



# AGS Regenerative Grid Simulator Technical Specifications



XI'AN ACTIONPOWER ELECTRIC CO., LTD.



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## 1. Product Overview

AGS series of regenerative grid simulator is AC power source with high precision, high dynamic, high efficiency and comprehensive simulation of public grid characteristics. For regulatory test, AGS models can be applied to IEC 61000-3-2 /-3-3 /-3-11 /-3-12 (international regulations for AC voltage testing), IEEE 1547 / IEC62116 (international regulations related to green power generation) and energy storage system (ESS) testing.



AGS series are regenerative and providing completely energy saving solutions. The test unit feeds the energy which generated during the test back to the public grid instead of dissipating as heat. It protects the environment and lowers the operation cost to the maximum extent. With this capability, these models can be applied to applications in green energy products, such as PV inverters, energy storage systems (ESS), power conditioning systems (PCS), micro grids, etc.

## 2. Device Selection

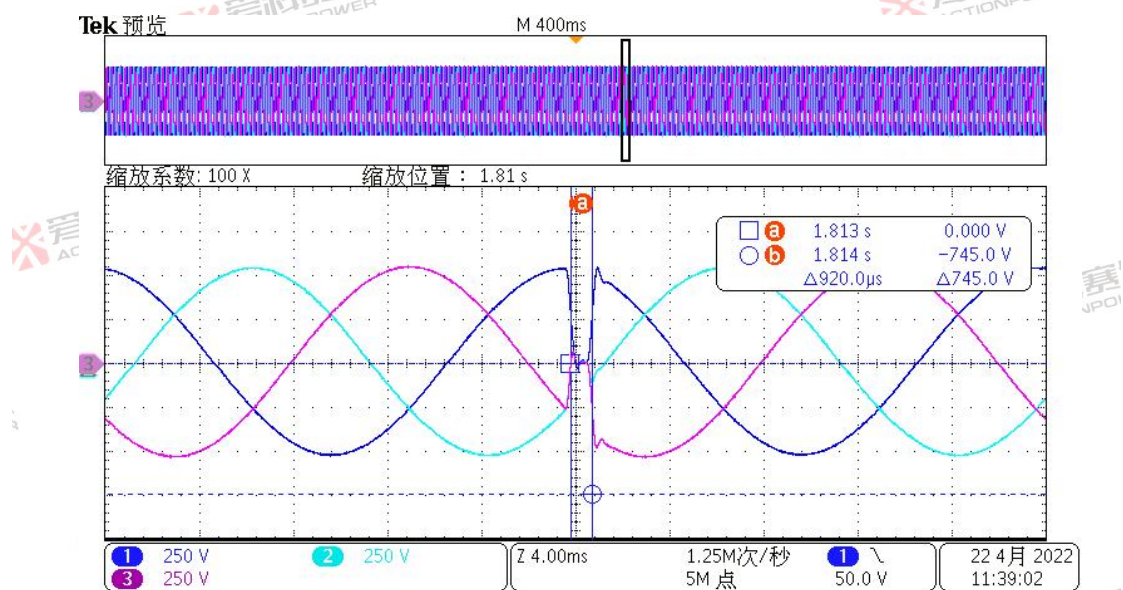
Model	Output Power (kVA)	Voltage Range (V) @L-N	Frequency range (Hz)	Maximum Current(A) @Three-phase	Weight (kg)	Dimensions (mm) W×H×D
AGS-30-4505	300	0-450	40-70	454	2630	2400×1950×1200
AGS-40-4506	400	0-450	40-70	606	2920	2400×1950×1200
AGS-50-4508	500	0-450	40-70	757	3860	3400×1950×1400
AGS-60-4509	600	0-450	40-70	910	4410	3400×1950×1400
AGS-75-4512	750	0-450	40-70	1136	5310	3400×1950×1400
AGS-100-4516	1000	0-450	40-70	1515	7720	6800×1950×1400
AGS-30-7003	300	0-700	40-70	286	2560	2400×1950×1200
AGS-40-7004	400	0-700	40-70	380	2770	2400×1950×1200
AGS-50-7005	500	0-700	40-70	476	2960	2400×1950×1200
AGS-60-7006	600	0-700	40-70	572	3670	3400×1950×1200
AGS-75-7007	750	0-700	40-70	714	5080	3400×1950×1400
AGS-100-7010	1000	0-700	40-70	1000	5810	3400×1950×1400
AGS-H30-8603	300	0-860	40-70	286	2560	2400×1950×1200
AGS-H40-8604	400	0-860	40-70	380	2770	2400×1950×1200

AGS-H50-8605	500	0-860	40-70	476	2960	2400×1950×1200
AGS-H60-8606	600	0-860	40-70	572	3670	3400×1950×1200
AGS-H75-8607	750	0-860	40-70	714	5080	3400×1950×1400
AGS-H100-8610	1000	0-860	40-70	1000	5810	3400×1950×1400

### 3. Features

- **High dynamics: Supporting 1ms interruption test**

The output voltage slew rate: 1V/μs



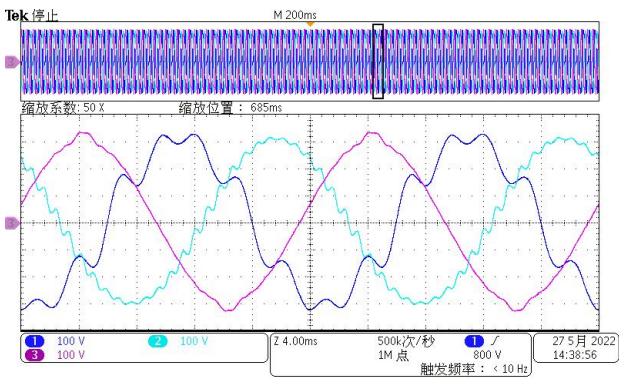
1ms interruption waveform

- **Parallel: Multiple units of the same model can be installed in parallel**

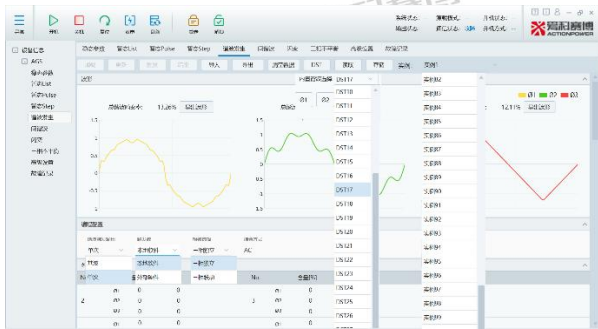
Multiple power supplies of the same model can be installed in parallel, adopting high-speed optical fiber communication technology, featuring strong anti-interference capability and zero delay. The max output power of AGS in parallel installation can reach to 8MW, with the technical specification equivalent to that of a single unit, enabling users to reconstruct testing scenarios with multi-workstation, multi-capacity and multi-voltage levels, significantly improving test efficiency for customers.

- **Harmonics/Inter-harmonics: Up to 49 harmonics can be synthesis simultaneously, and the total harmonic distortion content can be set up to a maximum of 40%**

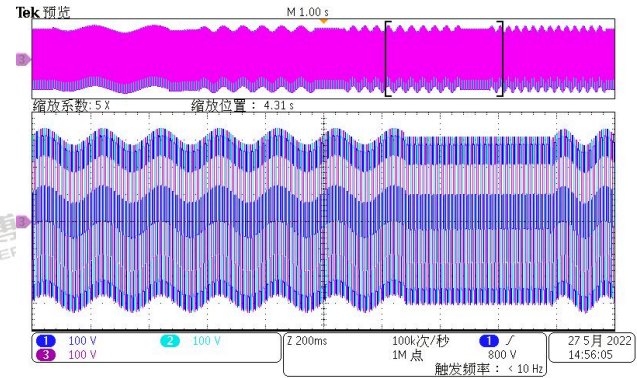
The power supplies allow 2-50 times of harmonics with fundamental frequency 50Hz or 60Hz, and allows the 1Hz-3000Hz inter-harmonics, creating a periodic distortion waveform. It can be used for the tests under IEC61000-3-2/3-12. The power supply has 27 built-in DST waveforms and 100 customized waveforms that can be function called by one click.



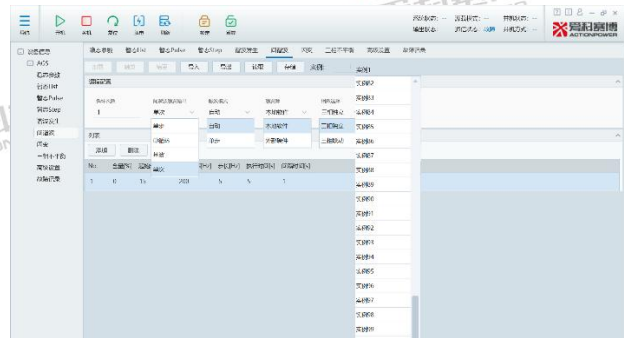
Harmonic Synthesis Waveform



Harmonic Interface

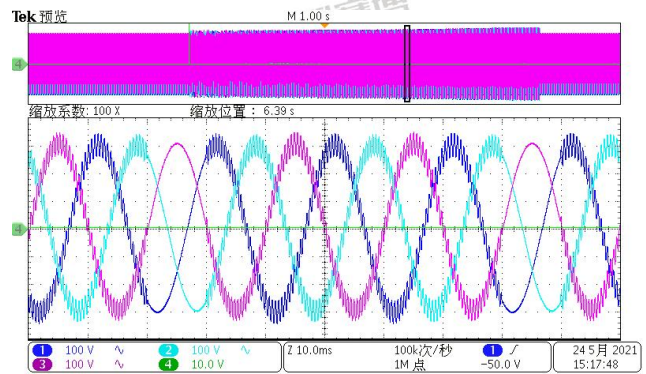
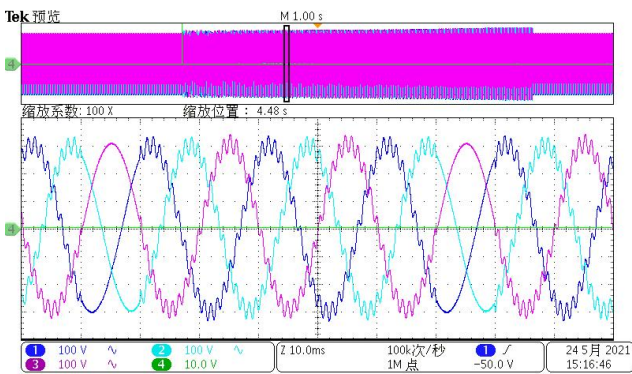


Inter-harmonic Synthesis Waveform



Inter-harmonic Interface

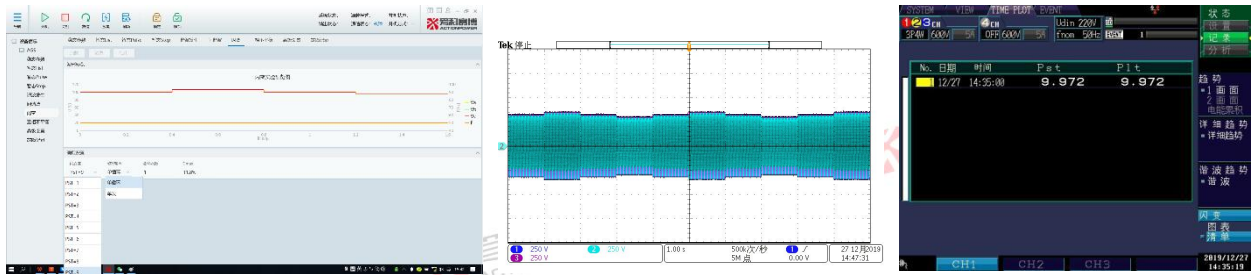
Starting frequency, ending frequency, interval time can be set for inter-harmonics to test the inter-harmonic sweep frequency, so as to meet the tests of IEC 61000-4-13 standard.



Inter-harmonic sweep

● **Flicker: Levels 1~10 can be called directly**

The power supply supports the setting of flicker levels; the flicker trend chart can be previewed, and the pst can be visualized. The flicker characteristics of the power grid can be easily simulated to test the flicker adaptability of the test object.



Flicker simulation

## 4. Product Functions

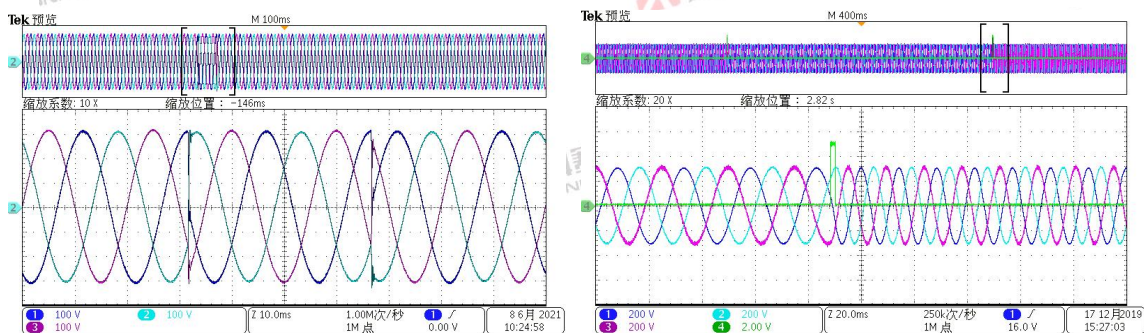
### 4.1 Pure sine wave output

The distortion factor of the power output is low and the output voltage is close to the standard sine wave, thus ensuring the accuracy of the test.



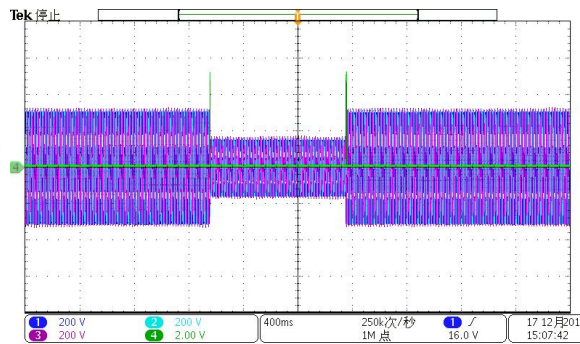
### 4.2 Independent setting of three phases

The three-phase output of the power supply can be set independently, which can simulate the normal and abnormal characteristics of three-phase balance or unbalance of various power grids. It can be set by individual or multiple programmable output on voltage, phase etc. of both single-phase and multi-phase.



Phase Change

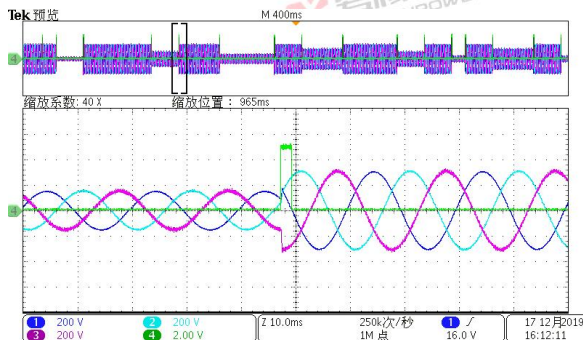
Frequency Change



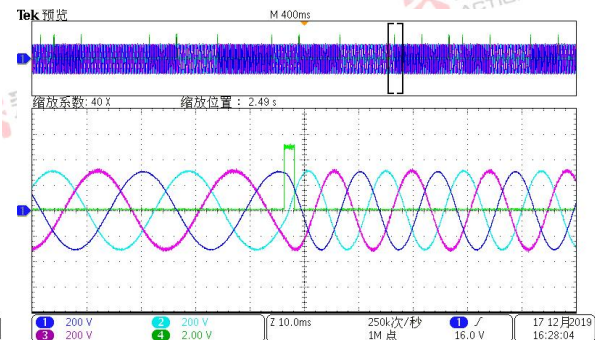
Voltage Change

### 4.3 Complete characteristics of power grid

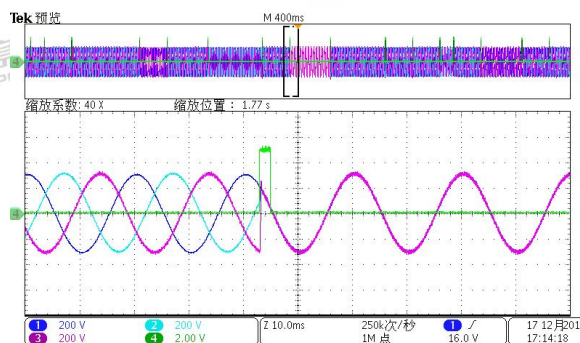
The AGS can not only simulate typical variations of frequency, voltage and phase of power grid, but also the voltage sag, short interruption, flicker, and frequency drift, especially for IEC 61000-4-11/-13/-14/-27/-28 tests. Moreover, it can simulate various power supply voltage deviation, frequency deviation, three-phase voltage unbalance, voltage fluctuation and flicker, etc.



Voltage Disturbance



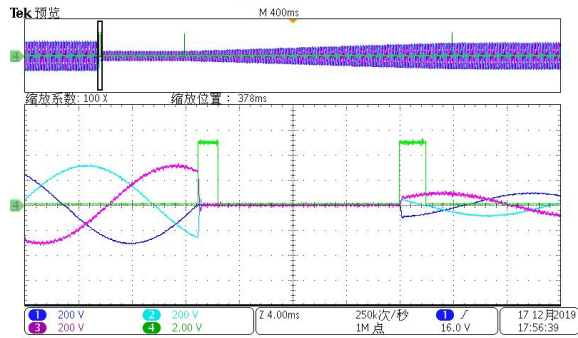
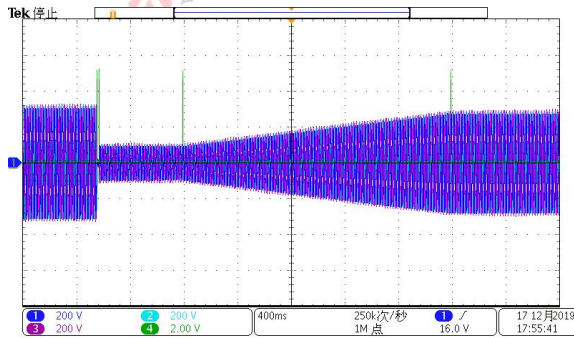
Frequency Disturbance



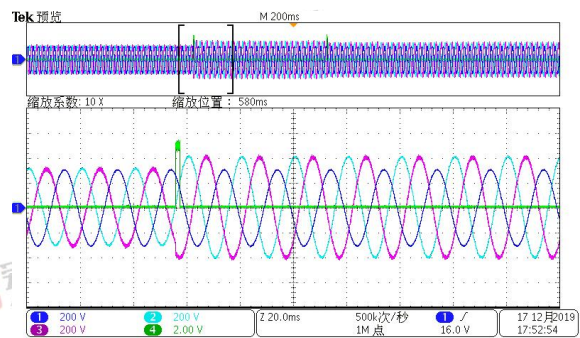
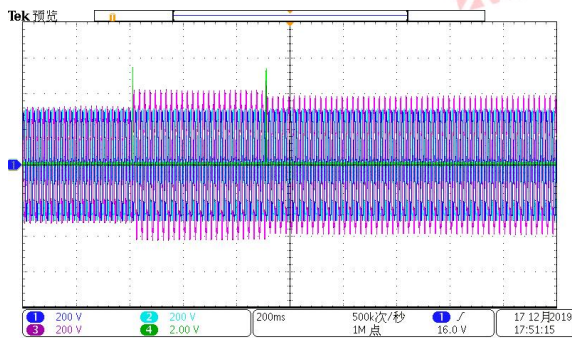
Phase Disturbance

#### 4.4 High & Low voltage ride through (H/LVRT)

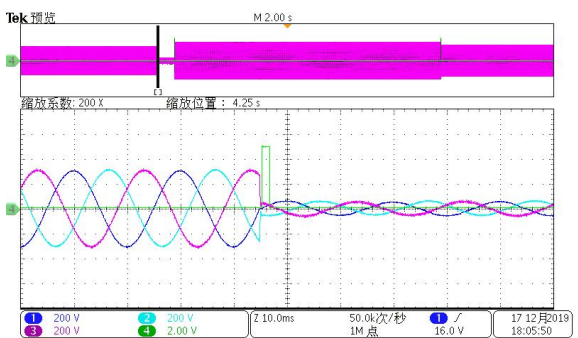
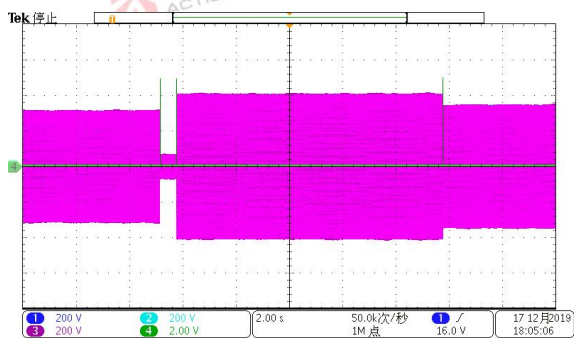
The single-phase, two-phase, and three-phase H/LVRT tests can be performed by AGS. The triggering phase angles of the ride through points can be set to meet the testing requirements of multiple standards. The minimum setting voltage of power supply is less than 5V, and the rise/fall time is 1ms.



Three-Phase Low Voltage Ride Through



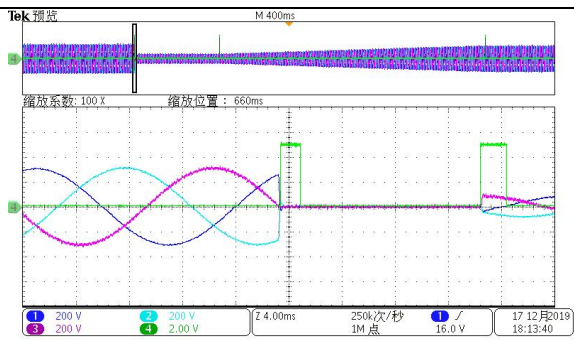
Single-Phase High Voltage Ride Through



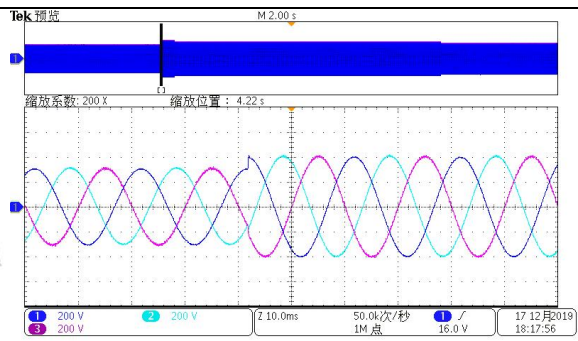
Three-Phase High and Low Voltage Ride Through Test

The triggering phase angle of ride through point can be set to meet the fault ride through test requirements in different countries.

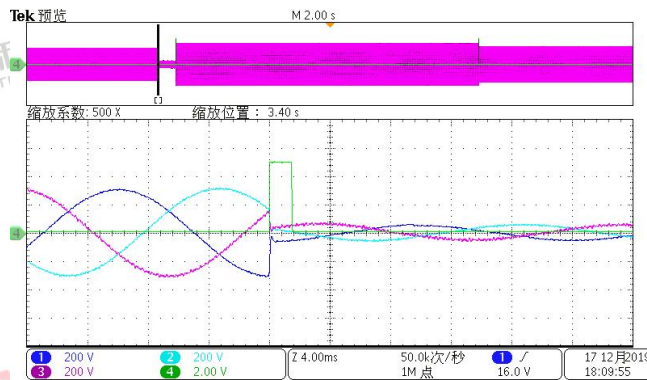




60° Low Voltage Ride Through

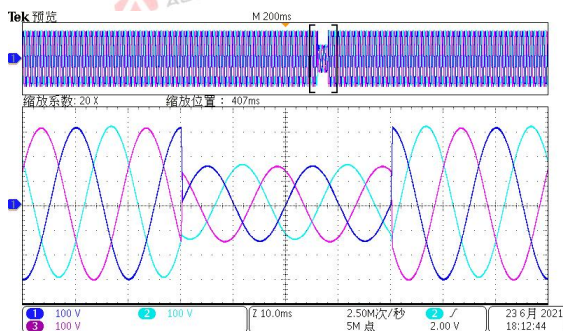


90° High Voltage Ride Through

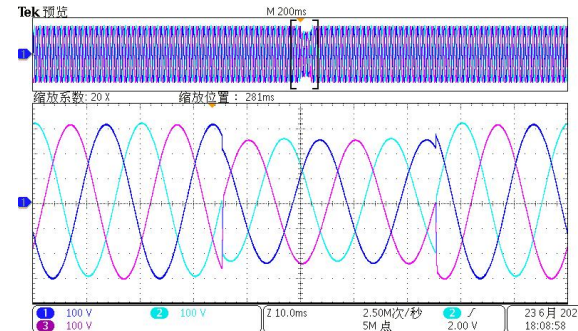


270° High and Low Voltage Ride Through Test

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

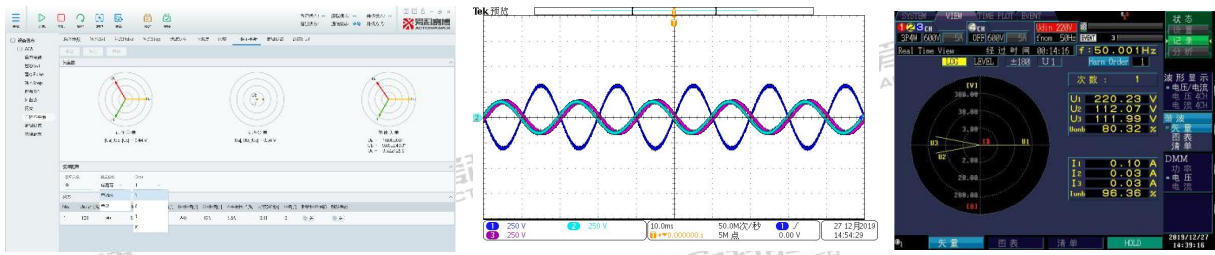


B-C Phase Switch LVRT

#### 4.5 Three-phase unbalance

The AGS can set the unbalanced voltage, phase and other information, and automatically display the unbalance factor, so that the power supply is output in an unbalanced state. To simulate the grid unbalance characteristics, and test the adaptability of the voltage unbalance degree of the device, it can also directly set the unbalance factor, automatically calculate and output the voltage, phase and other information under the unbalance factor.

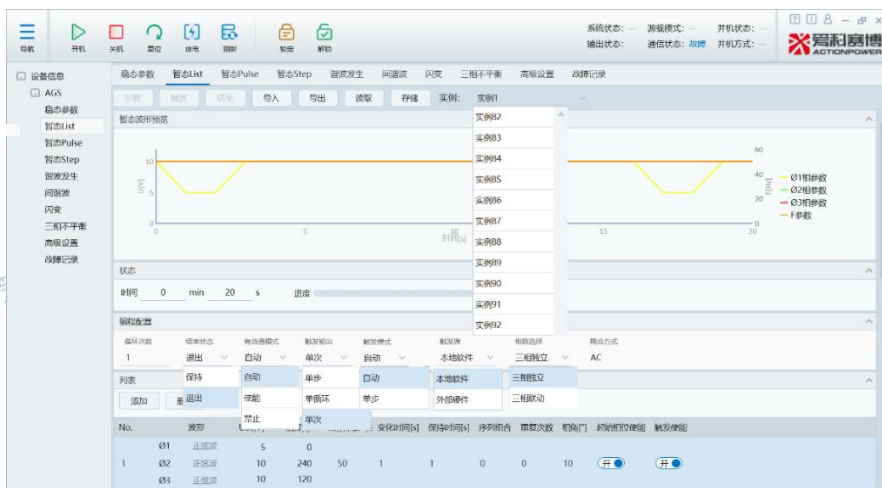
The AGS has the three-phase unbalance trend chart preview function, with simple and intuitive man-machine interaction.



Three-phase unbalance

#### 4.6 Universal programmable

The universal programming has three programming modes, List, Pulse and Step; List supports the programming outputs according to customer requirements, such as output voltage, frequency, phase and starting phase, fulfills the tests under complex operating conditions, and is applicable to the relevant tests such as over-voltage, under-voltage, over-frequency and under-frequency at different phases.



List interface

In Pulse mode, pulses can be added to the normal output fundamental wave. The fundamental wave voltage, frequency and phase starting angle can be set, while the pulse voltage, frequency phase period and pulse width can also be configured, so as to simulate the periodic pulse voltage oscillation waveform.



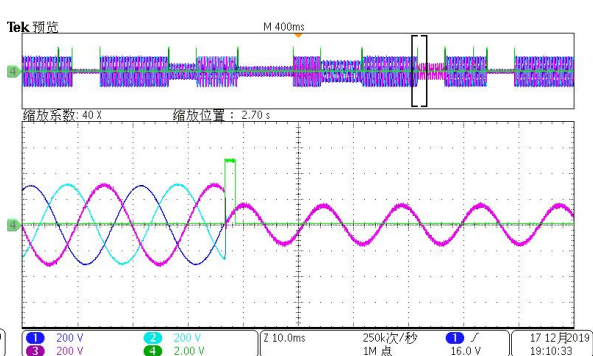
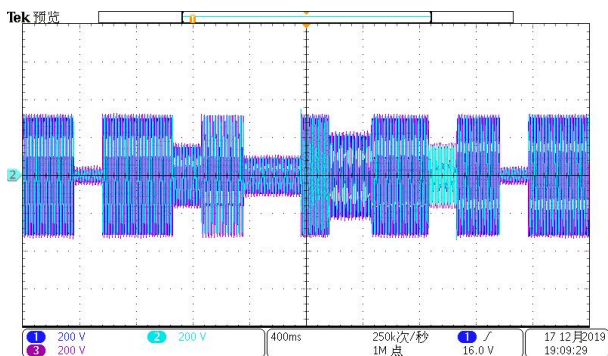
Pulse Interface

Step can increase or decrease the output voltage, output frequency etc., in order to facilitate the customer's single variable test.



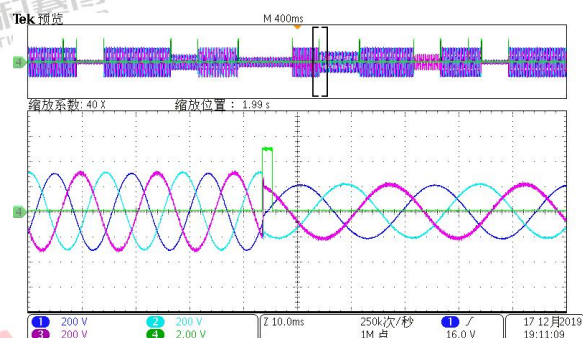
Step Interface

All AGS modes feature 100-step nested programming, with the entire programming loopable for 1000 times. Multi-sequence complex output mode can be combined through change time, maintenance time, programming steps, loop counts, etc. The synchronous signal triggering function is also provided, there is one path of low-voltage trigger signal electrically isolated from other parts of the device, and such signal is always synchronized with the power output parameters, including single-step, single-cycle, and single-trigger. Therefore, the customer can conveniently capture the test waveform. Programming data has memory function and supports import and export. The power supply can be continuously programmed within the output range, without distortion of waveform.



User-defined Waveform

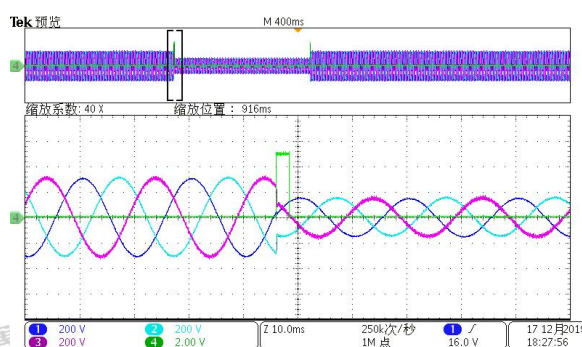
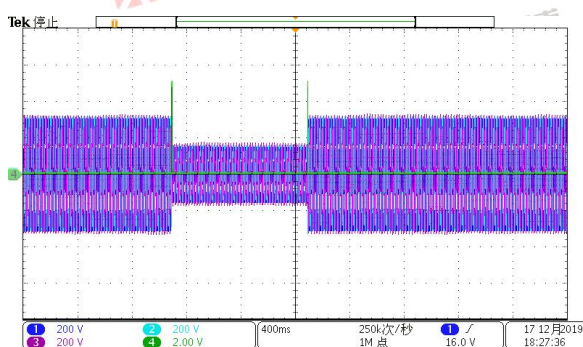
Voltage Phase Change



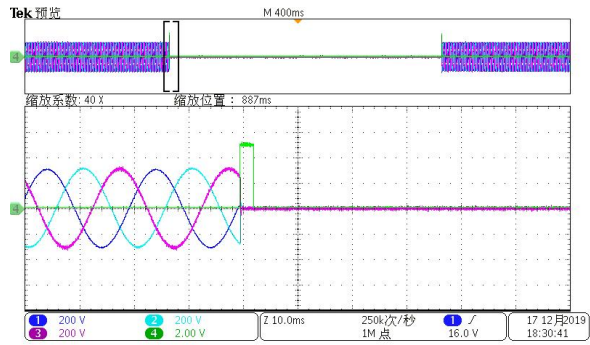
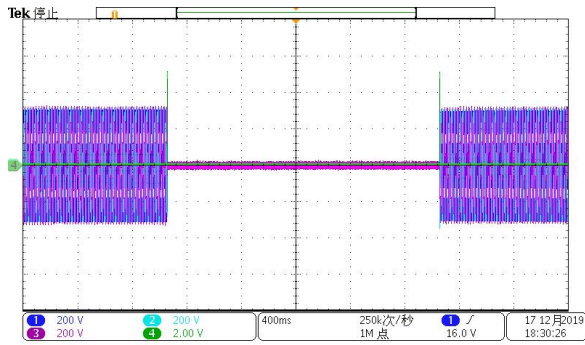
Frequency-voltage Variation

#### 4.7 Sag / interruption / variation

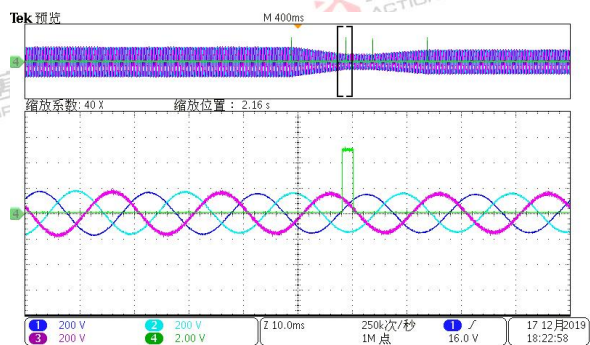
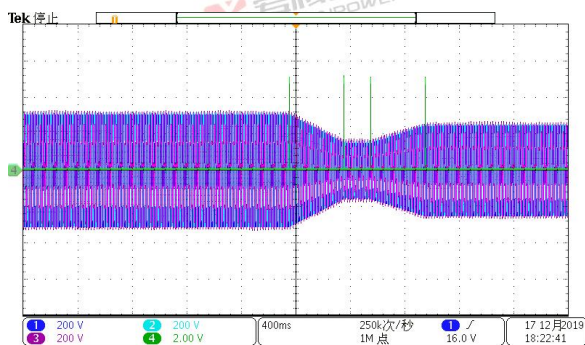
The parameter can be set for power supply and the voltage sag / interruption / variation characteristics of the public grid can be simulated to test the adaptability of the unit under test (UUT).



Voltage sag



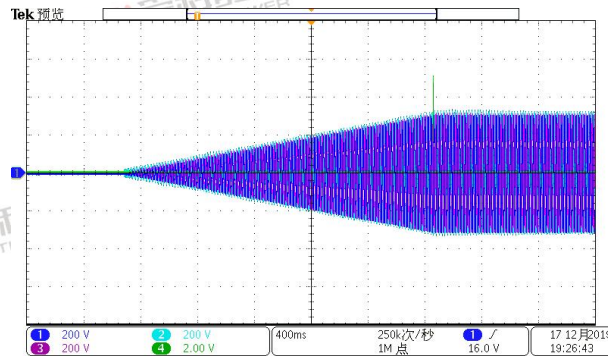
Voltage interruption



Voltage variation

#### 4.8 Output slow recovery

The starting slope of the output voltage can be set for the power supply to reduce the surge impact of power supply on the test object.

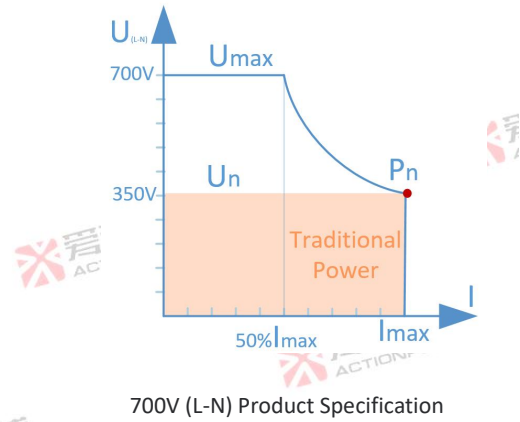
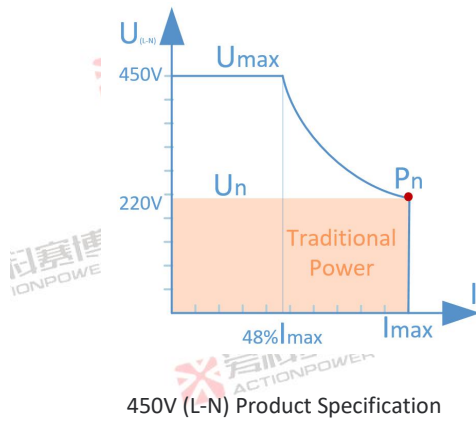


Slow recovery waveform

#### 4.9 Wide-Voltage output

The maximum output voltage of traditional power supplies is equal to the rated voltage, while the maximum output voltage of the power supply from Actionpower far exceeds the rated voltage. The output power is constant

when the output voltage of the power supply is higher than the rated voltage, thus maximizing the output capacity of the power supply.



## 5. Technical Parameters

	Category	
<b>Basic Parameters</b>	Output mode	Three-phase four-wire (A, B, C, N)
	Energy feedback	Receive load energy and feed it back to the grid
	Load power factor	-1~+1
	Isolation function	Electrical isolation of input and output
	Efficiency	Models of 300kW and above: > 94%, others: > 90%
AC output		
<b>Voltage</b>	Resolution (V)	0.01
	Accuracy	±0.1% F.S.
	DC component (mV)	<50
	Voltage distortion	Less than 0.5% @50Hz/60Hz>=220V for no-load Less than 1% @50Hz/60Hz>=220V for linear load Less than 1.0% @ other frequency >=220V for no-load Less than 1.5% @ other frequency >=220V for linear load
	Load regulation	±0.05% F.S @Linear load
	Line regulation	±0.05% F.S.@10%
	Voltage slew rate	AC>1.0V/μs

	Dynamic response	<1ms (10%-90%U <sub>max</sub> )
	Three-phase unbalance	Not exceeding 1/2 of the requirements in GB/T 15543-2008 (negative sequence voltage not exceeding 1%, short-time not exceeding 2%)
<b>Current</b>	Resolution (V)	0.01
	Accuracy	±0.2% F.S.
<b>Frequency</b>	Range (Hz)	40-70
	Resolution (Hz)	0.001
	Accuracy	0.01%
<b>Phase</b>	Scope	A = 0°, B = -120°, C = 120° (default) Programmable range: 0°-359.9°, independently adjustable for three-phase
	Accuracy	±0.3°
	Setting resolution	0.1°
<b>Harmonics</b>	Times	50 @50Hz, 50 @60Hz
	Content	Max 40% for 2-10 single harmonics, less than 40% for 2-10 total harmonics Max 20% for 10-20 single harmonics, less than 20% for 10-20 total harmonics Max 10% for 21-30 single harmonics, and no more than 10% for total harmonics Max 5% for 31-50 single harmonics, and no more than 5% for total harmonics It can simultaneously synthesis 49 harmonics
	Amplitude error	±5% harmonic of set value
	Phase angle range	0°-359.9°
	Preview function	Harmonic synthesis waveform can be previewed
	Editing mode	Import, export, read, storage
	<b>Inter-harmonic</b>	Frequency range
Programming steps		100 steps
Programming parameters		Content, start frequency, end frequency, step length, execution time, interval time, cycle times and sequence
Editing mode		Add, delete, import, export, store, read
	Flicker level	1.0-10.0, totally 10 levels in total, and one-key calling
	Adjustment step length	1

<b>Flicker</b>	Accuracy	±0.2
	Preview function	Preview of flicker trend chart, pst can be visualized
<b>Three-phase unbalance</b>	Adjustment mode	Three-phase voltage, phase; unbalance factor
	Unbalance factor range (%)	1~100
	Unbalance factor adjustment step length (%)	1
	Accuracy (%)	±0.5%
	Preview function	Three-phase unbalance trend chart can be previewed
<b>High &amp; Low Voltage Ride Through</b>	Mode	LVRT / HVRT / H&LVRT
	Configuration parameters	Voltage, frequency, phase, rise time, hold time, trigger phase angle and pulse output
	Relevant functions	GB/T, VDE-AR-N 4105, NRS 097-2-1, G83, and EN50438
<b>Universal programmable</b>	Programming mode	List, Pulse, Step
	Programming steps	100 steps
	Programming parameters of each step	Voltage, frequency, phase, change time, hold time, trigger phase angle and pulse output
	Rise time range	100μs-999s
	Top flat time range	100μs-999s
	Minimum programming time step	100μs
	Editing mode	Import, export, store, read
	Other functions	Three-phase unbalance, drop, interruption, H/LVRT and other functions, automated integration interface
	Operation mode	Run, stop, major cycle (1000) + minor cycle nested programming (9999)
	Trigger source	Local software, external hardware
	Trigger mode	Automatic, manual, external
<b>Measurement</b>	Voltage accuracy	±0.1% F.S.
	Frequency accuracy	±0.01%
	Current accuracy	±0.2% F.S.



	Active power accuracy	$\pm 0.3\%$ F.S.
	Apparent power accuracy	$\pm 0.3\%$ F.S.
Input	Wiring mode	Three-phase four-wire ABC+PE
	Frequency (Hz)	47 - 63
	Voltage range (V)	$380 \pm 15\%$
	Power factor	0.99 @ above half load
	Harmonic current	$\leq 3\%$
Others	Protection function	OVP, OCP, OPP, OTP, Phase loss protection
	Communication interface	Standard configuration: LAN; optional: RS485, CAN
	External locking	External interlocking input is normally on/off; external interlocking output is normally on/off
	Trigger signal	Trigger input/output
	Operation and display	Local touch screen control and remote upper computer control; display voltage, current, frequency and power
	Insulation and withstanding voltage	10M $\Omega$ /DC500V: 3600VAC/1min
	Cooling mode	Fan cooling
	Operating temperature	-10 $^{\circ}$ C~40 $^{\circ}$ C
	Relative humidity	10% to 90% RAH
	Altitude	$\leq 2000$ m