MVGS SERIES PROGRAMMABLE AC POWER SUPPLY

The MVGS (Medium-voltage Grid Simulator) Series is a high-performance, four-quadrant programmable AC power source specifically engineered for the testing and certification of megawatt-scale power electronics. Developed based on the proven BriPower ESA high-power technology platform, the MVGS series utilizes an advanced modular Power Cell Cascaded topology to achieve direct medium voltage output.

By eliminating the need for bulky and expensive external step-up transformers, the MVGS provides a "Direct-to-MV" output (ranging from 5kV to 50kV). This architecture ensures superior waveform quality with THD < 1%.

Designed for versatility in large-scale laboratory environments, the MVGS features configurable mediumvoltage inputs (e.g., 10kV, 13.8kV, 34.5kV, or 50kV), allowing for seamless integration into existing power grids. With its full four-quadrant regenerative capability, the system can act as both a grid simulator and a regenerative AC load, recycling up to 100% of energy back to the grid to significantly reduce operational costs and heat dissipation.

The MVGS series is the ideal solution for simulating complex global grid conditions—including fault ridethrough (LVRT/ HVRT/ZVRT), harmonic injection, and frequency disturbances—for next-generation applications such as AI data center Solid State Transformers (SST), megawatt-scale Energy Storage PCS, and high-power renewable energy systems.

Features

- **Configurable Medium-Voltage Input & Output**
- **Advanced Power Cell Cascaded Topology**
- **Four-Quadrant Regenerative Operation**
- **Comprehensive Grid Fault Simulation**
- **Sophisticated Power Quality Injection**

  Independent three-phase control for voltage, frequency, and phase.

  Harmonic & Inter-harmonic Generation: Supports up to the 50th order for immunity testing.

  Simulation of three-phase unbalance, voltage fluctuations, and flicker according to IEC standards.
- **Flexible System Expansion**

  Master-slave parallel operation allows capacity to scale from 1MVA up to 20MVA and above. Dual-mode cooling options: Forced Aircooling or Liquidcooling (-W option).

Configurable Input and Output Ranges

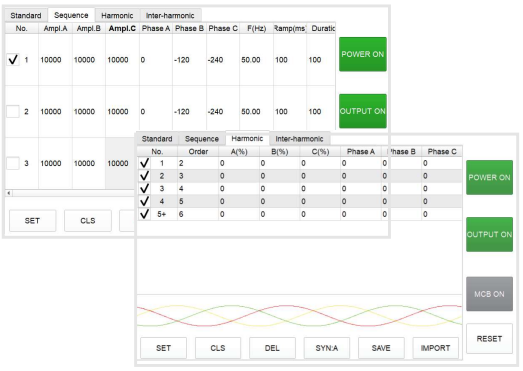
The MVGS series offers versatile AC input options tailored to match the specific local power distribution of each laboratory. The system's input voltage is factory-configured based on customer requirements - supporting a fixed selection of either standard low-voltage (e.g., 380V, 400V, or 480V L-L) or medium-voltage (e.g., 10kV to 35kV) inputs. By being pre-set at the factory to the designated grid voltage, the MVGS allows for direct connection without the need for additional external transformers.

For the output, it utilizes a modular Power Cell Cascaded topology to achieve Direct-to-MV output up to 50kV. The system capacity ranges from 1MVA to 10MVA, with the ability to scale up to 20MVA and above through master-slave parallel operation.

Sequence Output for Voltage and Frequency Disturbances

The integrated GUI supports a professional Sequence Mode that allows users to program complex grid disturbances.

- **Programmable Parameters:**
  Users can define output voltage, frequency, slew rates, dwell times, and switching times for each sequence step.
- **Transient Simulation:**
  The system can precisely simulate grid fluctuations, dips, sags, and swells.
- **Dynamic Performance:**
  It offers a rapid voltage step response time of < 1ms and a frequency change rate (RoCoF) of > 5Hz/s, enabling the reproduction of extreme transient grid faults.

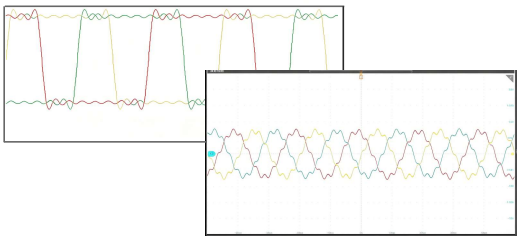


Independent Three-Phase Control for Unbalance Simulation

To simulate realistic and degraded grid conditions, the MVGS provides fully independent three-phase control. The voltage amplitude, frequency, and phase angle (0.1° resolution) of phases A, B, and C can be programmed independently to simulate three-phase unbalance and single-phase grounding faults.

Harmonic and Inter-harmonic Generation

- **Harmonics:**
  Supports the generation of up to the 50th order harmonics.
- **Inter-harmonics:**
  Allows for the superimposition of non-integer inter-harmonics to meet rigorous immunity testing requirements.
- **Customization:**
  Users can independently program the phase angle and amplitude for each harmonic component via the software interface.



Low and High Voltage Ride-Through (LVRT/HVRT)

The MVGS is a critical tool for certifying renewable energy inverters and PCS systems against grid-tie regulations.

- **Fault Templates:**
  It includes built-in programmable curves for Low Voltage RideThrough (LVRT), High Voltage Ride-Through (HVRT), and Zero Voltage Ride-Through (ZVRT).
- **Overvoltage Capability:**
  For HVRT testing, the system supports an overvoltage mode reaching 1.3 times the rated voltage.(-HV Option)
- **Support Verification:**
  It verifies the EUT's active and reactive power support capabilities during grid fault events.

Regenerative AC Load Mode (-LD)

Equipped with the -LD option, the MVGS series functions as a high-performance regenerative AC electronic load, capable of recycling up to 100% of the tested energy back to the utility grid. This mode offers five specialized sub-modes to address a wide range of testing requirements:

- **Constant Resistance (CR) Mode:**
  Designed for the simulation of three-phase resistive loads. Users can precisely configure CR parameters and execute complex resistance sequence simulations via the Graphical User Interface (GUI).
- **Constant Current (CC) & Constant Power (CP) Modes:**
  These modes simulate sinusoidal current loads, allowing users to adjust load current or power levels. The phase angle can be programmed between 90° and -90°, enabling the precise simulation of leading or lagging voltage-current relationships typical of inductive and capacitive loads.
- **Rectifier Load Simulation Mode:**
  Specifically engineered for testing non-linear rectifier loads, this mode enables users to define precise load characteristics by adjusting the Waveform Factor (WF) within a range of 0 to 2.121. A WF setting of 1.0 simulates a standard sine wave, whereas values below 1.0 are utilized for clipped wave simulation and values above 1.0 facilitate rectified wave simulation. (Crest Factor = WF*1.414)

PQ Mode

Primarily utilized for simulating complex loads or distributed energy resources, such as photovoltaics (PV). This mode supports bidirectional energy flow control, permitting power to flow seamlessly between the input and output terminals while allowing for independent programming of Active Power (P) and Reactive Power (Q).

Fixed Phase Difference Mode

The MVGS series includes a specialized Fixed Phase Difference Mode optimized for grid simulation, where the output terminal serves as a simulated grid environment:

- **Precision Phase Tracking:**
  The output voltage phase dynamically tracks the input voltage phase, maintaining a stable and constant angle difference.
- **Operational Stability:**
  The system ensures this precise phase relationship is maintained regardless of the transferred power, guaranteeing that the Equipment Under Test (EUT) operates reliably during power transfer simulations between different grid segments.
- **Advanced Fault Robustness:**
  The system is designed for high reliability and will remain operational without tripping, even in the event of a single-phase grounding fault on either the connected input or output grid lines.

Compliance with Global Testing Standards

The MVGS series is engineered to satisfy a wide array of international and regional standards for gridconnected equipment: GB/T 19964, IEEE 1547, UL 1741, IEEE 519, IEC 62116, CE conformity etc.

Advanced Graphical User Interface (GUI)

The system is controlled via an intuitive, Windows-based GUI installed on a 15.6-inch industrial TFT touch panel.

- **Comprehensive Control:**
  Provides full access to output settings, sequence programming, and hardware limits.
- **Real-time Monitoring:**
  Displays input/output voltage, current, power, and internal IGBT temperatures.
- **Data Tools:**
  Features high-speed waveform capturing (sampling up to 10k/s), real-time browsing, and historical data logging for post-test analysis.

High Power Supply Reliability

Designed for the rigors of high-power testing, the MVGS integrates multiple layers of protection and diagnostic tools.

- **Real-time Diagnostics:**
  Continuously monitors all critical nodes. Users can immediately locate issues through specific fault codes (e.g., OVP, OCP, OTP, module communication errors).
- **Robust Architecture:**
  Uses optical fiber communication between internal modules to ensure high noise immunity and system safety.
- **Safety Mechanisms:**
  Includes essential safety features such as emergency stop buttons (local and remote), insulation monitoring, and hardware interlocks tailored for medium-voltage environments.

General Specifications

Input	
AC input Voltage	10kV, 13.8kV, 34.5kV, 50kV (AC 3Φ) ±10% (Configurable)
Frequency	50Hz / 60Hz ±10%
Efficiency	≥90%
Power Factor	0.95
THDi	≤3%
Output	
Output Modes	AC, DC, AC+DC (standard/optional)
Power Level	1 MVA ~ 10 MVA (Expandable to 20MVA+)
Voltage Range	Up to 50kV (Line-to-Line, Configurable)
Overvoltage Mode	1.3 x Rated Voltage (Dedicated for HVRT testing)
Frequency Range	30 Hz ~ 70 Hz (Standard); Custom wide range available
Phase Output	Phase B/C relative to Phase A: 0.0 ~ 360.0°
Voltage Rise/Fall Time	< 1 ms (0% ~ 90% / 90% ~ 0%)
Frequency Change Rate	> 5 Hz/s (Programmable RoCoF control)
Harmonic Generation	Up to the 50th order
Load Regulation	0.2% F.S.
Line Regulation	0.1% F.S.
Output Voltage THD	≤ 1.0% (Linear Load, at base frequency)
Voltage Accuracy	≤ 0.2% F.S.
Current Accuracy	≤ 0.3% F.S.
Frequency Accuracy	0.01 Hz
Phase Accuracy	±0.3° @ 50Hz
Measurements	
Power Accuracy	0.3% F.S.
Voltage Accuracy	0.2% F.S.
Current Accuracy	0.3% F.S.
Frequency Accuracy	0.01 Hz
Others	
Standard Interface	LAN, RS485
Protection	Input OVP/UVP, Output OCP, OVP, OPP, OTP, Insulation Monitoring, Module Fault Detection
Cooling	Forced Air Cooling or Liquid Cooling (-W option)
Temperature	Operating: 0 ~ 40°C; Storage: -20 ~ 85°C
Operating Humidity	20 ~ 90% RH (Non-condensing)

Options

-HV	Increase max output voltage for HVRT test (overvoltage mode)
-LD	Regenerative load mode
-PQ	PQ mode
-FPD	Fixed phase difference
-W	Water Cooling

Model Configuration

MVGS AAA-BBB-CCC-DDD-EEE

AAA: Rated Output Power

BBB: Rated Output Voltage (L-L)

CCC: Rated Output Current (A)

DDD: Options

EEE: Input Voltage (L-L)