AGL Regenerative AC Source & Load Technical Specifications

XI'AN ACTIONPOWER ELECTRIC CO., LTD.

Contents

1. Product Overview

In 2022, Actionpower launched the fourth-generation A series regenerative AC source & load integrated panel, which has both the function of grid simulation and the AC load simulation to meet various tests in the green energy industries. The source mode can simulate both normal and abnormal characteristics according to international regulation; the load mode can simulate the linear RLC load, the rectified load and the switching load, thereby filling the market gap of high power AC electronic load.

The A series feedback AC source & load integrated panel has the matrix parallel capability, which can realize the multi-station independent operation in laboratory and improve the utilization efficiency of power supply. Actionpower has provided the third-party testing organization with four-station new energy test platform with capacity up to 6MW, which is the largest low-voltage test system in China.

In the industries related to green energy, such as PV inverter, energy storage system ESS/power conversion system PCS, micro-grid, onboard charger OBC/BOBC, high power charging pile, and uninterrupted power supply UPS, the combination of AC power supply and AC load functions in the product test helps customers to reduce procurement costs. Compared with the traditional reactive load, the equipment feeds the power back to the grid, which is more in line with the needs of the low-carbon society. It once again leads the development direction of the new generation high power AC power supply.

2. Selection

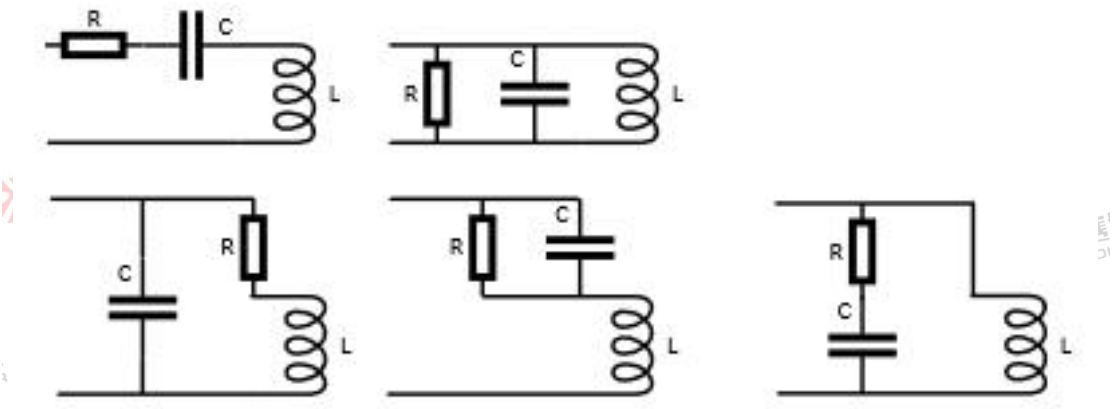
Model	Power (kVA)	Voltage Range (V) @L-N	Frequency Range (Hz)	Maximum Current(A) @Three-phase	Weight (kg)	Size (mm) W x H x D
AGL-30-4505	300	0-450	40-70	454	2930	2900×1950×1200
AGL-40-4506	400	0-450	40-70	606	3220	2900×1950×1200
AGL-50-4508	500	0-450	40-70	757	4360	4400×1950×1400
AGL-60-4509	600	0-450	40-70	910	4910	4400×1950×1400
AGL-75-4512	750	0-450	40-70	1136	6160	4400×1950×1400
AGL-100-4516	1000	0-450	40-70	1515	8720	8800×1950×1400
AGL-30-7003	300	0-700	40-70	286	2860	2900×1950×1200
AGL-40-7004	400	0-700	40-70	380	3040	2900×1950×1200
AGL-50-7005	500	0-700	40-70	476	3260	2900×1950×1200
AGL-60-7006	600	0-700	40-70	572	4170	4400×1950×1200
AGL-75-7007	750	0-700	40-70	714	5880	4400×1950×1400
AGL-100-7010	1000	0-700	40-70	1000	6610	4400×1950×1400
AGL-H30-8603	300	0-860	40-70	286	2860	2900×1950×1200
AGL-H40-8604	400	0-860	40-70	380	3040	2900×1950×1200
AGL-H50-8605	500	0-860	40-70	476	3260	2900×1950×1200

AGL-H60-8606	600	0-860	40-70	572	4170	4400×1950×1200
AGL-H75-8607	750	0-860	40-70	714	5880	4400×1950×1400
AGL-H100-8610	1000	0-860	40-70	1000	6610	4400×1950×1400

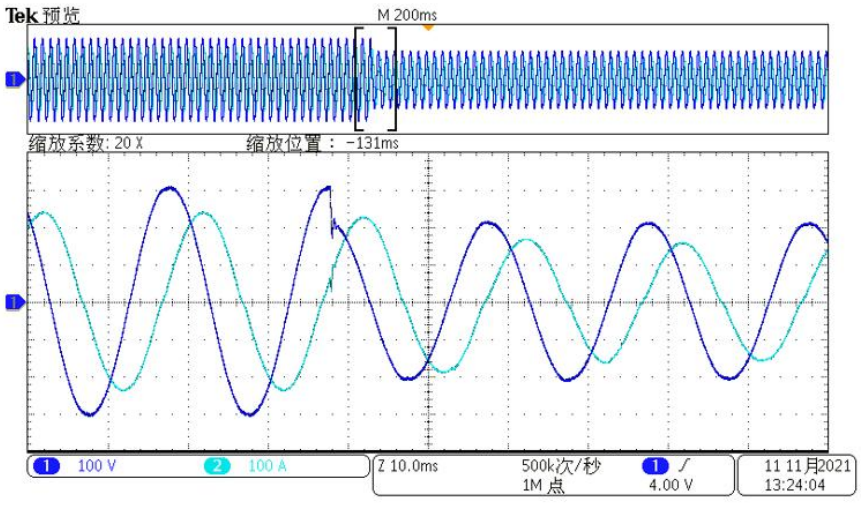
3. Advantages and Functions of AC Load

3.1 Linear Load Characteristic Simulation

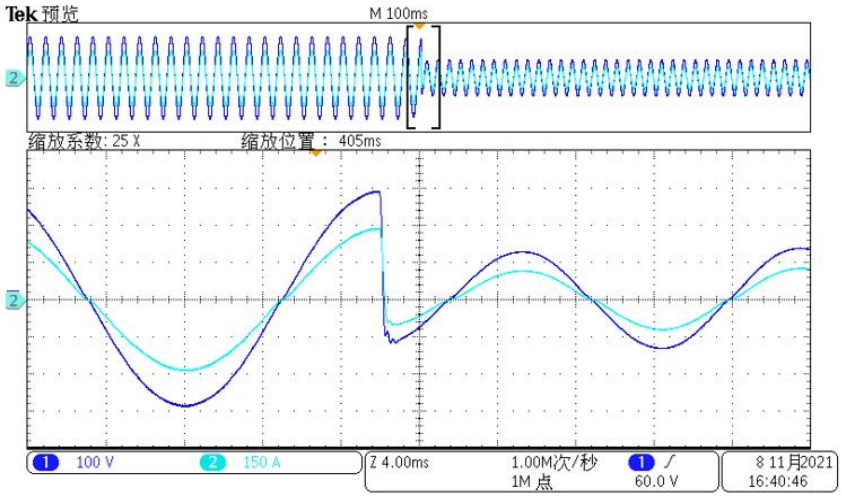
The A series feedback AC source & load integrated panel has 5 built-in RLC network models, which can flexibly adjust the parameters to simulate the linear load characteristics, in order to fully validate the product performance in different impedance modes.



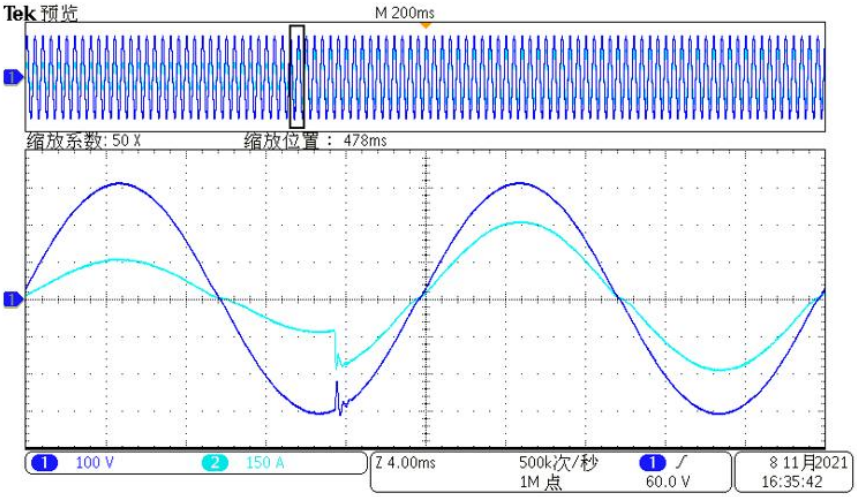
RLC load network topology



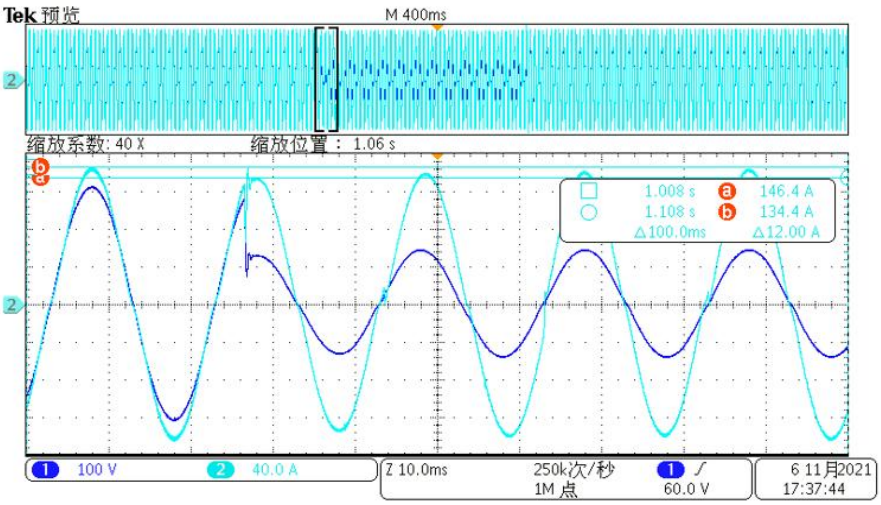
RLC mode: voltage amplitude transient change and power factor adjustment



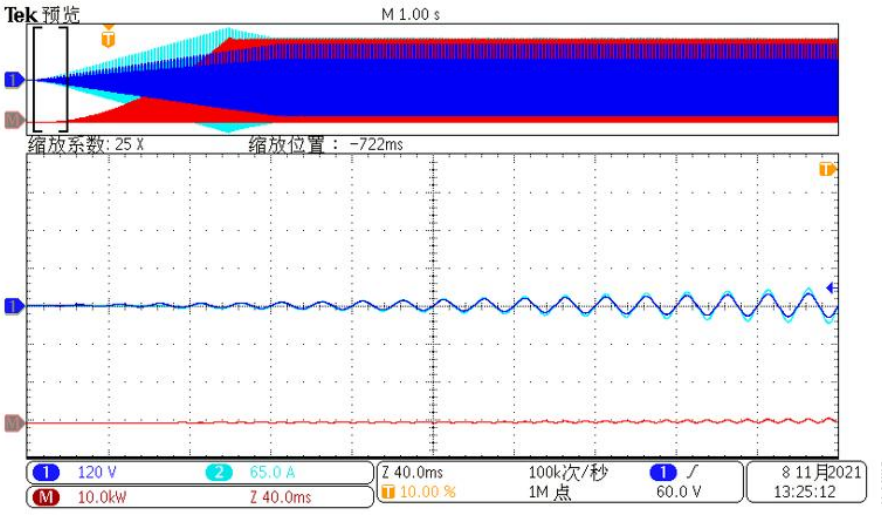
CR mode: voltage amplitude, phase, frequency transient change



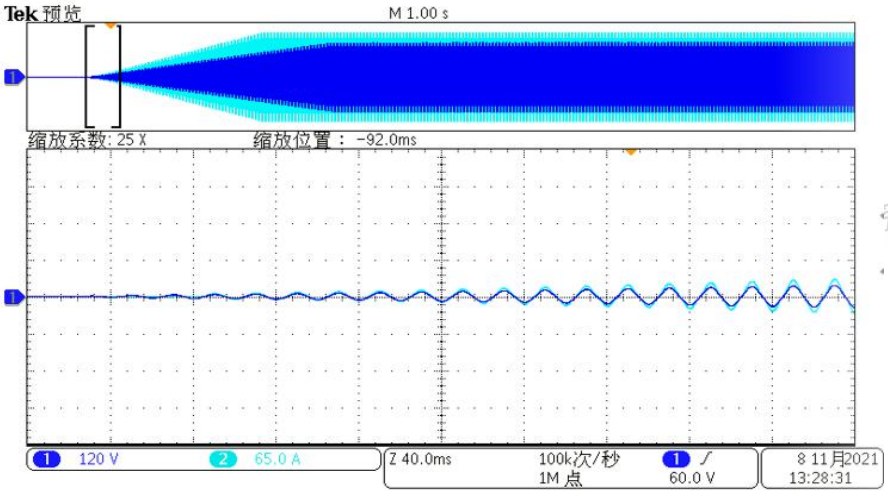
CR mode: resistance transient change



Voltage amplitude change in CC mode



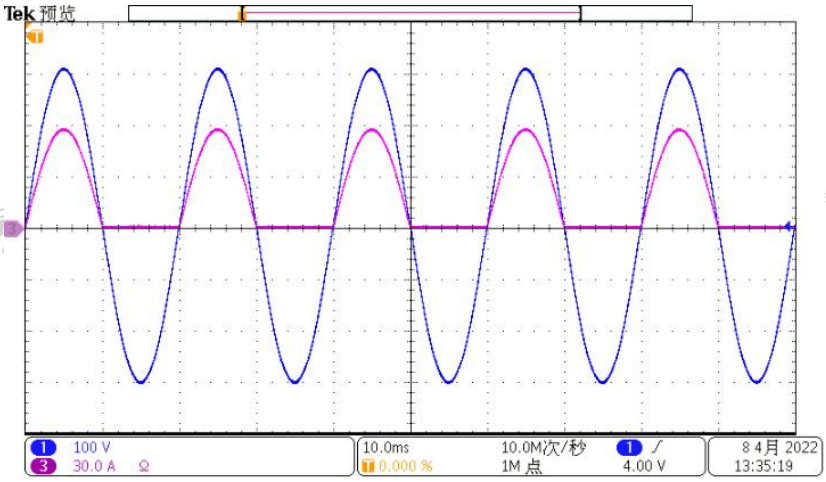
Zero-voltage startup to CP



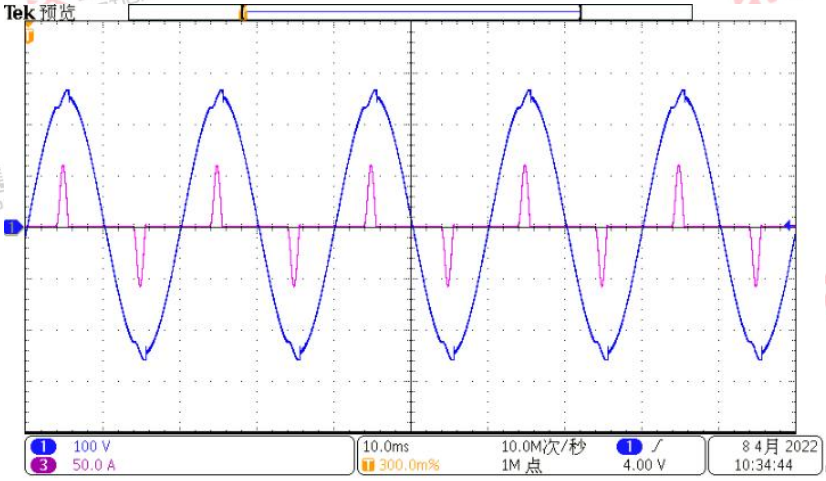
Zero-voltage startup to CC

3.2 Nonlinear Load Characteristic Simulation

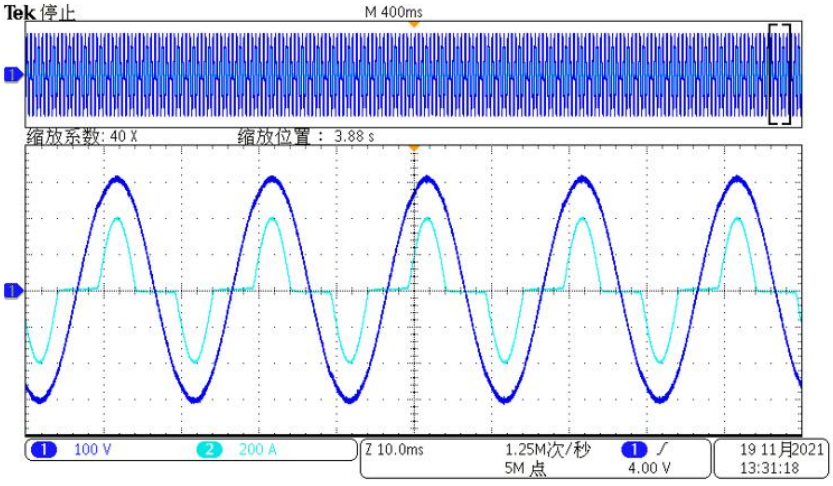
The A series feedback AC source & load integrated unit can also simulate the nonlinear load characteristics.



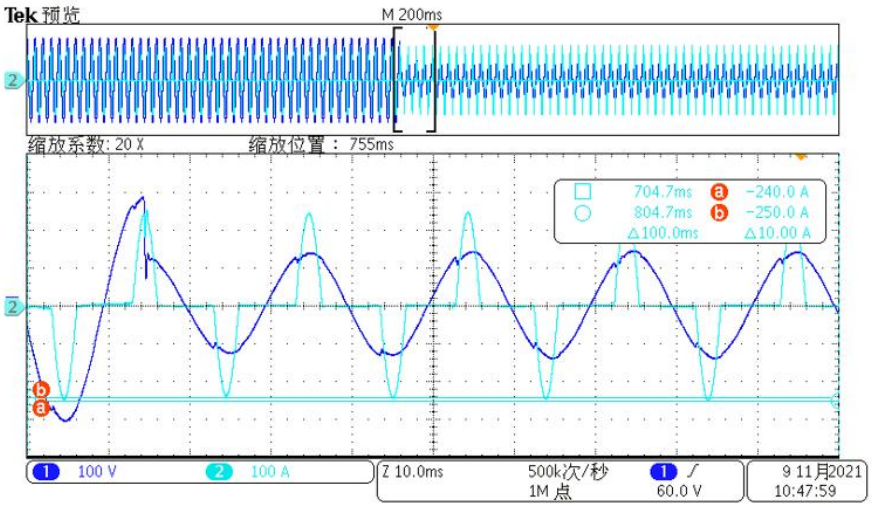
Rectifying load - half-wave rectification waveform



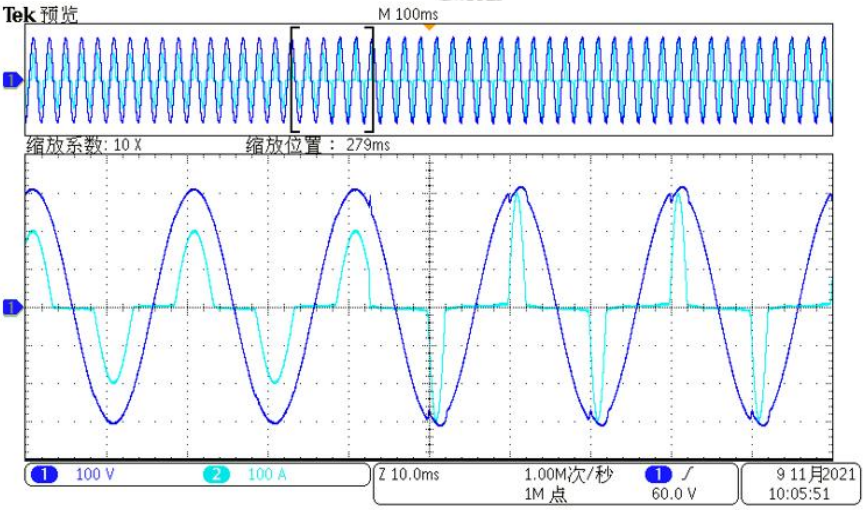
Rectifying load - CF=4 waveform



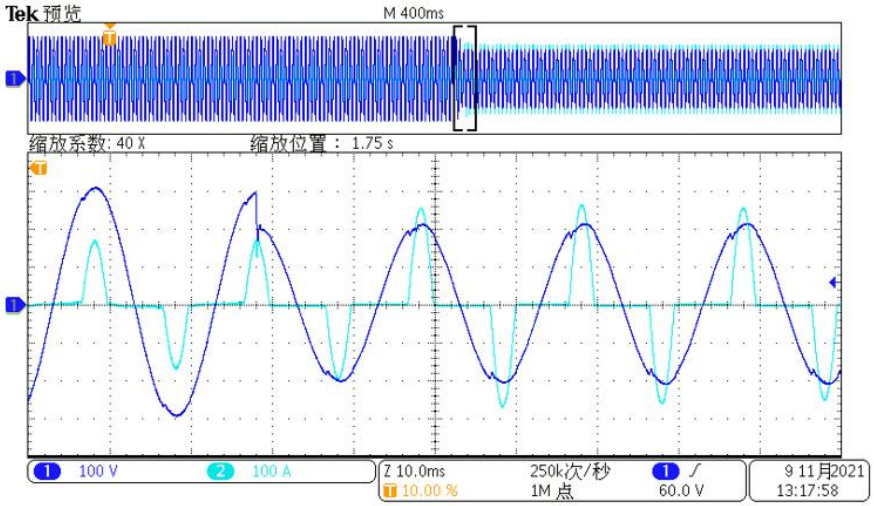
CF=2 Single-phase current in CC mode



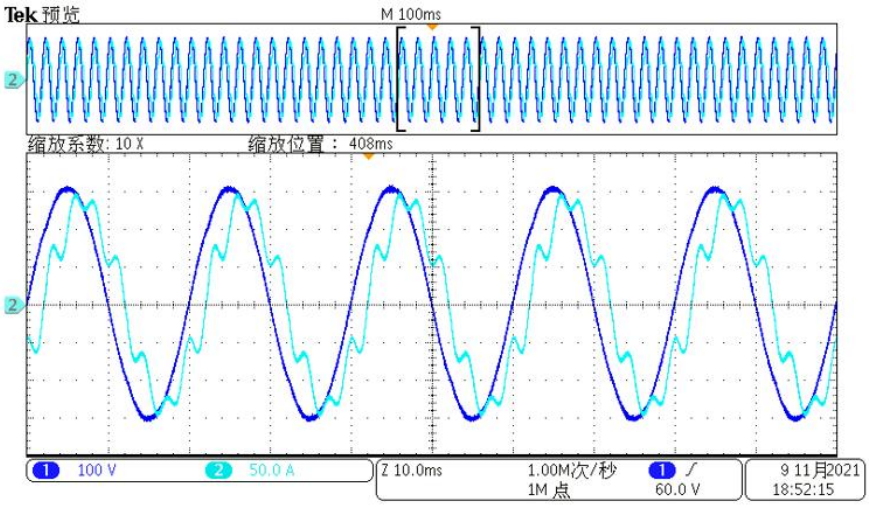
Rectifying load in CC mode CF=2.5, voltage amplitude transiently changes by 120V at 90° position



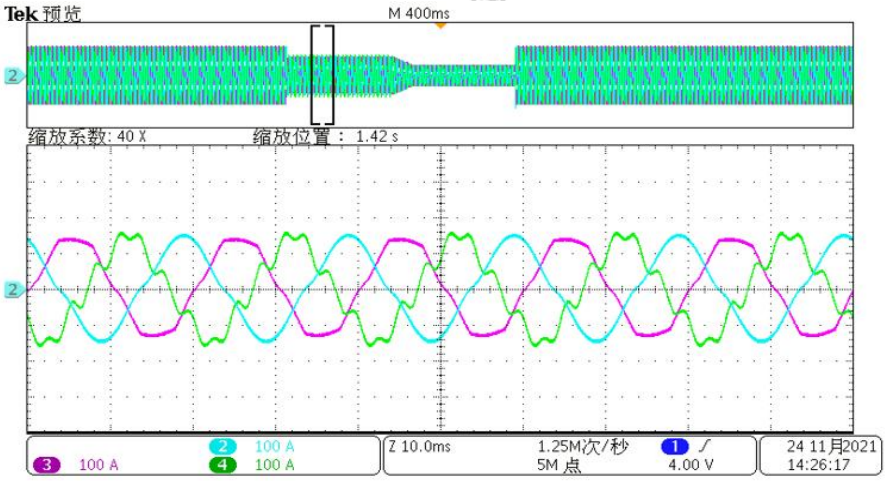
CF transient change in CC mode: CF changed from 2 to 3



CP mode: voltage amplitude transient change CF=2.5

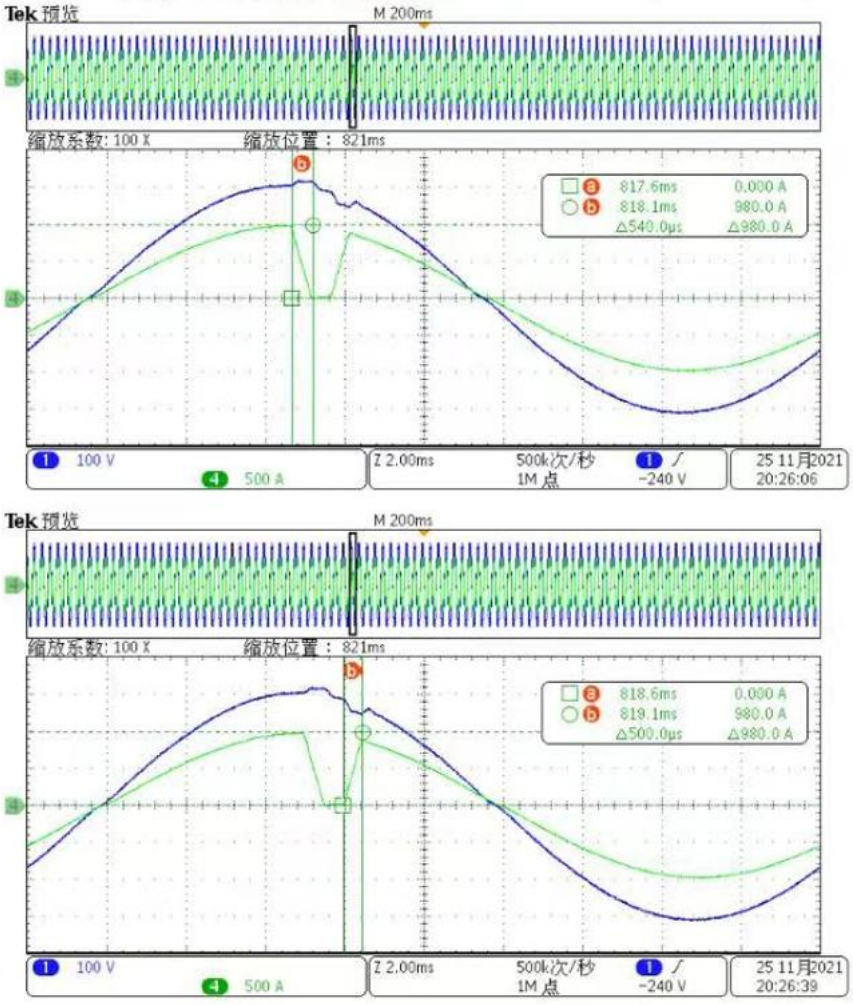


Current harmonic simulation



CC mode: three-phase independent current harmonic simulation

3.3 The 1ms dynamic in load mode

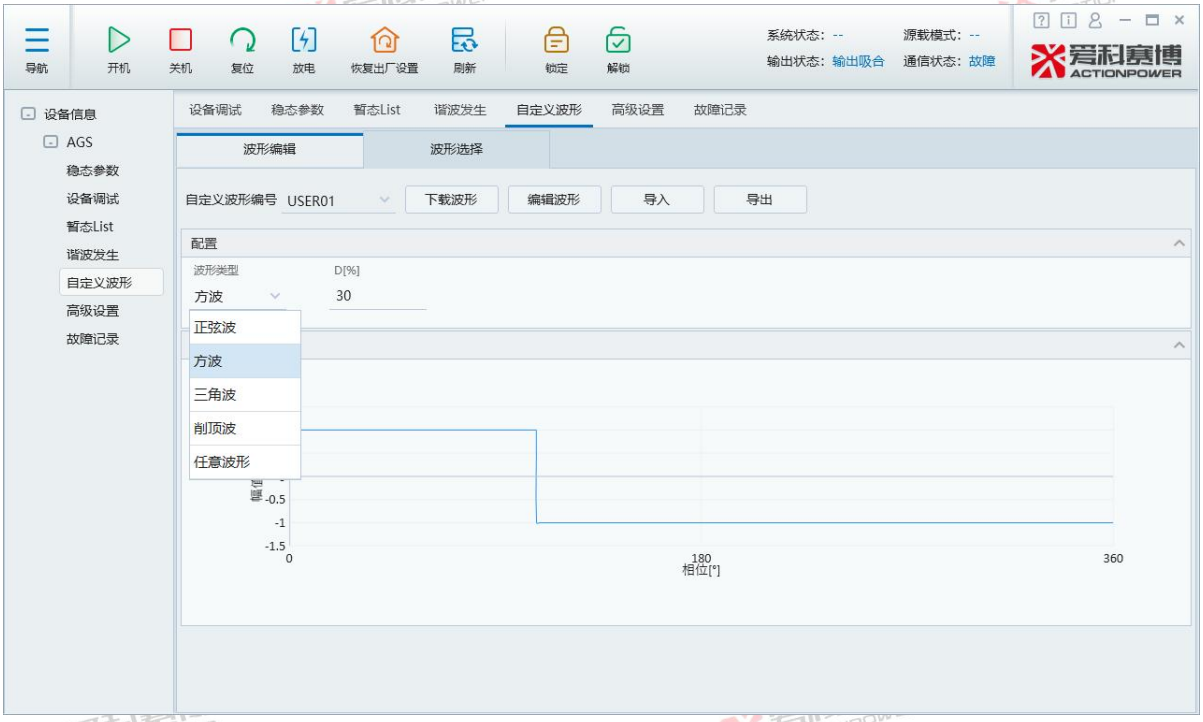


Current dynamic < 1ms

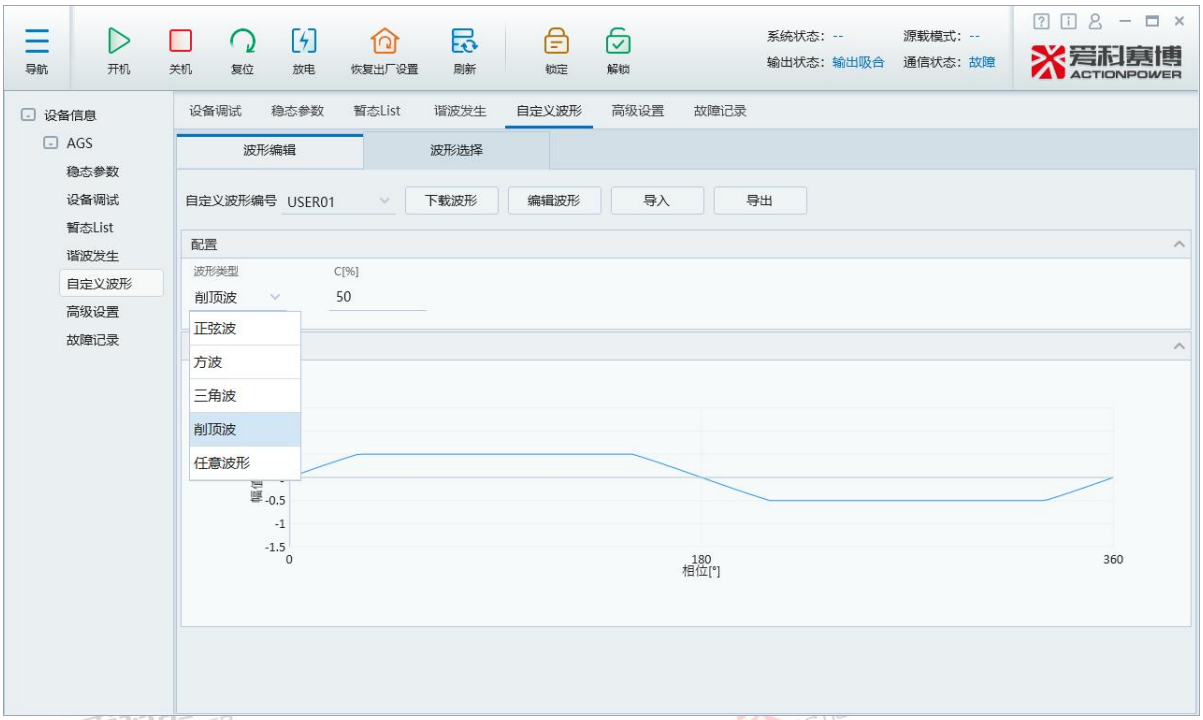
3.4 Complete Waveform Database

With various types of waveform, such as triangular wave, sine wave, square wave and clipping wave, the user can call the waveform from the menu and preview the selected waveform on the screen.

Triangular wave selection interface

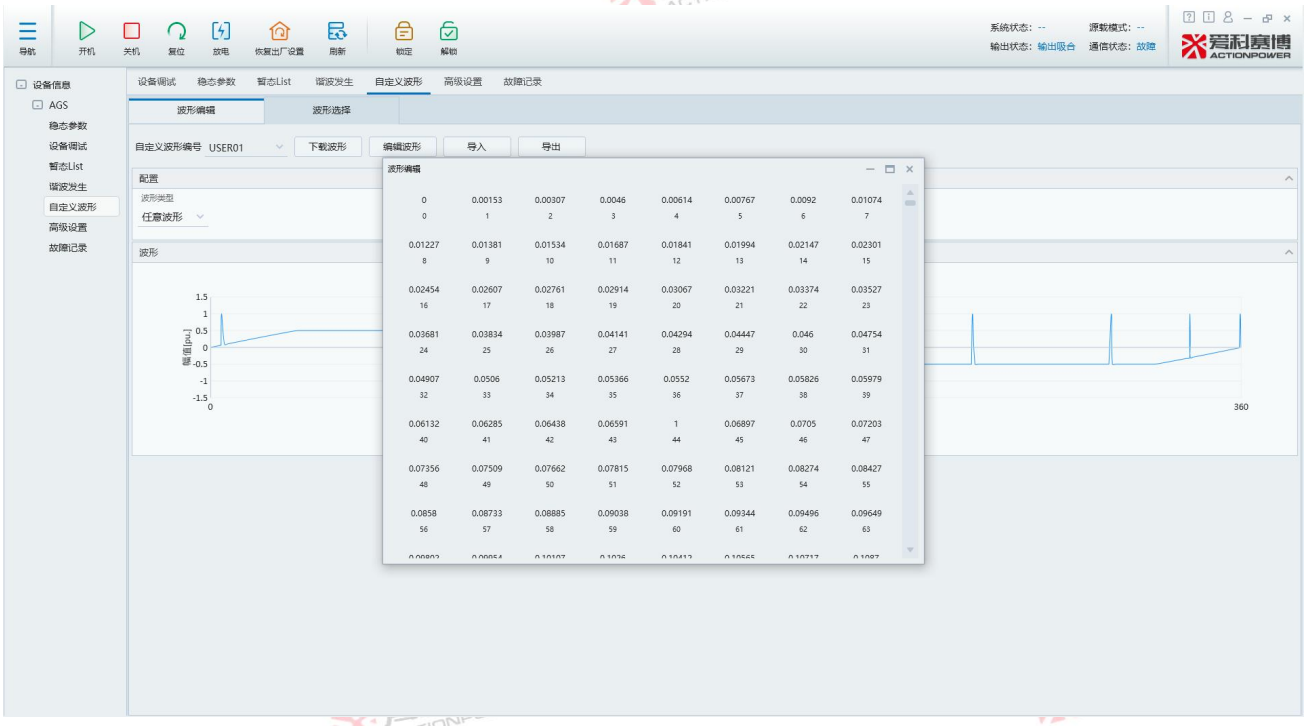


Square wave selection interface



Clipping wave selection interface

Waveform editing in customized mode can reproduce the real source waveform on site.



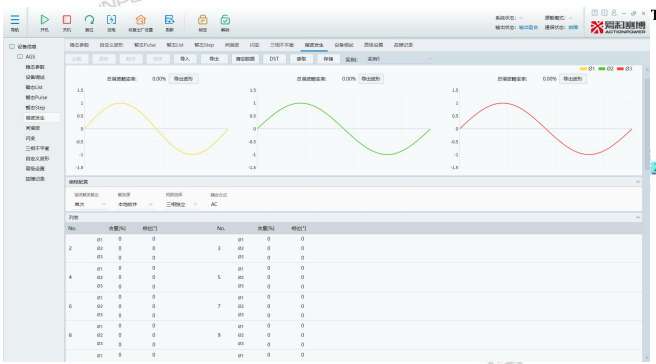
Customization edition interface

Customization waveform selection

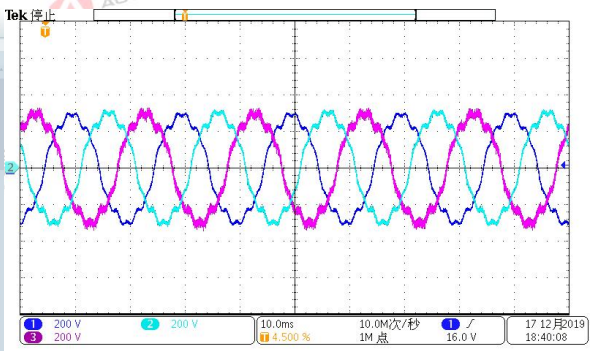
4. Advantages and Functions of Grid Simulation Source

4.1. Harmonics

The power supply allows to synthesis 2-50 times of harmonics with 50Hz or 60Hz fundamental frequency, and can be applied for the tests under IEC61000-3-2/3-12.



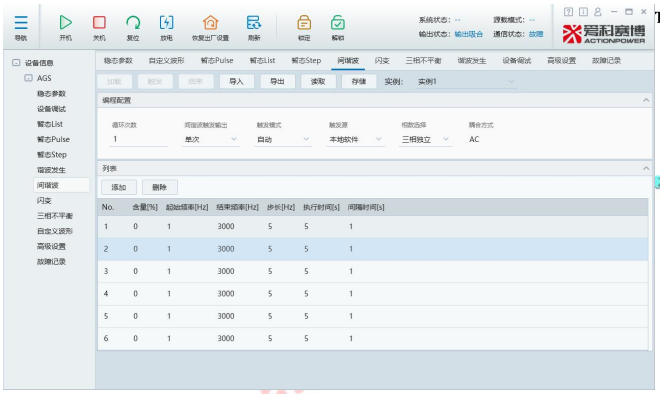
Harmonic Superimposition Interface



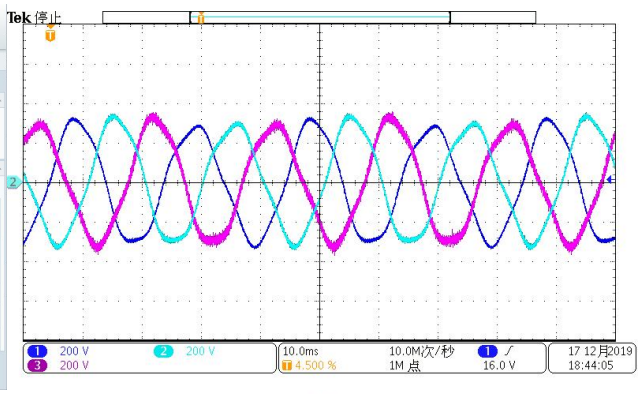
Harmonic Superimposition Waveform

4.2 Inter-harmonic

The power supply can synthesis the 1Hz-3000Hz inter-harmonics to form the distorted waveform of output voltage.

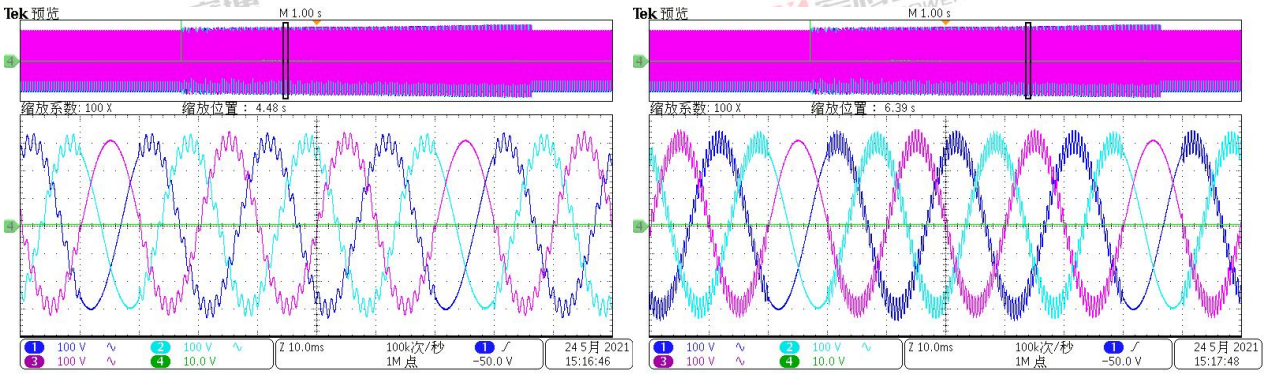


Inter-harmonic Setting Interface



Inter-harmonic Synthesis Waveform

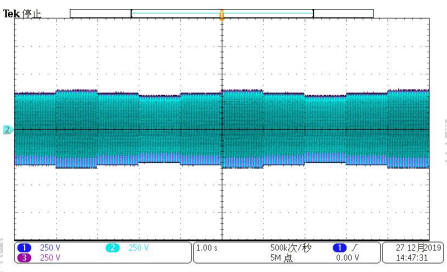
Starting frequency, ending frequency, interval and the like can be set for inter-harmonics to test the inter-harmonic sweep frequency, so as to be applied to the tests of IEC 61000-4-13 standard.



Inter-harmonic sweep

4.3 Flicker

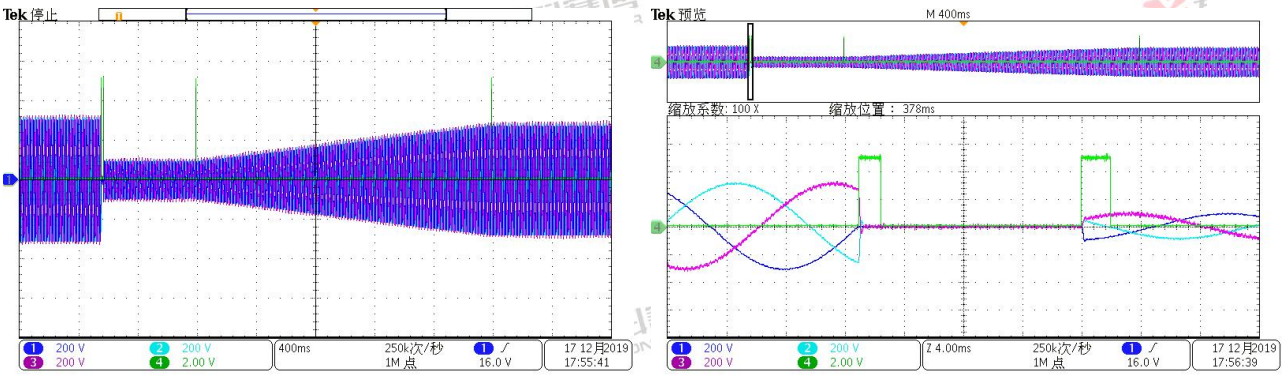
The flicker level can be directly set for power supply and the flicker characteristics of the power grid can be easily simulated to test the flicker adaptability of the test object.



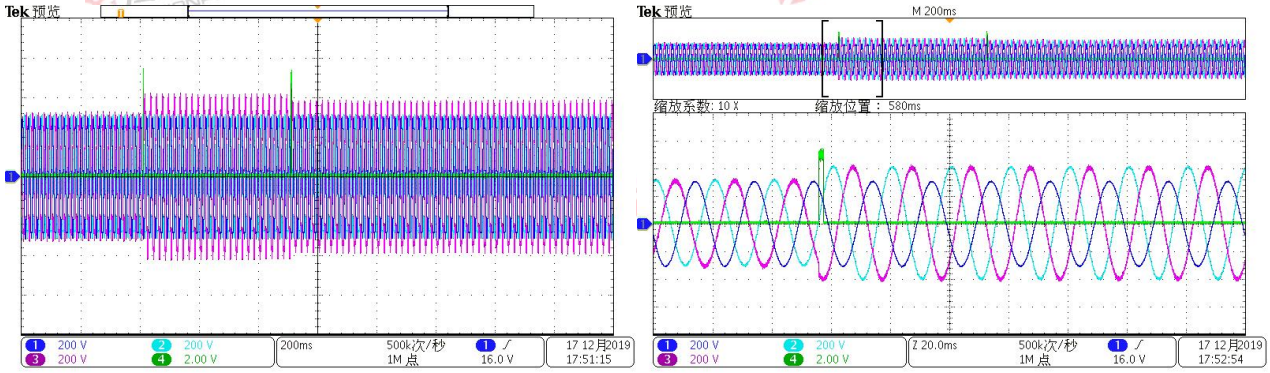
Flicker simulation

4.4 High/Low Voltage Ride Through

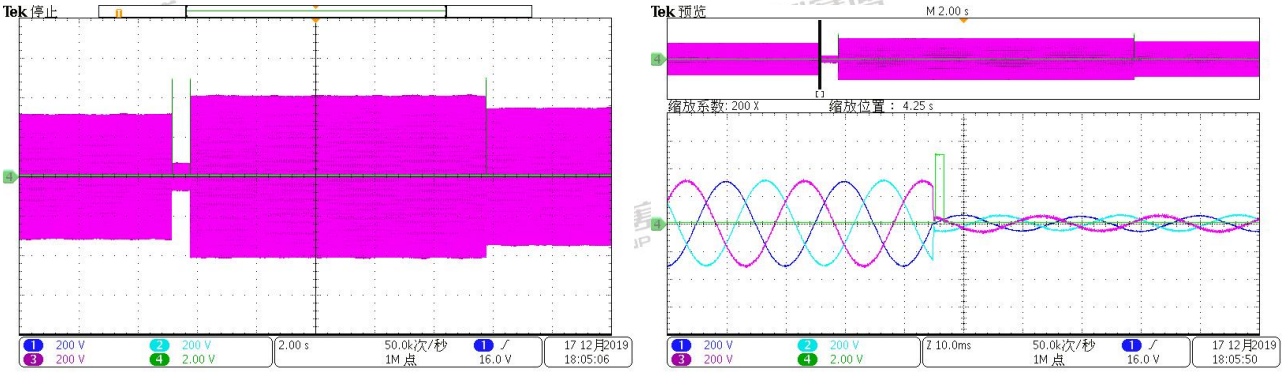
The single-phase, two-phase, and three-phase high/low voltage ride through tests can be performed for the power supply. The trigger phase angles of the ride through points can be set for the power supply to meet the requirements of tests under various standards. The minimum setting voltage of power supply is less than 5V, and the rise/fall time is 1ms.



Three-Phase Low Voltage Ride Through

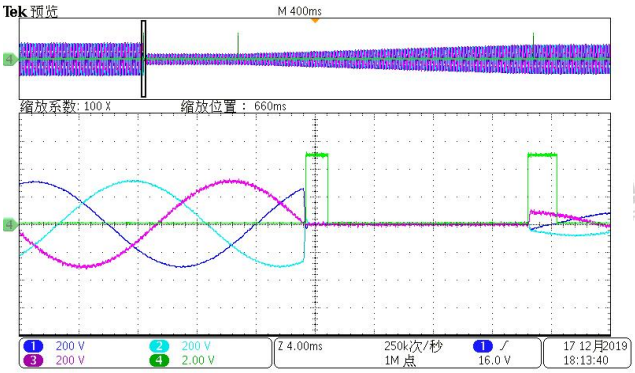


Single-Phase High Voltage Ride Through

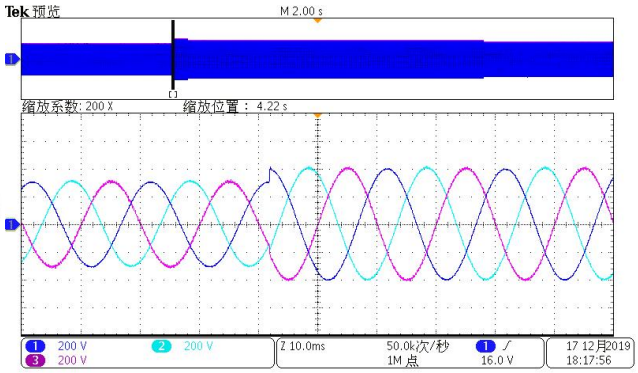


Three-Phase High and Low Voltage Ride Through Test

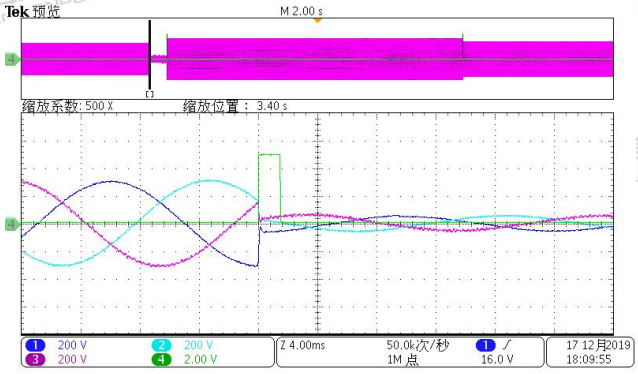
The trigger phase angle of ride through point is settable to meet the fault ride through test requirements of different countries.



60° Low Voltage Ride Through

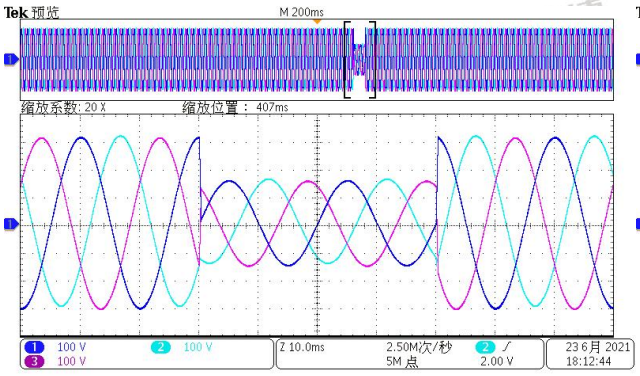


90° High Voltage Ride Through

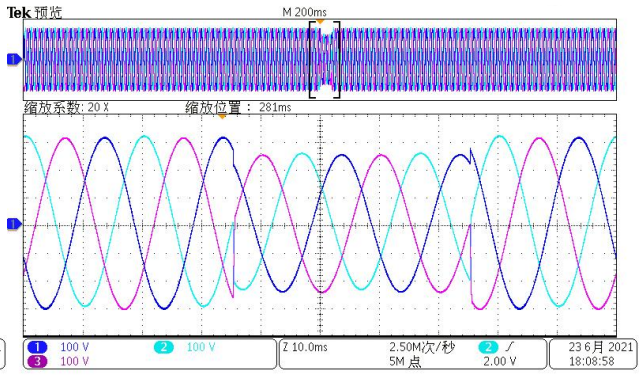


270° High and Low Voltage Ride Through Test

Phase A, B and C can be changed at the same time for low voltage ride through, phase B and C can be switched for low voltage ride through, so as to meet the tests of VDE-AR-N 4105 regulations.



Three-phase Change LVRT

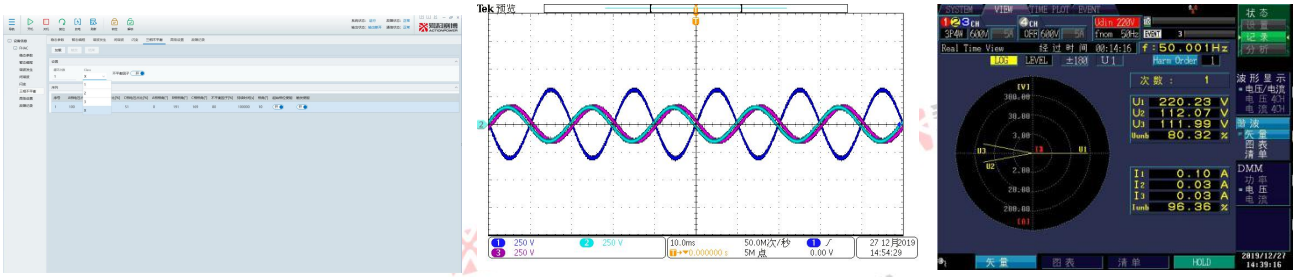


B-C Phase Switching LVRT

4.5. Three-phase Unbalance

The power supply can set the unbalanced voltage, phase and other information to make the power supply into an unbalanced state, and automatically display the unbalance factor. It can also directly set the unbalance factor, automatically calculate and output the voltage, phase and other information under the unbalance factor, easily simulate the grid unbalance characteristics, and be used to test the adaptability of the voltage unbalance degree of the tested

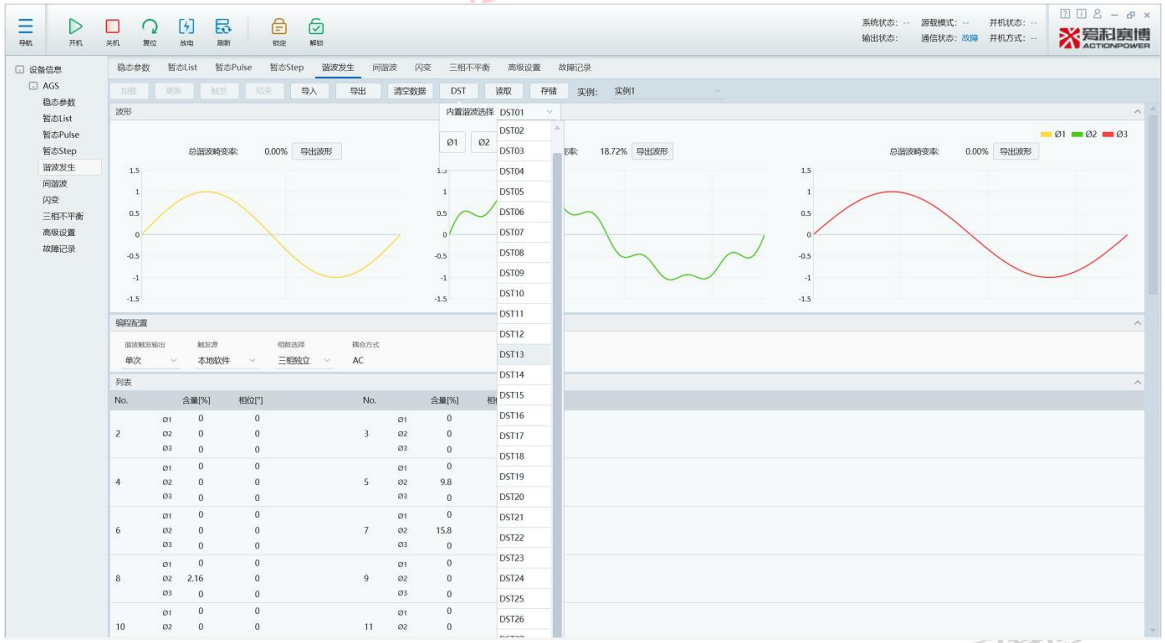
object.



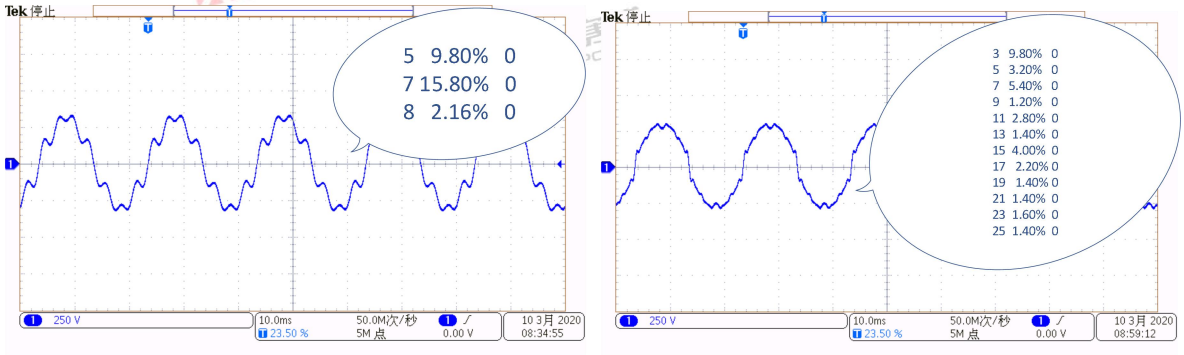
Three-phase unbalance

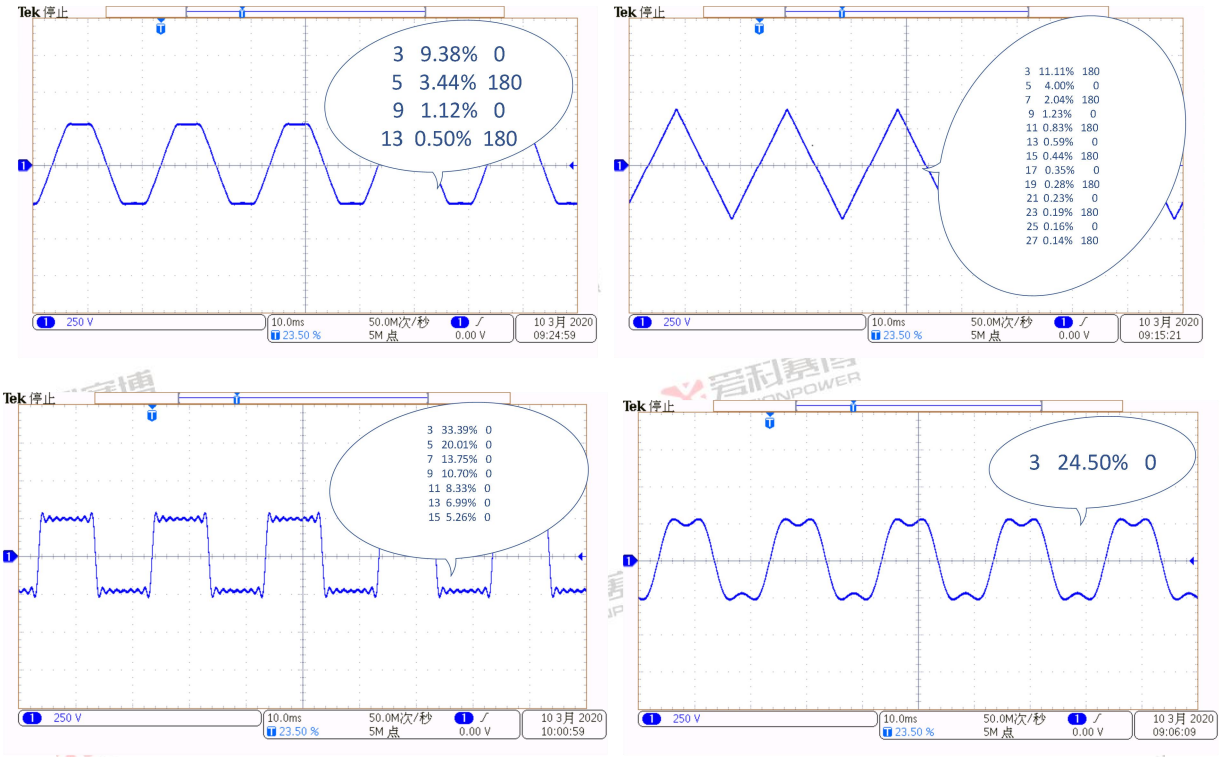
4.6. Complete Waveform Database

Built-in 27 kinds of typical harmonic voltage waveform help users to take one with one click.



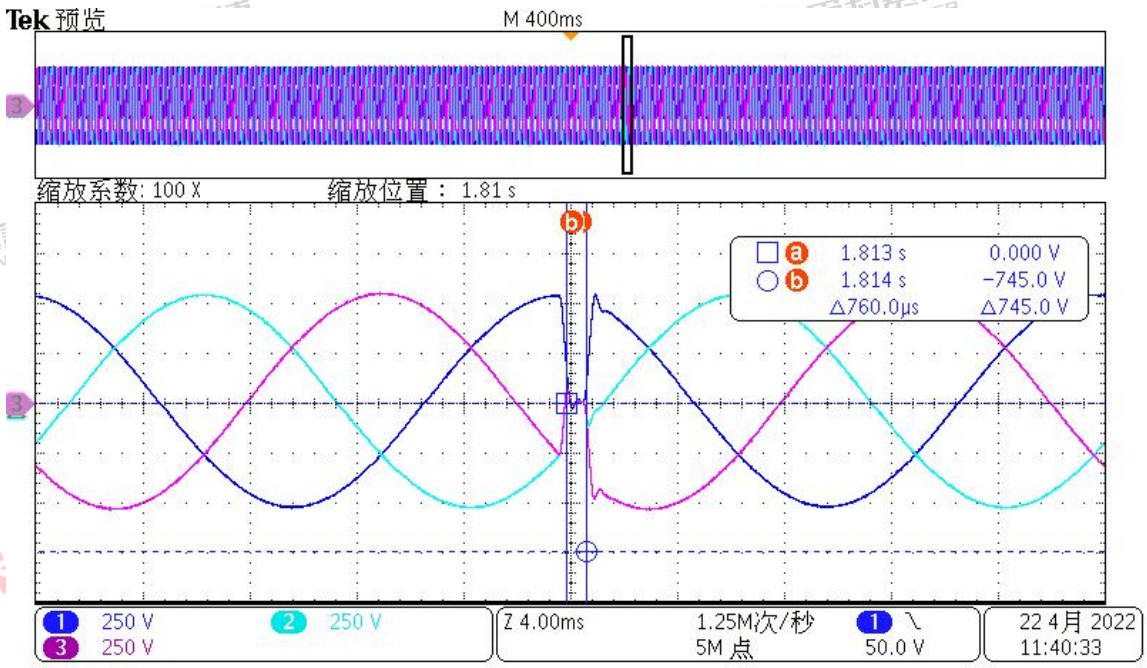
Harmonic calling interface





4.7 High-dynamic Grid Output Characteristics

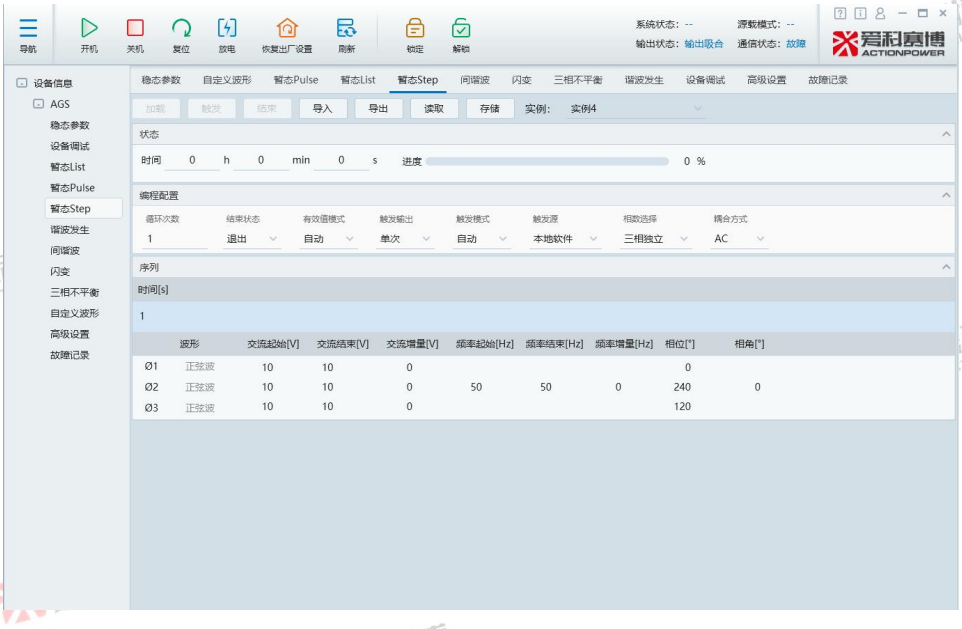
The power supply can be used for the 1ms interruption test.



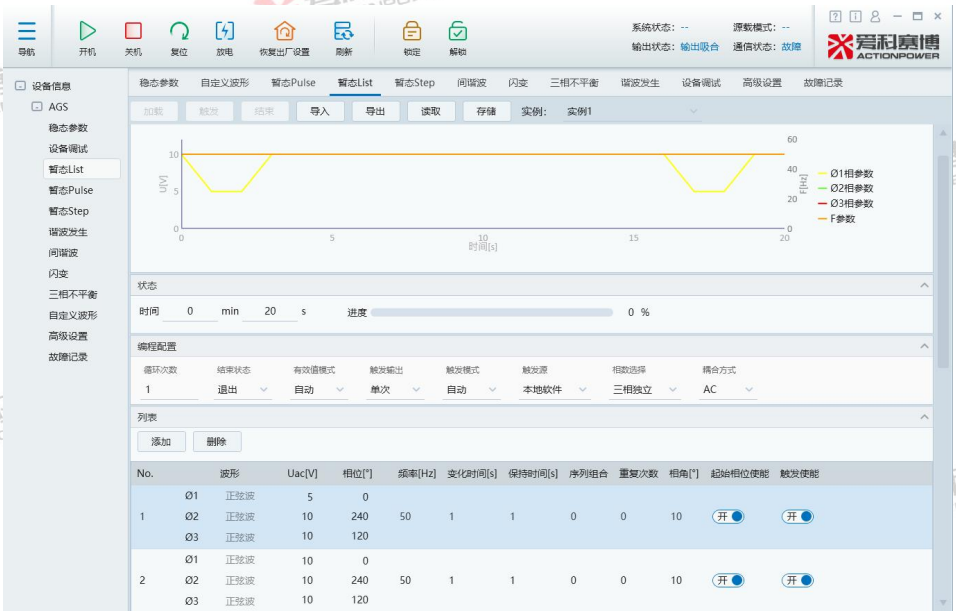
1ms interruption waveform

4.8 Universal Programmable

All AGL modes feature 100-step nested programming, with the entire programming loopable for 999 times. The output voltage, frequency, and phase can be programmed and output according to the customer's requirements. The multi-sequence complex output modes can be combined by variation time, holding time, programming steps, cycle times, etc. for tests under complex conditions and can be used for tests of over & under voltage, over & under frequency, etc. Programming data has memory function and supports import and export. The power supply can be continuously programmed within the output range with no distortion of waveform. Additionally, there is control of low-voltage trigger signal electrically isolated from other parts of the device in output, and such signal is always synchronized with the variation of power output parameters, single-step, single-cycle, single-trigger.

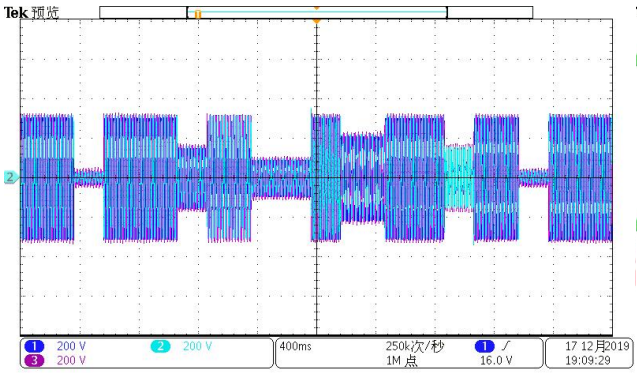


STEP mode setting interface

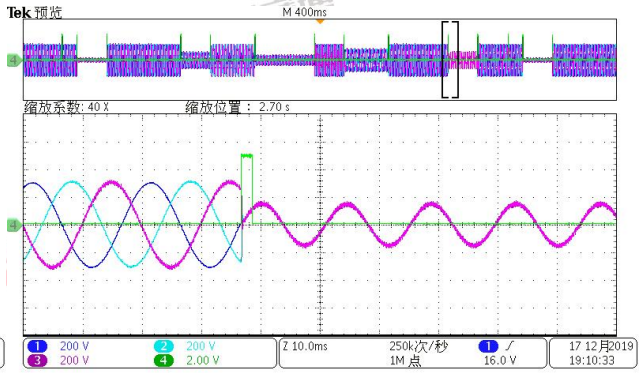


LIST mode setting interface

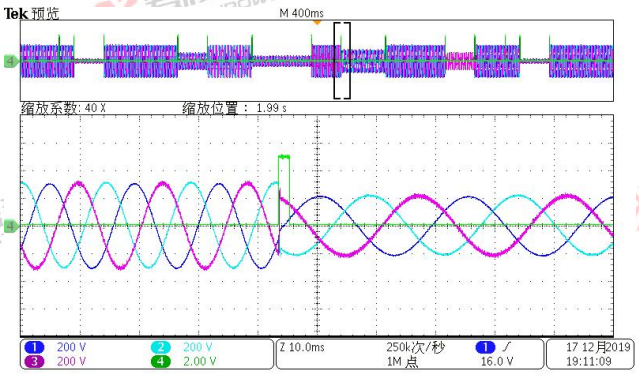
PULSE mode setting interface



User-defined Waveform



Voltage Phase Change



Frequency-voltage Variation

5. Technical Specification

5.1 Specification in Source Mode

Source Mode	
Category	
Basic Parameters	
Number of output phases	Three-phase three-wire ABC or three-phase four-wire ABCN
Load power factor	-1～+1
AC output	
Voltage	
Resolution (V)	0.01
Accuracy	±0.1% F.S.
Types of waveform	Sine
DC component (mV)	<50
Voltage distortion	<0.5% @50Hz/60Hz >=220V no-load <1% @Linear load
	<1.0%@40Hz~70Hz >=220V no-load < 1.5% @ Linear load
Load regulation rate	±0.1% F.S
Line regulation rate	±0.1% F.S. @10% variation
Voltage slew rate	AC＞1.0V/μs
Dynamic response	＜1ms（10%-90%Umax）
Three-phase unbalance	Negative sequence voltage less than 1%, short-time less than 2%
Frequency	
Resolution (Hz)	0.001
Accuracy	±0.01% or 0.005Hz, take the greater of the two
Phase	
Scope	A = 0°, B = -120°, C = 120° (default); programmable range: 0°–359.9°, independently adjustable for three-phase
Accuracy	±0.3°
Resolution	0.1°
Harmonics	
Times	50 times @50 , 50 times @60 , below nominal voltage
Component	Maximum 40% for 2-10 single harmonics, and no more than 40% for 2-10 total harmonics; Maximum 20% for 11-20 single harmonics, and no more than 20% for 11-20 total harmonics; Maximum 10% for 21-30 single harmonics, and no more than 10% for total harmonics; Maximum 5% for 31-50 single harmonics, and no more than 5% for total harmonics;

Amplitude error	±5%@ harmonic content setting value below 25 times
Phase angle range	0°-359.9°
Preview function	Harmonic synthesis waveform can be previewed
Editing mode	Import, export, read, storage
Inter-harmonic	
Frequency range	1Hz-3,000Hz, content <10%
Programming steps	100 steps
Programming parameters	Component, start frequency, end frequency, step length, time of execution, interval and cycles
Editing mode	Add, delete, import, export, store, read
Flicker	
Flicker level	1.0-10.0, totally 10 levels in total, and one-key call
Adjustment step length	1
Accuracy	±0.2
Preview function	Preview of flicker trend chart
Three-phase unbalance simulation	
Adjustment mode	Three-phase voltage, phase; unbalance factor;
Unbalance factor adjustment range (%)	1~100, one-key call
Unbalance factor adjustment step length (%)	1
Accuracy (%)	±0.5%
High & Low Voltage Ride Through	
Mode	LVRT / HVRT / H&LVRT
Configurations	Voltage, frequency, phase, rise time, hold time, trigger phase angle, and trigger pulse output
Regulations	GB/T, VDE-AR-N 4105, NRS 097-2-1, G83, and EN50438 standards.
Programmable	
Programming steps	100 steps
Programming parameters	Voltage, frequency, phase, change time, hold time, trigger phase angle, and trigger pulse output
Up time range	100μs-999s
Flat top time range	100μs-999s
Minimum programming time step	100μs
Editing mode	Import, export, store, read
Relevant functions	Three-phase unbalance, fall, interruption, HVRT,LVRT etc.
Operation mode	Operation, stop, cycling
Trigger mode	Automatic, manual, external
Measurement	
Output Voltage	
Resolution (V_rms)	0.01
Accuracy	±0.1% F.S.
Output frequency	

Resolution (Hz)	0.001
Accuracy	±0.01%
Output Current	
Resolution (A)	0.1
Accuracy	±0.2% F.S.
Active power	
Resolution (W)	1
Accuracy	±0.3% F.S.
Apparent power	
Resolution (VA)	1
Accuracy	±0.3% F.S.
Power factor	
Scope	-1.00~+1.00
Resolution	0.001
Power supply mode	
Wiring mode	Three-phase four-wire ABC+PE
Frequency (Hz)	47 — 63
Voltage range (V)	±15% @380V L-L
Power factor	0.99 @ above half load
Efficiency	Models of 300kW and above: > 94% Others: > 90%
Harmonic current	≤3%
Others	
Communication interface	Standard configuration: LAN; optional: RS485, CAN
External interlocking	External interlocking input is normally on/off; external interlocking output is normally on/off.
Trigger signal	Trigger input/output
Insulation and withstanding voltage	10MΩ/DC500V； 3600VAC/1min
Control and display	Local touch screen control, remote computer control, display voltage, current, frequency and power
Cooling mode	Fan cooling

5.2 Specification in Load Mode

Load mode	
Basic Parameters	
Load wiring	Three-phase three-wire ABC or three-phase four-wire ABCN
Load mode	

Linear load	CC: Current, power factor, load type, current slope, output waveform CP: Apparent power, power factor, load type, power slope, output waveform CR: Resistance value RLC: RLC connection mode R+L+C, R//L//C, (R//C)+L, (R+L)//C, (R+C)//L Resistance value, inductance value and capacitance value can be set
Nonlinear load	Current, power, peak factor, current slope, power slope
Zero-voltage start	Simulate on-load start, switch seamlessly to CC or CP after start, with configurable switching condition
Voltage	
Voltage distortion limit	Uthd <10% below 20 times
Current	
Resolution (A)	0.01
Accuracy (A)	±0.2% F.S. @ CC mode
Waveform	Sine, square wave, triangular wave, clipping wave, customized waveform
Current distortion	<2%@50Hz@ full load under rated voltage
Current slew rate	10%~90% nominal current > 1A/us
Dynamic response	< 1ms@10%~90% nominal current
Frequency	
Range (Hz)	40.00 - 70.0
Accuracy	±0.01Hz
Harmonics	
Harmonic order	50 times
Limit of each order	Max 40% for 2-10 single harmonics, and no more than 40% for 2-10 total harmonics; Maximum 20% for 10-20 single harmonics, and no more than 20% for 10-20 total harmonics; Maximum 10% for 21-30 single harmonics, and no more than 10% for total harmonics; Maximum 5% for 31-50 single harmonics, and no more than 5% for total harmonics;
Phase angle of each order	0°- 359.9°
Power	
Resolution (VA)	1
Accuracy (VA)	±0.5% F.S. @ CP mode
Power factor	
Power factor	-1-1 (resistance inductance, resistance capacity and current direction can be set)
Resolution	0.01
Crest factor	
Scope	1.414-4
Resolution	0.001
List programming	
Programmable steps	100 steps
Supported modes	CC, CP
Programmable parameters	Current/power, power factor, load type, change time, holding time, trigger phase angle, trigger pulse output

UP time range	100μs-999s
Flat top time range	100μs-999s
Minimum programmable time step	100μs
Editing mode	Add, delete, store, and read
Operation mode	Operation, stop, cycling
Trigger mode	Automatic, manual, external
Measurement	
AC voltage	
Resolution (V)	0.01
Accuracy	±0.1% F.S.
Output frequency	
Resolution (Hz)	0.001
Accuracy	±0.01Hz
AC current	
Resolution (A)	0.1
Accuracy	±0.2% F.S.
Active power	
Resolution (W)	1
Accuracy	±0.5% F.S.
Apparent power	
Resolution (VA)	1
Accuracy	±0.5% F.S.
Power factor	
Scope	-1.00~+1.00
Resolution	0.001
Crest factor	
Scope	1.414-4
Resolution	0.001
Power mode	
Wiring mode	Three-phase four-wire ABC+PE
Frequency (Hz)	47 – 63
Voltage range (V)	±15% @380V L-L
Power factor	0.99 @100%
Efficiency	> 0.93
Harmonic current	≤3%
Others	
Communication interface	Standard configuration: LAN; optional: RS485, CAN
External interlocking	External interlocking input is normally on/off; external interlocking output is normally on/off.
Trigger signal	Trigger input/output
Insulation and withstanding	10MΩ/DC500V； 3600VAC/1min

voltage	
Control and display	Local touch screen control and remote computer control; display voltage, current, frequency and power
Cooling mode	Fan cooling