B2C+

Regenerative DC Converter

B2C+ is CINERGIA's solution for Regenerative and Bidirectional DC Test Platforms. Thanks to its unique flexibility, it can be used in multiple applications: Renewable Energy Sources, Energy Storage Systems, Battery Testing and Characterization, Electrical Vehicles, EV Charging Infrastructure, Traction Converters and Avionics.

Key features

Bidirectional and Regenerative
Clean grid current: THDi < 3% and PF > 0.98
2 quadrants and 4 quadrants conf igurations

13 models from 7.5kW to 160kW
Parallelization of units to increase the power
Voltage Range: up to 750/800V

CV, CC, CO, CR modes
Battery Testing (charge/discharge/cycling)
Automated Test pro les (csv file)
Battery Emulation (option)
Pv Panel Emulation (option)

3channels / 1 channel / Multichannel /Bipolar
Power Amplifier mode for PHiL applications

Intuitive User Interface
Modbus/Ethernet Open protocol, Labview drivers

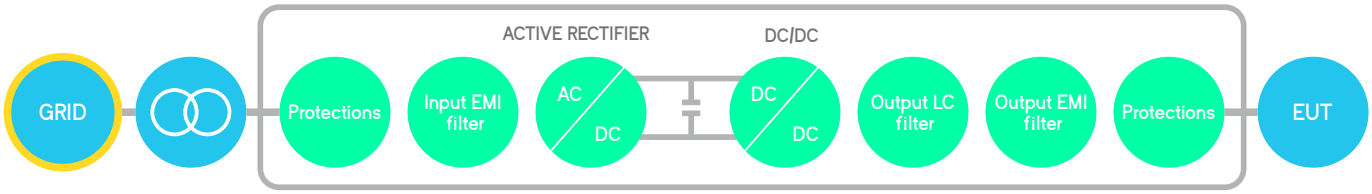
Highlights

- Efficiency and Flexibility
- Save Energy, Power and Time
- DC only
- Multichannel
- High-Resolution and Dynamics

Applications

- Electrical Vehicles and EVSE
- Power HIL
- PV Panel Emulation and PV Inverter Testing
- Battery Testing and Emulation
- Smartgrids and ESS
- Aeronautic (+270V / 0 / -270V)

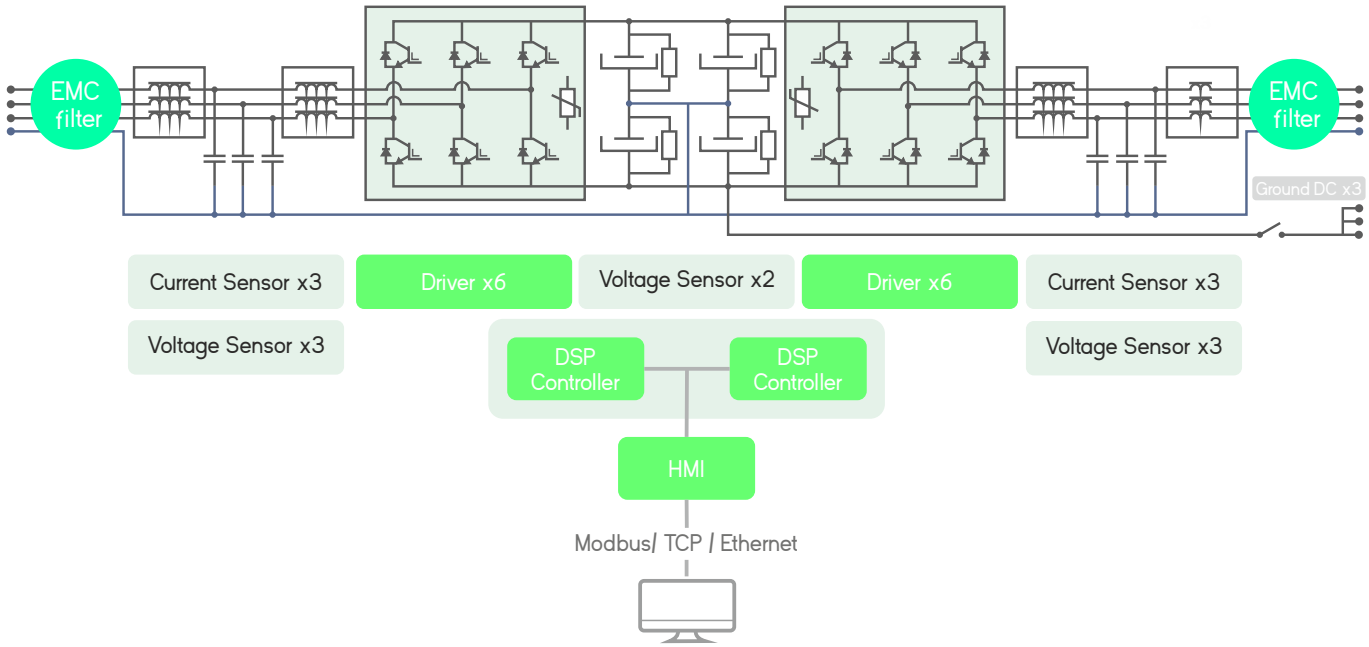
Bidirectional and Regenerative Hardware



The hardware platform is based on a Back-to-Back power conversion topology, formed by two IGBT-based power stages. The grid side stage is an Active Rectifier which produces clean sinusoidal currents with very low harmonic distortion and power factor close to one.

The EUT side stage can be configured for AC voltage source or AC current source or DC output. In AC, voltage/current are controlled by using state of the art digital Proportional-Resonant controllers. In DC, the three independent buck-boost bidirectional legs enable the separated control of three different DC voltages or currents.

Block diagram



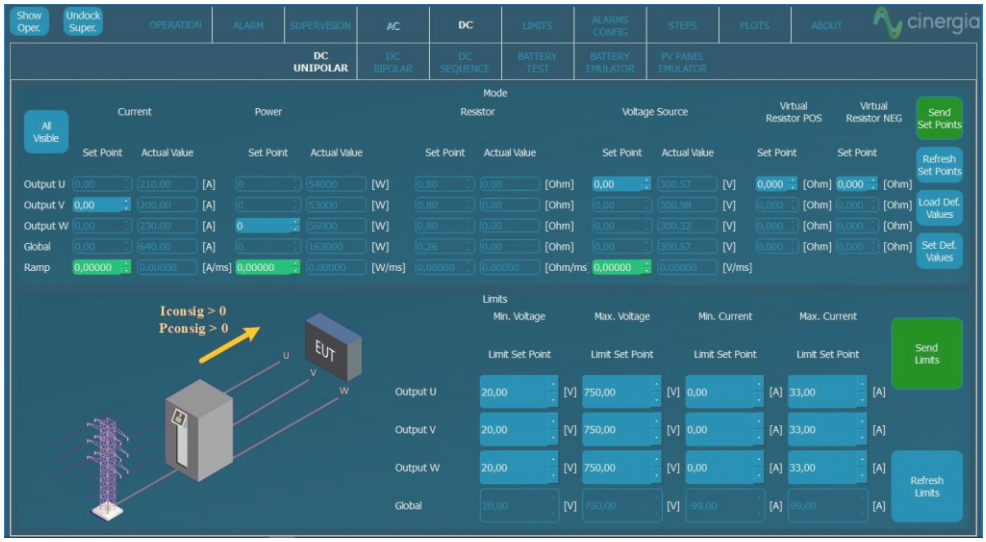
Local Interface

Analogue and Digital IO ports
The isolated digital and analogue inputs/outputs permit the connection of the unit to External Controllers and Power Hardware in the Loop systems (option).

4.3" Touchscreen
Allows the local parameterization and command of the device, configuration of the communications link, plots the main signals and enables the local datalogging.

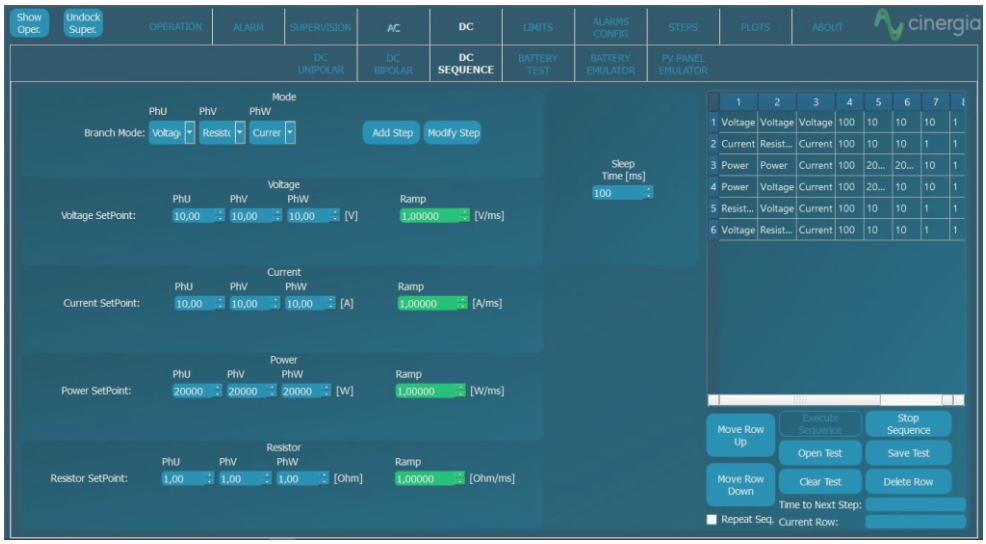
Safety First
The units integrate a local Emergency Stop pushbutton and two signals (input + output) to be connected to the laboratory interlock system. Additionally, the digital outputs can be interfaced to safety tower lights.

Software Interface in DC



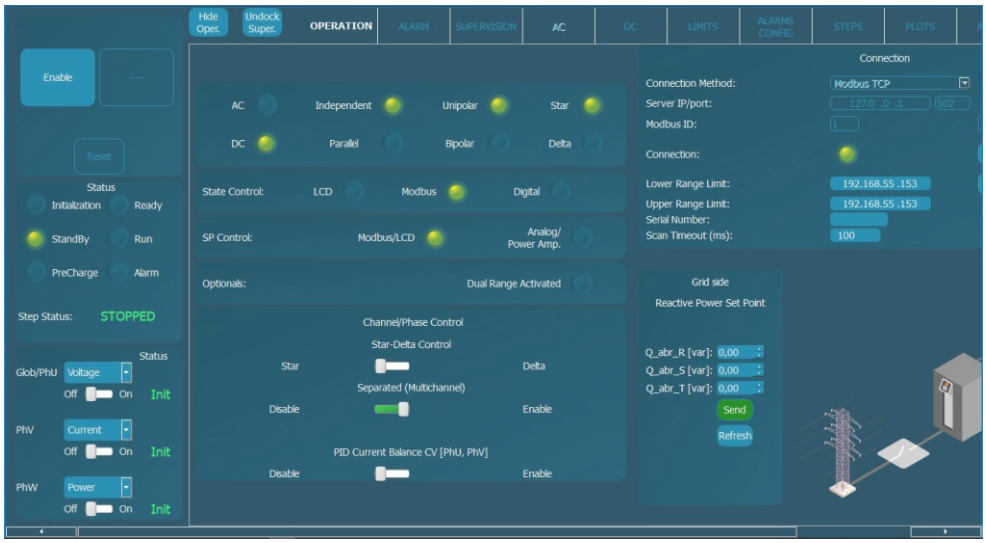
DC Operation

This panel allows the user to access all DC setpoints and limits. Thanks to the unique Multichannel feature, each phase can have a different Operation Mode: voltage, current, power, resistance and advanced DC applications. Transition ramps, voltage and current limits can be modified. The limits for sink and source operation are different for safer testing, specially in battery applications.



Sequence

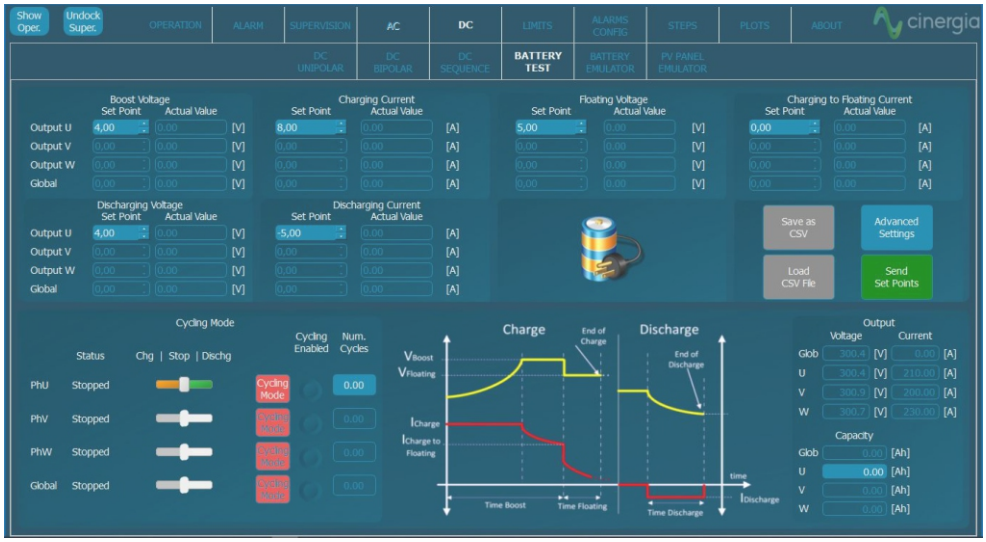
The User Interface Software integrates a Sequence Editor to create automatic test sequences, save them for future use and import them in .csv files.
A smart datalogger can be activated from the LCD of the unit to record automatically the resulting voltage and current measurements with a time resolution of 400 ms.



Multichannel

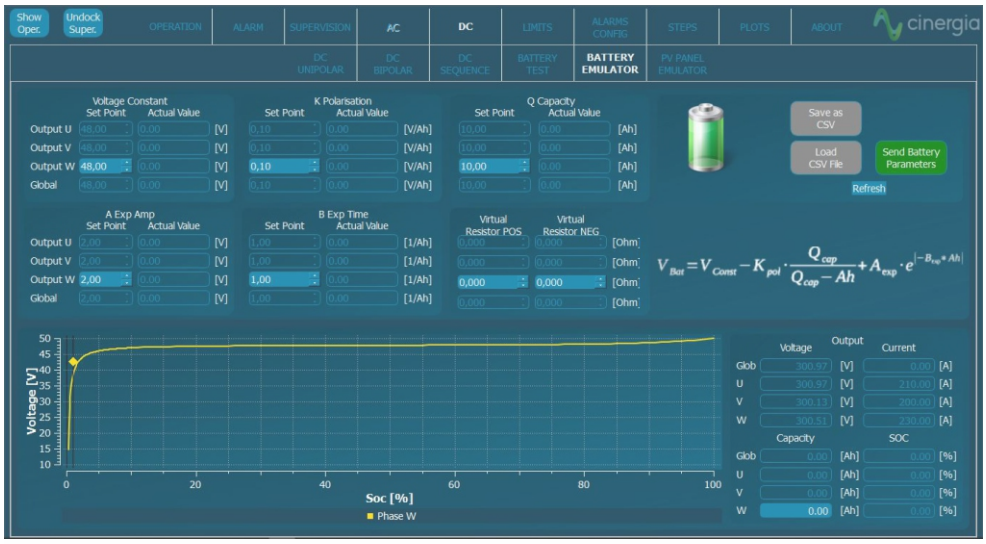
Enabling the Separated Channel Control converts the device in three functionally independent DC Bidirectional Power Supplies, sharing the common negative rail. Each channel can have a different status (ON, OFF, Warning, Alarm), Operation Mode (see Range and Specifications table), Setpoint, Ramp and Limits.

Advanced DC Applications



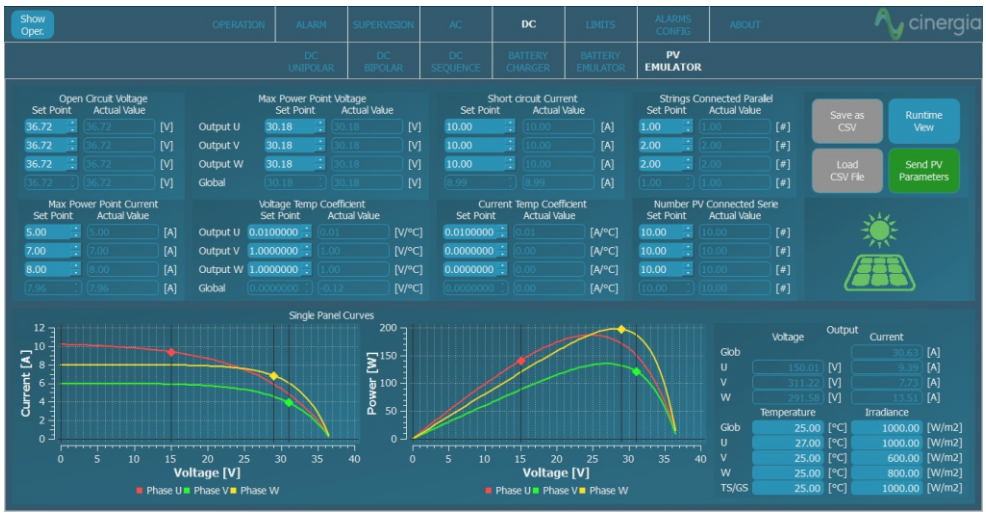
Battery Pack Testing

This functionality enables the user to precisely control the charge, discharge and cycling of a Battery. Basic parameters include the charge/discharge current, fast charge and floating voltages while Advanced parameters add Energy (Ah) and Time as transition conditions. Profiles for each Battery technology can be saved and imported in .CSV files.



Battery Emulation

The B2C+ integrates a mathematical model to emulate the voltage behaviour of a real battery pack. The output voltage will change as a function of the SOC and Current. By configuring the provided parameters, the voltage profile can be adjusted to match different technologies: LiIon, NiMH, NiCd, Pb, Flux, etc...



PV Panel Emulation

The PV Panel model is based on the single-diode equivalent circuit of a PV cell and the series-parallel connection of cells to form a panel. A Runtime functionality allows the simulation of a complete day by launching different irradiance and temperature setpoints from a .csv file, enabling the user burn-in and functional tests of PV Inverters.

B2C+ Range & Specifications

Input side (GRID side)

AC Voltage
Rated: 3x400Vrms + Neutral + Earth
Range: +15% / -20%
Rated AC Current
Depends on model (see Wiring Manual)
Frequency
48-62Hz
Current Harmonic Distortion
THDi < 3% at rated power
Current Power factor
PF › 0.98 at rated power
Efficiency
≥ 89% (7.5 & 10), ≥ 91% (15 to 30), ≥ 92% (40 to 200)

Output side in DC (EUT side)

Terminals
Number: 6 (3 positive + 3 negative)
Configuration of Channels
Unipolar Independent: 2Q, independent setpoints per channel
Unipolar Parallel: 2Q, one global setpoint for all channels
Multichannel: 2Q, independent start/stop, operation mode and setpoints per channel (note: multichannel is an option for ≥ 80kVA)
Bipolar (4Q two independent setpoints)
Voltage Mode (CV)
Range: 2Q: 20[1] to 750V (800V with High Voltage option)
4Q: 0 to +350V / 0 to -350 (+ rail / 0 / - rail, Bipolar configuration)
Setpoint Resolution: 10mV
Effective Resolution[2]: < 0.05% of FS[3]
Setpoint Accuracy[4]: ± 0.1% of FS[3]
Transient Time[5]: < 1ms (10% to 90% at a step to Vrated)
Ripple[7] (peak-peak): < 0.55% of FS[3]
Current Mode (CC)
Range: from 0 to ± 110% of Irated (see models table)
Setpoint Resolution: 10mA
Effective Resolution[2]: < 0.05% of FS[3] (< 0.1% models 7.5 & 10)
Setpoint Accuracy[4]: ± 0.2% of FS[3]
Transient Time[5]: < 1ms (10% to 90% at a step to Irated)
Ripple[7] (peak-peak): < 0.7% of FS[3]
Power Mode (CP)
Range: from 0 to ± 200%[8] of Prated (see models table)
Derived current setpoint: Psetpoint / Vmeasured
Setpoint Resolution: 1W
Effective Resolution[2]: < 0.1% of FS[3] (< 0.25% models 7.5 & 10)
Setpoint Accuracy[4]: ± 0.4% of FS[3]
Transient Time[5]: < 2.5ms (10% to 90% at a step to Prated)
Resistance Mode (CR)
Range: from 0.1 to 1000 Ohm
Derived current: Vmeasured / Rsetpoint
Setpoint Resolution: 0.01 Ohm
Setpoint Accuracy[4]: ± 0.2% of FS[3]
Transient Time[5]: < 2ms (10% to 90% at a step to Rrated))

Operation Modes

DC
- Programmable Voltage (CV)
- Programmable Current (CC)
- Programmable Power (CP)
- Programmable Resistance (CR)
- Power Amplifier (HiL)
- Steps

Optional Battery Testing (BTest) (charge/discharge/cycling)
Optional Battery Emulation (Bemu)
Optional PV Panel Emulation (PVEmu)

Overload/ Overcurrent

Admissible DC overcurrent is: 110% of rated value during 1 minute
Admissible overloads: 125% of rated value during 10 minutes, 150% during 1 minute, 200% during 2 seconds

User Interface

Local Control (4.3" Touchscreen panel)
- Isolated Digital port: 6 inputs, 4 outputs
- Isolated Analogue port: 6 inputs (rms setpoints or power amplifier), 6 outputs (rms readback or real-time readback)
- Interlock port: 1 NC Input, 1 NO Output
- Emergency Stop pushbutton

Remote Control Port
- LAN Ethernet with Open Modbus-TCP protocol
- RS485 (option), CAN and RS232 (using external gateway)

Software
- Graphical User Interface for Windows 7/10
- LabView drivers and open Labview interface example

Protections

Overvoltage (peak, rms), Overcurrent (peak, rms), Overload Shortcircuit, Emergency Stop, Watchdog, Heart Beat, Output Contactor, Wrong Configuration
Alarms and Limits are user configurable and can be saved in a password protected EEPROM

Mesurements[6]

Grid Voltage (rms), Current (rms), Power (P,Q) and Frequency
Output Voltage (rms, avg), Current (rms, avg), Power (P,Q) and Frequency
Heatsink Temperatures (x2) and DC Link Voltage
Datalogging available through FTP connection

Ambient

Operating temperature[8]: 5-40°C
Relative Humidity: up to 95%, non-condensing
Cooling: Forced air
Acoustic noise at 1m: < 52dB(A) (7.5 to 60), < 65dB(A) (80 to 120),< 70dB(A) (160 and 200)

Standards

CE Marking
Operation and Safety: EN-50178, EN-62040-1
EMC: EN-62040-2
RoHS

All specifications are subject to change without notice.

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(1) Minimum voltage setpoint is 0V in DC. The recommended minimum setpoint for long-term use is 20Vrms in AC and 20V in DC.
(2) Effective resolution measured with a 400ms window
(3) FS Range of voltage is 800V (with High Voltage option)
FS Range of current is 2·| 110% to Irated (see models table)
FS Range of power is 2·| 200% to Prated (see models table)
(4) Accuracies are valid for settings above 10% of FS
(5) Measured with the rated resistive load and high-dynamics controllers configuration
(6) Accuracy of measurements is ±0.1% of FS for rms voltage, ±0.2% of FS for rms current, ±0.4% of FS for active power (valid only above 10% of FS)
(7) Consult us for lower voltage/current ripple requirements
(8) Rated power figures are given at 20°C
(9) The maximum output voltage depends on frequency following V·f < 46000

Models

B2C+

Reference	DC Power Rated [5]	DC Voltage Normal Range / HV option	Rated DC Current Independent Unipolar Mode	Parallel Unipolar Mode	+ / 0 / - Bipolar 40 Mode	Weight (kg)	Dimensions DxWxH (mm)
B2C+7.5	7.5kW	10-750 / 800V	±10A	±30A	±10A	155 kg	770x450x1100 mm
B2C+10	10kW	10-750 / 800V	±15A	±45A	±15A	155 kg	770x450x1100 mm
B2C+15	15kW	10-750 / 800V	±20A	±60A	±20A	155 kg	770x450x1100 mm
B2C+20	20kW	10-750 / 800V	±25A	±75A	±25A	155 kg	770x450x1100 mm
B2C+30	27kW	10-750 / 800V	±30A	±90A	±30A	155 kg	770x450x1100 mm
B2C+40	40kW	10-750 / 800V	±40A	±120A	±40A	190kg	770x450x1100 mm
B2C+50	50kW	10-750 / 800V	±50A	±150A	±50A	190kg	770x450x1100 mm
B2C+60	54kW	10-750 / 800V	±57A	±171A	±57A	190kg	770x450x1100 mm
B2C+80	80kW	20-750 / 800V	±105A	±315A	±105A	270kg	880x590x1320 mm
B2C+100	100kW	20-750 / 800V	±130A	±390A	±130A	295kg	880x590x1320 mm
B2C+120	108kW	20-750 / 800V	±130A	±390A	±130A	295kg	880x590x1320 mm
B2C+160	145kW	20-750 / 800V	±155A	±465A	±155A	545kg	850x900x2000 mm
B2C+200	160kW	20-750 / 800V	±185A	±555A	±185A	555kg	850x900x2000 mm

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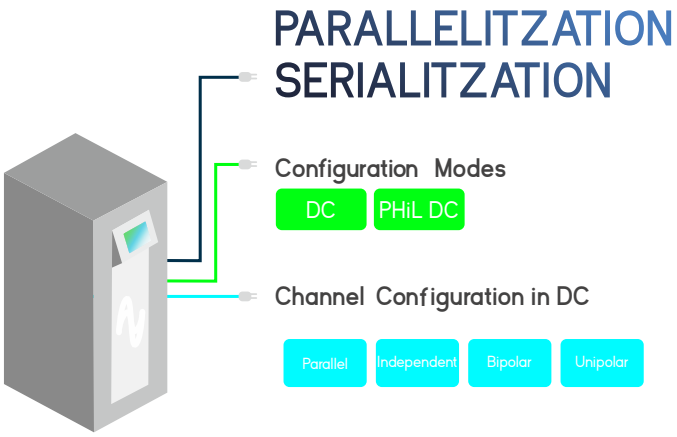
Galvanic Isolation (optional)

	Circuit Breaker Recommended	Weight (kg)	Dimensions DxWxH (mm)
IT 7.5i	Type C - 25A	145 kg	Inside the cabinet
IT 10i	Type C - 25A	145 kg	Inside the cabinet
IT 15i	Type C - 32A	145 kg	Inside the cabinet
IT 20i	Type C - 40A	145 kg	Inside the cabinet
IT 30i	Type C - 50A	195 kg	Inside the cabinet
IT 30e	Type D - 80A	174 kg	595x415x708 mm
IT 40e	Type D - 100A	217 kg	789x490x865 mm
IT 50e	Type D - 125A	280 kg	789x490x865 mm
IT 60e	Type D - 160A	381 kg	789x490x865 mm
IT 80e	Type D - 200A	435 kg	964x684x1252 mm
IT 100e	Type D - 250A	458 kg	964x684x1252 mm
IT 120e	Type D - 315A	514 kg	964x684x1252 mm
IT 160e	Type D - 400A	612 kg	964x684x1252 mm
IT 200e	Type D - 500A	753 kg	1192x744x1430 mm



Options

Choose your options

- Galvanic Isolation
- Multichannel mode: allows different operation mode, start/stop/reset per channel (included in all models from 7.5 to 60, both included)
- 30kHz Switching Frequency: only available for models 15 (derated to 7.5kW), 20 (derated to 7.5kW) and 30 (derated to 10kW)
- Isolation monitor (advised for IT systems)
- Low voltage ripple capacitance
- Anti-islanding monitor (only advised in net injection to the grid and following local regulations)
- High Voltage (HV): voltage up to 295Vrms phase-neutral in AC up to 800V in DC.
- RS485
- Battery Emulation
- Battery Test
- PV Panel Emulation

CINERGIA, Regenerative Power Electronics Solutions

- Grid Emulators AC, DC, AC/DC
- Electronic Loads, AC, DC, AC/DC, HF (360-900Hz)
- Didireccional DC, Battery Emulators, PV Panel Emulators

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