
**Key features**

- Bidirectional and Regenerative
- Clean grid current: THDi < 3% and PF > 0.98
- 2 quadrants and 4 quadrants configurations
- 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 profiles (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: 20, independent setpoints per channel
  - Unipolar Parallel: 20, one global setpoint for all channels
  - Multichannel: 20, 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 to 750V (800V with High Voltage option)
  - 4Q: 0 to +350V / 0 to -350 (+ rail / 0 / - rail, Bipolar configuration)
  - Setpoint Resolution: 10mV
  - Effective Resolution: < 0.05% of FS
  - Setpoint Accuracy: ± 0.1% of FS
  - Transient Time: < 1ms (10% to 90% at a step to Vrated)
  - Ripple: < 0.55% of FS
- **Current Mode (CC)**
  - Range: from 0 to ± 110% of Irated (see models table)
  - Setpoint Resolution: 10mA
  - Effective Resolution: < 0.05% of FS (< 0.1% models 7.5 & 10)
  - Setpoint Accuracy: ± 0.2% of FS
  - Transient Time: < 1ms (10% to 90% at a step to Irated)
  - Ripple: < 0.7% of FS
- **Power Mode (CP)**
  - Range: from 0 to ± 200% of Prated (see models table)
  - Derived current setpoint: Psetpoint / Vmeasured
  - Setpoint Resolution: 1W
  - Effective Resolution: < 0.1% of FS (< 0.25% models 7.5 & 10)
  - Setpoint Accuracy: ± 0.4% of FS
  - Transient Time: < 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: ± 0.2% of FS
  - Transient Time: < 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

## Measurements
- Grid Voltage (rms), Current (rms), Power (P,Q) and Frequency
- Output Voltage (rms, avg), Current (rms, avg), Power (P,Q) and Frequency
- Heat sink Temperatures (x2) and DC Link Voltage
- Datalogging available through FTP connection

## Ambient
- Operating temperature: 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

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All specifications are subject to change without notice.

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)
4 Accuracies are valid for settings above 10% of FS
5 Measured with the rated resistive load and high-dynamics controllers configuration
6 Accuracies 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 Vf < 46000
## Models

### B2C+

<table>
<thead>
<tr>
<th>Reference</th>
<th>DC Power</th>
<th>DC Voltage</th>
<th>Rated DC Current</th>
<th>Weight</th>
<th>Dimensions</th>
</tr>
</thead>
<tbody>
<tr>
<td>B2C+7.5</td>
<td>7.5kW</td>
<td>10-750 / 800V</td>
<td>+10A Independent Parallel Bipolar 4Q Mode</td>
<td>155 kg</td>
<td>770x450x1100 mm</td>
</tr>
<tr>
<td>B2C+10</td>
<td>10kW</td>
<td>10-750 / 800V</td>
<td>±15A Independent Parallel Bipolar 4Q Mode</td>
<td>155 kg</td>
<td>770x450x1100 mm</td>
</tr>
<tr>
<td>B2C+15</td>
<td>15kW</td>
<td>10-750 / 800V</td>
<td>±20A Independent Parallel Bipolar 4Q Mode</td>
<td>155 kg</td>
<td>770x450x1100 mm</td>
</tr>
<tr>
<td>B2C+20</td>
<td>20kW</td>
<td>10-750 / 800V</td>
<td>±25A Independent Parallel Bipolar 4Q Mode</td>
<td>155 kg</td>
<td>770x450x1100 mm</td>
</tr>
<tr>
<td>B2C+30</td>
<td>30kW</td>
<td>10-750 / 800V</td>
<td>±30A Independent Parallel Bipolar 4Q Mode</td>
<td>155 kg</td>
<td>770x450x1100 mm</td>
</tr>
<tr>
<td>B2C+40</td>
<td>40kW</td>
<td>10-750 / 800V</td>
<td>±40A Independent Parallel Bipolar 4Q Mode</td>
<td>190 kg</td>
<td>770x450x1100 mm</td>
</tr>
<tr>
<td>B2C+50</td>
<td>50kW</td>
<td>10-750 / 800V</td>
<td>±50A Independent Parallel Bipolar 4Q Mode</td>
<td>190 kg</td>
<td>770x450x1100 mm</td>
</tr>
<tr>
<td>B2C+60</td>
<td>60kW</td>
<td>10-750 / 800V</td>
<td>±60A Independent Parallel Bipolar 4Q Mode</td>
<td>190 kg</td>
<td>770x450x1100 mm</td>
</tr>
<tr>
<td>B2C+80</td>
<td>80kW</td>
<td>20-750 / 800V</td>
<td>±80A Independent Parallel Bipolar 4Q Mode</td>
<td>270 kg</td>
<td>880x590x1320 mm</td>
</tr>
<tr>
<td>B2C+100</td>
<td>100kW</td>
<td>20-750 / 800V</td>
<td>±100A Independent Parallel Bipolar 4Q Mode</td>
<td>295 kg</td>
<td>880x590x1320 mm</td>
</tr>
<tr>
<td>B2C+120</td>
<td>120kW</td>
<td>20-750 / 800V</td>
<td>±120A Independent Parallel Bipolar 4Q Mode</td>
<td>295 kg</td>
<td>880x590x1320 mm</td>
</tr>
<tr>
<td>B2C+150</td>
<td>150kW</td>
<td>20-750 / 800V</td>
<td>±150A Independent Parallel Bipolar 4Q Mode</td>
<td>545 kg</td>
<td>850x900x2000 mm</td>
</tr>
<tr>
<td>B2C+160</td>
<td>160kW</td>
<td>20-750 / 800V</td>
<td>±160A Independent Parallel Bipolar 4Q Mode</td>
<td>545 kg</td>
<td>850x900x2000 mm</td>
</tr>
</tbody>
</table>

### Galvanic Isolation (optional)

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

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### Options

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

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CINERGIA, Regenerative Power Electronics Solutions

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

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CINERGIA: Regenerative Power Electronics Solutions

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