Battery Test for DC converters (Optional)

Revision number	Document changes	Date
V1	Creation	November 17
V2	Upgrade chapter	January 18
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V4	New document format	April 18
V5	New Chapter	June 18

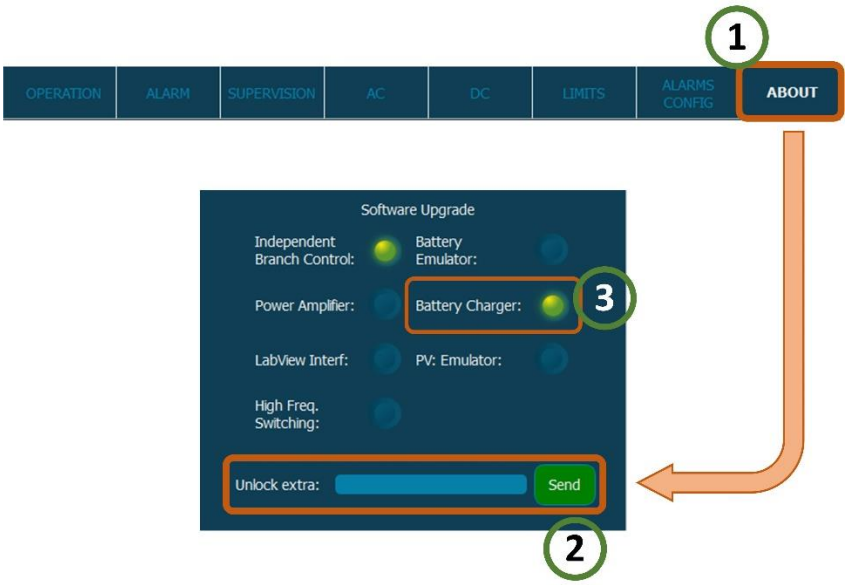
1. GENERAL

Cinergia equipment with DC output can be used as a constant voltage or current source, but they can also behave as a battery tester, battery emulator or as a photovoltaic panel emulator. This document provides the necessary information to control the DC converter behaving as a **Battery Tester**.

The converter must be in DC UNIPOLAR mode to work as a Battery Tester. But the equipment can be in INDEPENDENT (3 independent battery tester) or in PARALLEL (only 1 battery tester).

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

The delivered code must be introduced in the *Unlock extra* reserved space and, afterwards, press the button *Send* (number **2** in the figure below) in the *About* tab. When the Battery Test is activated, the LED beside the option (**3** in the figure below) is shining:



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 of the equipment and the interface 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.

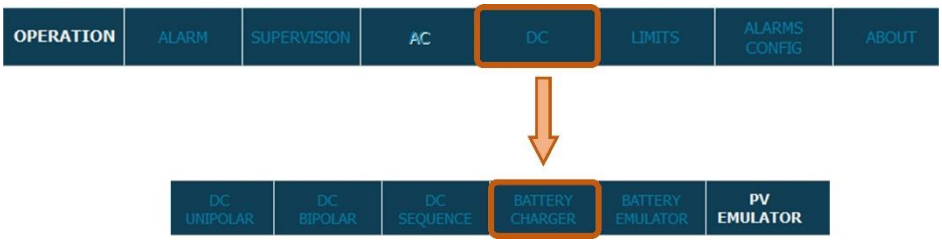
This manual is valid for the following versions of interface:

1.511, 1.512, 1.512x, 1.06xx 2.00xx

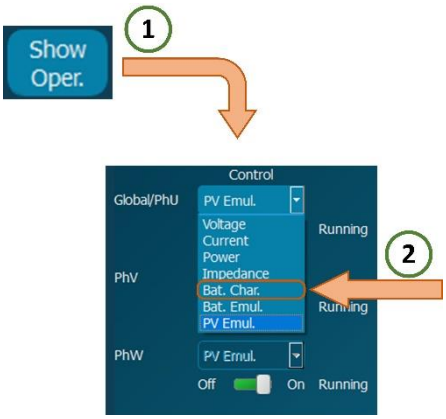
2. BATTERY TEST

2.1. Tabs and Control

In this function mode, the power converter can emulate any kind of battery by introducing the parameters in the corresponding tab, which is in the DC part:

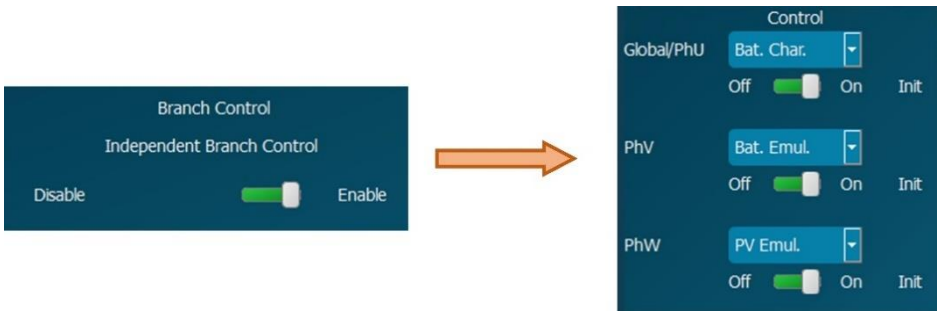


First, the user needs to select the Battery Test mode in the Control part of the interface. To do so, click to the button Show Operational on the left top part of the interface and find the Battery Test control:



Once the user is in the Battery Test tab and the control of the equipment is Bat. Test., all is ready to proceed and emulate any kind of a photovoltaic panel by introducing all the parameters.

Having the equipment with the *Independent Branch Control* enabled, each channel can be in a different control mode:

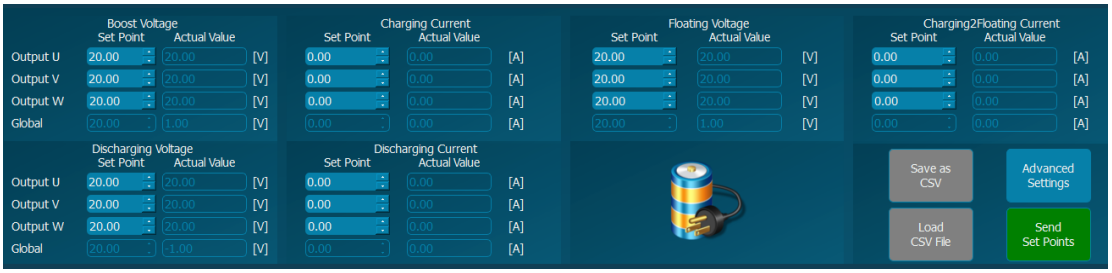


It is very important to be aware of the control configuration and the values of each channel before making the equipment go to *Run* state.

2.2. Parameters

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:



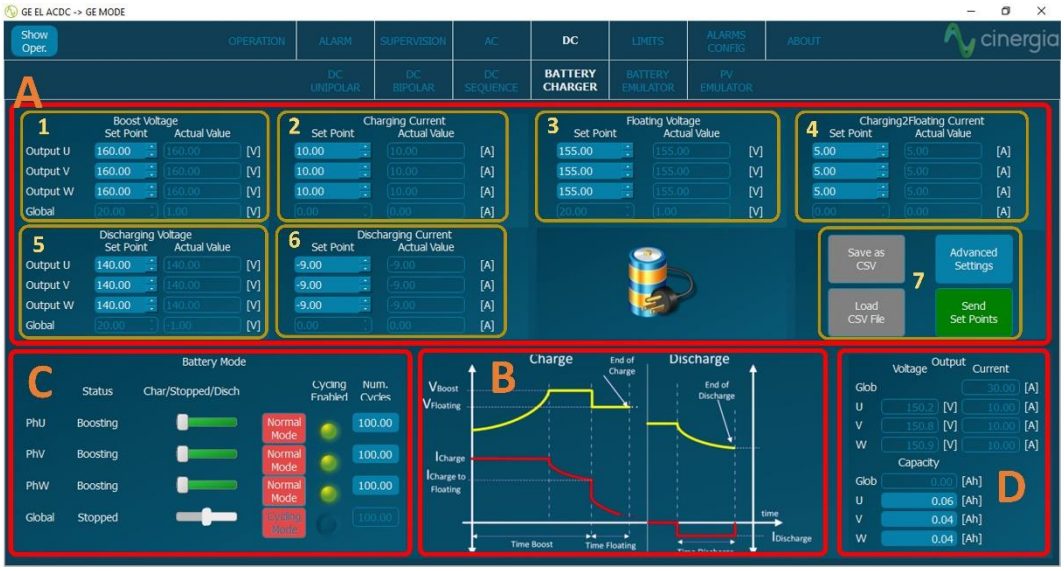
These parameters can be modified in any state of the equipment, even in *Run*. Be sure, before sending any parameter, that the EUT and the Cinergia converter will accept the changes.

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

The limits of the equipment in the *Limits* tab can also be configured for more security.

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 (independent unipolar connection) or 1 power supply (parallel unipolar connection).

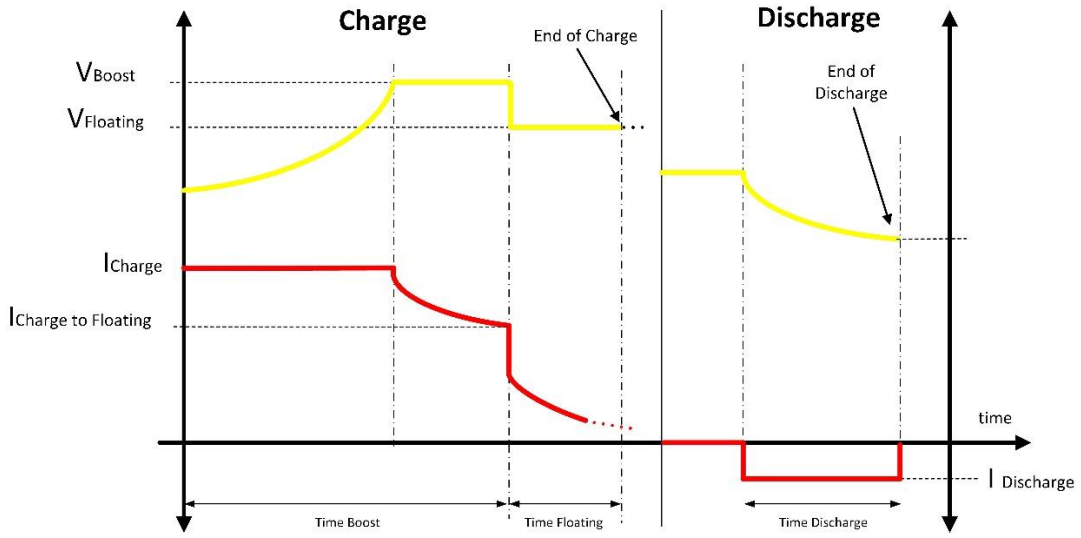
To understand each part of the Battery Test tab, the following image makes a detail of it:



- **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:

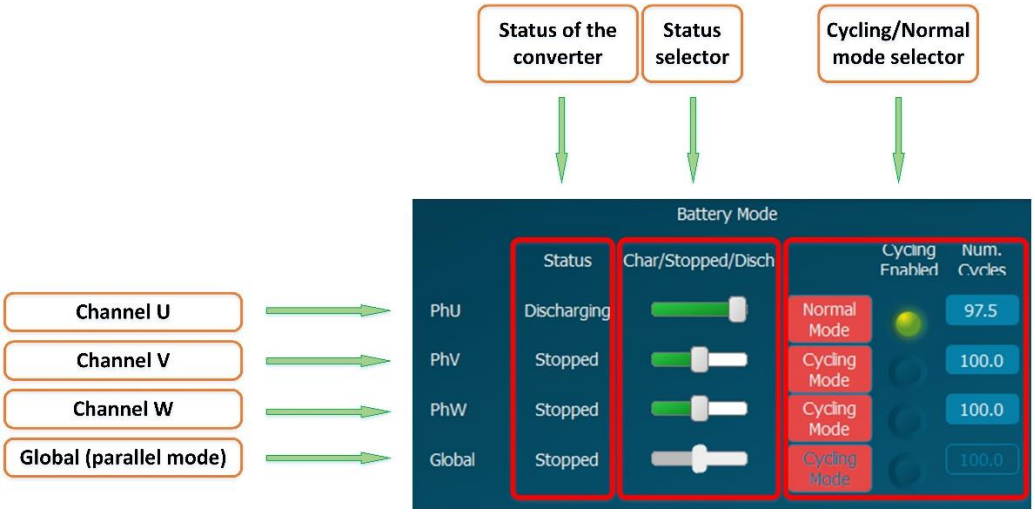
	First Column			
	U	V	W	Global
Boost Voltage	110	110	110	10
Charging Current	20	20	20	0
Floating Voltage	109	109	109	9
Charging to Floating Current	8	8	8	0
Discharging Voltage	106	106	106	6
Discharging Current	-20	-20	-20	0
Boost Time	3600	600	600	600
Floating Time	5	0	0	0
Time Transition	5	0	0	0
Time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

This csv file can only contain numbers.

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. Please go to the part *Advanced Parameters* of this manual to read more about it.

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 *Boosting, Full Charging, Floating*, *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 parallel mode (global).

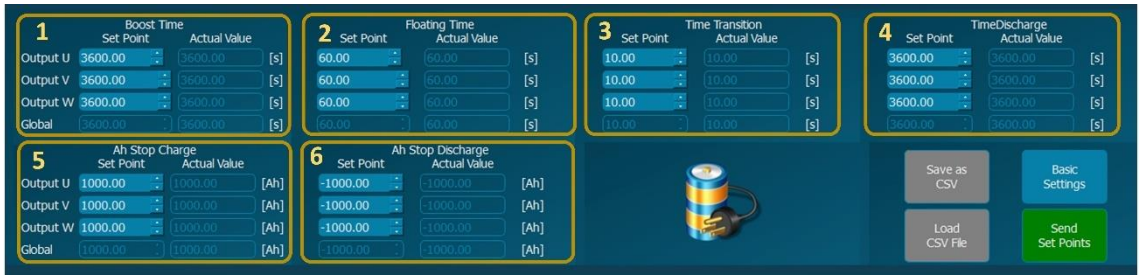
- **D:** This window contains indicators of the voltage and current for each channel. It also has another parameter to be introduced in the converter: the amps per hour of the battery. This value must be negative and is the value that indicates the capacity of the battery. For example, if the battery 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.

2.2.1. Advanced Parameters

The control of the converter takes also into account these parameters, so it is important to know which the values of them are. For example, if the *Boost Voltage* of the Basic Settings is set to 300V and the *Boost Time* of the Advanced Settings is set to 60s, it is possible that this condition of 60s is finished before than the voltage reaches 300V, so the converter will finish the boosting process.



1. **Boost Time.** Maximum time (in seconds) that the equipment will be boosting. The maximum time is almost 4 months and the minimum are 0s.
2. **Floating Time.** Maximum time (in seconds) that the equipment will be floating. The maximum time is almost 4 months and the minimum are 0s.
3. **Time Transition.** Maximum time (in seconds) that the equipment will be waiting for the transition (from charged to discharge). The maximum time is more than 1 day, and the minimum is 0s.
4. **Time Discharge.** Maximum time (in seconds) that the equipment will be discharging. The maximum time is more than 1 day, and the minimum is 0s.
5. **Ah Stop Charge.** Maximum value of Ah that the converter will allow to charge the battery. The maximum is 1000000000Ah and the minimum is 0Ah.
6. **Ah Stop Discharge.** Maximum value of Ah that the converter will allow to discharge the battery. The maximum is 0Ah and the minimum is -1000000000Ah.

Remember that the *Basic Settings* and the *Advanced Settings* are working together. It means that the equipment will reach, for example, the Boost condition will be accomplished when the *Boost Voltage* is reached, OR the *Boost Time* is reached.

The buttons of *Save as CSV* and *Load CSV File* are the same as the ones in the basic parameters. So, the csv file will be the same. The same csv contains the basic and the advanced parameters. To return to the basic parameters view press the button *Basic Settings*.

3. FILE EXAMPLES

Cinergia provides, in the delivered USB stick, the CSV (Coma Separated Value) files detailed in the previous chapter.

In case of using these CSV examples, be sure that the EUT admits the voltage and the current loaded in the Cinergia converter with the CSV file.

The CSV file loads and saves all the parameters, which means the basics (chapter *2.2. Parameters* part A 1 to 6) and the advanced (chapter *2.2.1. Advanced Parameters* parts from 1 to 6)