Control
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Local Touchscreen Manual

Regenerative Power Converters

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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.

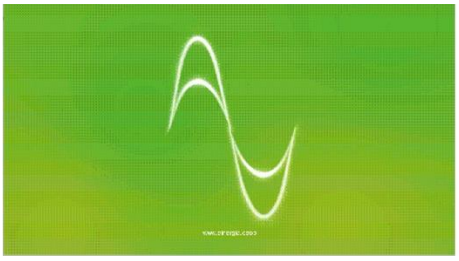
Cinergia is in constant development to deliver always the best service to you, so it is possible to find some discrepancy between this manual and the real converter itself. Don't hesitate to contact us and ask for the latest version of the documentation.

2. LOCAL TOUCHSCREEN CONTROL PANEL

The equipment of Cinergia has the possibility to be controlled with the local touchscreen situated in the front panel of the equipment, which also delivers the necessary information of the status of the converter. The following list illustrates the basic functionalities of the touchscreen:

- Information about the status of the converter (initialization, ready, standby, run, Precharge or alarm).
- Information about the connection and configuration (independent/parallel, unipolar/bipolar and AC/DC).
- Information of the input and output voltage, current and power.
- Operate with the equipment by changing the status.
- Send setpoints and configure limits and ramps.
- Create plots.
- Change the IP of the equipment.
- Configure the analogue output.

When the LCD touchscreen is not in use during a certain among of minutes, there will appear a screen saver which can be disabled by touching the screen anywhere. The following images show two different moment of the screen saver:

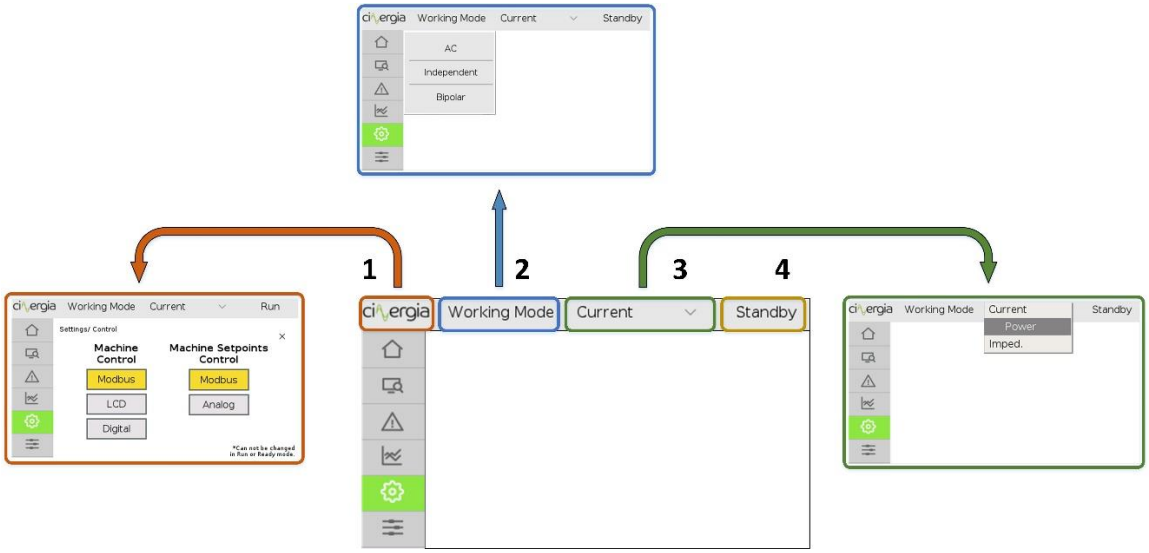


3. DISTRIBUTION OF THE TOUCHSCREEN

To create a friendly navigation of the LCD, Cinergia has designed a tab distribution ubicated in the right of the screen. There is also an upper bar, which has the purpose to inform and modify the control operation and mode as well as the status of the equipment.
All these tabs are described in the following points.

3.1. Upper bar

The following diagram details the top bar of the touchscreen, which is always visible and operative.



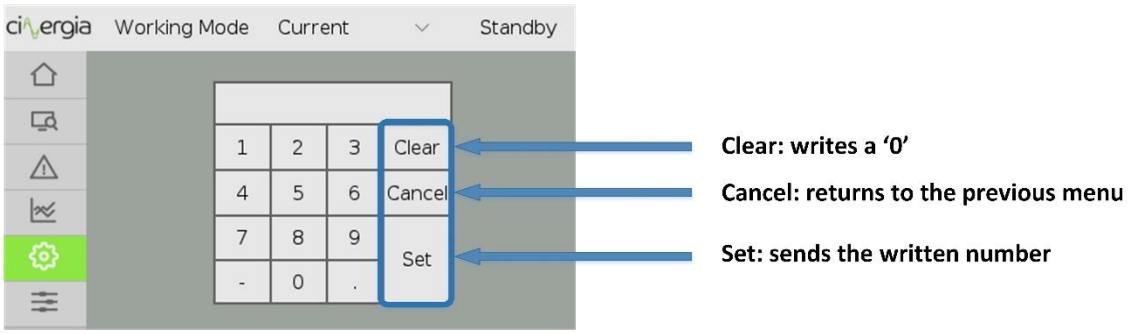
By means of the bar in the upper side of the touchscreen, the user is constantly aware and can modify the following variables by pressing the touchscreen:

1. **Control of the equipment.** The local touchscreen will go to the settings options where the user can decide which is the control of the equipment (Modbus, LCD or Digital)
2. **Working connection mode.** Information about the mode (AC/DC, Independent/Parallel and Unipolar/Bipolar)
3. **Control mode.** The user can modify the control of the equipment (Voltage, Current, Power or Impedance). Current, Power and Impedance control is only available in DC mode.
4. **State of the power supply.** Information about the state (Initialization, Standby, Precharge, Ready, Run or Alarm). When the equipment is in alarm, there will appear a red sign.

The rest of information can be found throughout the lateral tabs.

3.2. Keyboard

There are different menus and submenus in the LCD touchscreen that requires to introduce numbers. All them are introduced using a standard keyboard which is the same for all screens. It is the following:



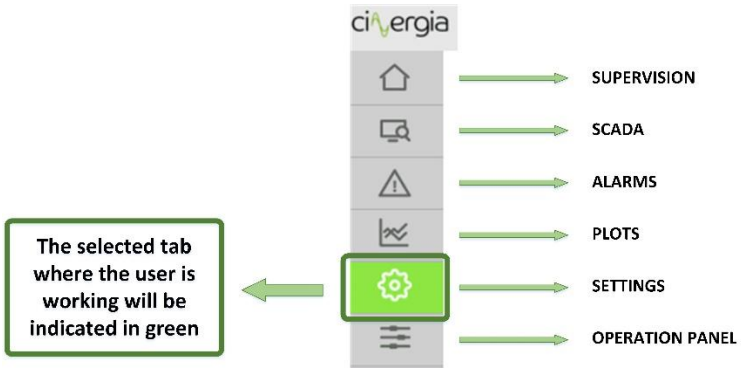
The use of the keyboard is very simple: introduce the number normally. It can be written in positive, negative and with decimals depending on which is the introducing parameter. For example, if the user is changing the IP address, the number cannot be negative or with decimals, but if the introduced number is a current setpoint, the number can be positive, negative and with decimals.
It does not matter if the negative key is pressed at the beginning or at the end of writing the number.

However, there are 3 important keys to describe:

a. *Clear*. Writes a '0' if the user needs to reintroduce the number because of any mistake.
b. *Cancel*. Return to the previous menu without sending any number to the equipment. For example, if the user requires to send a limit, by touching this key the screen will go to the limits menu without sending any limit.
c. *Set*. It sends the number to the equipment and returns to the previous menu.

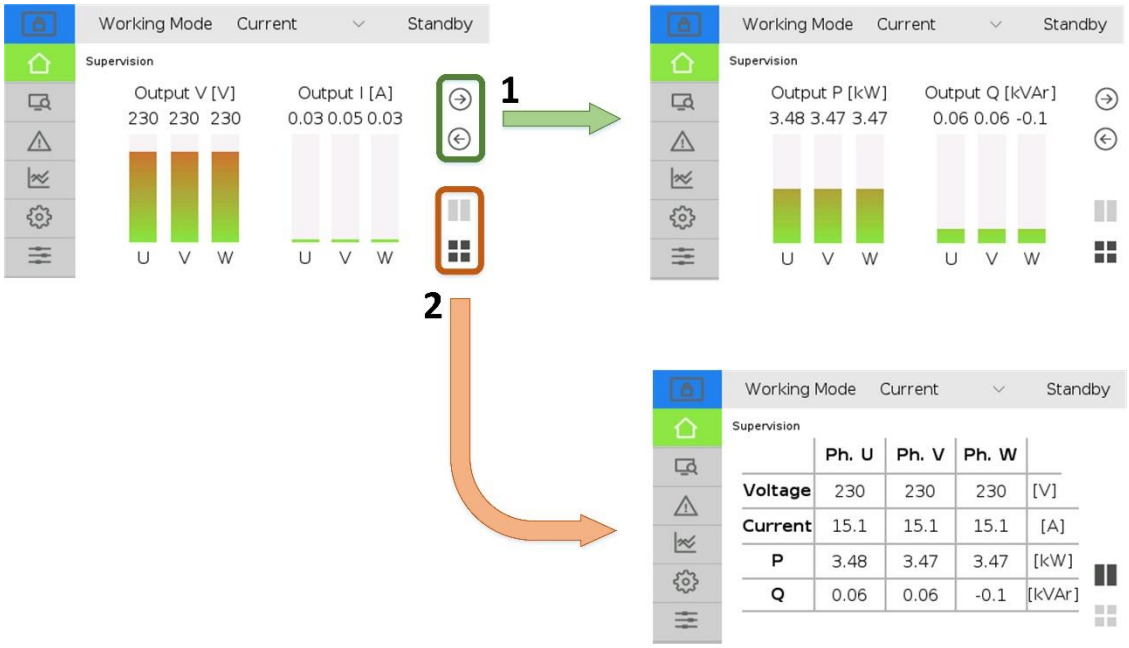
3.1. LCD tabs distribution

As it is mentioned before, the touchscreen is distributed in tabs located in the left of the LCD. There are six main menus: Supervision, SCADA, Alarms, Plots, Settings and the Operation Panel. A description of each one can be found in the following points.



3.1.1. Supervision

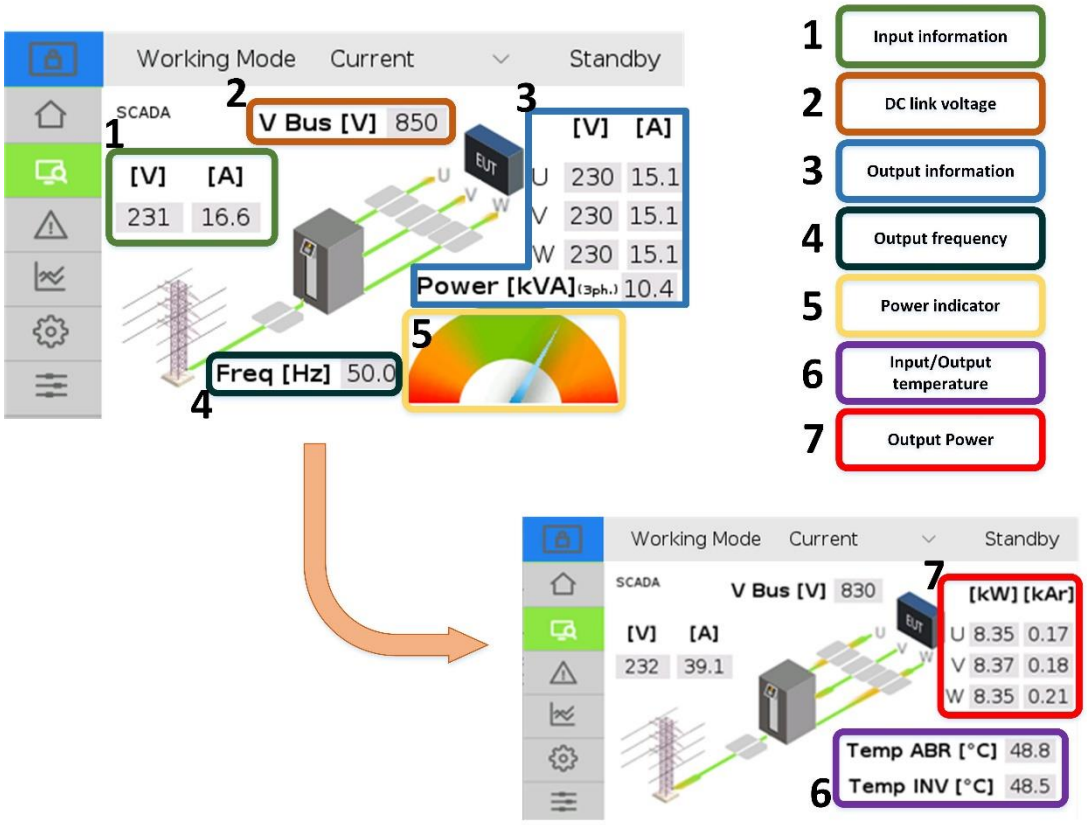
Information tab. It shows the main variables of the inverter: voltage, current and power. You can choose between bars or table visualization.



1. Bar visualization. Change screens using left and right arrows to see voltage and current or power. The bars will be filled depending on the scale fund of the equipment.
2. Table visualization. Using these two buttons, the user can change between bars or table visualization. The table allows to have a general overview of all the parameters of the equipment in only one screen.

3.1.2. Scada

The Scada window is exclusively informative. It shows the main variables of the inverter. The following schematic points the parts of the window and these points are described below.

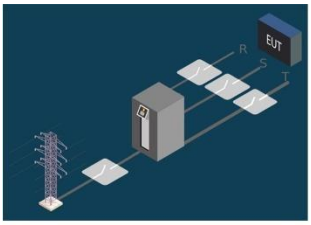


1. Input voltage and current. The input voltage of the converter is the three-phase line voltage whereas the current is the global current flowing in or out the converter. Remember that the Cinergia equipment is a regenerative supply, so it can work as a source (delivering current to the EUT side) or as a load (absorbing current from the EUT side).
2. Voltage in the DC link (bus) of the converter. When the equipment is in *Ready* state, the bus will be around 600V and it will be around 800V while being in *Run* state. Otherwise it will be decreasing following the discharge curve of the capacitors until it reaches 0V.
3. Output (EUT) voltage, current and power. This part of the tab shows the voltage and current of each channel and the global power (the addition of all phases).
4. Frequency in the output (EUT) side. If the Cinergia equipment is an AC voltage source, the output frequency will be chosen within the specified allowed range (10 to 400Hz) whereas if the equipment is an AC current source, the frequency will be read from the AC voltage source connected in the EUT side.
5. Power diagram. This indicator displays the total output power of the converter. It will move to the right or to the left depending on the behavior of the equipment (load or source).

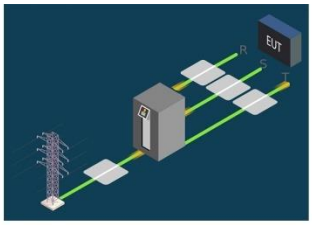
By touching any part of the Scada screen it will appear information about the power and temperature. To return to the other visualization, touch the screen again in any part of the Scada tab.

6. Input and output temperature of the converter. If the temperature (input or output) reaches the limit there will appear the alarm *Heatsink Temperature*.
7. EUT side power (active and reactive) per channel.

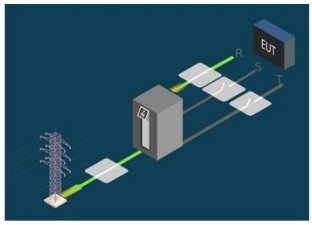
The image in the middle of the Scada tab details the working state of the equipment per phase using a drawing:



EQUIPMENT NOT RUNNING



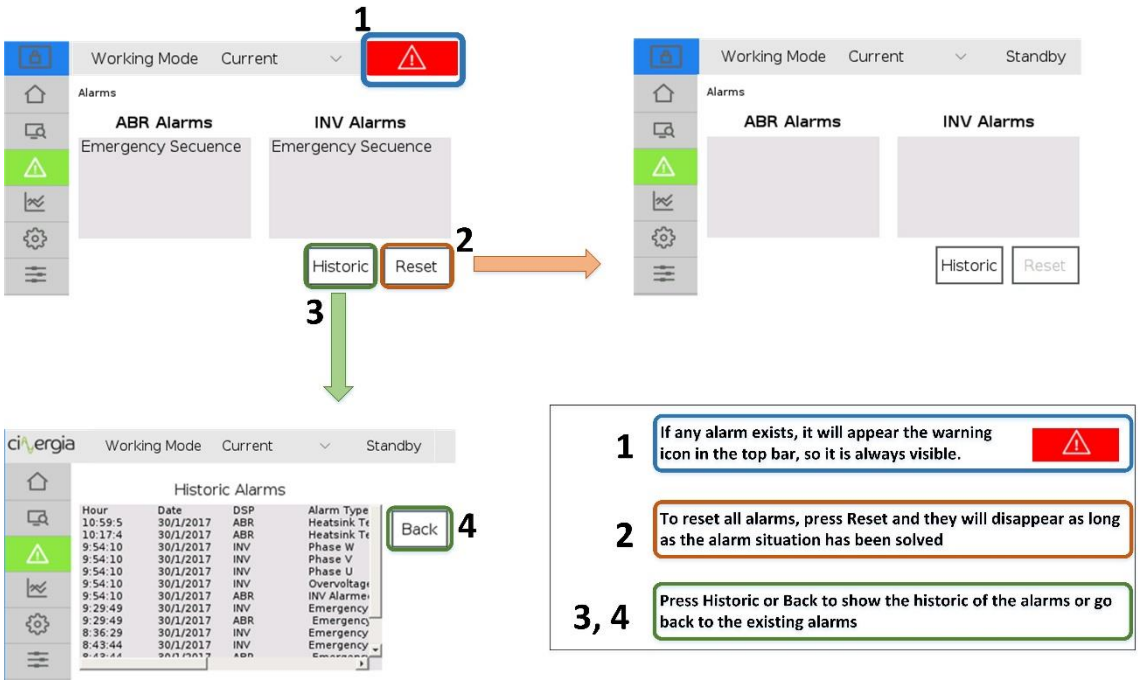
EQUIPMENT WITH ALL 3 PHASES RUNNING



EQUIPMENT WITH U PHASE RUNNING (only with separate mode)

3.1.3. Alarms

The Alarms window displays information about the power supply alarms. Any existing alarm will appear in this window.

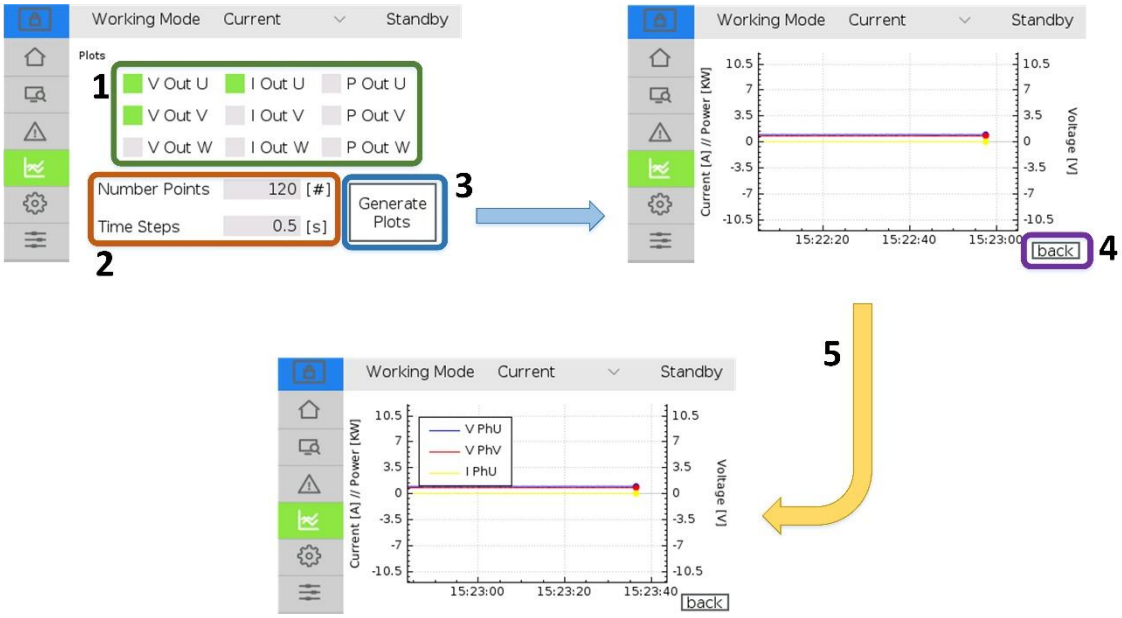


1. If any alarm occurs, the red symbol of emergency will appear on the right-top of the LCD touchscreen.
2. To reset the alarms and continue working with the equipment, press the *Reset* button. The alarm state will disappear as long as the alarm situation has been solved and the screen of alarms will be cleaned.
3. It is also possible to see the historic of alarms, which will show all the alarms from the first time that the equipment is turned on. Press the *Historic* button to visualize all the alarms.
4. Press *Back* to return to the alarms main menu again.

The equipment cannot work meanwhile it is in the alarm state.

3.1.4. Plots

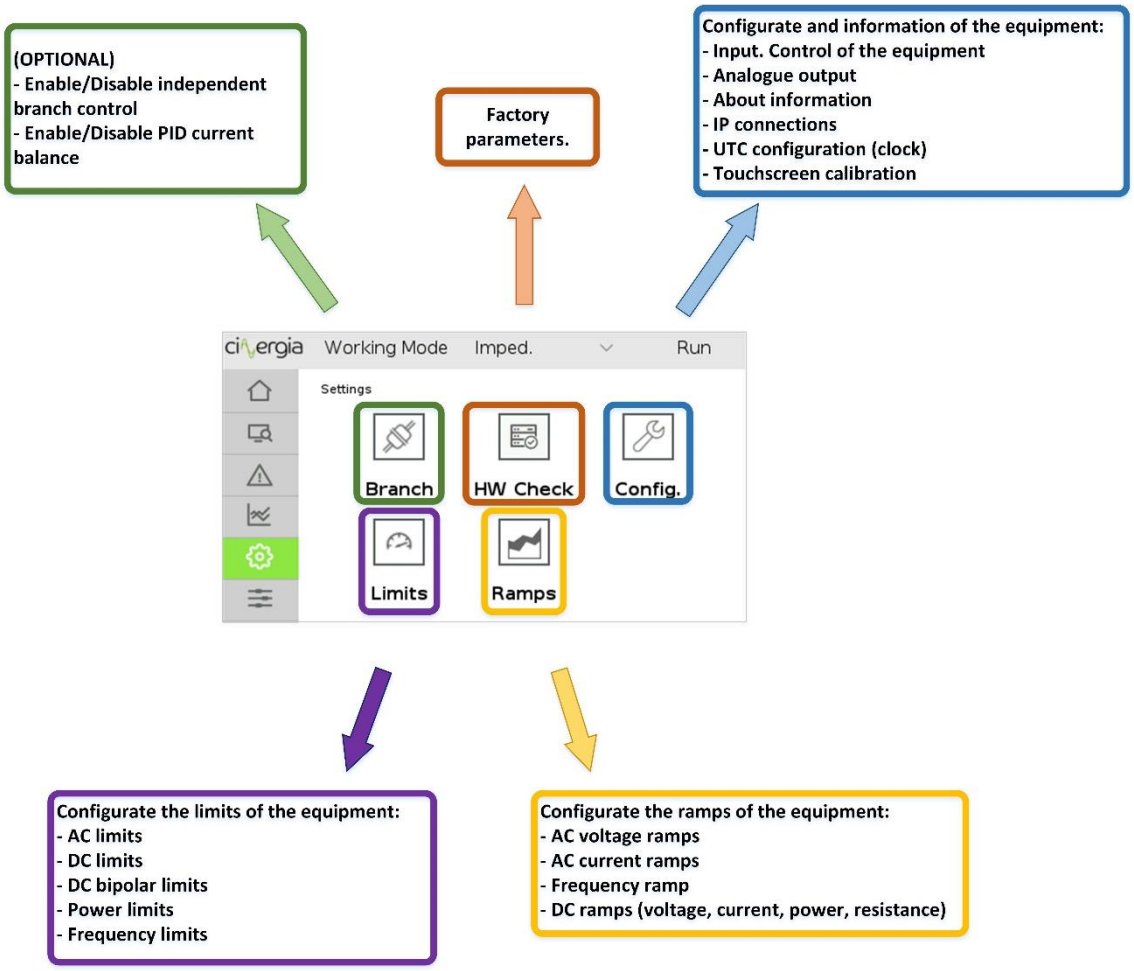
The LCD touchscreen can generate plots of the voltages, currents and powers of each phase. Follow the steps described below to create them.



1. Select the items you want to be in the plot. The available parameters are output voltage, current and power for each phase. The selected items are illuminated in green. To deselect them, press the left square again and they will be not illuminated anymore.
2. The plot will get the value of the selected items in **1** every time indicated in *Time Steps*. The *Number of Points* are the points that will appear of the same item in all the horizontal axis. For example, if the *Number of Points* is 120 and the *Time Steps* is 0.5s (default values), the plot will get values of the selected items in **1** every 0.5s and the horizontal axis will show 120 · 0.5 = 60s of points.
3. Once the items are selected and the numbers in point **2** are ready, press *Generate Plots*. The horizontal axis is for the time whereas the verticals ones are for the current and power (left) and voltage (right).
4. Press *back* to return to the plots menu.
5. By pressing anywhere in the generated plot, it will appear the legends with the colors and the items being created in the graph. Pressing the plot again, the graph legends will disappear.

3.1.5. Settings

In this tab, the user will be able to introduce all the configurations and parameters of the equipment. The following schematic describes the available functions of this tab:

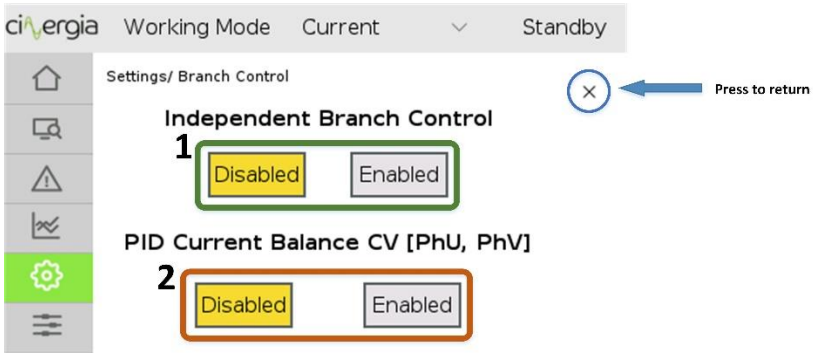


In the following points, each part of this *Settings* tab is described.

I. *Branch*

It is important to notice that the independent branch control is an extra for the equipment and it has an additional cost.

The function of independent branch allows to work with each channel of the equipment independently. It means, for example, that phase U can be in voltage mode and V and W in current mode, which can be very useful because the same Cinergia equipment can work as a voltage and current source at the same time.



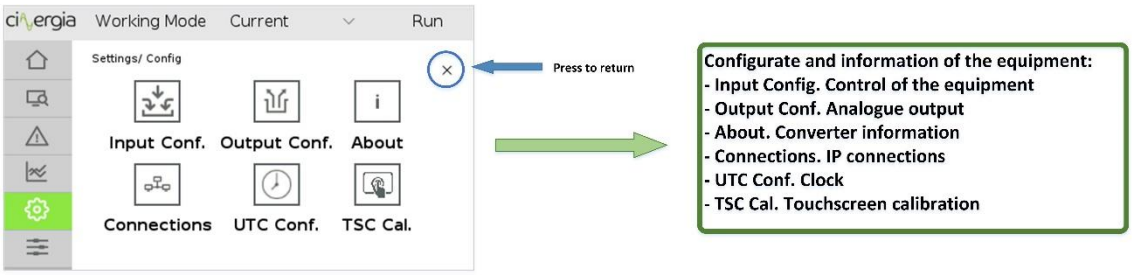
1. Enable and disable the independent branch control. The selected mode is illuminated in yellow.
2. There is the possibility to work with the phases U and V both in voltage mode. To do so, a software PID can be activated with this button to get a balance in the current flowing in both voltage source channels.

II. *HW Check*

For now, this is an internal option of Cinergia and is in development process to be available for the user as soon as possible.

III. *Config.*

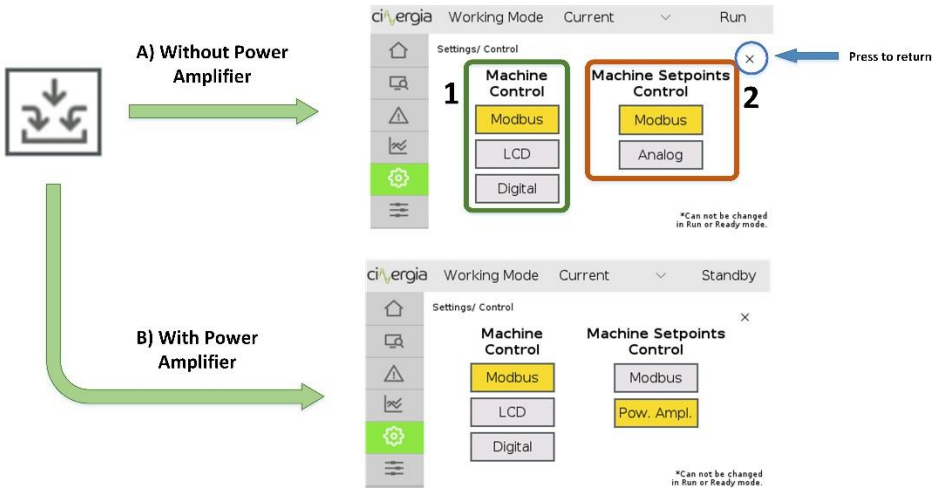
In this tab, the user can introduce the general and specific parameters into the equipment:



Each submenu is described below:

a. *Input Conf.*

The input configuration allows to choose the control of the equipment. It is separated with two parts: the machine control and the setpoints control. The machine control are the signals which makes the converter to be in the different states such as enable, run, ready… whereas the setpoints control sends to the equipment the value of the setpoint.
The selected option will be illuminated in yellow.
The following schematic explains the different ways to send these signals:

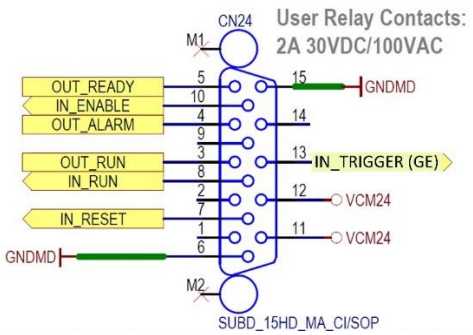


It is important to notice that the Power Amplifier control is an extra for the equipment and it has an additional cost.

A) Without Power Amplifier. It is separated the *Machine Control* and the *Machine Setpoints Control*. As it is explained before, the first one (**1**) allows the user to control the equipment status. This control can be done through these different possibilities:

a. *Modbus*. Send the control signals via the interface delivered by Cinergia.
b. *LCD*. Control the equipment state using the LCD touchscreen. Using this option, a blue lock will appear on the top left of the touchscreen. It means that the converter will only follow the instructions of the LCD even though the interface tries to control it.

c. *Digital.* This option allows to control the converter using the digitals signals gathered in the **X17** DB15 connector in the front panel connections which its pinout is the following:



The converter will follow the instructions coming from the selected option. While there is a selected control, the other two controls are not available.

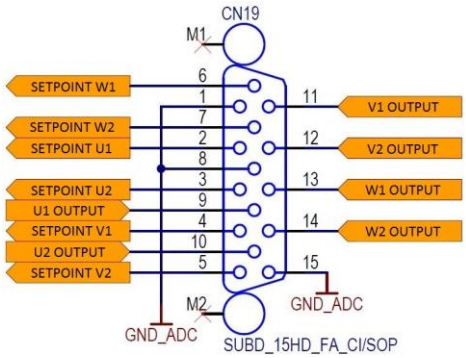
The *Machine Setpoints Control* (**2**) is separated in two options:

a. *Modbus.* The setpoints are sent using the interface delivered by Cinergia.
b. *Analog.* The setpoints are sent using the DB15 connector gathered in **X15**.

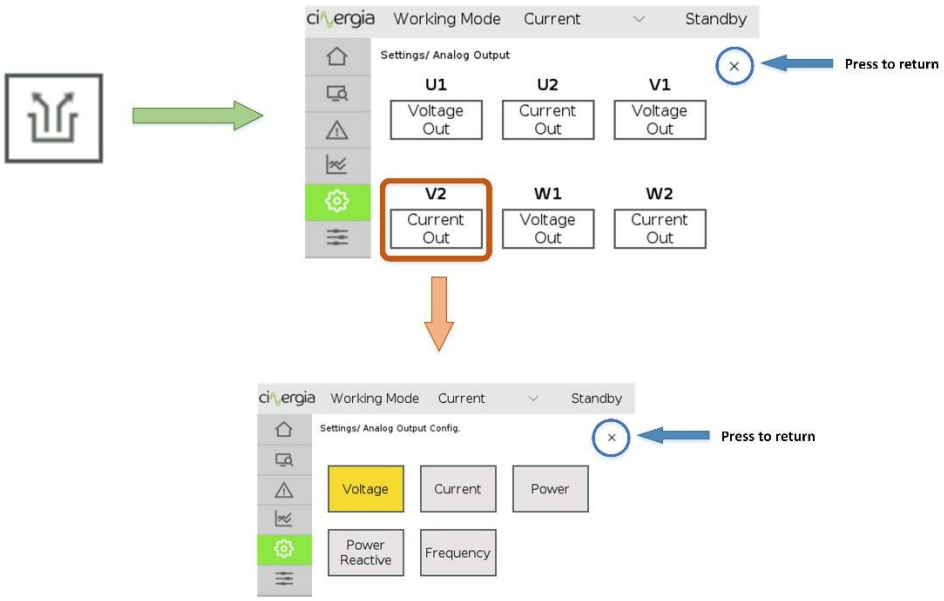
B) With Power Amplifier. It is almost the same as the option without power amplifier, but the setpoints can be sent via *Modbus* and *Power Amplifier*. This last option is explained in the manual of the equipment and it means that the user can introduce the desired waveform in the **X15** connector and it will appear in the output.

b. Output Conf.

This window allows the user to set the analogue outputs. Each channel has 2 analogue outputs (for example, output **U** has analogue outputs **U1** and **U2**) and each output can be configured as *Voltage*, *Current*, *Power*, *Power Reactive* (only AC) or *Frequency* (only AC). These analogue outputs will be gathered in the **X15** DB15 connector in the front panel, which its pinout is the following:



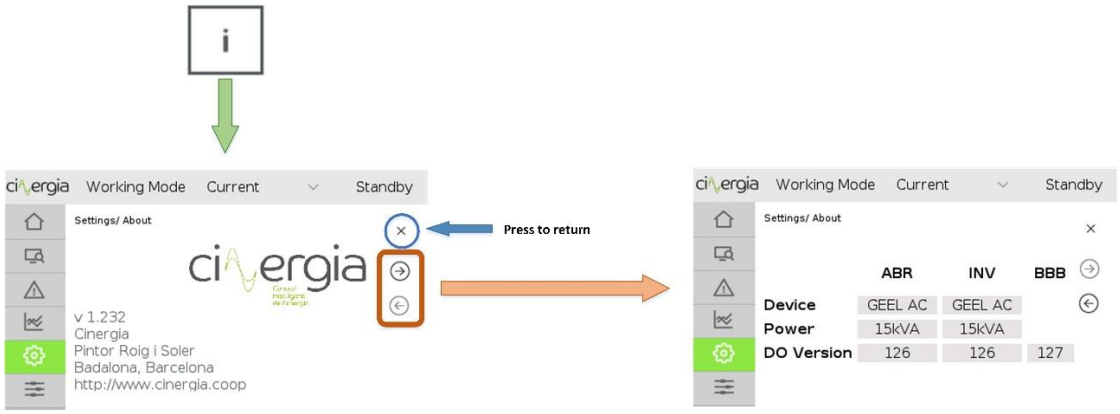
Once the user goes in the *Output Conf* menu will be able to select and configure the 6 analogue outputs (**U1**, **U2**, **V1**, **V2**, **W1** and **W2**). By pressing one of them, another screen will appear with the available options depending on the kind of equipment:



The selected analogue output will be illuminated in yellow.

c. *About*

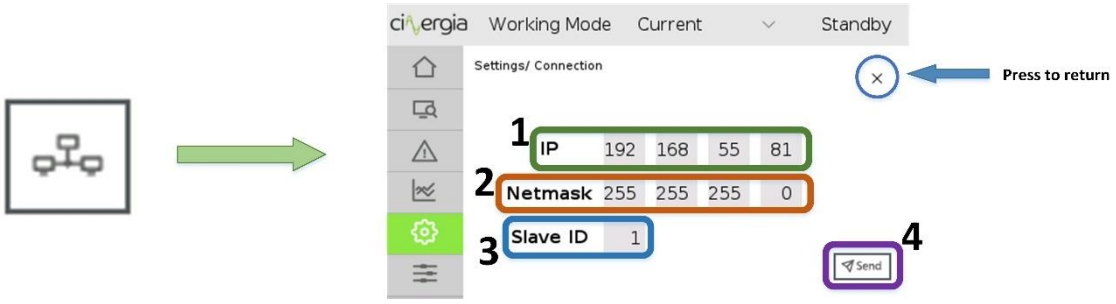
It shows the basic information of the converter. It contains the address and the webpage of Cinergia as well as the device information. The user can consult it by touching the arrows on the right of the screen.



d. *Connections*

This is the menu where the user can visualize all the connections parameters.

To know more about these parameters, please read the document *Connecting Cinergia units to PC*.



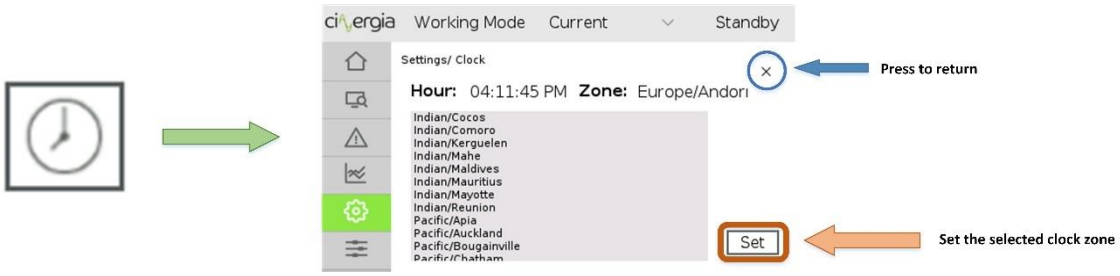
To change the values of the following parameter, touch the number and the LCD will go to the keyboard explained in the chapter *3.2. Keyboard* of this manual.

1. *IP*. There are four parts to be filled and they depend on the required or desired net where the converter will be connected. To change the IP, touch on each window with numbers.
2. *Netmask*. Configure the Netmask according with the PC netmask.
3. *Slave ID*. If the connection of the Cinergia equipment is not in serial (RS485 or RS232), this parameter is not important because the Modbus is based in a point-to-point communication. When the equipment is using a serial communication, set this parameter according to the other equipment in the same net.
4. *Send*. Once all the parameters are ready, press this button and they will be send to the converter.

When the user changes the IP of the equipment, it will go to alarm state (*Heartbeat* alarm). If the interface is running with the old IP, it will be disconnected and to reconnect it will be necessary to use the new introduced IP. Local touchscreen will turn on automatically after maximum 2 minutes.

e. UTC Conf.

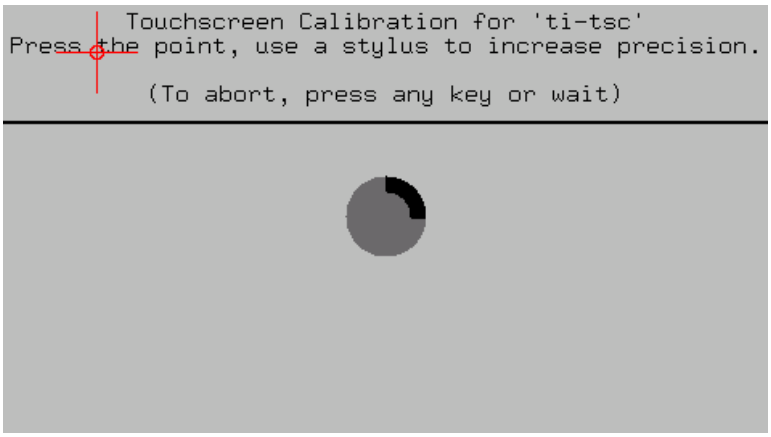
This menu allows to configure the clock zone where the equipment is working. It is used for the *Historic* of the alarms and the horizontal axis of the plots in the LCD and the PC interface.



Move the finger up and down in the window to find the desired time zone and press it when it is found. Afterwards select it and press *Set*. It will be changed automatically.

f. TSC Cal.

(TouchScreen Calibration). Select this option to calibrate the touchscreen. To do so, follow the instructions that appear in the LCD. It is only necessary to touch the four red crosses that will appear:



Once the four red crosses are touched, the touchscreen will go back to the previous menu (Settings/config).

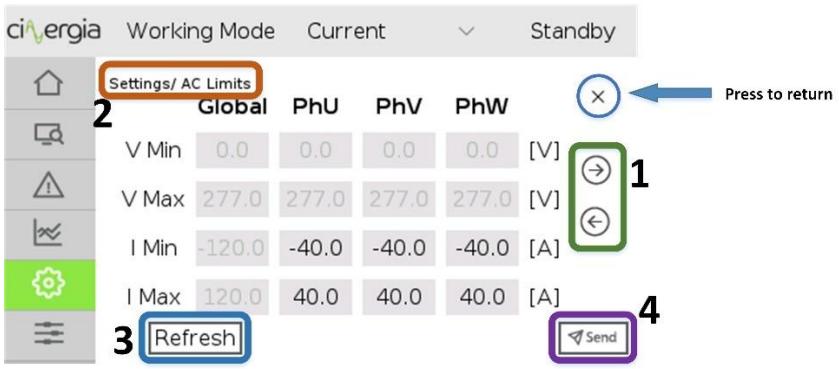
IV. *Limits*

The user can define the limits of the equipment in this menu. 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.

The LCD touchscreen will freeze or unfreeze (illuminate) the available parts where the user can introduce the parameters depending on the equipment (AC or DC, voltage source or current source and parallel or independent connection)

Each limit window is practically the same, the main difference are the values to introduce. For example, bipolar limits will not have *Global* values to introduce because it cannot be in parallel mode. Or, another example, frequency limits are for all the phases so it does not make differences between each channel. The following image details one of these window with the buttons to navigate in it.



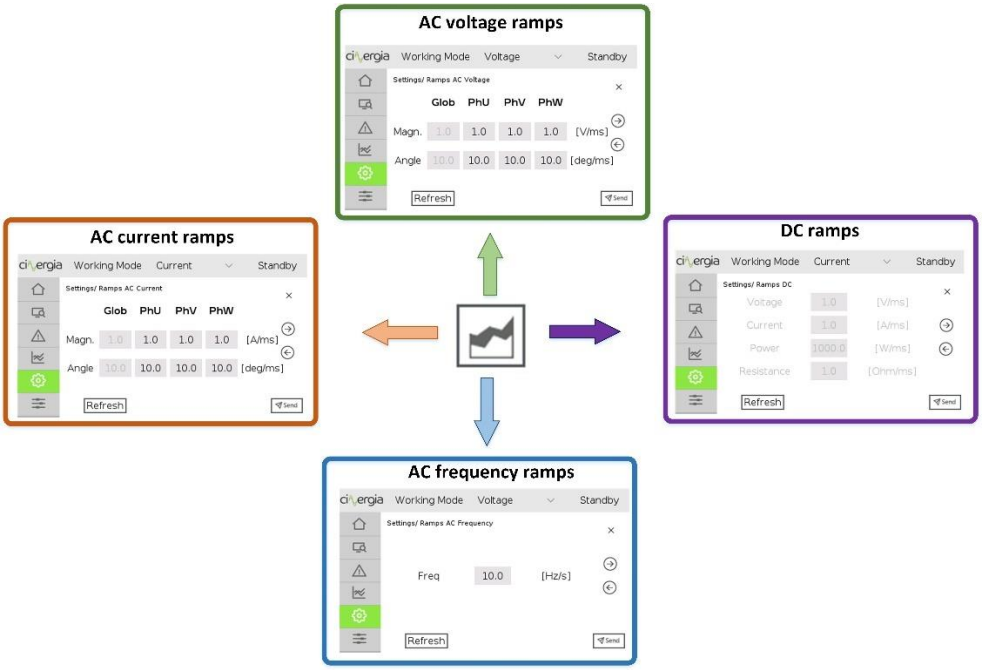
1. Change the limit window with the left and right arrows.
2. The actual window is indicated so that the user can see which are the limits to introduce. For example, this image above is for the *AC Limits*, and the equipment is in current mode, so the available limits to introduce are the current ones while the voltage values are frozen and the user cannot touch them.
   To change the values, touch the number and the keyboard explained in the chapter *3.2. Keyboard* will appear.
3. *Refresh* button is used for show which are the limits in the equipment. It is useful to touch this button when the user sets new limits in the converter to see if the new values have been correctly introduced.
4. Press *Send* when all the values are ready in the window.

V. *Ramps*

The ramps control the softer or faster change of the setpoints to avoid peaks or possible damages in the equipment under test. The ramps are not always necessary. The equipment has default ramps, but they can be changed in this window or in the interface.
The available ramps to change are the followings:

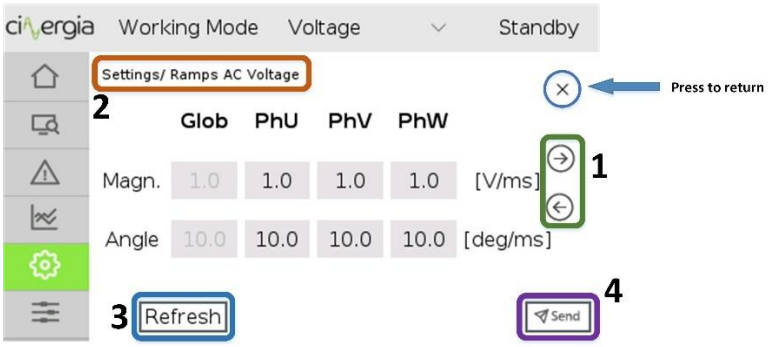
- AC voltage (magnitude and phase angle)
- AC current (magnitude and phase angle)
- Frequency (only AC)
- DC (voltage, current, power and resistance)

It is represented in the following diagram:



The LCD touchscreen will freeze or unfreeze (illuminate) the available parts where the user can introduce the parameters depending on the equipment (AC or DC and voltage source or current source)

Each ramp window is practically the same, the main difference are the values to introduce. For example, in AC there are differences between each channel whereas in DC, each ramp is for all three channels at the same time. The interface allows to configure the three channels with different values each one. Frequency ramp is also for all three channels at the same time. The following image details one of these window with the buttons to navigate in it.



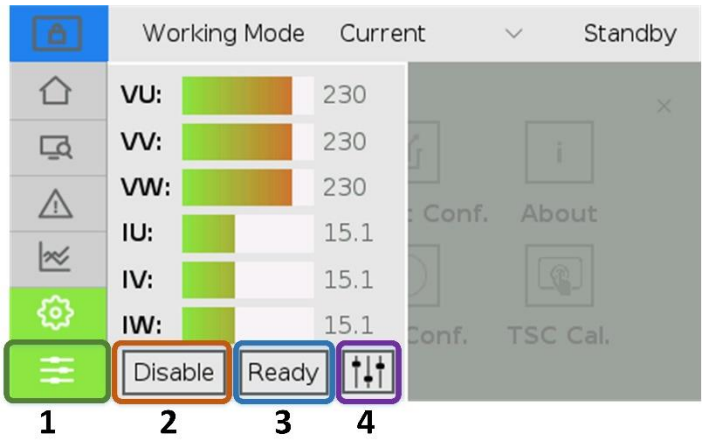
1. Change the ramp window with the left and right arrows.
2. The actual window is indicated so that the user can see which are the ramps to introduce. For example, this image above is for the *AC Voltage Ramps*, and the equipment is in voltage mode, so the values can be changed and the windows are illuminated. However, the equipment is not in parallel mode, so the *Global* values are frozen and the user cannot touch them.
   To change the values, touch the number and the keyboard explained in the chapter *3.2. Keyboard* will appear.
3. *Refresh* button is used for show which are the ramps in the equipment. It is useful to touch this button when the user sets new ramps in the converter to see if the new values have been correctly introduced.

4. Press *Send* when all the values are ready in the window.

A setpoint with a ramp higher than 5A/ms will produce over peaks bigger than 10%.

3.1.6. Operational Panel

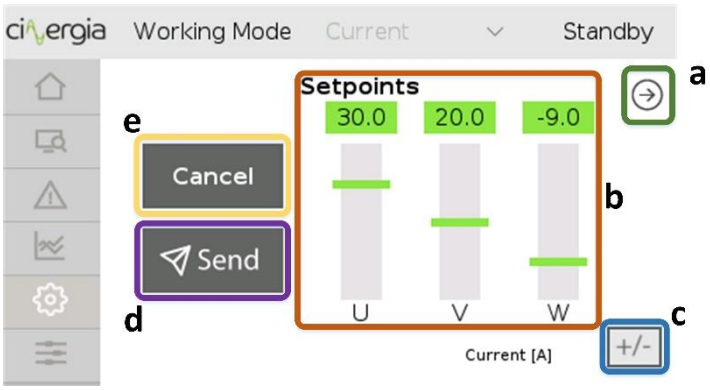
It is possible to view the voltages and the currents in the output of the converter at any time by pressing the left-down button.



1. By touching this button, the LCD will show a supervision window without being important the actual tab. To return to the previous (or another) tab, press the desired tab in the left.

Control the equipment with the following buttons:

2. *Enable* and *Disable* the converter.
3. Set the converter into *Ready* or *Run* state.
4. Send the desired setpoints to the equipment. Depending on the kind of the equipment, the available setpoints will be different. For example, a voltage source will not be able to send current setpoints and a current source will not be able to send frequency setpoints. The LCD touchscreen will make available the setpoints to be send. The following image details how to send a setpoint:



a. Change the setpoint window to find the desired setpoint to change.
b. The setpoints will appear with bars and can be modified by touching this bar until it reaches the desired value or can also be modified touching the number above the bar. It will go to the keyboard explained in the chapter *3.2. Keyboard*.
c. To change the sign of the setpoint press this button. If it is positive will change into negative and the other way around.
d. Once all the values are ready, press this *Send* button

The equipment needs to be in *Run* state to send the setpoints, otherwise the values will not be sent.

If the user needs the converter to work as a load, the setpoint must be with a negative sign. On the other hand, the converter will work as a source with a positive sign.

e. By pressing *Cancel*, the LCD will go to the last tab where the user was without sending any setpoint value.