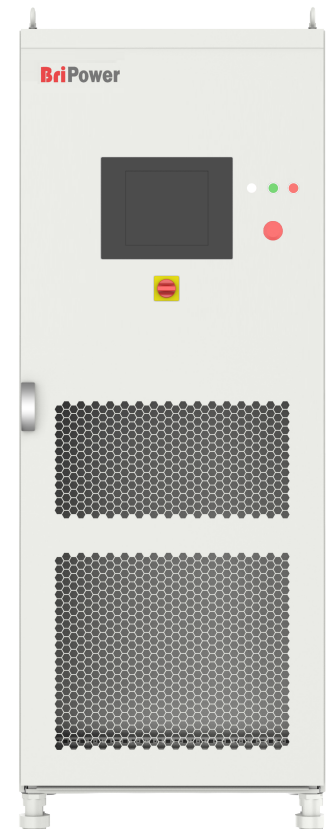


BriPower ESA Series High Power AC Source

Features

- Customized power, voltage and current ranges
- Grid Simulator, 4-Quadrant operation (-R Option)
- Independent 3-phase output
- Sequence programming
- Up to 50th harmonic waveform generation
- HVRT, LVRT, continuous ride through test support
- Island mode for anti-island test
- ON/OFF phase angle programmable
- Current limit mode for short circuit test
- TTL trigger signal available with voltage or frequency change
- DC output (-DC option)
- Regenerative eLoad, electronic RLC load (-LD Option)
- Line impedance (R and L) simulation (-IMP Option)
- Add single phase output (-1P Option)
- Watercooling (-W Option)
- Master/Slave interface for power extension (-MS Option)
- Extend to higher output frequency (only CV mode) (-HFXXX Option)
- Soft start
- Custom waveforms (sine, clipped sine wave, rectified wave)
- TFT touch screen
- LAN and RS485 interfaces
- Optional analog interface (-ATI Option)
- Mod-bus/SCPI
- Local and remote emergency stop
- Remote sense
- CE conformity



Overview

The BriPower ESA series uses advanced PWM technology, and provides high flexibility for various applications with customized power, voltage and current ranges; master/slave connection is available for power upgrading. Customized system is up to 4MW and above.

ESA series is high-performance and multi-functional grid simulator (-R option) and also regenerative eLoad (-LD option).

ESA series has powerful mathematics and control capabilities with dual DSP+FPGA design. Measurement waveforms are realtime displayed and saved with 10k/s sampling rate. Inside the system, optical fibers are used for communication and system status monitor function provides realtime monitoring on all main components, communication connections and systems, which makes ESA series a reliable power product.

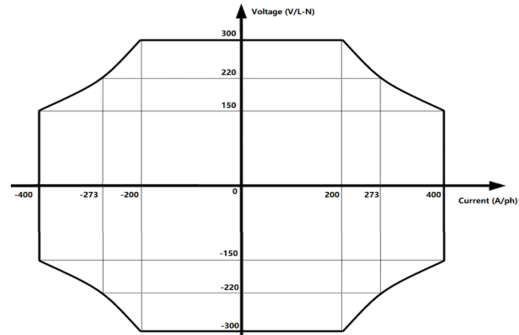
GUI software is available on the touch panel, which uses windows. System status indicators and emergency stop are installed on the front panel. RS485, LAN and optional RS232 and analog control interfaces are available for automated test applications.

Bi-direction Power Source (-R Option)

ESA works in 4-Quadrant mode, and bi-directional power flow is available with -R option.

Constant Power output

ESA series AC power supply has an automatic wide-range output function. Under the condition of rated output power, the output range of voltage/current can be adjusted, such as: high-voltage small current or low-voltage large current (also applicable in sink power mode). The same type of power supply can cover a wider range of power applications.



Example: 180kVA, 300V L-N, 400A/ph

Grid Simulation

ESA series using as grid simulator meets the requirements for grid tied DG regulations testing, such as: abnormal state simulation of voltage and frequency, high voltage ride through test, low/zero voltage ride through test, anti-islanding test, etc. GUI software is provided to simulate various grid disturbances simulations, such as voltage and frequency fluctuations, voltage sags, high voltage ride through, low/zero voltage ride through, three-phase unbalance, harmonics and inter-harmonics.

• Voltage/frequency sequence programming

Sequence mode is available. The three phases are independent, and parameters of output voltage, frequency, slew rate, ON/ OFF output phase angle, dwell time, switching time are programmable.

Standard	Sequence	Harmonic	Inter-harmonic						
No.	Ampl.A	Ampl.B	Ampl.C	Phase A	Phase B	Phase C	F(Hz)	Ramp(ms)	Duratio
✓ 1	220	220	220	0	-120	-240	50.00	100	100
✓ 2	110	110	110	0	-120	-240	50.00	100	100
✓ 3	110	110	110	0	-120	-240	90	100	100
✓ 4	110	110	110	0	60	-270	90	100	100
✓ 5	110	110	110	0	-120	-240	90	100	100
✓ 6	300	300	300	0	0	-240	50	100	100
✓ 7	220	220	220	0	0	-240	50	100	100
✓ 8	0	100	200	0	0	-240	50	100	100

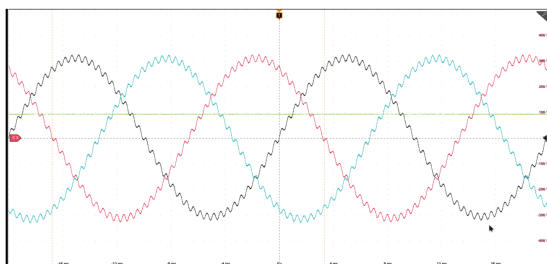
Sequence Programming

Standard	Sequence	Harmonic	Inter-harmonic						
No.	Order	A(%)	B(%)	C(%)	Phase A	Phase B	Phase C		
✓ 1	3	33.39	33.39	33.39	0	0	0		
✓ 2	5	20.01	20.01	20.01	0	0	0		
✓ 3	7	13.75	13.75	13.75	0	0	0		
✓ 4	9	10.7	10.7	10.7	0	0	0		
✓ 5	11	8.37	8.37	8.37	0	0	0		
✓ 6	13	7.05	7.05	7.05	0	0	0		

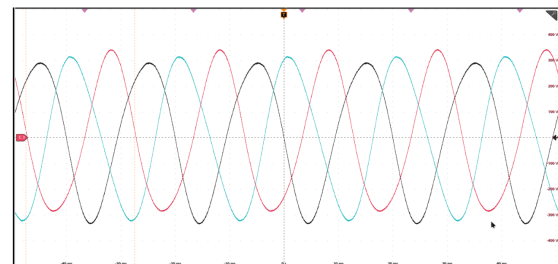
Harmonic/Inter-Harmonic Editing

• Harmonic and inter-harmonic waveforms

Up to 50th harmonic waveform and inter-harmonic waveform generation is available on ESA series. Three phases are independently programmable with setting phase angle and amplitude of the harmonic through the GUI.



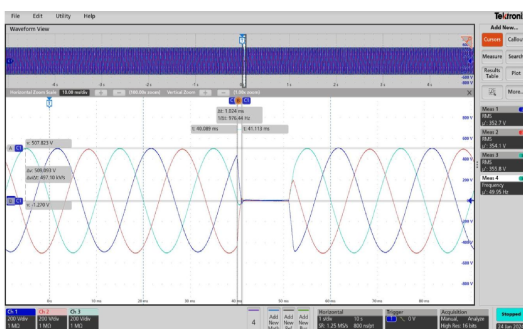
Harmonic Waveform



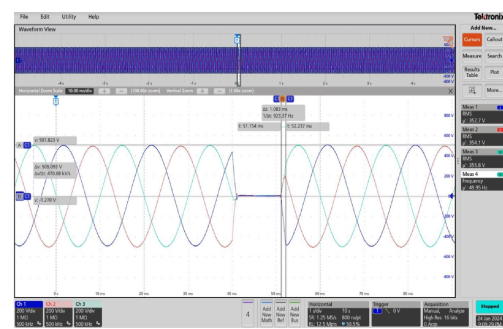
Inter-Harmonic Waveform

• Voltage drop simulation (LVRT test)

ESA series provides firmware and software support for low/zero voltage ride through tests.



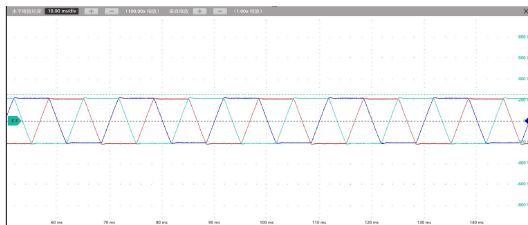
Voltage drop (90%~0%) <1ms



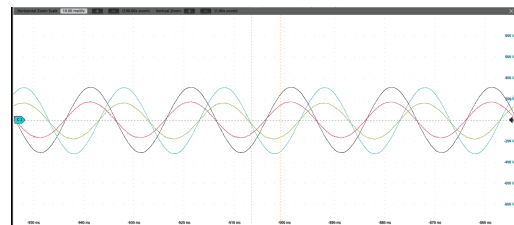
Voltage rise (0%~90%) <1ms

Re-generative AC Load (-LD option)^{1,2}

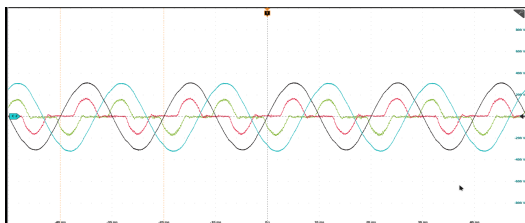
ESA series with -LD option has the function of regenerative electronic AC load, which consists of CR mode, CC mode, CP mode and Rectifier mode. CR mode is used to simulate three-phase resistive loads. CC and CP modes are for adjusting load current or power, in which two modes, phase angle can be programmed from 90° to -90° to simulate inductive and capacitive loads. Rectifier mode is to simulate non-linear loads, and waveform factor (WF, setting range: 0~2.121) is programmable in this mode.



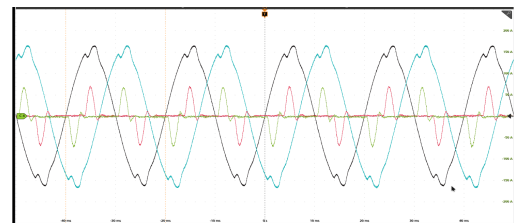
WF=0.5



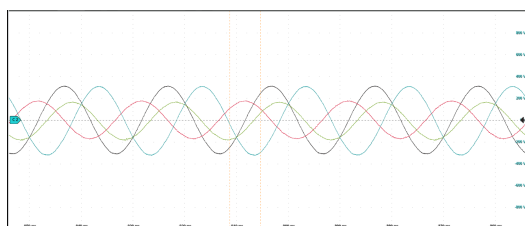
WF=1



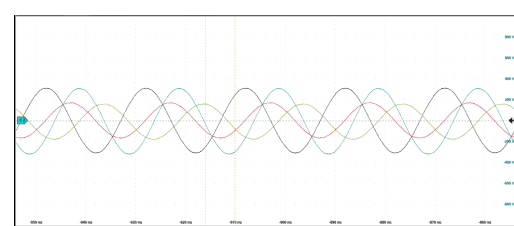
WF=1.414



WF=2.121



Angle=+90°



Angle=-90°

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 WF refers to the ratio of the peak value of a custom waveform to that of standard sine wave. The custom waveform will be clipped sine wave when $WF < 1$, it will be rectified wave.

Extends to 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: $R_{max} = 0.2 U_{rated} / I_{rated}$; $L_{max} = R_{max} / 314$

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. The custom waveform will be clipped sine wave when $WF < 1$, it will be 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.

Standard	Sequence	Harmonic	Inter-harmonic	Waveform
Freq.(Hz)	50			
Voltage(V)	A	B	C	
	0	0	0	
Phase	0	-120	-240	
Ilim(A)	30	30	30	
Plim(kW)	5	5	5	SET
Offset(V)	0	0	0	SET
Impedance	0.001	mH	0.001	Ω SET

Line impedance Simulation

Standard	Sequence	Harmonic	Inter-harmonic	Waveform
	A	B	C	
WF	1	1	1	SET

The numerical range is 0 to 2.121.
A value of 1 corresponds to a sine wave,
less than 1 corresponds to a clipped wave,
and greater than 1 corresponds to a rectified wave.

Custom waveform

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.

P-Q	RLC
No.	PEUT (% of EUT rating)
1	100
2	66
3	33
4	100
5	100
6	100
7	100
8	100
9	100
10	100
11	100

Reactive load (% of QL)	PAC (% of nominal)	QAC (% of nominal)
0	0	0
-5	-5	-5
5	5	5
-5	-5	-5
5	5	5
-5	-5	-5
5	5	5

IsLand

Quality Factor[%] 100.0

Phase Capacitance(W) 0.0

No. 1

PAC(% of nominal) 0.0

QAC(% of nominal) 0.0

SET

Mode 1

P-Q	RLC	
A	B	C
R 100.00 Ω	R 100.00 Ω	R 100.00 Ω
L 500.00 mH	L 500.00 mH	L 500.00 mH
C 1000 uF	C 1000 uF	C 1000 uF

SET

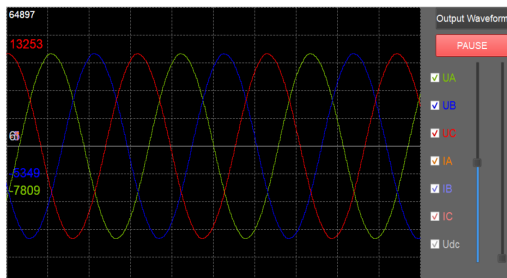
Mode 2

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

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



Waveform Display

Operation Mode	Load Mode	Control Mode	Output Mode
CV	CC	STD	AC
CC	CP	SEQ	AC+DC
E-LOAD	CR	ATI	DC
	RLC		

Measurements: %f, V/A

Settings: Inter-Harmonic Set L, %f, V/A

Harmonic Set: WF Enable, Dark Mode

Display Waveform

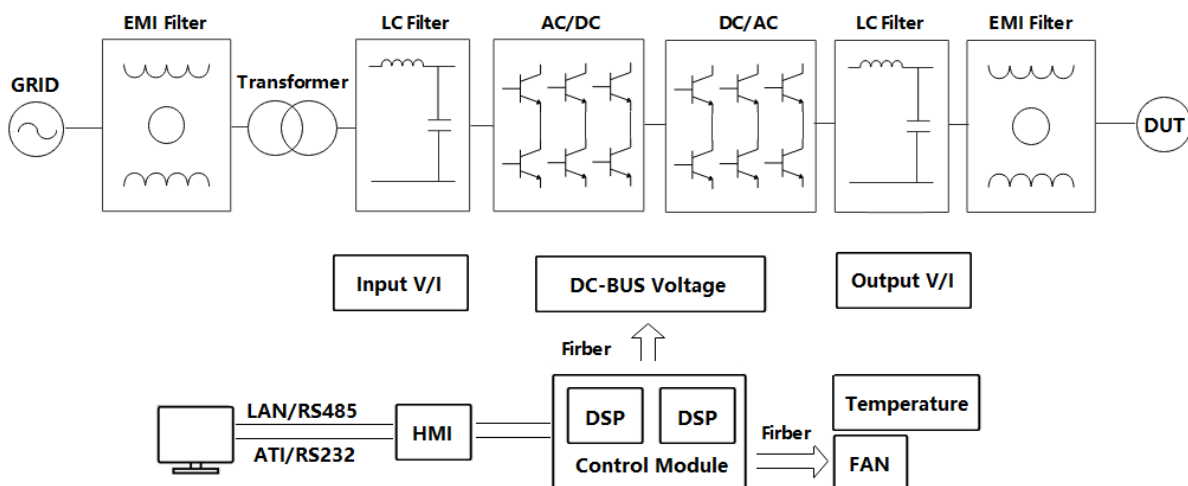
System

17_05_38System Ready
ModelSc:0
17_11_07System Ready
ModelSc:2
17_11_32Output Side Error
17_11_32Input Timeout of Pre-Charge
17_11_32System Fault
17_11_54System Ready
ModelSc:4

System Status

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.

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 Modes	AC
Power Level	Single system 30-240KVA, customized up to 4MW and above
Voltage Ranges	0-300V L-N (std), voltage can be customized.
Current Ranges	Please refer to the Standard Models Specification
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)

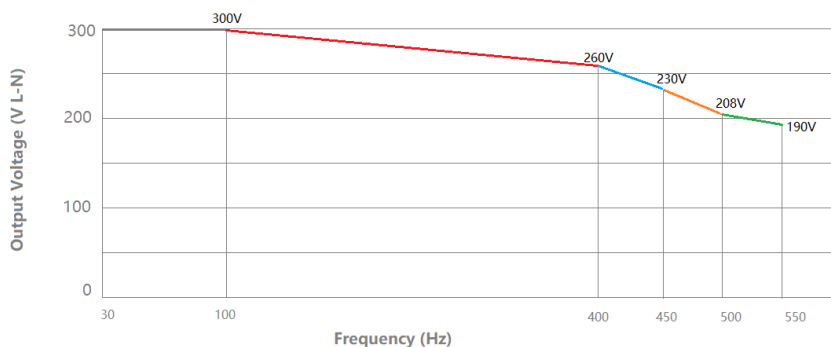
Options

-232	RS232 program interface
-LD	Regenerative AC load function
-R	Regenerative mode
-ATI	Analog control interface (0~5V)
-DC	Extend to DC output
-1P	Add single phase output
-IMP	Line impedance (RL) simulation
-MS	Master-Slave interface
-W	Use water-cooling
-TR	Change to transformer output topology
-62116	Island mode for IEC 62116 anti-island test
-HVXXX ⁴	Extend output voltage range to 400V, 530V or 700 V (L-N)
-CFG ⁵	Configurable Power/Voltage/Current range
-HFXXX ⁶	AC output frequency extended to XXXHz (only for CV mode)
-FHR	Frequency resolution 0.005Hz (max frequency: 70Hz)

⁴ For -HVXXX option, the model number will be ESA AAA-HVXXX-CCC-DDD (AAA: power, XXX: voltage, CCC: current, DDD: other option). There is only one voltage range, for example, ESA 250-HV530-378, the output voltage range is 0~530V L-N. The current range is not decreased with -HVXXX option, which means, for example ESA 250-HV530-378 has the same current range as standard model ESA 250-300-378. The ESA units can output full power at 220V L-N.

⁵ Customized power/voltage/current range is possible with -CFG option. Please consult factory

⁶ Max VF Derating 300V L-N Range



AC Input Configuration⁷

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

⁷ 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