SOLUTIONS FOR ELECTROMOBILITY
Electromobility Platform

Mobility is one of the main challenges of the 21st century. Environmental concerns are driving a growing demand for more efficient and cleaner means of transportation. Advances in the field of electromobility are mainly linked to the development of battery technology and power electronics for charging, discharging and driving electrical motors.

Our knowledge and experience is your best partner in e-mobility test platforms.

CINERGIA has thorough experience in providing solutions for R&D, Functional and End of Line test in this field. Our products have been improved from the experience gained by applying our technology to many e-mobility projects and working closely with our customers. This technical note describes the functions and characteristics of the main devices involved in the EV-Charging process and the testing solutions that CINERGIA can propose.
Electrical Vehicle Supply Equipments (EVSE), also called Off-board chargers, are the components interfacing the public grid to an electric vehicle. They are standardized in 4 different modes, described in the following page, depending on the power, safety functionality and communication capabilities.

EVSE manufacturers need to test their units from the AC grid side and the EV output side. Our Grid Simulator (GE+) can be used to provide stable and clean voltages, as well as to generate worldwide grids. When needed, the Grid Simulator will create disturbances following IEC 61000-4/11/13/14/28 standards. Our Regenerative Electronic Load will emulate the electrical behaviour of an EV both in AC (EL+) or in DC (B2C+) to test the output of a charger or a mode 2 cable. When simultaneity is not required, the combined All-in-one product (AC/DC, GE/EL) will offer the most cost-effective solution.
What charging modes exist?

The charging process of the electric vehicle has been regulated by IEC-61851, where four charging modes are defined.

**Mode 1:** Slow charge in AC. From a conventional, standard plug base. There is no pilot function between the vehicle and the charging point.

**Mode 2:** Slow charge in AC. The cable includes communications, a ground monitoring system for safety and pilot function.

**Mode 3:** Semi-fast charging in AC. Fixed charging point integrating communications, a ground monitoring system for safety and a pilot function.

**Mode 4:** Fast charging in DC. The charging point comprises an AC / DC converter, ground monitoring protection and communications integrated into the charger.
Our Solutions for

**EVSE Mode 2** Test Platform for Type 2 Charging Cables

<table>
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<th>GE+</th>
<th>EL+</th>
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**SUITABLE PRODUCTS**
- GE+ to emulate the grid
- EL+ to simulate EV
- GE&EL+ for non-simultaneous use (suitable in all applications)

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**EVSE Mode 3** Test Platform for Wall Chargers

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<th>GE+</th>
<th>EL+</th>
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**SUITABLE PRODUCTS**
- GE+ to emulate the grid
- EL+ to simulate EV
- GE&EL+ for non-simultaneous use (suitable in all applications)

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**EVSE Mode 4** Test Platform for DC Chargers

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<th>GE+</th>
<th>B2C+</th>
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**SUITABLE PRODUCTS**
- GE+ to emulate the grid
- B2C+ to simulate EV
- GE+ v AC/DC for non-simultaneous use (suitable in all applications)

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**Multistandard EVSE**

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<tr>
<th>GE+</th>
<th>EL+ vAC/DC</th>
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**SUITABLE PRODUCTS**
- GE+ to emulate the grid
- EL+ vAC/DC to simulate EV
- GE&EL+ for non-simultaneous use (suitable in all applications)
These AC to DC converters are used to charge the battery, in DC, directly from the public grid. They are embedded on the car, so they need to be light and in consequence, they are typically low power AC to DC converters. In some cases, however, the charger is part of the drive train converter allowing high power charging.

Our Grid Simulator (GE+) is perfect to test the AC side of the charger in stable and distorted conditions and perform functional and immunity assessment. The DC side will be tested using our DC Electronic Loads (B2C+) which include a software option to emulate the electrical behaviour of a battery.

Our devices can reduce the total power used thanks to his regenerative hardware. A flexible option to perform all kind of tests.
Our Solutions

Test Platform for OBC charger

**SUITABLE PRODUCTS**

- GE+ to emulate the grid
- B2C+ to simulate Battery
- GE+ AC/DC for non-simultaneous use (suitable in all applications)

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Battery Emulation


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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...
Vehicle to grid and Vehicle to home solutions are next generation systems envisioned to convert the electrical vehicle into an active agent of the electrical grid. These systems are able to reduce the power consumption (becoming a controllable load) or to supply energy from the EV battery into the grid to provide ancillary services in high-demand scenarios. New revolutionary developments go even further in using the EV battery as the energy resource of an isolated grid.

Test Platform for OBC in V2G system

SUITABLE PRODUCTS

GE+ to emulate grid
B2C+ to simulate Battery
GE+ vAC/DC for non-simultaneous use (suitable in all applications)

Test Platform for OBC in Vehicle to insulated grid

SUITABLE PRODUCTS

EL+ to emulate grid or loads
B2C+ to simulate Battery
EL+ vAC/DC for non-simultaneous use (suitable in all applications)
The constant research in this field has allowed to improve the performance in terms of autonomy, density and power ratings, among others. A key factor in this process is testing the new developments for verification and characterization of batteries. B2C+ (DC Bidirectional Converter) is CINERGIA’s model specially designed to test battery packs. Through our software, advanced tests can be configured and automated for charging, discharging, cycling, ageing and characterizing. Driving profiles can be emulated by downloading csv files.
Battery Pack Testing

### SUITABLE PRODUCTS
- B2C+ with Battery Test & PHIL Operation Mode

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 Pack Testing
- Characterization
- Burn-in & Production Test
- Charger
- Discharge
- Cycling

### EV Drive train emulation

### SUITABLE PRODUCTS
- B2C+ with Battery Emulation Mode
- B2C+ with PHIL Operation Mode & Power Operation Mode

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 to record automatically the resulting voltage and current measurements with a time resolution of 400 ms.
The GE&EL product family is the aggregation of Grid Simulators, Electronic Loads and Bidirectional DC Converters in one product.

Grid Simulators are power electronic devices that emulate AC electrical grids in both normal and disturbed conditions.

The EL+ family is power electronic device designed to emulate AC and DC electrical loads.

CINERGIA’s DC Programmable Power Supplies are designed to generate a controlled DC source or load.

Models
- All-Terrain vAC/DC
- All-in-one vAC
- GE+ vAC/DC Full
- GE+ vAC
- EL+ vAC/DC Full
- EL+ vAC
- B2C+

AC Power
- 7.5kW - 160kW
- 7.5kW - 160kW

DC Power
- 7.5kW - 160kW
- 7.5kW - 160kW

AC Current (per phase)
- 11A - 232A
- 11A - 232A

DC Current (per phase/parallel)*
- ±10A / ±30A - ±185A / ±555A
- ±10A / ±30A - ±185A / ±555A

AC Voltage (normal range/HV option)
- 10V-750V/800V - 20V-750V/800V

DC Voltage (independent /parallel)
- ±10A / ±30A - ±185A / ±555A

Key features
- Bidirectional and Regenerative
- Clean grid current: THDi < 3% and PF > 0.98
- Same power in DC and AC
- Parallelization of units to increase the power
- The most flexible testing equipment in a single cabinet

For further information, consult our website www.cinergia.coop or contact us.