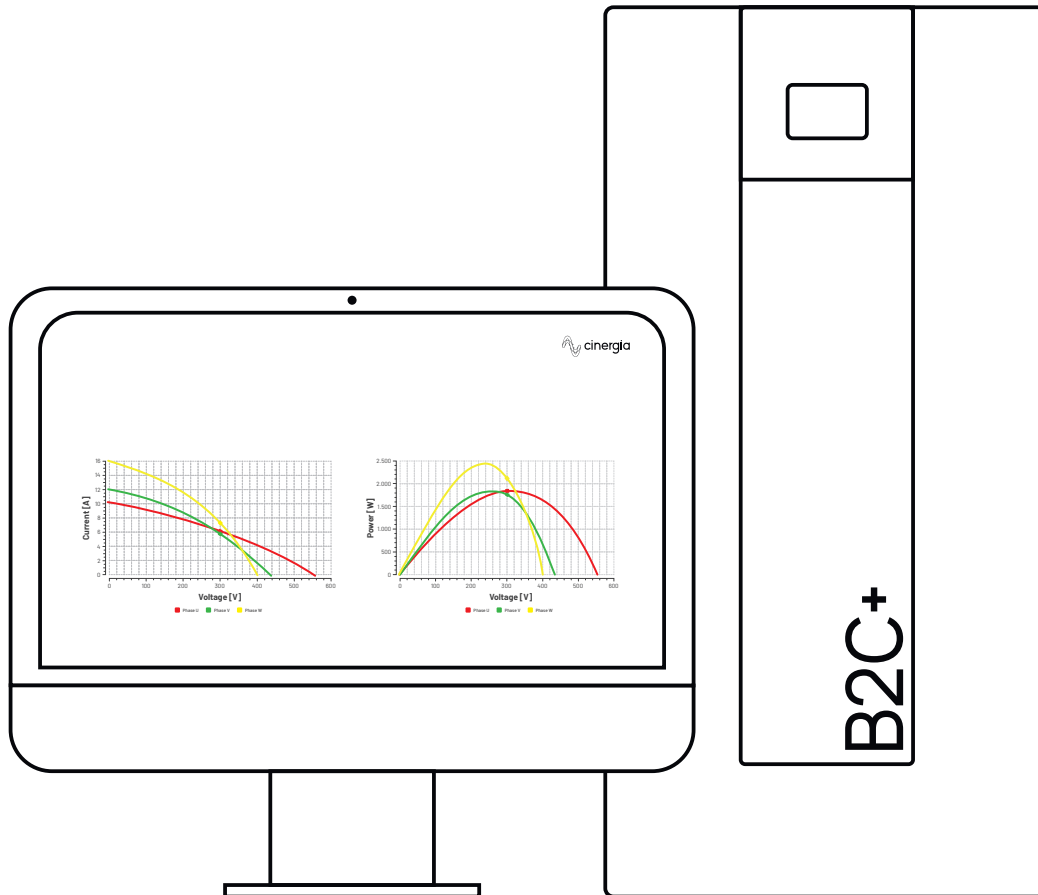




PV Panel Emulator



Advanced DC Software Application

CINERGIA's DC Programmable Power Supplies are designed to generate a controlled DC source or load, but they can also behave as a battery charger, battery emulator or as a photovoltaic panel emulator. This document provides the necessary information to control the DC converter behaving as a PV Panel Emulator.

CINERGIA can provide all the power devices needed to test photovoltaic inverters in a closed energy loop. On such a platform, the total power and energy

consumption of the grid will be reduced to the losses of the power converters involved in the test, typically in the range of 20-35% of the power generated by the Inverter under test. In R&D, the main advantage will be the reduction in power required: a 100kW Inverter could be tested in a laboratory with a 20 to 35kW installation. In burn-in and end-of-line tests, the energy savings will be added to a significant reduction in the energy bill.



The most notable

CINERGIA offer a solution that is characterized by a clear and intuitive design. Its easy handling saves us time in the test setup.



Clear and Intuitive

Control Buttons

Save as
CSV

Save all parameters of the configuration in a CSV file, to use anytime.

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.

Load as
CSV

Load parameters of configuration from the CSV file.

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.



Parameters

Open Circuit Voltage		Max Power Point Voltage		Short Circuit Current	
Set Point	Actual Value	Set Point	Actual Value	Set Point	Actual Value
36,72	36,72 [V]	Output U 30,18	30,18 [V]	10,00	10,00 [A]
36,72	36,72 [V]	Output V 30,18	30,18 [V]	10,00	10,00 [A]
36,72	36,72 [V]	Output W 30,18	30,18 [V]	10,00	10,00 [A]
0,00	0,00 [V]	Global 0,00	0,00 [V]	0,00	0,00 [A]

Max Power Point Current		Voltage Temp Coefficient		Current Temp Coefficient	
Set Point	Actual Value	Set Point	Actual Value	Set Point	Actual Value
5,00	5,00 [A]	Output U 0,0100000	0,0100000 [V/°C]	0,0100000	0,0100000 [A/°C]
7,00	7,00 [A]	Output V 1,0000000	1,0000000 [V/°C]	0,0000000	0,0000000 [A/°C]
8,00	8,00 [A]	Output W 1,0000000	1,0000000 [V/°C]	0,0000000	0,0000000 [A/°C]
0,00	0,00 [A]	Global 0,0000000	0,0000000 [V/°C]	0,0000000	0,0000000 [A/°C]

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.

Max Power Point Current

It is the current that makes the maximum power.

Max Power Point Voltage

It is the voltage that makes the maximum power.

Short Circuit Current

Current that the converter will reach with voltage zero (short circuit).

Voltage Temperature Coefficient

Datasheet parameter. It is negative.

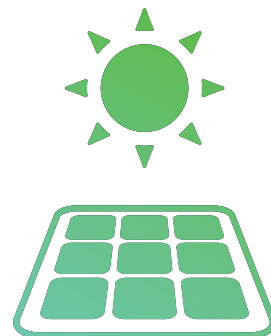
Current Temperature Coefficient

Datasheet parameter.

Strings Connected Parallel		
Set Point	Actual Value	
1.00	1.00	[#]
2.00	2.00	[#]
2.00	2.00	[#]
0.00	0.00	[#]

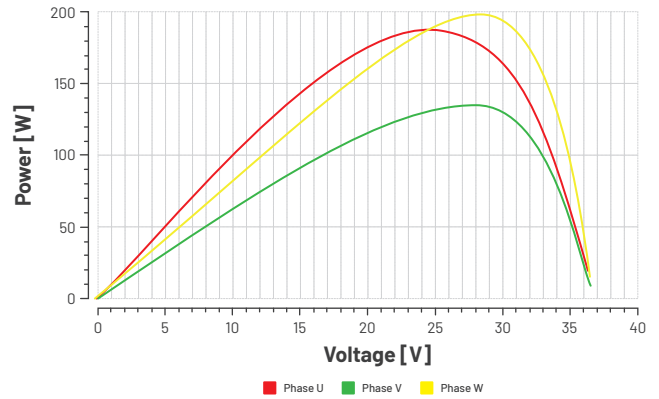
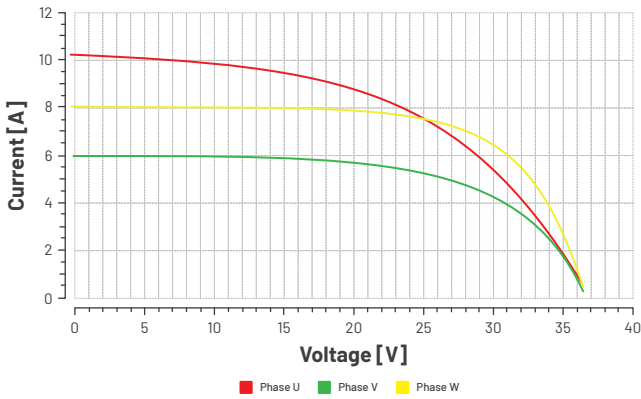
Panels Connected in Series		
Set Point	Actual Value	
10.00	10.00	[#]
10.00	10.00	[#]
10.00	10.00	[#]
0.00	0.00	[#]

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.

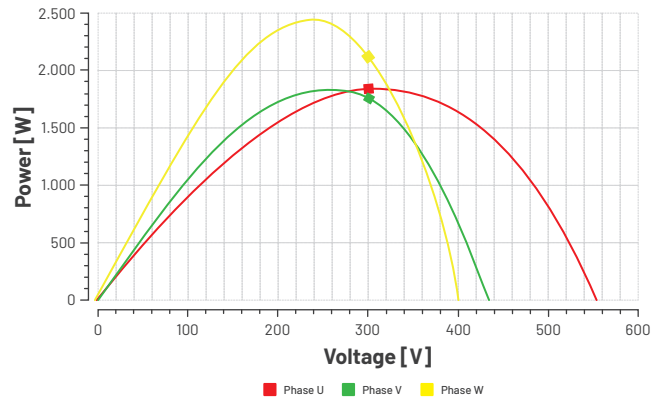
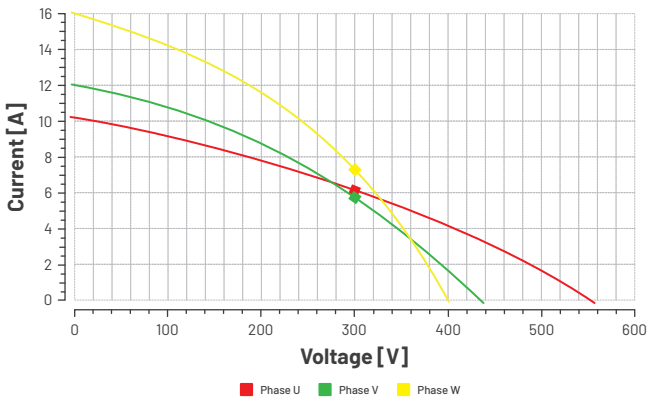




Single Panel Curves example



Multipanel Curves example



Output		
	Voltage	Current
Glob		210.00 [A]
U	300.78 [V]	210.00 [A]
V	300.32 [V]	200.00 [A]
W	300.36 [V]	230.00 [A]
Temperature		Irradiance
Glob	25.00 [°C]	1000.00 [W/m ²]
U	27.00 [°C]	1000.00 [W/m ²]
V	25.00 [°C]	600.00 [W/m ²]
W	25.00 [°C]	800.00 [W/m ²]
TS/GS	25.00 [°C]	1000.00 [W/m ²]

Output

Voltage, Current, Temperature & Irradiance

These output real-time values show the voltage and current, but also the Temperature and the Irradiance, which these two last 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.



Runtime View

The converter allows to emulate different temperatures and radiation within a sequence:



A
The table contains all the parameters, which are time (in milliseconds), global temperature, global radiation and temperature and radiation for all three channels as the first row explains.

	Time [ms]	Glob Temp [C]	Glob Rad.	U Temp [C]	U Rad. [W/m ²]	V Temp [C]	V Rad. [W/m ²]	W Temp [C]	W Rad. [W/m ²]
20	5000	21	675	22	725	23	775	24	825
21	5000	20	650	21	700	22	750	23	800
22	5000	19	625	20	675	21	725	22	775
23	5000	18	600	19	650	20	700	21	750
24	5000	17	575	18	625	19	675	20	725
25	5000	16	550	17	600	18	650	19	700
26	5000	15	525	16	575	17	625	18	675
27	5000	14	500	15	550	16	600	17	650

B
This part is used to execute the sequence and save or load the parameters from a csv file.

1. Use the buttons Save as CSV and Load CSV File to save and recuperate parameters of the A table. It is useful to create a sequence and recuperate it later. The button Run Table or Stop starts or stops the sequence.

2. The LED shows if the sequence is running or not.




3. The location of the csv file is displayed in this zone.





Cinergia products that integrate PV Panel Emulator

		 All Terrain GE&EL+ vAC/DC Grid Simulator + Electronic Load <small>The GE&EL product family is the aggregation of Grid Simulators, Electronic Loads and Bidirectional DC Converters in one product.</small>	 GE+ vAC/DC Full Grid Simulator <small>Grid Simulators are power electronic devices that emulate AC and DC electrical grids in both normal and disturbed conditions.</small>	 EL+ vAC/DC Full Electronic Load <small>The EL+ family is power electronic device designed to emulate AC and DC electrical loads.</small>	 B2C+ Bidirectional DC Converter <small>CINERGIA's DC Programmable Power are designed to generate a controlled DC source load.</small>	
AC Power		7.5 kW - 160 kW	7.5 kW - 160 kW	7.5 kW - 160 kW	-	
DC Power		7.5 kW - 160 kW	7.5 kW - 160 kW	7.5 kW - 160 kW	7.5 kW - 160 kW	
AC Current		11 A - 232 A	11 A - 232 A	11 A - 232 A	-	
DC Current		±10 A / ±30 A - ±185 A / ±555 A	±10 A / ±30 A - ±185 A / ±555 A	±10 A / ±30 A - ±185 A / ±555 A	±10 A / ±30 A - ±185 A / ±555 A	
Operations Mode	AC	Programmable Voltage	●	●	-	-
		Programmable Current	●	-	●	-
		Programmable Power	●	-	●	-
		Programmable Impedance	●	-	●	-
		Power Amplifier (PHIL)	●	●	●	-
		Steps AC	●	●	●	-
		IEC Testing <small>Optional</small>	● <small>Optional</small>	● <small>Optional</small>	-	-
	DC	Programmable Voltage	●	●	●	●
		Programmable Current	●	●	●	●
		Programmable Power	●	●	●	●
		Programmable Resistance	●	●	●	●
		Power Amplifier (PHIL)	●	●	●	●
		Steps DC	●	●	●	●
		Battery Testing <small>Optional</small>	● <small>Optional</small>	● <small>Optional</small>	● <small>Optional</small>	● <small>Optional</small>
		Battery Emulation <small>Optional</small>	● <small>Optional</small>	● <small>Optional</small>	● <small>Optional</small>	● <small>Optional</small>
		PV Panel Emulation <small>Optional</small>	○ <small>Optional</small>	○ <small>Optional</small>	○ <small>Optional</small>	○ <small>Optional</small>

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