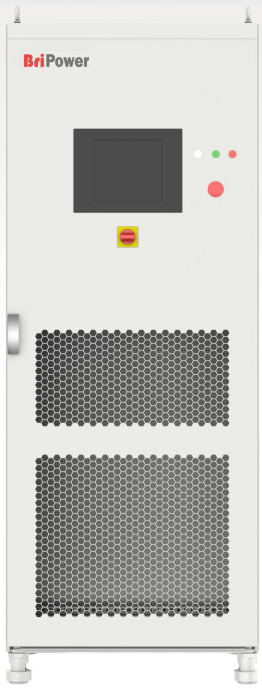
ESA SERIES HIGH-POWER AC POWER SUPPLY



The ESA Series high-power AC power supply features a modular design with optional functions, delivering highly configurable power solutions, offering flexible output performance and multiple control methods, including communication interfaces and graphical software, to meet diverse testing and power supply requirements. ESA Series is widely used in applications such as new energy testing, power electronics R&D, motor drive systems, industrial manufacturing, and scientific research.

Product Features

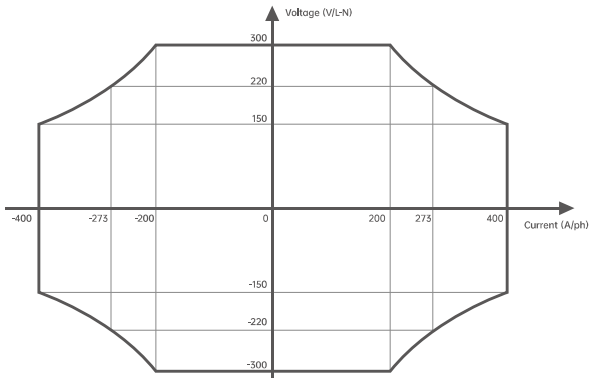
- Configurable output power, voltage, current, and frequency ranges
- Master-slave parallel operation for system expansion
- Programmable voltage/frequency sequences via GUI with controllable slew rates
- Optional DC output mode
- Built-in soft-start function to suppress inrush current
- Custom waveform output (clipped wave, rectified wave)
- Optional air-cooling or liquid-cooling configurations
- Grid simulator
- Regenerative electronic load
- RLC electronic load
- Touchscreen with GUI software
- LAN and RS485 interfaces
- Optional analog I/O interfaces
- Modbus and SCPI protocol
- Remote sense

Four-Quadrant Operation

The "-R" option provides four-quadrant operation, allowing for bidirectional energy flow.

Highly Configurable Output Performance

A core competency of the BriPower ESA series is the ability to configure output power, voltage, and current ranges according to specific customer application requirements. For applications demanding wide-range output, the systems can be tailored to enable precise control over either high-voltage/low-current or low-voltage/high-current operation.



ESA 180KVA,300V,400/ph Output IV Curve

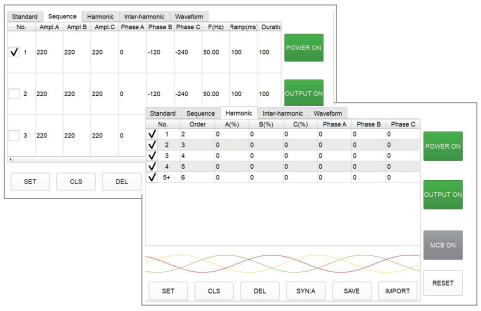
Grid Simulator

The ESA Series with the -R option functions as a grid simulator via its four-quadrant operation, capable of compliance testing for distributed generation. Key capabilities include simulating voltage and frequency fluctuations, dips, (LVRT/HVRT), three-phase unbalance, and harmonics.

- **Three-Phase Independent Output**
- **Programmable Voltage/Frequency/Phase Sequences**
- **Up to 50th Harmonic Waveform Generation**
- **LVRT/HVRT and continuous fault ride-through**
- **Islanding Mode:**
  RLC load simulation for anti-islanding testing
- **Programmable Phase Angle Jumps**
- **Current-Limited Output Mode:**
  Supports short-circuit testing at output terminals
- **TTL Trigger Signal Output:**
  Activates during voltage/frequency transitions
- **Line Impedance (RL) Simulation**

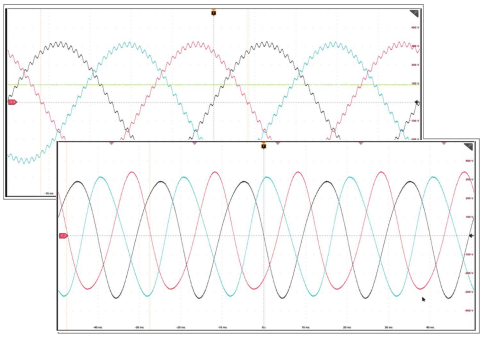
Programmable Voltage/Frequency/Phase Sequences

The GUI allows precise programming of output parameters including voltage, frequency, slew rates, and phase angles with full independent control over all three phases.

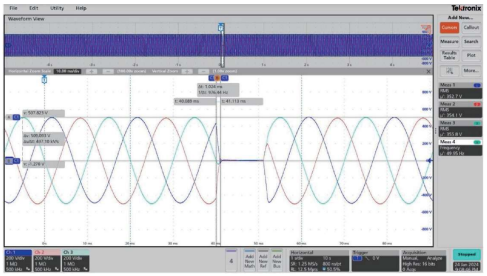


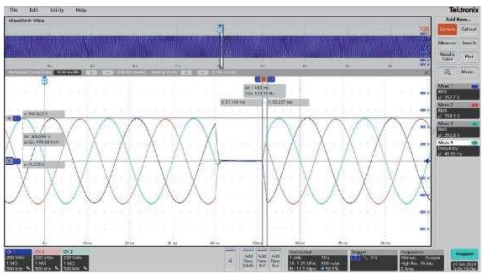
Harmonic & Interharmonic Generation

The ESA Series generates harmonics up to the 50th order and supports interharmonic editing. The GUI software allows precise programming of phase angles and amplitudes, allowing for independent three-phase waveform generation.



High/Low Voltage Ride-through





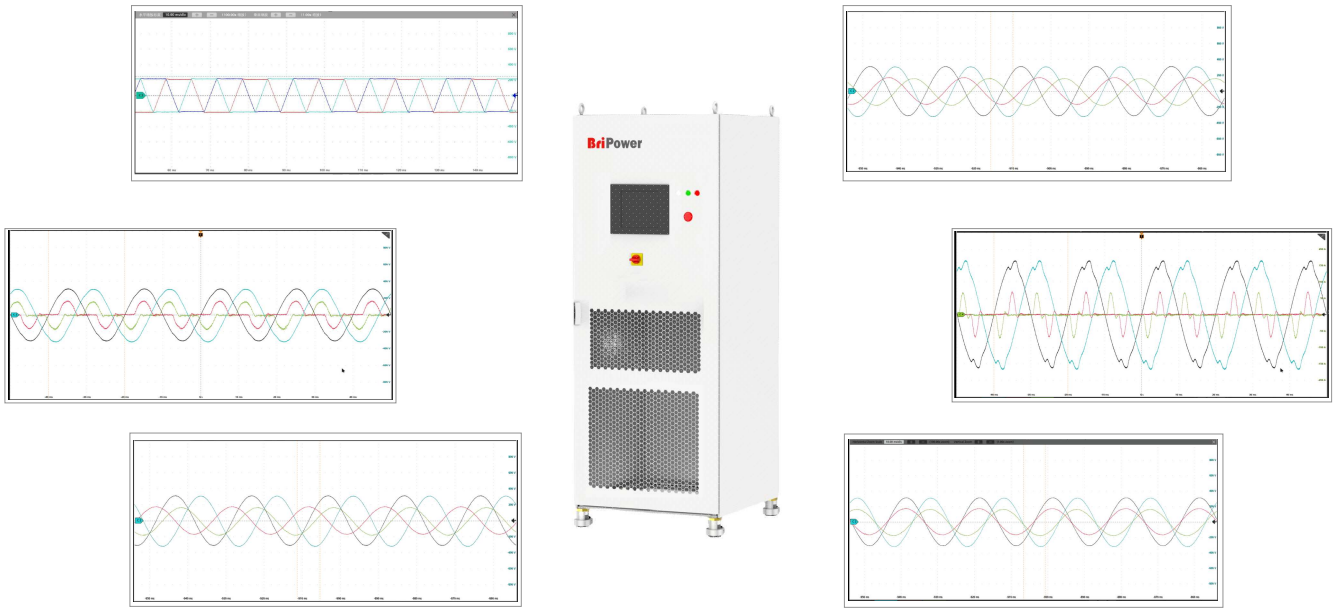
Re-generative AC Load (-LD option) [1,2]

With the -LD option, the ESA Series operates as a regenerative AC load, featuring four operational modes:

Constant Resistance (CR) Mode: Simulates three-phase resistive loads. Users can configure CR mode and set three-phase resistance parameters , enabling resistance sequence simulation.

Constant Current (CC) & Constant Power (CP) Modes: Simulate sinusoidal current loads. Users can adjust load current/power and phase angle (adjustable from90° to -90°), replicating leading/lagging voltage-current phase relationships in inductive/capacitive loads.

Rectifier Load Simulation Mode: Designed for nonlinear rectifier load testing. Users can configure CC/CP modes and set waveform parameters (e.g., Waveform Factor:0–2.121, CF=WF*1.414) .



Extends to Independent DC output (-DC option)

DC output mode is available with the -DC option. The output will be DC and AC 0~100Hz. There is up to 50% output power and current derating below 30Hz.

Line impedance (RL) Simulation (-IMP option)

-IMP option is designed to simulate line impedance by setting R and L value. The setting range is: Rmax=0.2Urated/Irated; Lmax=Rmax/314

1. ESA-LD as regenerative eLoad is design for sine waveform input, if the input is not a pure sine waveform, the output current waveform could be distorted. The -LD option must be used in combination with the -R option.
2. When WF=1, the output waveform is a sine wave; when WF<1, the output waveform is a clipped wave; when WF>1, the output waveform is a rectified wave.

PQ Control Mode (Active / Reactive Power Control)

The PQ mode enables independent decoupled control of Active Power (P) and Reactive Power (Q), allowing for precise bi-directional energy flow and power dispatching across all four quadrants. This functionality is engineered for highlevel power system research and equipment validation:

- **Distributed Energy Resource (DER) Simulation:**
  By configuring high-precision power schedule curves, the system authentically replicates the dynamic output fluctuations of solar or wind power caused by environmental variables.
- **Flexible Distribution & Microgrid Interconnection:**
  Specifically designed for testing Solid State Transformers (SST) and Soft Open Points (SOP), the mode accurately simulates power transfer and load balancing between different grid sectors.
- **Uninterrupted Operation Under Grid Faults:**
  The system demonstrates superior grid resilience, maintaining continuous operation without tripping even if a single-phase metallic grounding fault occurs at either the input or output grid terminals, ensuring the integrity of long-term testing data.

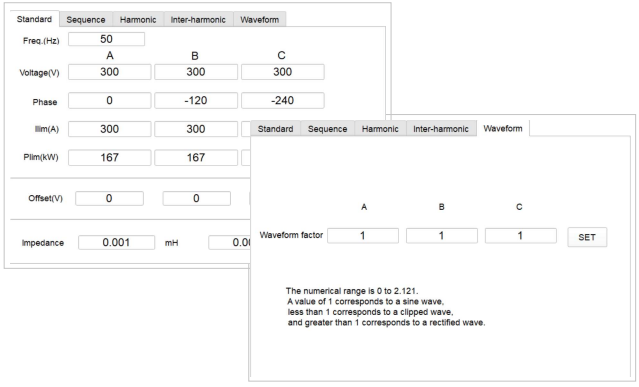
Fixed Phase Difference Mode

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.

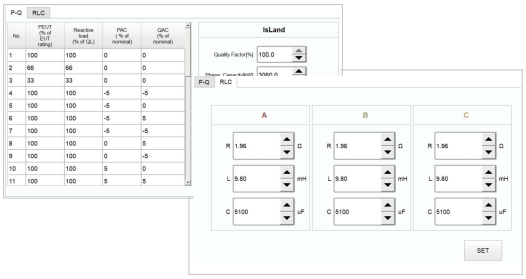
Custom waveform

Custom waveforms including clipped sine wave and rectified wave are available with ESA series. The waveform is programmable by modifying waveform factor. Waveform factor (WF) refers to the ratio of the peak value of a custom waveform to that of standard sine wave. When WF=1, the output waveform is a sine wave; when WF<1, the output waveform is a clipped wave; when WF>1, the output waveform is a rectified wave.This function is available in CV mode when ESA is used as source, and also in rectifier mode when ESA is used as eLoad.



Island mode for IEC 62116 anti-island test(-62116 Option)[3]

Island mode of ESA simulates RLC load behavior for anti-island test. Two simulation modes are provided, which are setting parameters of PAC, QAC, PEUT and QL in mode 1, and setting R, L, C Value in mode 2.



Graphical User Interface

GUI software is installed in front touch panel, which uses Windows OS. The software provides following functions:

-Output settings and limits

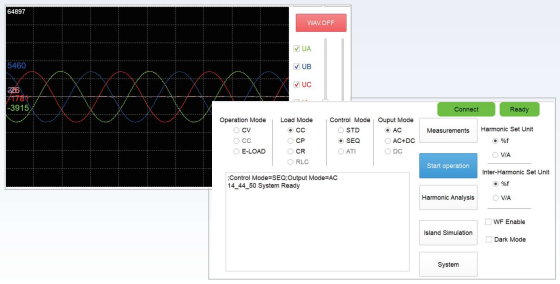
-Sequence output settings

-Generate harmonic and inter-harmonic waveforms

-Display measurements: voltage, current, power, etc

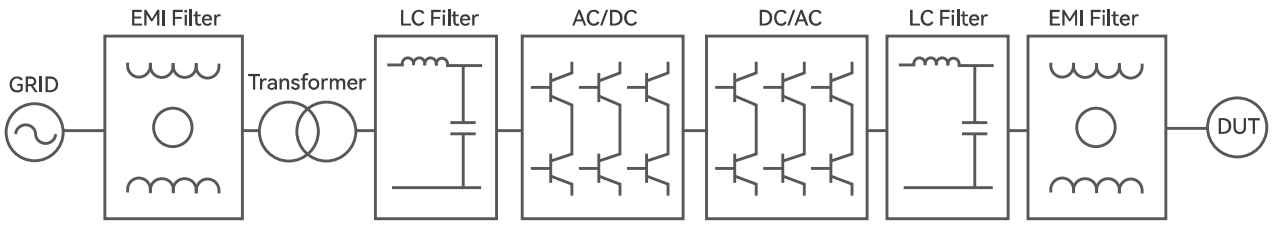
-Capture, display and save output voltage and current waveforms

-Display power source faults



Block Diagram

The topology of standard ESA is shown in Figure. The transformer for isolation and phase-shift is on the front by default, and then the 3-phase AC input is rectified by four quadrant PWM converters for DC bus, which is followed by DC/AC power modules. Three channels of DC/AC power modules are used for independent 3-phase AC output.



Note: The ESA series AC power supply topology with -TR option is different from the above figure.

3. ESA-62116 can only simulate RLC load for sine waveform, 50/60Hz input.

General Specification (customized unit specification will be shown in the proposal)

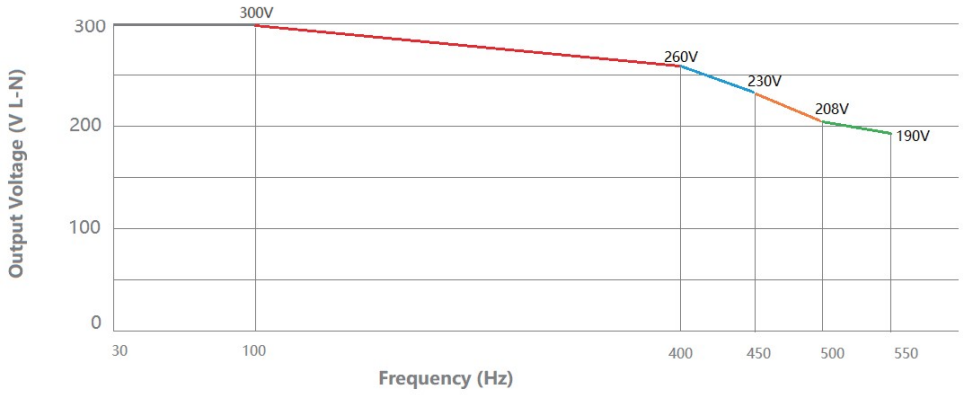
Input	
AC input Voltage	3P+N+PE, 380VLL±10%(std)
Frequency	47-63Hz
Efficiency	≥90%
Power Factor	0.95
THDi	≤3%
Output	
Output Mode	AC (std),DC,AC+DC (-DC option)
Power Range	Configurable, from 30KVA~10MVA
Voltage Range	Configurable, 0~300V L-N (std), 50kV L-N (max)
Current Range	Configurable, up to 10kA/ph
Frequency range	30-100Hz (std), 40-70Hz (TR option)
Phase output	Phase B/C relative to phase A, 0.0~360.0°
Voltage Rise Time (0%~90%)	<1ms (std), <2ms (TR option)
Voltage Fall Time (90%~0%)	<1ms (std), <2ms (TR option)
Harmonic Generation	Up to 50th
Load Regulation	0.2%FS
Line Regulation	0.1%FS
Output Voltage THD	<1%FS (Resistive Load, @50/60Hz)
Power Accuracy	0.3%FS
Voltage Accuracy	0.1%FS (std), 0.2%FS (TR option)
Current Accuracy	0.2%FS
Frequency Accuracy	0.01Hz
Phase accuracy	±0.3° @50Hz
Power Resolution	0.1kW
Voltage Resolution	0.01V
Current Resolution	0.1A
Frequency Resolution	0.01Hz
Phase Resolution	0.1°
Measurements	
Power Accuracy	0.3%FS
Voltage Accuracy	0.1%FS(std), 0.2%FS (TR option)
Current Accuracy	0.2%FS
Frequency Accuracy	0.01Hz
Phase accuracy	±0.3° @50Hz
Others	
Standard Interface	LAN/RS485
Optional Interface	ATI/RS232
Protection	OVP, OCP, OPP, OTP
CE Conformity	EN 62040-1, EN 62040-2
Cooling	Forced Air Cooling
Temperature	Operating: 0~40°C Storage: -20~85°C
Operating Humidity	20-90%RH (None Condensing)

Standard Models Specification

Model	Power	Voltage	Current	Dimension (W*D*H mm)	Weight(kg)
ESA 45-300-68	45kVA	300V	69A	800*800*2000	770
ESA 60-300-91	60kVA	300V	91A	800*800*2100	980
ESA 120-300-182	120kVA	300V	182A	1600*900*1700	1400
ESA 180-300-273	180kVA	300V	273A	1600*900*2100	1800
EAS 240-300-364	240kVA	300V	364A	1800*900*2100	2100
ESA 300-300-455	300kVA	300V	455A	2000*1000*2100	2700

Options

-232	RS232 program interface
-LD	Regenerative AC load function
-R	Regenerative mode
-ATI	Analog control interface (0~5V)
-DC	Extend to Independent DC output (&-1P 3-ph output DC in parallel)
-1P	Add single phase output
-IMP	Line impedance (RL) simulation
-W	Use water-cooling
-TR	Change to transformer output topology
-62116	Island mode for IEC 62116 anti-island test
-HFXXX[4]	AC output frequency extended to XXXHz (only for CV mode)
-FHR	Frequency resolution 0.005Hz (max frequency: 70Hz)
-PQ	PQ mode
-FPD	Fixed phase difference



AC Input Configuration[5]

Please specify the input voltage (L-L)

/380, Input Voltage 380VLL±10%, 3P+N+PE/3P+PE

/400, Input Voltage 400VLL±10%, 3P+N+PE/3P+PE

/480, Input Voltage 480VLL±10%, 3P+N+PE/3P+PE

4. Max VF Derating 300V L-N Range
5. Other AC input is available, please consult factory.

Model Configuration

ESA AAA-BBB-CCC-DDD/EEE

AAA: Power, KVA

BBB: Voltage (L-N), V (std, 300V L-N)

CCC: Current (per Phase), A

DDD: Option

EEE: Input configuration