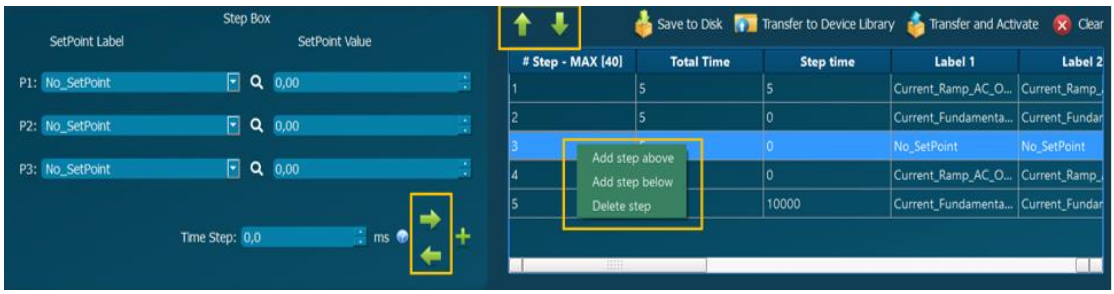
- 2: Searching for a specific Setpoint with the Magnifier icon . It will pop-up a Search dialog.



- 3: Searching for a specific Setpoint by its group. To access to it, Right-click on the object. It will pop-up a menu with some clarified classification:



STEP 2: Perform the test to execute. Once the user has configured correctly the parameters corresponding to the desired behaviour, it is time to add the values to the table by clicking the + .

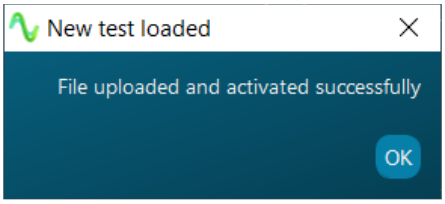


There are several operations that can be done on a selected step from the table (see yellow squares in the previous image):

- *it can be replaced with a new one, with* *button.*
- *its values can be cloned into the step box, with* *button.*
- *its position in the* table can be modified, with and buttons.
- It must be noticed that, when a step is selected, the button will insert the new step below the selected one.
- Right clicking on the table, a pop-up table menu will appear (see picture above): *Add step above*, *Add Step below*, *Delete step*.

STEP 3: Load and **activate** the Steps file **(section D)**. When all the steps are introduced, the use can save the table locally by clicking *Save to Disk* (which will pop-up a File Explorer asking for a path and a name) or saved in the unit by clicking *Transfer to Device Library*. However, in order to execute the step directly, it must be clicked the *Transfer & Activate* button and waiting until a pop-up appears with a satisfactory image.

STEP 4: Waiting for the confirmation of the unit. It will not be fully uploaded until the dialog "*New test loaded*" of success appears on the interface, as following:



STEP 5: **Run** the loaded sequence through Control Box (**section E**). You can do it with the "**Play**" button next to the Load and Activate sequence. You will see that some elements will have changed. Also you can take two actions in this state:

g. **Pause** the sequence: This will reestablish the sequence to the base values (those specified in "Frequency" and "Nominal", on the left of Send Manual Values). Once there, you can Play the sequence to restart from the point that was paused, or you can stop it, so it will end there and values will be also restored to the "Frequency" and "Nominal".

h. **Stop** the sequence. This stops the test and also restores the values to the specified in "Frequency" and "Nominal".

Please remember to add the values to the table and transfer it clicking "Transfer & Activate" icon if you want to activate the steps file.

4.9. PLOTS (Optional)

This tab provides to the user recording or datalogging some specific internal values from the unit during tests.

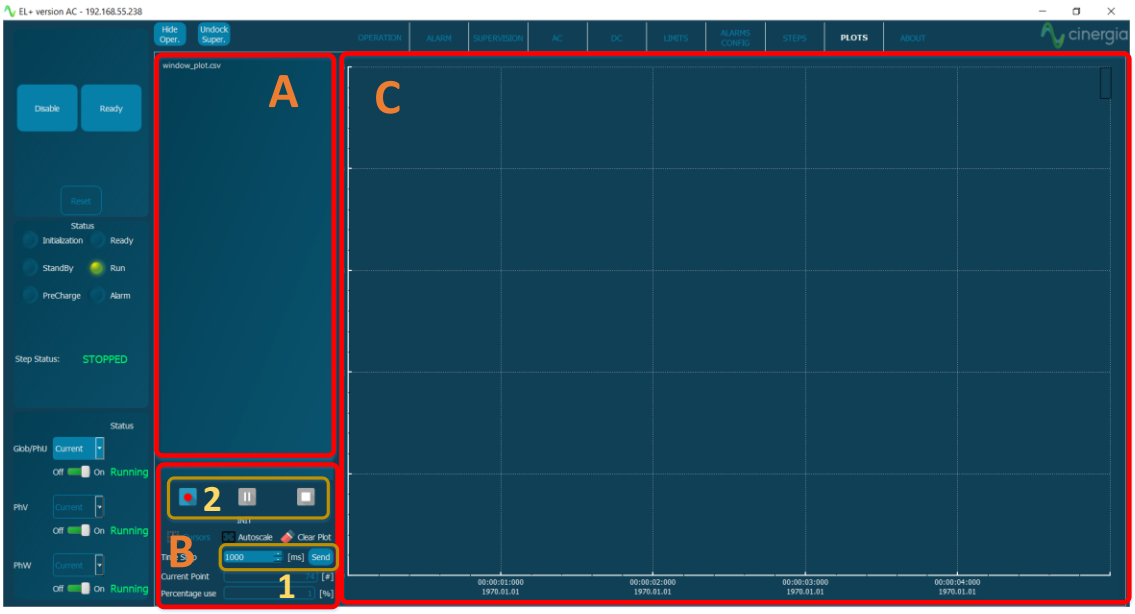
The PLOTS recording is an optional called ***Datalogger***. Please, if you are interested on this optional, contact with Cinergia.

To activate this optional, contact Cinergia to get the upgrade code. Upgrading it has an additional cost.

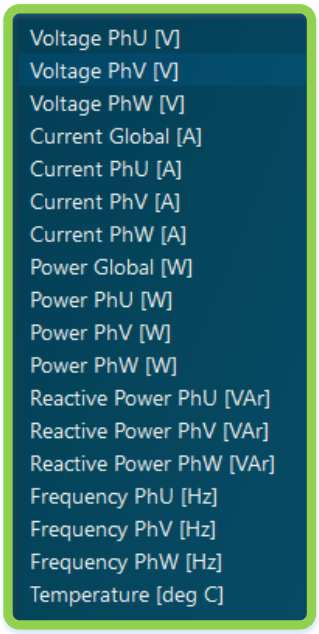
The unit is recording ONLY in RUN state. In other states the Datalogger is on PAUSE mode.

The unit records all the value in RUN status ONLY. In other status, the Datalogger is paused.

Please, find below the PLOTS tab:



- **A: List of internal plots done.** The user can find all the plots done and save in the unit. The user can select the plot to represent on the graphical zone (marked in C).
  On each plot, there is the parameters listed below datalogged.



- **B: Function Icon.** Depends on the AC fault selected different data configuration will appear. The user can configure all the parameters to reproduce the desired AC fault to execute on.
  - **1. Time step (ms).** The user can define the time between samples to record. The minimum effective value of acquisition time is 200ms.
  - **2. Stop/Run/pause Icon.** The user can start recording the plot, pause or stop using these three icons.
  - **Status of the Datalogging.** The unit is showing the status of the Datalogging: PRE-RECORD (waiting for a RUN state), RECORDING, PAUSED, INIT (ready to be used).
  - **Graphical options Icon.** The use can add cursor and autoscale the plots represented. The Clear Plot icons clear all the plots represented on the Graphical zone.
  - **Current point:** The user can check the current point from the current plot done. This is the total number of points registered by the unit. If the user multiplies this value with the Time Step, it is possible to know the total time recorded.
  - **Percentage use.** The user can check the percentage of memory used on the current SD due to all the plots done and saved.
- **C: Graphical zone to draw the plots saved.** The user can show any variable recorded clicking over it. It is possible to reproduce more than one variable of more than one plot saved.

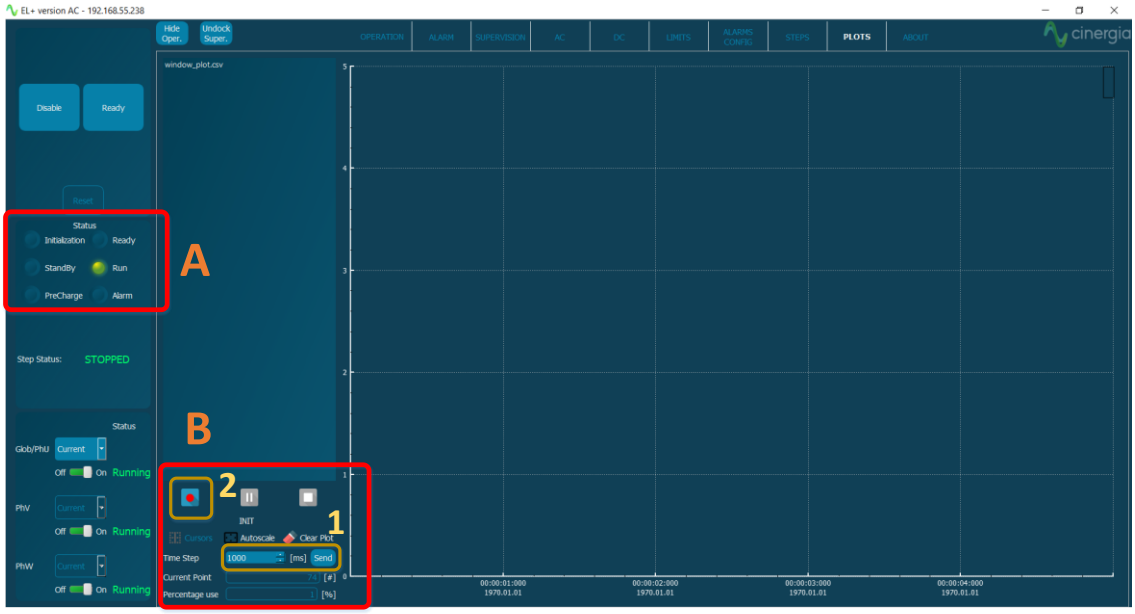
4.9.1. Working and example of usage

In this section the workflow of the execution of a PLOT datalogging is explained.

Take into account that the unit must be in RUN to start recording any information.

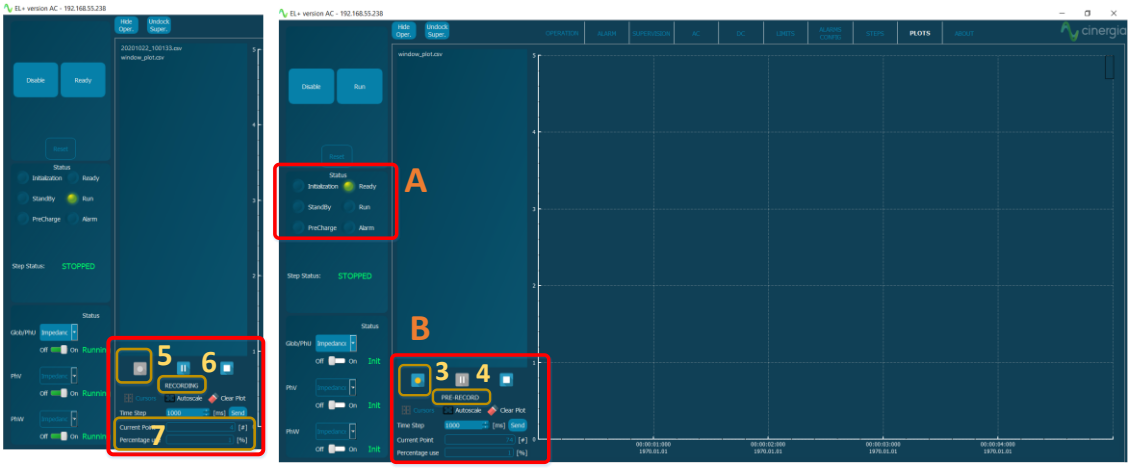
STEP 1: Go to **PLOTS** tab. Remember that the unit must be in **RUN** (marked **A** on the figure below) to start recording, in other case, the datalogger will be waiting in pause mode.

STEPS 2: Configure the **Time Step** value (number **B.1** on the figure below). Configure the acquisition time. The minimum time is 200ms. The unit will take all the parameter values each time.



STEP 3: RUN the Datalogger, pressing the recording button (number B.2 on the previous figure). The unit will take all the parameters every time configured.

Take into account that the parameters will be recorded ONLY if the unit is in RUN status. When the Datalogger is working (RECORDING), and the unit goes to **READY** (number A), **PRE-RECORD** is shown to indicate that the PLOT is paused (see picture below). Once the unit goest o RUN again, the Datalogger restarts.



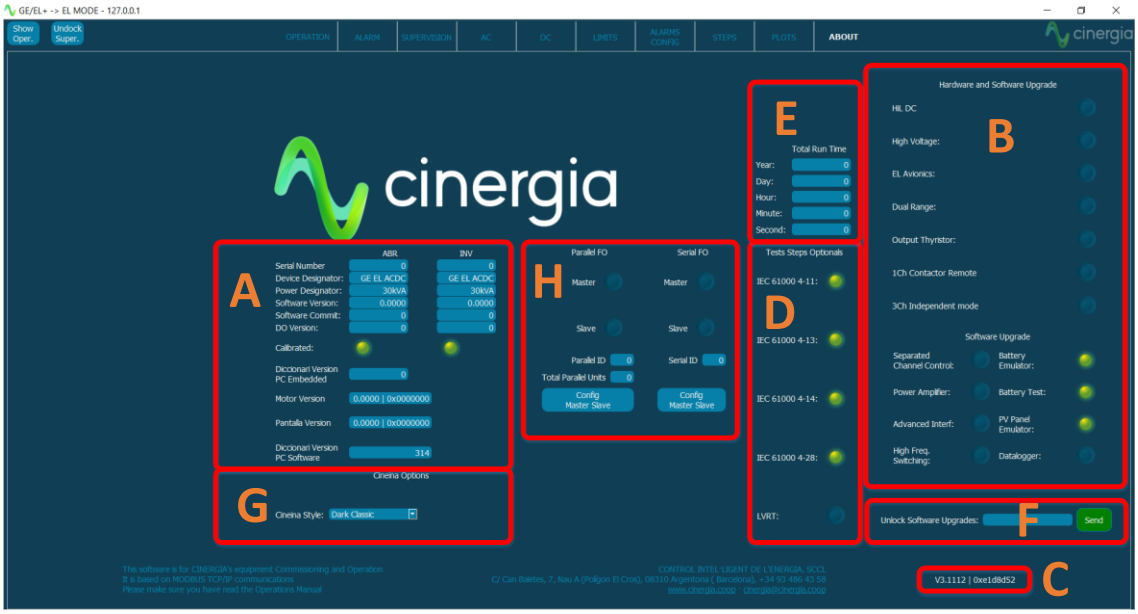
STEP 4: The user can **PAUSE** (number **8** on picture below) or **STOP** (number **10**) the Datalogger pressing the buttons. In case of Pause, the unit will report the state as shown on picture below (number **9**).

STEP 5: Once the **STOP** is pressed, the new datalogger file generated will appear on the list (section **C** number **11**).

The user can download this files via ftp.

4.10. ABOUT

This tab shows the characteristics of the equipment. It is very important to get acquainted with this tab because in case of problems with the equipment, CINERGIA will require this information to success with the reparation.
The user can also confirm the optional activated or not in its own unit.



- **A:** Basic description parameters of the equipment. This basic information will be very useful to Cinergia in case of problems with the equipment. If this happens, please make a screenshot of this tab.
  On this section the user can confirm the software version of each element.
- **B: Hardware and Software optional** of the equipment. This basic information will be very useful to Cinergia in case of problems with the equipment. If this happens, please make a screenshot of this tab.
  On this section, the user can confirm the software and hardware options activated has the equipment.
  Please, check that your unit has active all the *Optionals* paid. In case of error, please contact Cinergia: some of this *Optionals* only needs a password to activate and it is not needed to send back the unit to Cinergia's laboratory.
- **C:** Interface version. This information will also be useful to Cinergia in case of problems.
- **D:** *Test predefined Optionals* activated (OPTIONALS): IEC and LVRT are available.
- **E:** *Total Run Time***.** The unit has an internal Run Time counter as an information that is activated only when the unit is in RUN status.
- **F:** *Unlock Software Upgrades* button. By entering the password delivered by Cinergia, it is possible to unblock the available optional of the equipment. The OPTIONAL will be indicated with a LED so, for example, in the figure above the only activated optional is the *Multichannel or Separated Branch Control*. It has an additional cost. In case to get the activation code, introduce it, press *Send* and do not get any result, please make a screenshot of this tab to send it to Cinergia.
- **G:** Interface look type. The user can choose to different skins of the Cinergia's interface: blue or dark one and a grey or light one.

- **H:** Parallel and serial operation configuration. The ePLUS platform units has the capability to connect up to 4 units in PARALLEL and 2 units in SERIAL. For more information read the specific manual of *Parallel and Serial Operation User Manual*.

In case of problems with the converter, please make a screenshot of the ABOUT TAB and send it to Cinergia. The user must connect to the equipment to be sure that the interface tab charges all the internal parameters of the unit.

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Please, don't hesitate to contact on support@cinergia.coop our technical support team in case of any doubt or question.