



EV Charging Test Solutions

DC Fast Charging, OBC, EVSE, V2G, V2H

Product Guide





EV Charging Test Solutions



Charging Modes/Levels

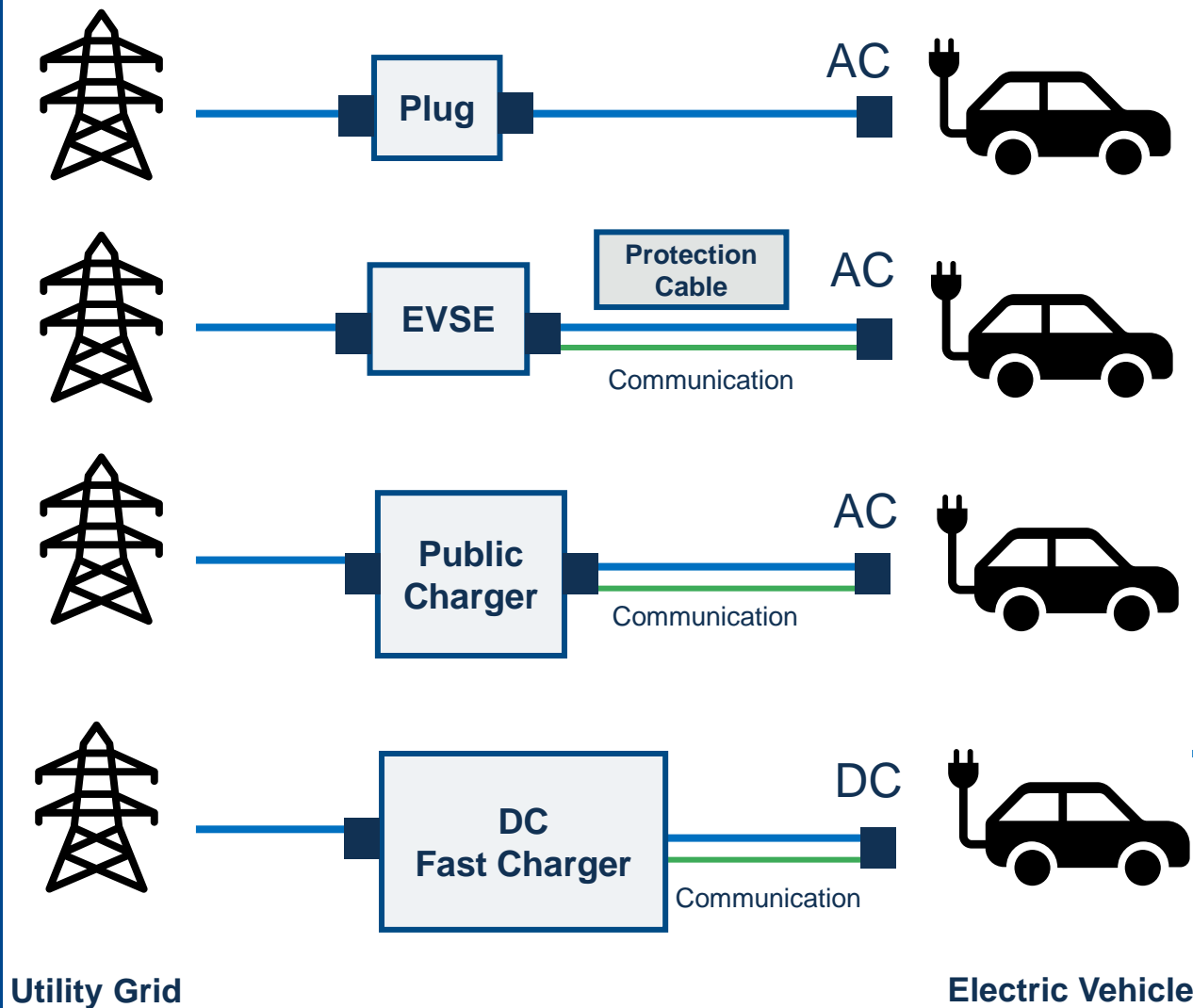
IEC 61851-1 - the International standard for electric vehicle conductive charging system defined 4 Modes of EV charging.

- Mode 1 – Very Slow AC (residential)
- Mode 2 – Slow AC (residential)
- Mode 3 – Semi-Fast AC (public charger)
- Mode 4 – Fast DC (public charger)

SAE defines these charging modes as levels

- Level 1 = Mode 1
- Level 2 = Modes 2 and 3
- Level 3 = Mode 4

EV Charging Modes



Mode 1 – Very Slow AC Charging

- Standard AC outlet (16A max)
- Direct to onboard charger (OBC)
- No Communication

Mode 2 – Slow AC

- Home charging (32A max)
- Uses EVSE & OBC
- Protection via cable signaling

Mode 3 – Semi-Fast AC

- Faster AC charge (80A max)
- Fixed public charging stations & OBC
- Signaling and communication

Mode 4 – Fast DC Charging

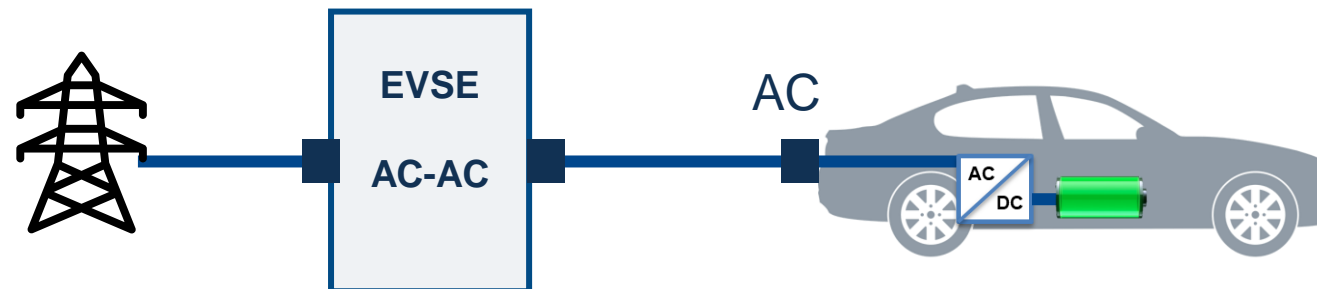
- Fastest charging mode (50-300kW)
- Direct to battery (bypasses OBC)
- Signaling and communication

AC vs. DC Charging

Mode 2 / Mode 3

Slow to Semi-Fast AC Charging

- Lower infrastructure cost, higher availability
- OBC can reduce max charging rate
- Mode 2 – Residential charging - 6kW to 22kW
- Mode 3 – Public station - 6kW to 44kW
- Faster charging controlled with communication

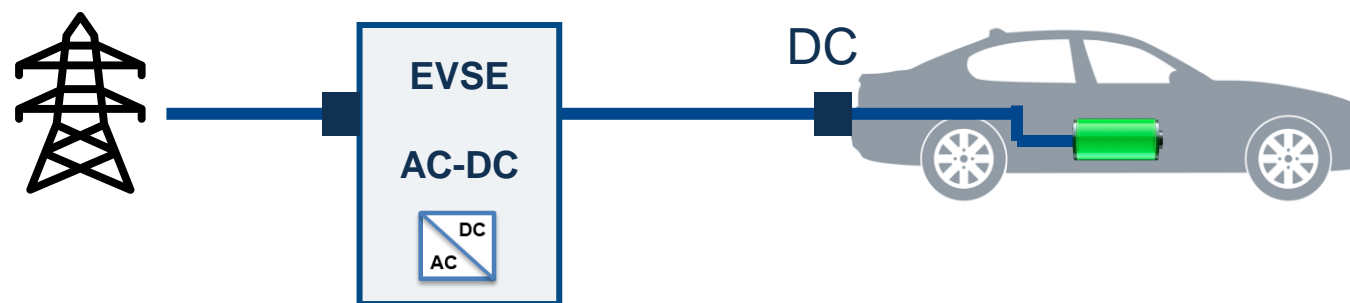


AC Charging Modes 2, 3: Alternating Current (AC) is supplied to the onboard charger (OBC) which is the battery charger.

Mode 4

DC Fast Charging

- Direct to battery charging (no OBC)
- Higher infrastructure cost, higher complexity
- Requires communication controls
- Suitable for public charger stations
- Can be very high power > 300kW

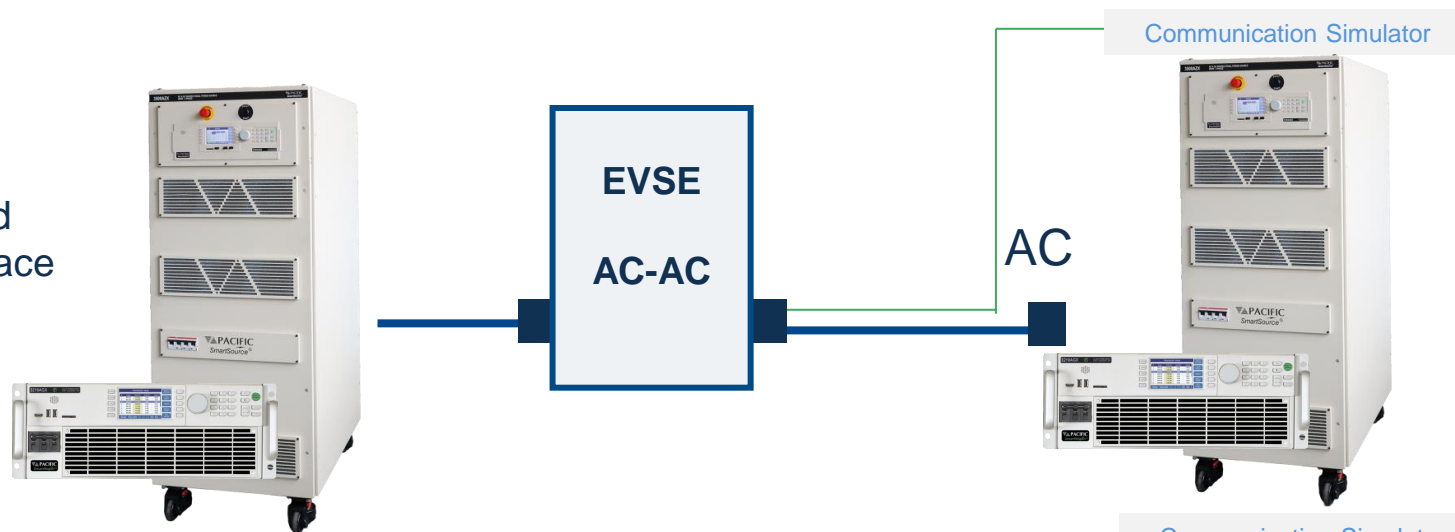


DC Charging Modes 4: DC directly charges the battery.

Charging Modes

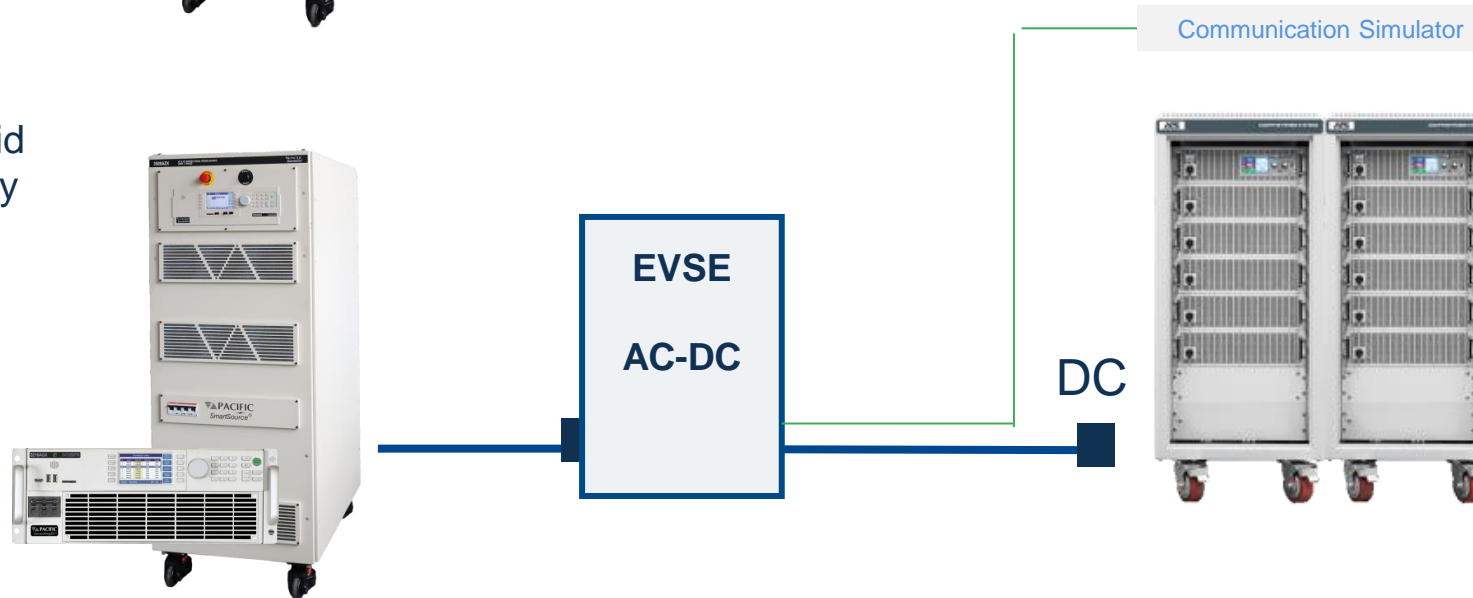
Mode 1, 2, 3 – AC to AC Charging

- RSG to emulate the utility grid
- RLS to simulate EV AC interface



Mode 4 – DC Fast Charging

- GSZ to emulate the utility grid
- DC to emulate the EV battery





EV Charger Testing

Fast Charger, OBC, EVSE, V2G & more

Level 1/ Mode 1 – Very Slow AC Charging

- Standard AC outlet (16A max)
- Direct to onboard charger (OBC)
- No Communication

Level 2/ Mode 2 – Slow AC

- Home charging (32A max)
- Uses EVSE & OBC
- Protection via cable signaling

Level 2/ Mode 3 – Semi-Fast AC

- Faster AC charge (80A max)
- Fixed public charging stations & OBC
- Signaling and communication

Level 3/ Mode 4 – Fast DC Charging

- Fastest charging mode (50-300kW)
- Direct to battery (bypasses OBC)
- Signaling and communication



EV Charging Test Solutions



Fast Charging



EVSE



On-Board Charger (OBC)



Vehicle 2 Grid

Key Advantages

- Modular & scalable power
- Fast transient capabilities
- Regenerative power

Test Solutions

- Regen Grid Simulator
- Regen 4 Quadrant AC / DC Load
- Bidirectional DC Power Source, Battery emulator

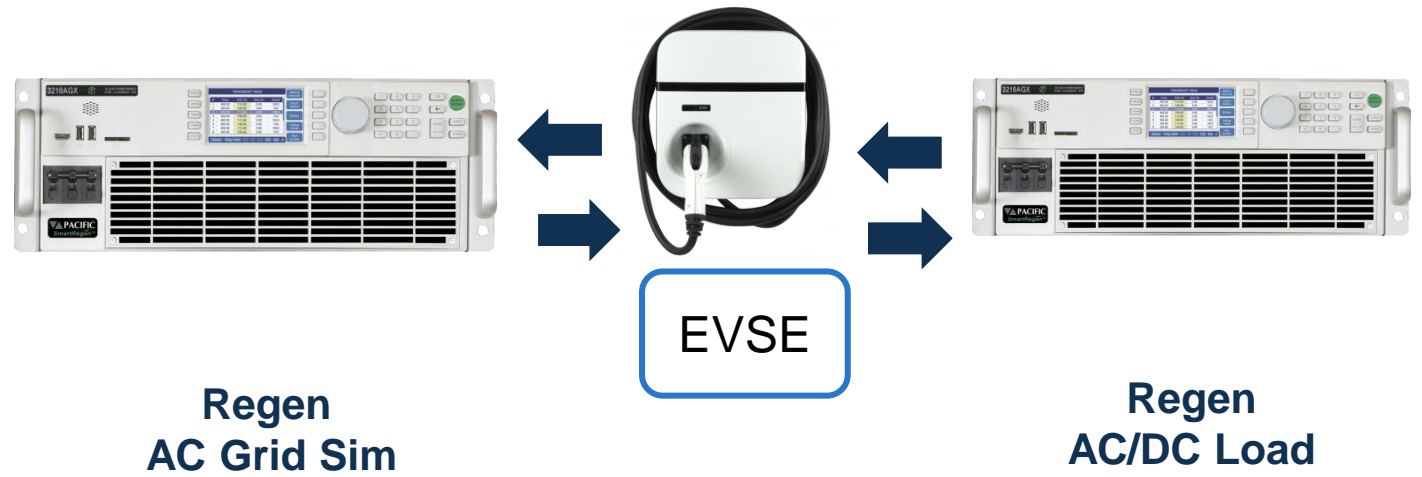


Mode 2: EVSE
6kW to 44kW



Mode 3: AC Public Charger
6kW to 44kW

Grid Simulation & AC Charging



- Regenerative Grid Simulator simulates the utility grid
- Regenerative 4 Quadrant AC Load emulates the AC loading



Mode 4: DC Fast Charger
50-350kW

DC Fast Charger



**Regen
AC Grid Sim**



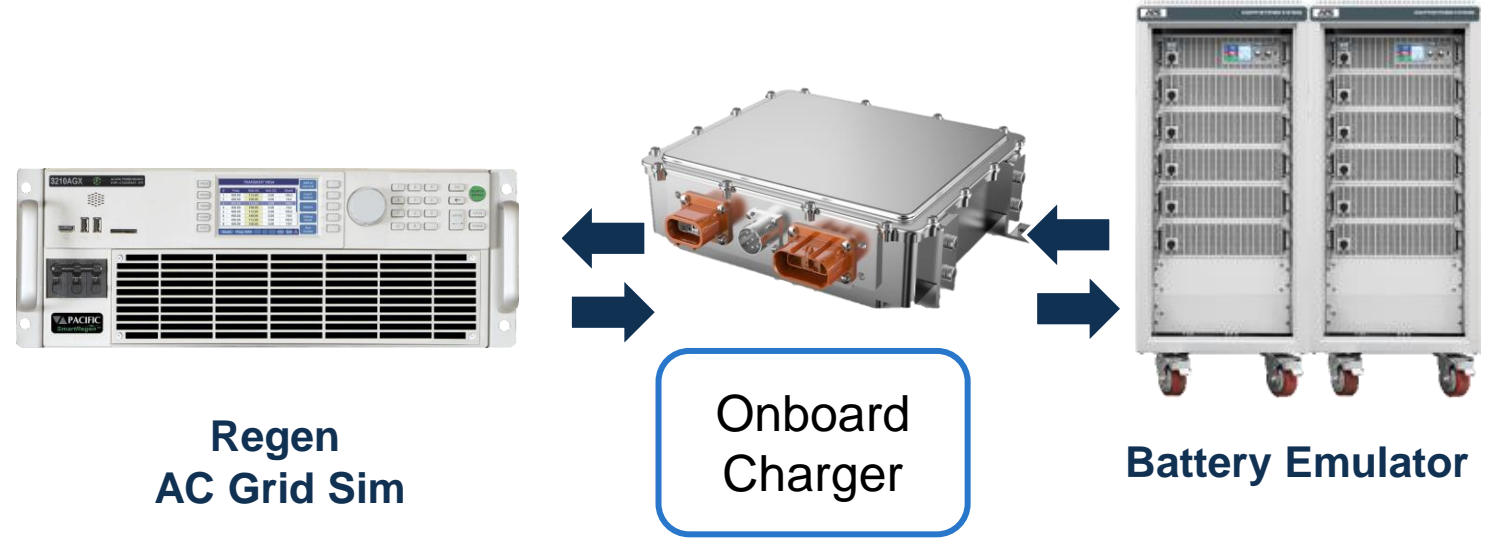
**DC Fast
Charger**



**Battery
Emulator**

Regenerative Grid Simulator
simulates the utility grid

Grid Simulation

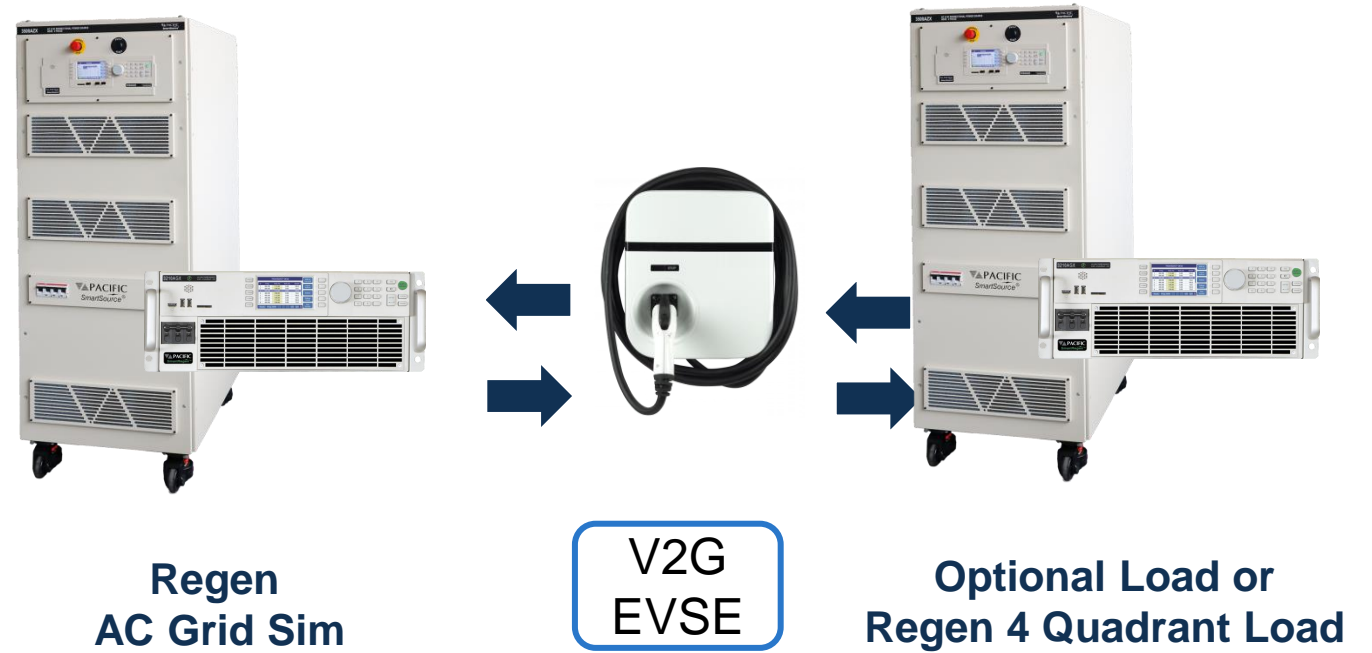


- Regenerative Grid Simulator simulates the utility grid
- Battery Emulator emulates the battery



On-Board Charger

Grid & AC Load Simulation



Regen
AC Grid Sim

V2G
EVSE

Optional Load or
Regen 4 Quadrant Load

- Regenerative Grid Simulator simulates the utility grid
- Regenerative 4 Quadrant AC Load emulates the AC loading



Vehicle to Grid



Regenerative > 90%

Greater than 90% energy efficiency. Source & sink to emulate bidirectional power.



Powerful Hardware

Robust SiC topology for advanced applications.



Constant Power Voltage Range

Seamless testing over a wide voltage range without power interruption. Test wide variety of products.



Ultra Flexible Output Configuration

Simultaneous AC and DC operation per phase AND automatic switching of outputs provides extensive flexibility.



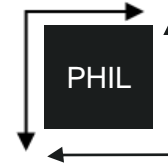
Programming Capability

Multiple control options, intuitive user interface, powerful waveform tools, and simplified set-up saves time.



Modular & Scalable Power

Modular power up provides future-proofing. Upgrade modules later if needed.



Optional PHIL & Load

Optimized for PHIL applications with high-speed analog I/O and low latency. (AZX/GSZ/ELZ Series)

Optional AC/DC load capability.



Smart Design & Safety

Built-in galvanic isolation, protection limits, and air-filters provide added protection. Continuous self-calibration. Compact and Mobile-friendly cabinets.



SmartSource Suite Control

Embedded Real-Time Remote-Control Platform to easily create, modify, and run test programs.



Regenerative Grid Simulators

Ideal for testing Grid-Tied devices (PV inverter, ESS, EV Chargers V2G) or microgrids and PHIL applications

Grid Simulator with Optional Load or PHIL

- AC, DC (AC+DC Option)
- Ultra configuration flexibility
- Exceptionally High Currency
- Harmonics & Inter-harmonics
- Load Option
- **PHIL Option (GSZ Series)**

Test to regulatory standards (e.g. IEEE 1547, UL 1741, IEC 61000-3, IEC 61000-4, etc.)



RGS Series



12kW up to 252kW

- 12kW up to 168kW; Dual cabinets up to 252kW
- 0-350 VAC L-N 1 ϕ / 0-606 VAC L-L 3 ϕ ; -500Vdc to +500Vdc
- 15 – 200Hz
- High Power Density in Compact 4U Chassis

GSZ Series



30kW up to 440kW

- 30, 45, 55kW; Parallel cabinets up to 440kW
- Voltage: 0~225Vac & 0~440Vac; 0~335Vdc & 0~650Vdc
- 15 – 200Hz
- 3 DSP controllers, PHIL Amplifier Mode Option



Regenerative Electronic Loads

Ideal for AC & DC Loading Applications

High Power Regenerative 4 Quadrant Load

- AC, DC
- Ultra configuration flexibility
- Exceptionally High Currency
- Harmonics with Inter-harmonics Option
- **RLC Circuit Emulation Modes (ELZ Series)**
- **PHIL Option (ELZ Series)**



RLS Series



6kW up to 252kW

- 6kW up to 168kW; Dual cabinets up to 252kW
- Voltage: 0-350 VAC L-N 1 ϕ / 0-606 VAC L-L 3 ϕ ; -500Vdc to +500Vdc
- 15 – 1200Hz
- High Power Density in Compact 4U Chassis

ELZ Series



30kW up to 440kW

- 30, 45, 55kW; Parallel cabinets up to 440kW
- Voltage: 5~225Vac & 5~440Vac; 0~335Vdc & 0~650Vdc
- 15 – 1000Hz; 1 – 15Hz Mode
- 3 DSP controllers, PHIL Amplifier Mode Option



Battery Emulator

Ideal for Battery Emulation or DC Loading Applications



High Power Regenerative, Bi-Directional DC Power Supplies

- 2 quadrant source and sink
- Modular, scalable power
- Ultra configuration flexibility
- Parallel up to 32 cabinets
- Constant Power, True Auto-ranging



APS DCB SERIES



2.5kW, 5kW, 7.5kW 10kW, 15kW or 30kW

- Voltage: 0 – 2000Vdc
- Current: 0 – 1000Adc

Bi-directional DC power supply/load - two quadrant (source and sink) in 3U or 4U chassis.

APS DCB SERIES CABINETS



30kW up to 450kW

- Voltage: 0 – 2000Vdc
- Current: 0 – 15,300Adc

High Power options over 15kW, two or more DCS or DCB Series DC power supplies can be paralleled up to 8 cabinets.



The Power of Expertise.