BriPower ZGX Series

User Manual

About BriPower

Nanjing Bridge New Energy Technology (Bridge Technology) was founded on Jan 12th, 2016, focusing on business of regenerative power supplies and electronic loads. We are devoted to providing high quality products and solutions for customers.

Our product brand is BriPower™.

- Bi-directional AC sources
- Bi-directional DC sources
- Regenerative loads
- Custom Power Solutions

The BriPower™ AC&DC power systems are widely used in new energy and related fields.

Our Factory is on ISO Certified and The Quality Management System Confirms to the Standard GB/T19001-2016/ ISO9001-2015.

Legal Notices

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The pictures used in this manual do not represent the pictures of the products purchased by the user. The actual products purchased by the user may be customized versions, which may not match the manual in terms of appearance, weight, and technical parameters. For specific understanding of the actual appearance and technical parameters of related products, please contact Bridge Technology.

Software Statement

ZGX series provides GUI software, which is installed on the TFT-Touch panel which using the Linux system. Unless interoperability is required by law, it is prohibited to reverse program, disassemble, or decompile the software.

Date and Reversion

Date	Version	Reversion record
Feb, 2024	1.0	Complete the user manual

Safety Requirements

Please read the manual thoroughly before putting the equipment into operation. Pay regard to the following safety instructions and keep the manual nearby for future purpose to avoid any damage to the equipment. To prevent potential hazards, please follow the instructions in the manual to safely use the instrument. Bridge Technology have no liability for failures caused by violate protective measures or other safety regulations.

- **Unpacking**

  Please make sure that the shipping carton and the packing is without any damage. If any external damage is found, it is important to record the type of damage. Please keep the original packing to ensure the product is adequately protected in case it needs to be transported to the factory or make a claim.

- **Surroundings**

  To avoid electrical hazards or product failure, the equipment should be installed indoor which meets the environment requirements.

- **Operator**

  The equipment operator must follow the warnings, safety instructions and accident prevention measures in the manual.

- **Visual Inspection**

  After unpacking, please immediately check whether there is any defects or damage of the equipment during transportation. If there is obvious physical damage, please do not use the equipment. Please notify the carrier and the agent of Bridge Technology immediately.

- **Power Operation**

  Please confirm the model and voltage / current rating on the nameplate before operating. Damage caused by wrong power supply is not covered by the warranty.

- **Use Suitable Cables**

  Please select the appropriate cable according to the equipment specifications of the local country.

- **Equipment Grounding**

  The equipment is grounded through the protective ground bus. To avoid electrical hazards, connect the ground terminal to the protective ground terminal before connecting any input or output terminals.

- **Appropriate Overvoltage Protection**

  Make sure that there is no overvoltage on the product (such as overvoltage caused by lightning). Otherwise, the operator may be in danger of electrical hazards.

- **Avoid Exposing Circuits or Wires**

  When the module is powered on, do not touch the exposed connectors or components.

Safety Notices and Symbols

Safety Symbols

SHOCK HAZARD

WARNING

PROTECTIVE EARTH TERMAINAL

Other Symbols

IMPORTANT INFORMATION

Safety Information

	**WARNING** If improperly operated, it may cause injury or danger immediately.
	**WARNING** Potentially dangerous situation or practice. If not avoided, it will result in serious injury or death.
	**CAUTIOUS** Potentially dangerous situation or practice. If not avoided, may result in product damage or loss of important data.
	**SHOCK HAZARD** Danger, caution or warning caused by electricity. To avoid the risk of electric shock, the power supply must be firmly connected to the ground wire and other equipment wiring. Within a few seconds after the power supply is off, the high voltage at the output terminal may be maintained. Do not touch the cable or terminal block immediately.
	**IMPORTANT INFORMATION** Important information when operating the equipment/software.

Content

Chapter 1 Equipment Introduction

1.1 System Overview

1.1.1 Overview of ZGX series

The ZGX series is a compact modular design power supply with SiC PWM technology, providing full functions of grid simulator, battery simulator, PV simulator, regenerative AC/DC load, bipolar DC source, and RLC/RCD load. The 15KVA bidirectional power supply is designed in a 4U chassis and can be upgraded to 960KVA system by master/slave paralleling. The maximum output of each unit is AC 450V L-N, 30A/ph, DC~1KHz or DC 636V, 90A.

1.1.2 Model Description

Model: ZGX 15-AAA/BBB

AAA: Option

BBB: Input Configuration (/380, Input Voltage 380VLL±10%, 3P+PE. /400, Input Voltage 400VLL±10%, 3P+PE. /220, Input Voltage 220VLN±10%, 1P+N+PE)

1.1.3 Features and configuration

- Compact modular design, 15KVA in 4U
- Bi-directional design
- Output: AC, DC, AC+DC
- Single unit: maximum 15KW, 450V L-N, 30A/ph, DC-1KHz output
- Power expansion to 960KVA by master/slave paralleling (using single mode fiber, SMF)
- Single phase, 3-phase, split phase, and multi-channel output
- Various modes: Regenerative AC/DC source, regenerative AC/DC load, BiPolar DC source
- Regenerative RLC load in full frequency range
- True current source in CC mode
- Up to 100th harmonics waveform generation, inter-harmonic generation
- Soft start: effectively restrain the impulse current when power on
- Triger out, TTL signal output for voltage or frequency change
- Error locating function
- LAN interface
- MOD-bus /SCPI protocols
- Grid simulation, battery simulation, PV simulation
- 24 months warranty

1.1.4 Specification

Table 1-1

Model No.	**ZGX 15**
AC Input	
Provide pre-charge circuit. Effectively restrain the impulse current when power on	
Voltage[1]	3P+PE, 380VLL±10%/3P+PE, 400VLL±10% 1P+N+PE, 220VLN±10%
Frequency	47-63Hz
Efficiency	≥85%
Power Factor @ Rated Power	>0.99
THDi	<1%
Output	
Output Modes	AC, DC, or AC+DC
Power Level	15KW
Load Regulation	0.1%FS
Line Regulation	0.1%
AC Output	
Voltage Range (L-N)	Max 300V L-N @ DC~1000Hz; Max 450V L-N @ DC~70Hz
Current Range	30A/ph (3-phase) or 90A (single phase)
Frequency Range	0.01 ~ 1000Hz
Phase Angle Range	Phase B/C relative to phase A, 0.0~360.0°
THD	<0.5%FS @DC~400Hz (measured at 250VL-N, Resistive Load) <1%FS @400~1000Hz (measured at 250VL-N, Resistive Load)
Harmonic waveform Generation	Up to 100th
Voltage Slew Rate	≤3V/us
Current Slew Rate	0.5A/us
Small signal bandwidth	10kHz
Power Accuracy	0.2%FS
Voltage Accuracy	0.1%FS
Current Accuracy	0.2%FS
Frequency Accuracy	0.01%FS+0.01Hz
Phase Angle Accuracy	<1° (@50Hz)
Power Resolution	0.001kW
Voltage Resolution	0.1V

[1] When the AC input of ZGX 15 is single-phase 220V L-N, the total output power of the three-phase is 5KW. Please refer to 2.2.2.2 for the connection method details.

Current Resolution	0.01A
Frequency Resolution	0.01Hz (~100Hz), 0.05Hz (>100Hz)
Phase Angle Resolution	<0.1°
DC Output	
Voltage Range	0-636V
Current Range	30A/ch (3-channel) or 90A (single channel)
Voltage Accuracy	0.1%FS
Voltage Resolution	0.1V
Current Accuracy	0.1%FS
Current Resolution	0.01A
Voltage Ripple	0.1%FS
AC+DC Mode	**Max Power, Voltage and Current are the same as DC Mode**
AC Power Measurement Accuracy	0.2%FS
AC Voltage Measurement Accuracy	0.1%FS
AC Current Measurement Accuracy	0.2%FS
DC Voltage Measurement Accuracy	0.1%FS
DC Current Measurement Accuracy	0.1%FS
Frequency Measurement Accuracy	0.01%+0.01Hz
RLC/RCD Load Simulation[2]	
R	Range: 0.1~1000Ω. Resolution: 0.1Ω. Accuracy: ±0.1%FS
L	Range: 0.1~5000mH. Resolution: 0.5mH. Accuracy: ±0.1%FS
C	Range: 0.001~5mF. Resolution: 0.1mF. Accuracy: ±0.1%FS
Others	
Standard Interface	LAN
Protection	OVP, OCP, OPP, OTP
IP Ingress protection	IP21
Cooling	Forced Air Cooling
Temperature	Operating: 0~40℃ Storage: -20~85°C
Operating Humidity	20-90%RH (None Condensing)

[2] The accuracy measured at 50/60Hz.

1.2 Appearance and structure of Equipment

1.2.1 Appearance and Outline

The appearance of the ZGX 15 is shown in Figure 1-2-1, 2, 3. The ZGX series is a compact modular design power supply with a depth of only 670mm. There are Power On button/Indicator 1, Indicator 2, Main circuit breaker and Touch panel displayer (7 inch) on the front panel. There are Input/Output Terminals, LAN interface, Debug interface, Remote sense interface, External emergency stop interface, Master-Slave interface and TTL interface on the rear panel. The dimension of ZGX 15 is 440*670*178 (W*D*H, mm).

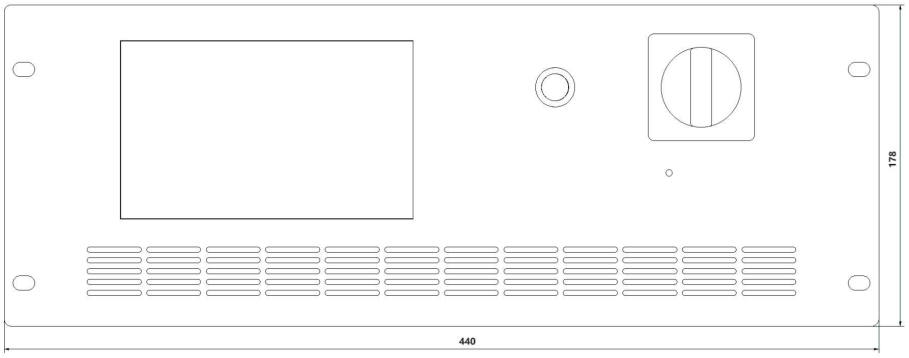

Figure 1-2-1 Front View

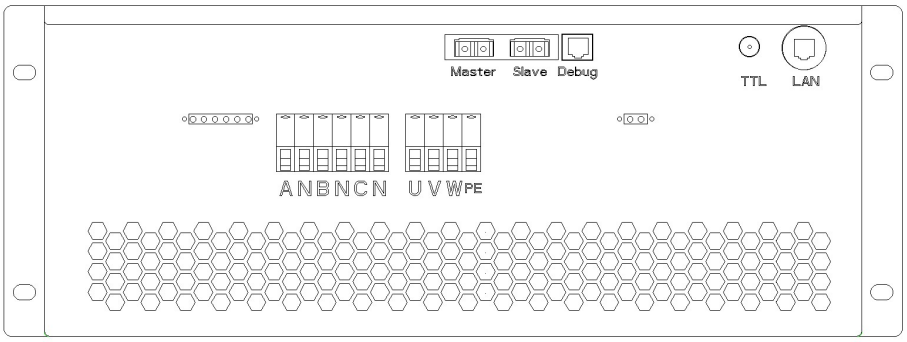

Figure 1-2-2 Rear View

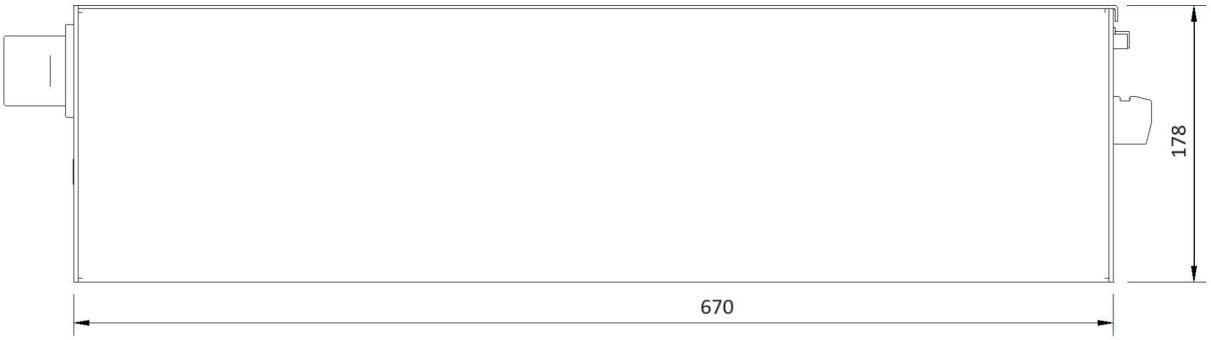

Figure 1-2-3 Right View

1.2.2 Front Panel

There are Power On button/Indicator 1, Indicator 2, Main circuit breaker and Touch panel displayer (7 inch) on the front panel.

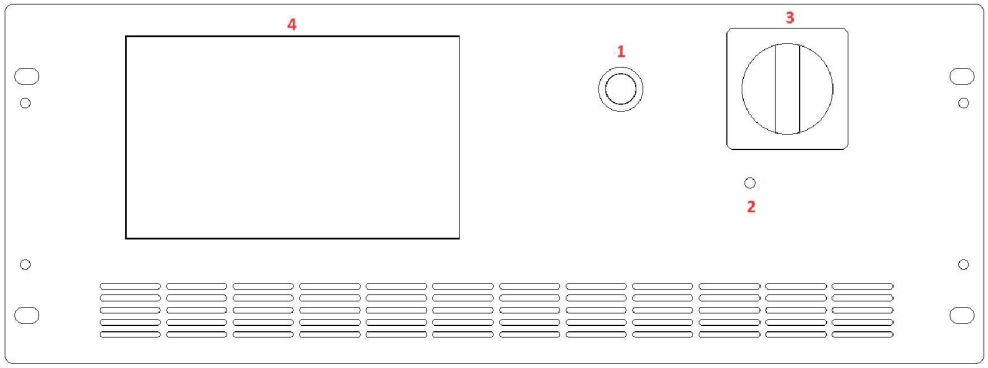

Figure 1-2-4 Front Panel

Table 1-2

No.	Description	Note
1	**Power On Button/ Indicator 1**	Function 1: Indicator 1.
		Function 2: Same function as the "Power On/Off" button on the software panel
2	**Indicator 2**	Indicator 2.
3	**Main Circuit Breaker**	Used to power on/off. Turn clockwise/counterclockwise to Power On/Off.
4	**Touch Panel**	7-inch touch screen, providing a GUI software interface

IMPORTANT INFORMATION

The operating modes of the Indicator 1 and Indicator 2 are as follows:

- When Indicator 1 is flashing and Indicator 2 is off —— indicates that the device is in standby mode;
- When Indicator 1 is always on and Indicator 2 is flashing —— indicates that the input works normally;
- When Indicator 1 is always on and Indicator 2 is always on —— indicates that the input&output works normally;
- When Indicator 1 is off and Indicator 2 is flashing —— indicates that the device is in fault state.

1.2.3 Rear Panel

There are Input terminals (U/V/W/PE), Output terminals (A/N/B/N/C/N), LAN interface, Debug interface, Remote sense interface, External emergency stop interface, Master-Slave interface and TTL interface on the rear panel.

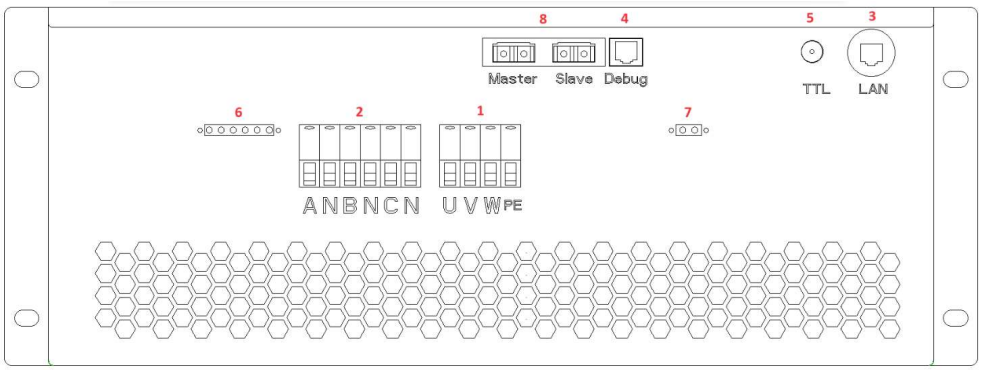

Figure 1-2-4 Rear Panel

Table 1-3

No.	Description	Note
1	**Input Terminals**	AC input terminals: U/V/W/PE
2	**Output Terminals**	AC/DC Output terminals: A/N/B/N/C/N
3	**LAN Interface**	Used for remote control. (for users)
4	**Debug Interface**	Used for debugging and firmware update (for factory use before shipment, please don't use without permission)
5	**TTL Interface**	Triger out interface, TTL signal output for voltage/frequency change
6	**Remote Sense Interface**	Remote sense interface: A/N/B/N/C/N
7	**External emergency stop interface**	External emergency stop interface: +/-
8	**Master-Slave interface**	Used for communication when power supplies of the same power are connected in parallel.

IMPORTANT INFORMATION

For 6, 7, 8 in Table 1-3:

After completing the corresponding wiring, please check the function on the software panel "Configuration" - "System", then the function will take effect.

1.3 Interface Description

1.3.1 Input Terminals/Output Terminals

The input/output terminals are on the rear panel (Figure 1-3-1), and the input terminals include: U, V, W, PE; The output terminals include: A, N, B, N, C, N. Users can choose appropriate specifications of cables based on the input/output voltage and current level of the device (please refer to user manual 2.2.1 Input/Output Cable Selection for wiring methods).

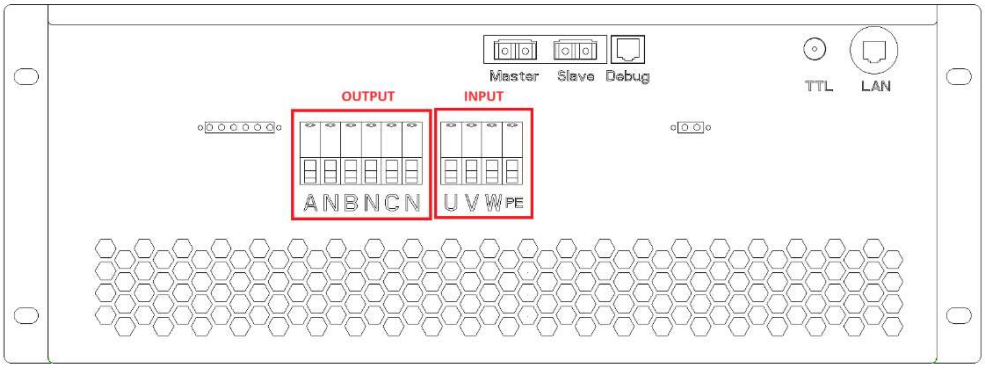

Figure 1-3-1

1.3.2 LAN Interface

The LAN interface (Figure 1-3-2) on rear panel is used for remote control. Please refer to 5.3.1 for remote control setting details.

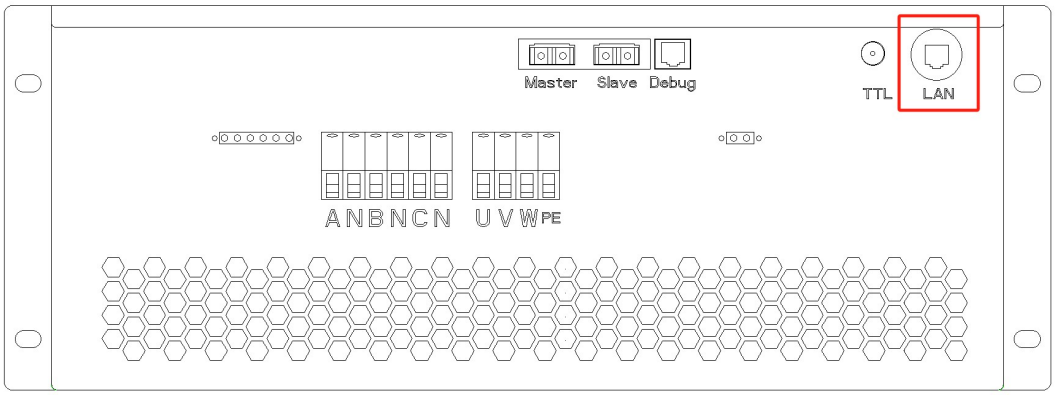

Figure 1-3-2

IMPORTANT INFORMATION

The network wire used for LAN connection is Straight-Through Wired Cable.

1.3.3 Debug Interface

The Debug interface (Figure 1-3-3) on rear panel is used for debugging and firmware update (for factory use before shipment, please don't use without permission).

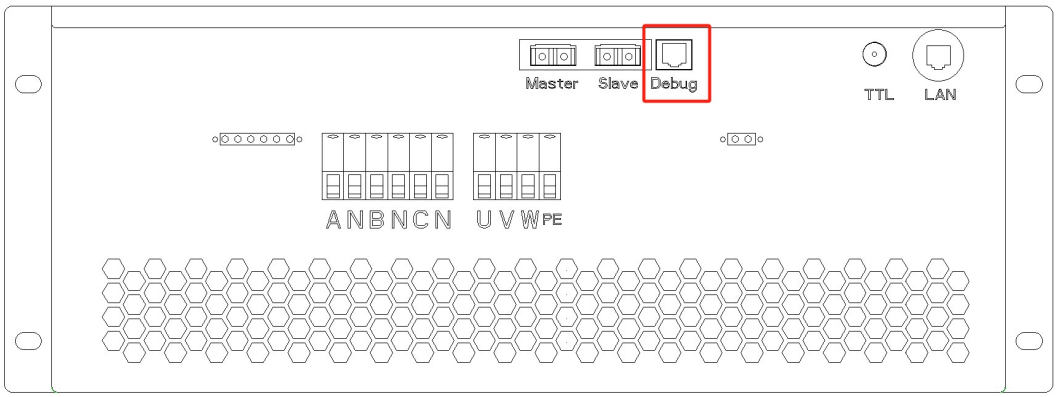

Figure 1-3-3

1.3.4 TTL Interface

The TTL interface is on the rear panel (Figure 1-3-4). Connect the TTL interface to the oscilloscope, when the voltage/frequency changes, the user can observe the TTL signal level changes through the oscilloscope.

The connection between the ZGX and the signal generator is shown in Figure 1-3-5.

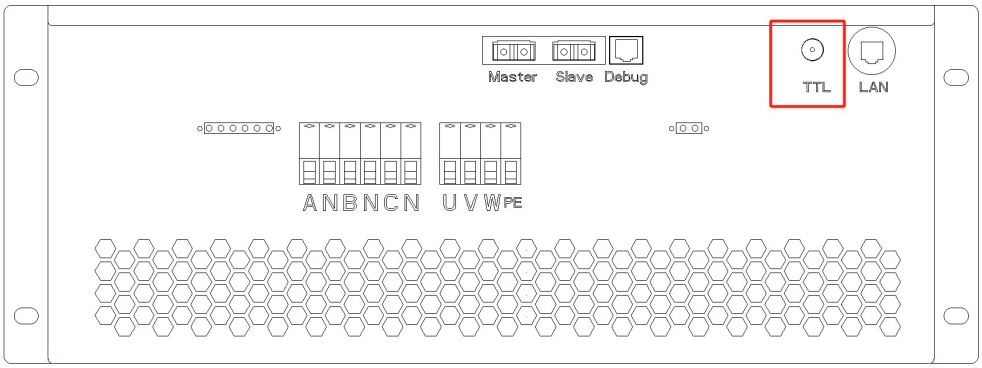

Figure 1-3-4

Figure 1-3-5

1.3.5 Remote Sense Interface

The Remote Sense Interface is on the rear panel (Figure 1-3-6). ZGX will adjust its output to compensate for the voltage drop, so that the voltage across the DUT is equal to the set voltage, so as to achieve the accuracy of the test.

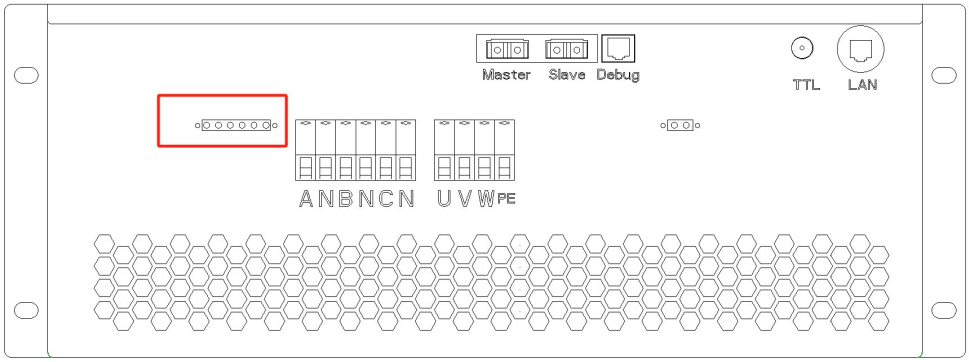

Figure 1-3-6

The connection between the ZGX and the Remote Sense Interface is shown in Figure 1-3-7.

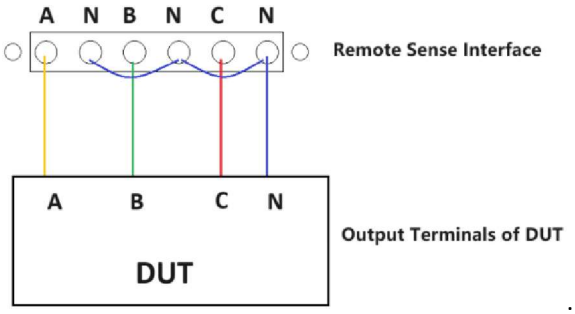

Figure 1-3-7

IMPORTANT INFORMATION

The remote sense interface is connected to the output by default before leaving the factory. If the user needs to compensate at the input of the DUT, please remove the default connection cables, and then connect the remote sense interface to the input of the DUT.

1.3.6 External Emergency Stop Interface

The External Emergency Stop Interface is on the rear panel (Figure 1-3-8), which can be connected to the user's external emergency stop switch.

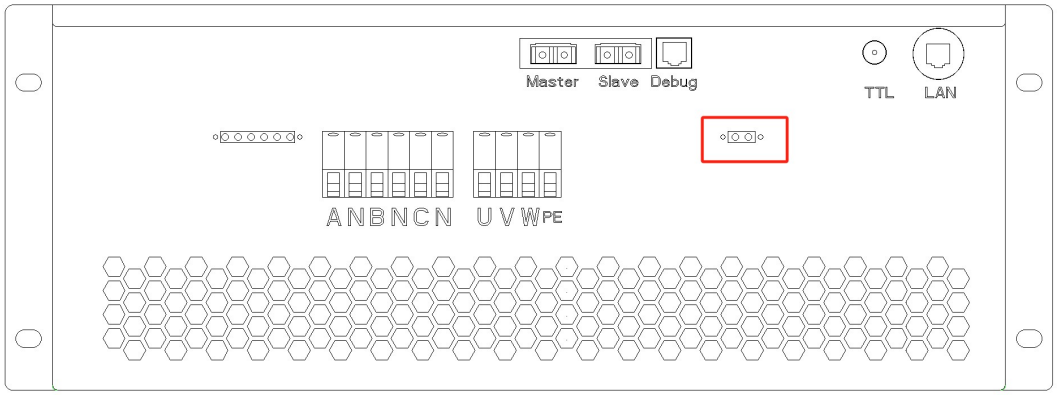

Figure 1-3-8

The connection between the ZGX and the Remote Sense Interface is shown in Figure 1-3-9.

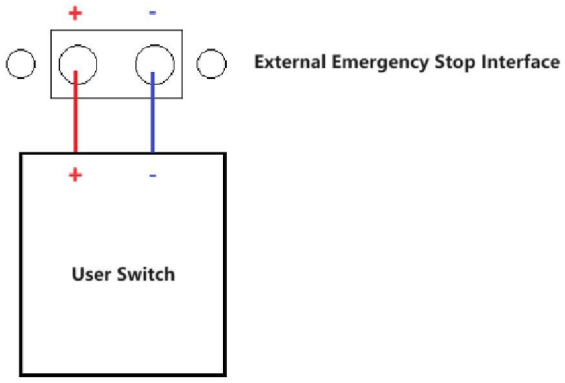

Figure 1-3-9

1.3.7 Master-Slave Interface

ZGX supports parallel connection of the same unit. The Master-Slave interface is on the rear panel (Figure 1-3-10).

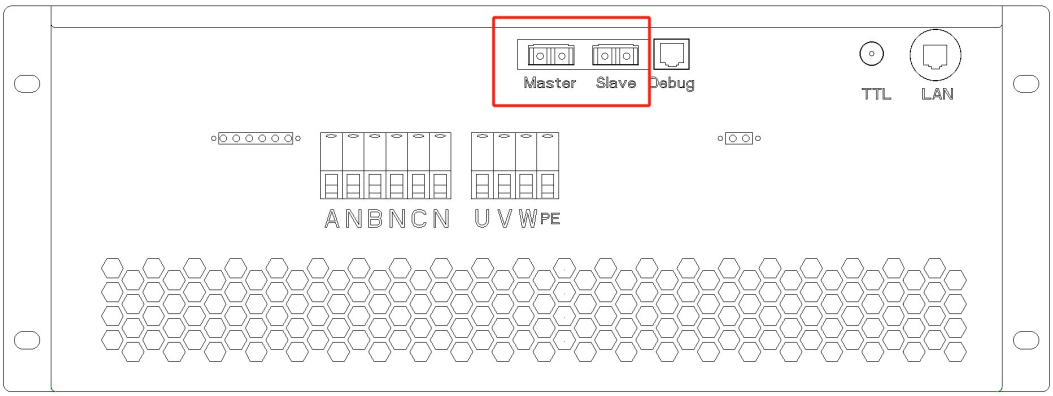

Figure 1-3-10

Connect the parallel input/output terminals and parallel fiber optic cables as shown in Figure 1-3-11.

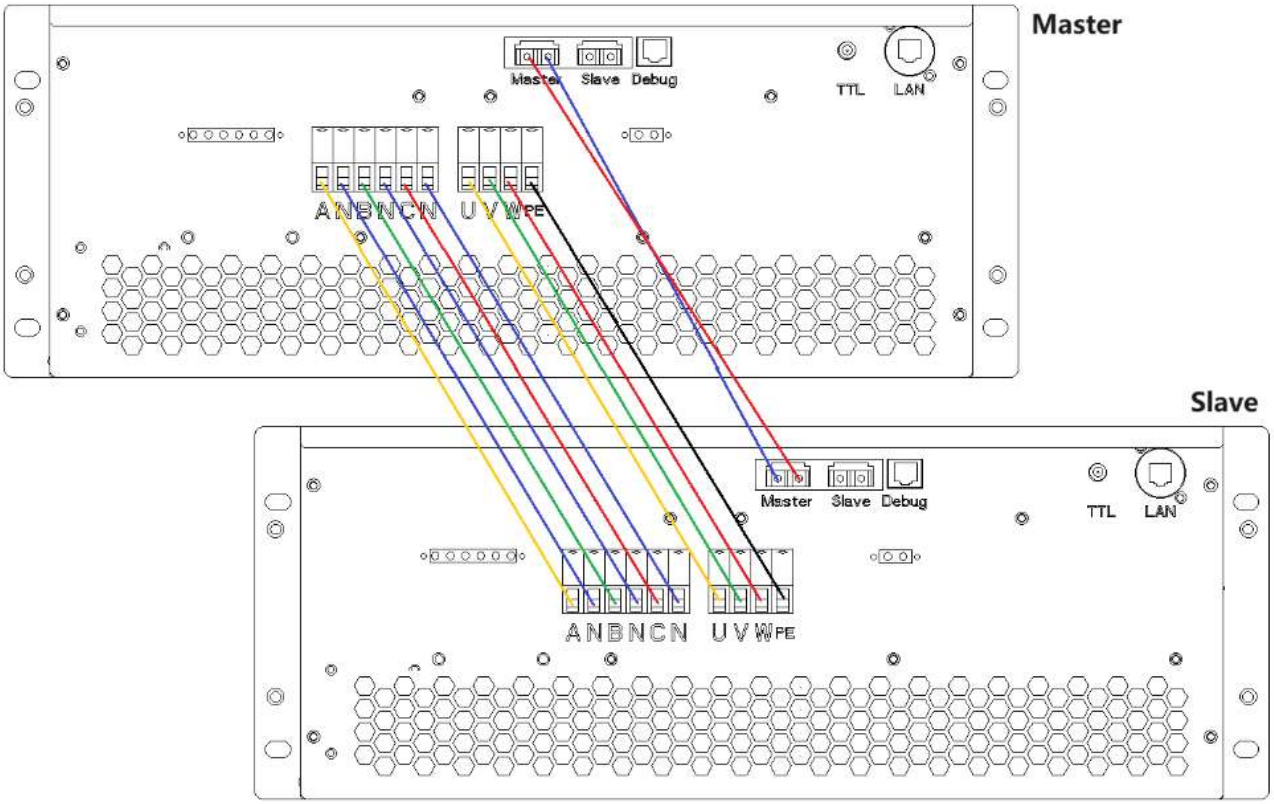

Figure 1-3-11

IMPORTANT INFORMATION

For 1.3.5, 1.3.6, 1.3.7: After completing the corresponding wiring, please check the function on the software panel "Configuration" - "System", then the function will take effect.

- 1.3.5 Remote Sense Interface—— "Configuration" - "System" – “Remote Sense”;
- 1.3.6 External Emergency Stop Interface—— "Configuration" - " System" – “External E-Stop”;
- 1.3.7 Master-Slave Interface—— "Configuration" - " System" – “Independently/Parallel Master/Parallel Slave”

Chapter 2 Equipment Installation

2.1 Check before Installation

2.1.1 Check the Packing

When receiving the ZGX series device, if the packing is damaged, do not dispose of the damaged packing or cushioning materials before checking the integrity of the device and electrical/mechanical testing. The shipper/carrier should be responsible for product damage caused by the shipment. The factory has no liability for free repair or replacement. Please keep the packing box and packing materials and record the type of damage to return the device.

2.1.2 Check the Equipment

Open the outer packing and check with visual inspection or hand feeling when the device is in non-working status. To ensure:

- There are no serious appearance defects caused by product assembly, and there are no bad phenomena such as assembly seams and breaks that exceed specifications.
- There are no defects that seriously affect the appearance of the product, such as scratches, indentation, color difference, paint drop, etc.

IMPORTANT INFORMATION

If the product has any mechanical damage, missing parts, fails electrical or mechanical tests, please contact Bridge Technology. Do not disassemble the equipment without permission.

2.2 Equipment Installation

2.2.1 Selection of Input/Output Cables

Before the equipment is installed, the user should confirm the model number, then select the appropriate specifications of the cables according to the input/output voltage/current level.

No.	Description	Cable Diameter
1	**Input Cables: U/V/W**	1*4mm^2
2	**Input Cable: PE**	1*4mm^2
3	**Output Cables: A/B/C**	1*4mm^2
4	**Output Cable: N**	1*4mm^2

WARNNING

If the equipment is disassembled and installed at a low temperature, water droplets may condense. The device must be completely dry before installation. Otherwise, there is a risk of electrical hazards and damage to the device.

2.2.2 Installation Steps

2.2.2.1 When Input is: 3P+PE/380V L-L or 400V L-L

Step 1: Connect the input cables (U/V/W/PE) with the input terminals.

Step 2: Connect the output cables (A/N/B/N/C/N) with the output terminals.

Step 3: Connect the input cables to the user's circuit breaker, then connect the output cables to the DUT.

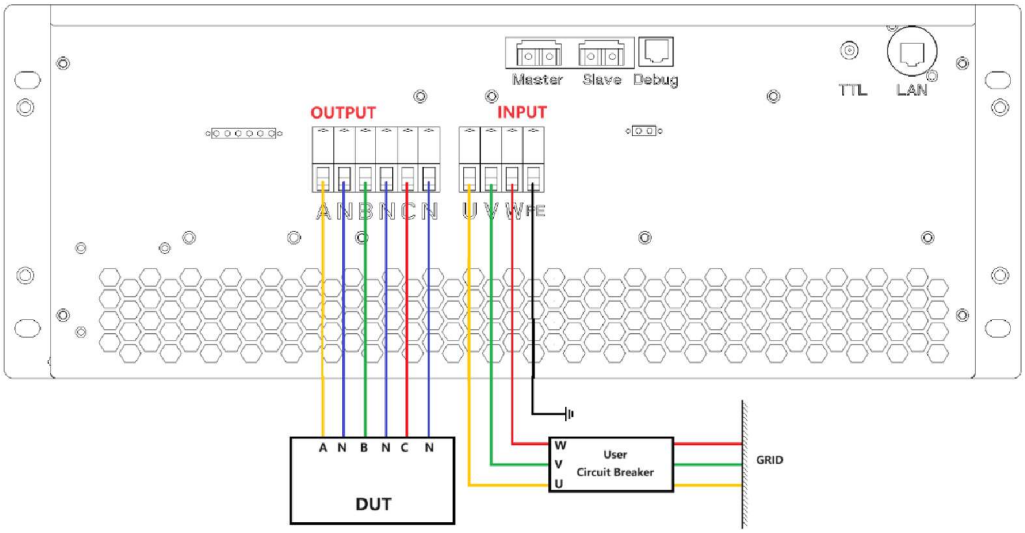

Figure 2-2-1 Connection method of Three-phase Output

ZGX 15 also has a single-phase output function. By changing the connection method (Figure 2-2-2), the output current can be increased to three times the single-phase output current.

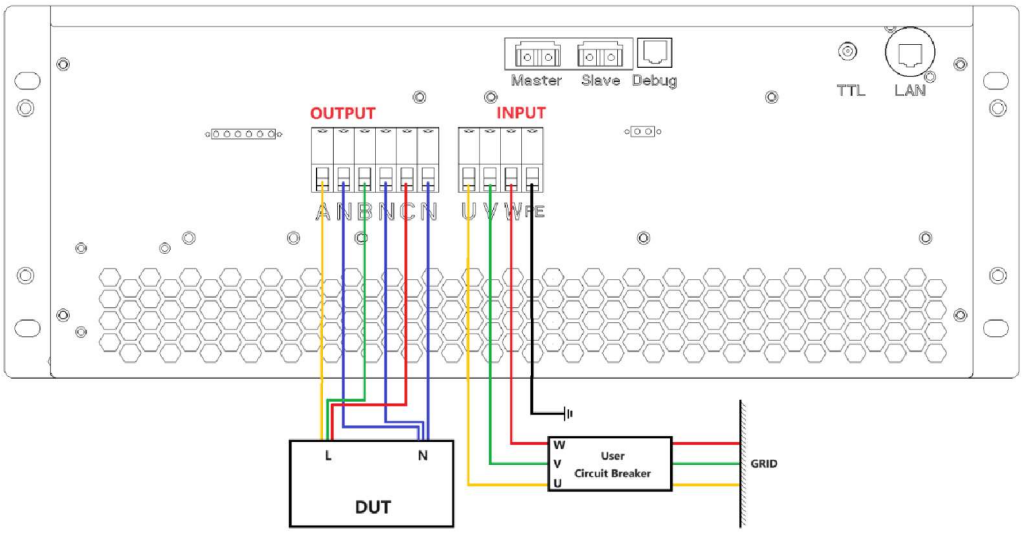

Figure 2-2-2 Connection method of Single-phase Output

SHOCK HAZARD

1. All three N cables at the output must be connected.
2. To avoid electrical hazards, connect the ground terminal to the protective ground terminal before connecting any input or output terminals.
3. 3. Before connecting the cable, make sure that the upper-level switch is off. Do not live working.

2.2.2.2 When Input is: 1P+N+PE/220V L-N

Step 1： Short the input terminals V and W, and connect the input cables to the input terminals (U/V/PE).

Step 2： Connect the output cables (A/N/B/N/C/N) with the output terminals.

Step 3： Connect the input cables to the user's circuit breaker, then connect the output cables to the DUT.

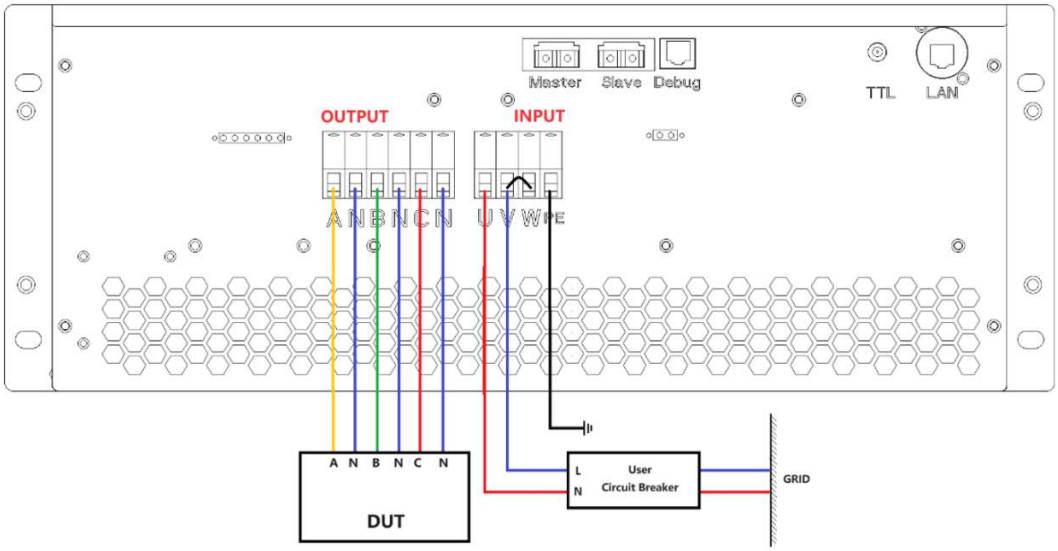

Figure 2-2-3 Connection method of Three-phase Output

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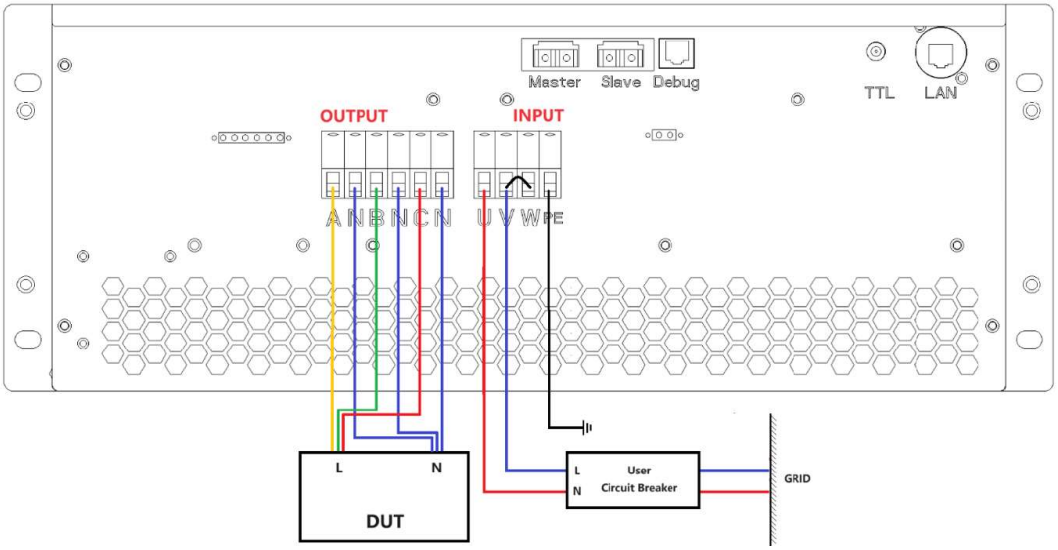

Figure 2-2-4 Connection method of Single-phase Output

SHOCK HAZARD

1. All three N cables at the output must be connected.
2. To avoid electrical hazards, connect the ground terminal to the protective ground terminal before connecting any input or output terminals.
3. 3. Before connecting the cable, make sure that the upper-level switch is off. Do not live working.

2.3 Parallel Installation

ZGX supports parallel connection of the same unit. The Master-Slave interface is on the rear panel (Figure 2-3-1).

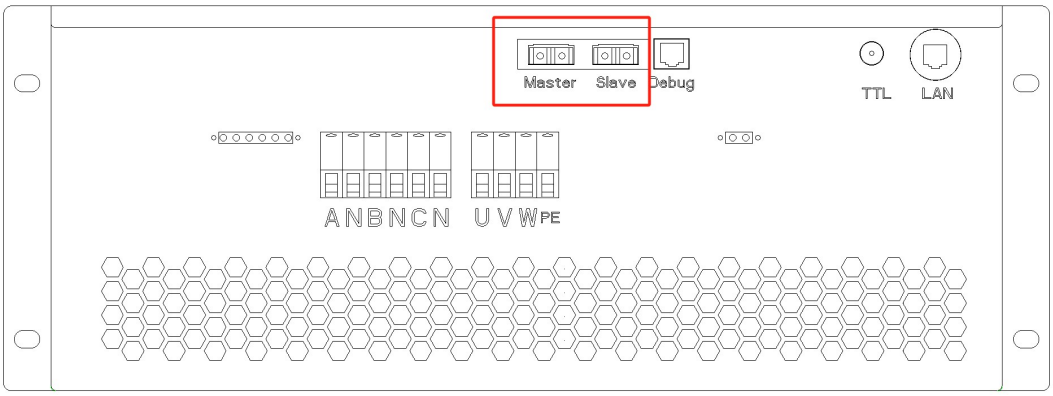

Figure 2-3-1

Connect the parallel input/output terminals and parallel fiber optic cables as shown in Figure 2-3-2.

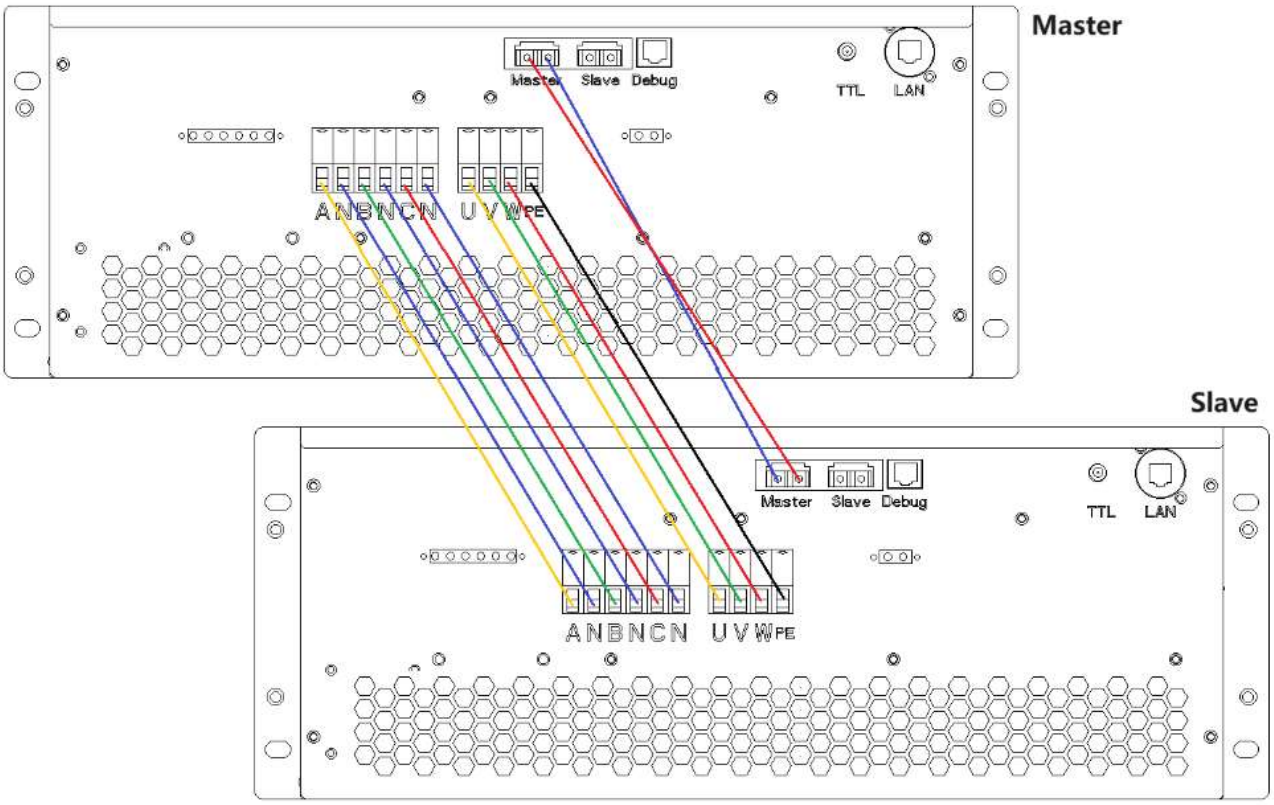

Figure 2-3-2

IMPORTANT INFORMATION

After completing the corresponding wiring, please check the function on the software panel "Configuration" - "System"– “independently/Parallel Master/Parallel Slave”, then the function will take effect.

Chapter 3 Power On/Off Operation

3.1 Power On Operation

Step 1： After completing the installation, close the user's circuit breaker on the GRID.

Step 2： Close the circuit breaker on front panel (Figure 3-1-1), the power supply will be standby.

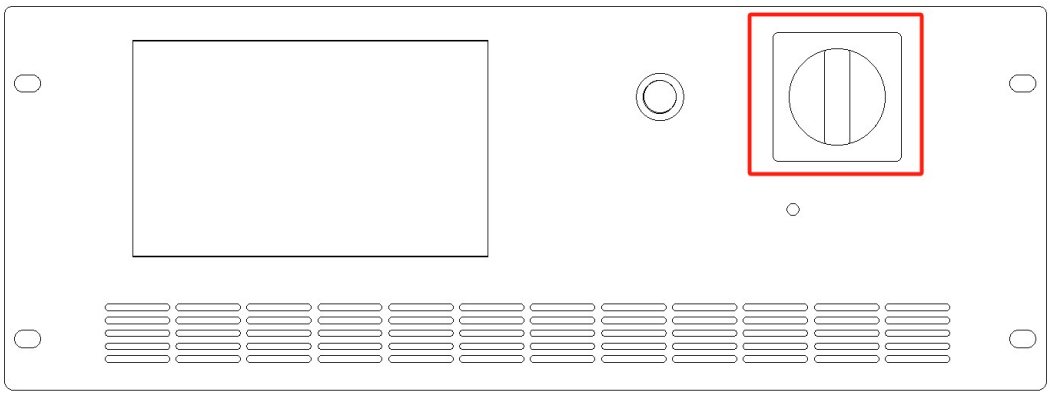

Figure 3-1-1

3.2 Power Off Operation

Step 1： Close the GUI software on the TFT-Touch panel /PC and shut down.

Step 2： Open the circuit breaker on front panel (Figure 3-1-1)

Step 3： Open the user's circuit breaker on the GRID.

CAUTIOUS

To prevent any damage to the equipment, make sure to confirm the correct wiring sequence.

SHOCK HAZARD

The voltage generated by ZGX series equipment may cause personal injury or death. When the power is on, do not touch the exposed connectors and parts.

SHOCK HAZARD

Make sure that there is no overvoltage on the product (such as overvoltage caused by lightning), otherwise there may be a risk of electrical hazards.

Chapter 4 Function and Feature Introduction

4.1 Operation Modes ----- Bi-Directional AC/DC Source

ZGX series is comprehensive, fast dynamic grid simulator for distributed generation system testing, such as the electrical characteristics of energy storage PCS, PV inverter, etc. The simulation functions include voltage and frequency fluctuation, voltage drop, high voltage ride through, low/zero voltage drop, three-phase unbalance, harmonic and inter-harmonic etc. The ZGX series meets the requirements of grid tied DG regulations testing, such as: grid voltage abnormality test, grid frequency abnormality test, high voltage ride through test, low/zero voltage ride through test, anti-islanding test, etc. ZGX series provides GUI software to simulate various real-world power grid operating conditions.

- **Voltage/frequency sequence programming**

  The ZGX series provides voltage and frequency sequence programming function. The parameters such as output voltage, frequency, slew rate, ON/ OFF output phase angle, duration time, switching time are programmable, and three phases are independent for settings.

- **Harmonic and inter-harmonic waveforms**

  Dual DSP+FPGA technology are use in ZGX series to generate up to 100th harmonic. ZGX series supports inter-harmonics editing. Users can program the phase angle and amplitude of the harmonic through the GUI, allowing generate three-phase harmonic/inter-harmonic waveforms independently.

- **Voltage drop simulation (LVRT test)**

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

ZGX series has also DC output mode and works as regenerative DC source for battery testing, battery simulation etc.

4.2 Operation Modes ----- AC/DC Load

In the regenerative AC load mode, CR mode, Rectifier mode, and CC/CP phase lead/lag mode are available.

- **CR Mode**

  CR mode is used to simulate three-phase resistive loads, the CR mode and three-phase resistance parameters can be set through the panel and can realize the program of resistance sequence.

- **Rectifier Mode**

  Rectifier mode can be used to simulate non-linear loads, the CC/CP mode and CF (setting range: 1.414~3) parameters can be set through the panel.

- **CC/CP phase lead/lag Mode**

  CC/CP phase lead/lag mode can simulate sinusoidal current, Constant current CC and constant power CP modes are available to adjust load current or power, phase angle can be set from 90°to -90° simulating the voltage and current conditions under inductive and capacitive loads.

4.3 Operation Modes ----- Bi-Polar (-BP option)

The ZGX series also provides bipolar DC output, and in this mode, phase A is used as POS+ output, phase B is used and NEG- output, the Neutral terminals of phase A and B are shorted and used as PE.

The output power is 10KW in bipolar output mode, and the voltage range is +/-636V, the current range is +/-30A.

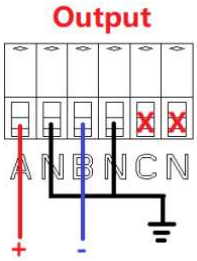

Figure 4-3-1

4.4 Operation Modes ----- RLC Load

The ZGX series provides RLC load simulation mode, which simulates the impedance of the combinations of R, L and C components. The three phases are independently programmable, and the R, L, C values can be set respectively.

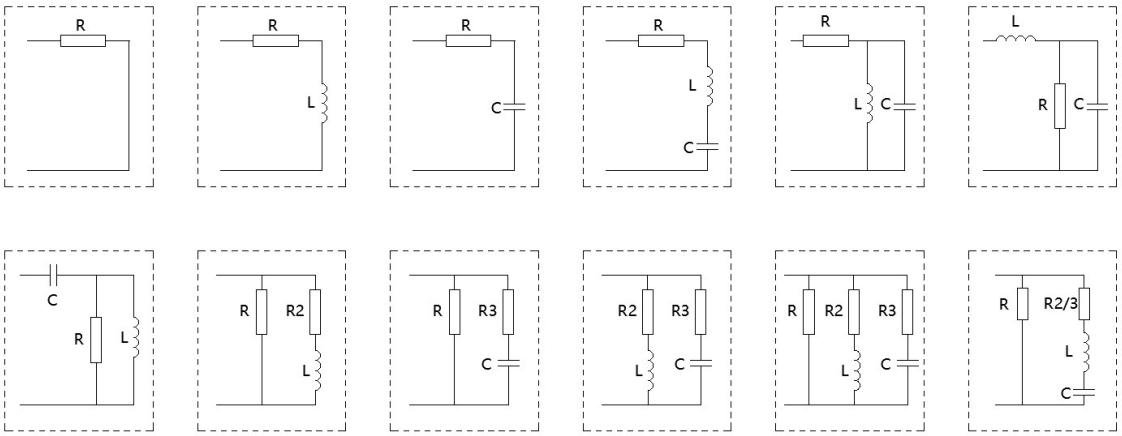

Figure 4-4-1

4.5 Operation Modes ----- RCD Load

The ZGX series provides RCD non-linear load simulation function for testing UPS power supplies, inverters, etc. The ZGX has four built-in RCD electrical topologies, 3-phase independently programmable, with individually programmable R, L and C parameter values.

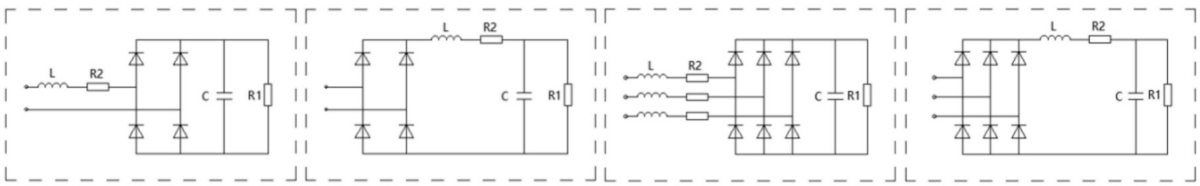

Figure 4-5-1

4.6 Application ----- Avionics Power Line Simulation

The ZGX series has an output frequency range of DC~1KHz, which meets the requirements of avionics bus simulation, including conditions of normal working, power interruption (conversion), abnormal power supply, emergency power supply, startup, power failure, etc.

4.7 Application ----- Battery Simulation (-BSS option)

The ZGX series provides GUI software to simulate the charging and discharging characteristics of the power battery pack/package and it provides battery simulation software, which can simulate different types of batteries, lithium-ion batteries, etc., supporting multiple parameter settings, including: battery capacity, the number of cells in series and parallel, the state of charge, etc.

4.8 Application ----- PV Simulation (-PV option)

The ZGX GUI software also provides function of PV simulation to simulate IV curves of various solar panels, under various temperature and irradiance condition, and conduct static and dynamic MPPT tests according to EN 50530: 2010.

Chapter 5 GUI Software Introduction

5.1 Software Overview

ZGX series provides GUI software, which is installed on the front touch screen. (The software can also be installed on the control PC connected to the power supply).

- When Indicator 1 is flashing and Indicator 2 is off —— indicates that the device is in standby mode;
- When Indicator 1 is always on and Indicator 2 is flashing —— indicates that the input works normally;
- When Indicator 1 is always on and Indicator 2 is always on —— indicates that the Input & Output works normally;
- When Indicator 1 is off and Indicator 2 is flashing —— indicates that the device is in fault state.

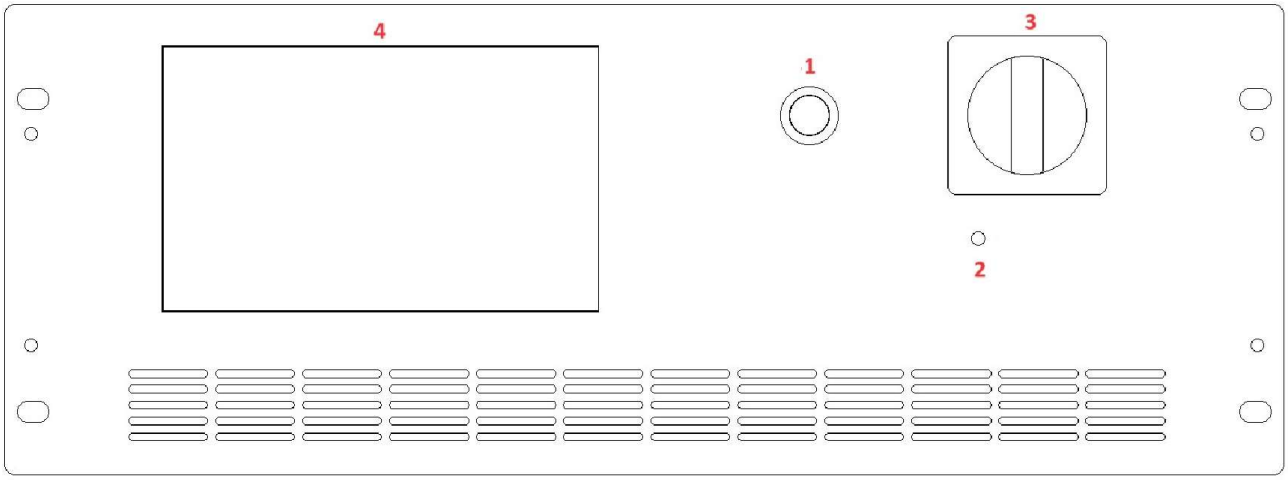

Figure 5-1-1

If the communication connection is normal, the communication status indicator on the software panel will display "Conn" (Figure 5-1-2). If the communication connection is abnormal, the communication status indicator will display as "DisConn" (Figure 5-1-3).

Figure 5-1-2

Figure 5-1-3

After setting the parameters, power on the ZGX. If the ZGX can run normally without any faults, the operating status indicator will display as "Normal" (Figure 5-1-4); If the ZGX malfunctions, the operating status indicator will display as "Fault" (Figure 5-1-5).

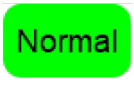

Figure 5-1-4

Figure 5-1-5

Figure 5-1-6 shows the main menu.

Figure 5-1-6

The overview of the functions as follows:

- HOME (please refer to 5.2 for details):
  - Mode selection: including Operating Mode, Output Mode, Control Mode, and Load mode;
  - Control Button: user can open different main panels by clicking on different control buttons, including Measurements, Settings, Harmonic Analysis, Display Waveform, System

- Configuration (please refer to 5.3 for details)

  Including: Communication, System, Display

- Measurements (please refer to 5.4 for details)

  Including: Standard Measurements, Harmonic Analysis

- Settings (please refer to 5.5 for details)

  Including: AC Settings, DC Settings, Load Settings, List Mode

- WAVE (please refer to 5.6 for details)

  Including: Display Waveform

- State (please refer to 5.7 for details)

  User can query the running status and fault words.

5.2 HOME

Click "HOME" to enter the main panel (Figure 5-2-1).

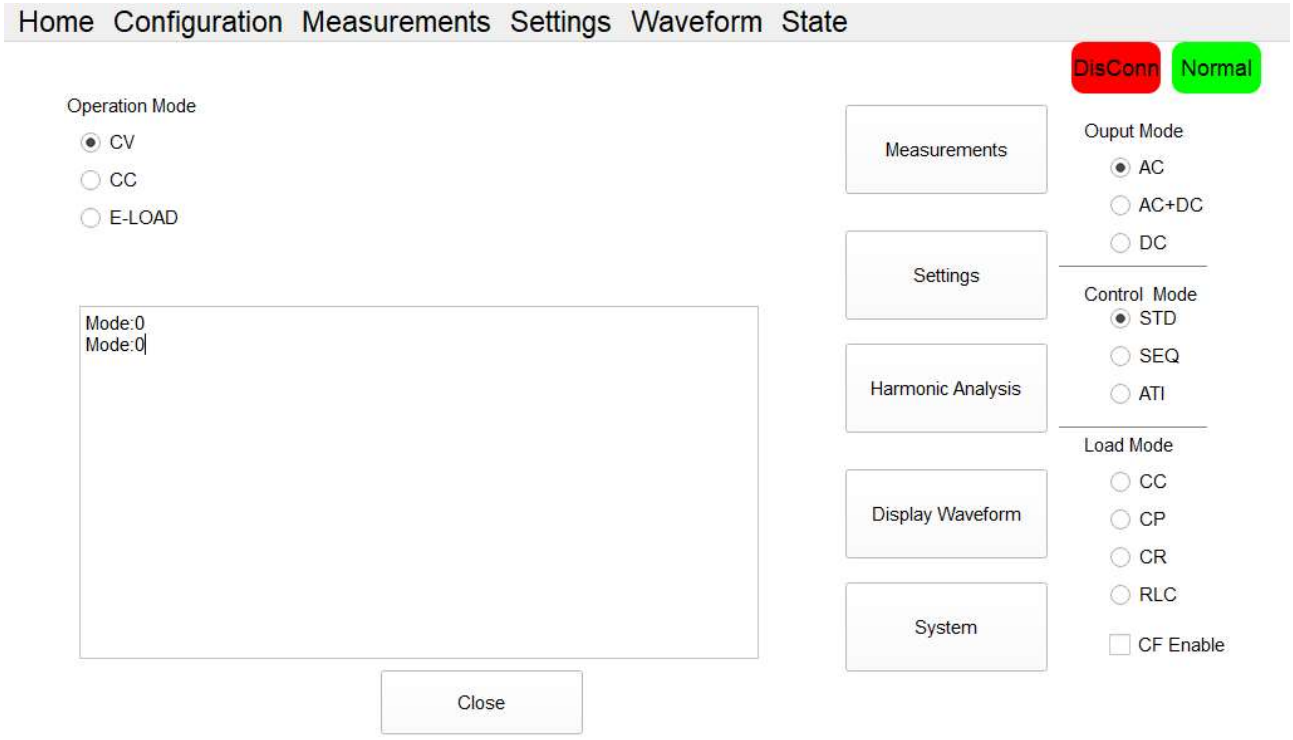

Figure 5-2-1

Table 5-1

No.	Description	Note
1	**Operation Mode**	Including: CV (constant voltage), CC (constant current), E-LOAD
2	**Output Mode**	Including: AC, AC+DC (add DC offset components on AC output), DC
3	**Control Mode**	Including: STD (Standard Mode), SEQ (Sequence Mode), ATI (Analog input signal control output mode)
4	**Load Mode**	Including: CC, CP, CR, RLC, CF Enable **Note:** The “CF Enable” checkbox is usually used in combination with CC or CP modes.
5	**Control Buttons**	By clicking different control buttons, the software will jump to different panels: Click "Measurements" ------ Standard Measurements panel; Click "Settings" ------ AC Settings panel or DC Settings panel or Load Settings panel; Click "Harmonic Analysis" ------- Harmonic Analysis panel; Click "Display Waveform" ------ Display Waveform panel; Click "System" ------ System panel.
6	**Close Button**	Click the "Close" button to exit the software interface
7	**Display Area**	Display fault records

5.3 Configuration

" Configuration " including: Communication, System, Display. (Figure 5-3-1).

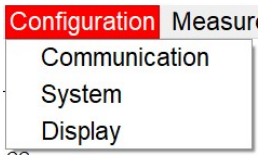

Figure 5-3-1

5.3.1 Communication

Users can select Local/Remote control methods, remote control communication settings on "Communication" panel.

Table 5-2

No.	Description	Note
1	**Remote/Local**	Local control or Remote control
2	**Remote Control** **Communication Settings**	Remote PC IP: XXX.XXX.X.XX. Remote PC Port: XXX Device IP: XXX.XXX.X.XX. Device Port: XXX
3	**SET**	Click the "SET" button, and the parameters set will take effect.
4	**HOME**	Click the "HOME" button to return to the HOME main interface

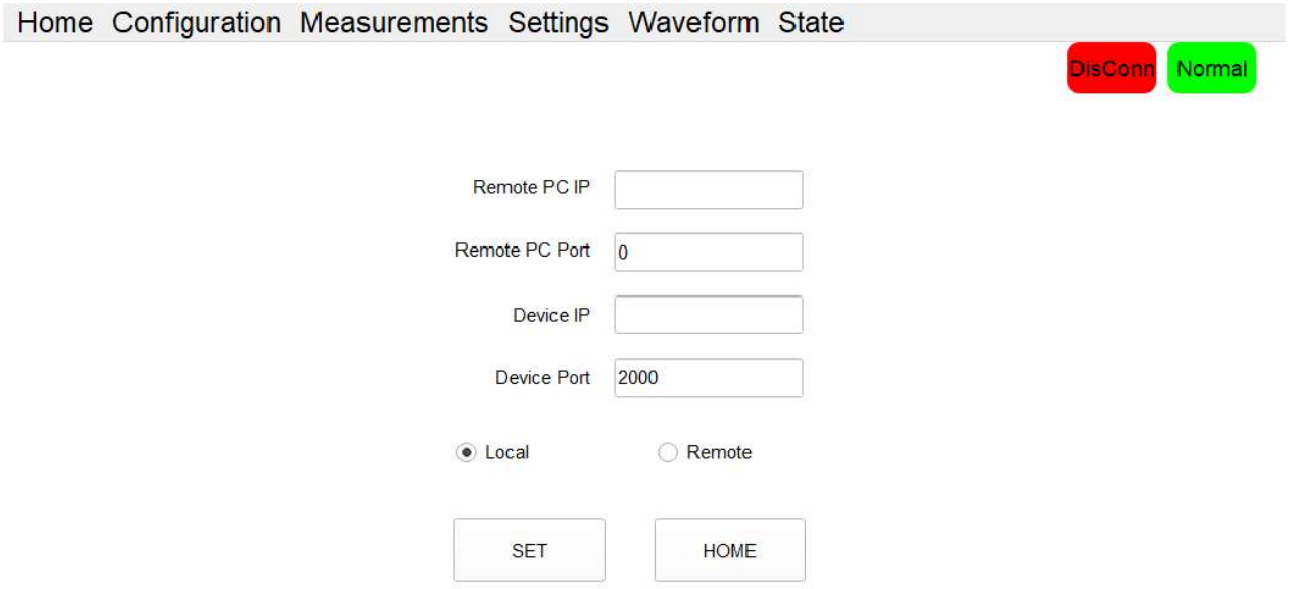

Figure 5-3-2

5.3.2 System

Users can select different functions and set protection parameters on the "System" panel.

Table 5-3

No.	Description	Note
1	**Operation Mode**	Independently/Parallel Master/Parallel Slave

2	Functions Selection	**Without N:** please check this option when ZGX is used as a load and there is no N-line connected between the DUT and ZGX.
		External E-Stop: the external emergency stop is effective when check this option
		Load of 3ph PS: please check this option when ZGX is used as a load and the frequency of the DUT remains unchanged (such as three-phase power supply/motor).
		Line Impedance: the line impedance simulation function is effective when check this option.
		Remote Sense: the remote sense function is effective when check this option.
		AC220 Input: the single-phase 1P+N+PE/220VLN input is valid when check this option.
		Enable Phase-shifting: the ON/ OFF output phase angle is effective when check this option.
		Disable Transient OCP: the output overcurrent protection function can be temporarily disabled when check this option (for special tests when overcurrent protection is not required).
		Three Phase Parallel: the three-phase parallel output is valid when check this option.
3	Protection Parameters Settings	**OCP:** Overcurrent protection value (rms), when the output current exceeds this value, the output will be cut off.
		OVP (Peak): Overvoltage protection value (peak), when the instantaneous output voltage exceeds this value, the output will be cut off
		OPP: Overpower protection value (rms), when the output power exceeds this value, the output will be cut off
		OLP: Undervoltage protection value (rms), when the input voltage is lower than this value, the output will be cut off
		Current Limit (Peak): Maximum current limit value (peak), when the output current exceeds this value, it will be limited below the current value.
		Voltage Ramp: AC/DC voltage ramp rate
		Current Ramp: AC/DC current ramp rate

4	SET	Click the "SET" button, and the parameters set will take effect.
5	HOME	Click the "HOME" button to return to the HOME main interface

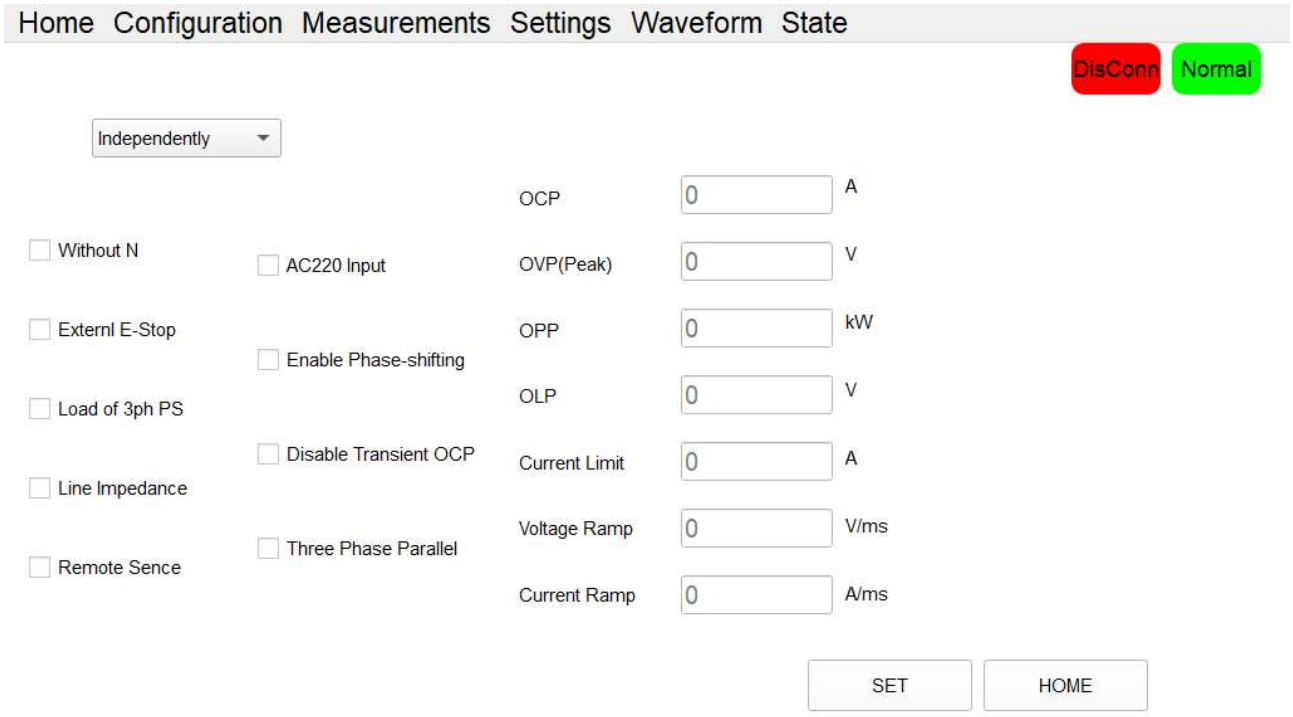

Figure 5-3-3

IMPORTANT INFORMATION

When the ZGX is in normal working condition, parameters such as OCP/OVP/OPP/OLP/Current Limit/Voltage Ramp/ Current Ramp can be directly modified without powering off.

IMPORTANT INFORMATION

Before checking "External E-Stop"/"Remote Sense"/"AC220 Input"/"Three Phase Parallel", please ensure that the connection of cables is completed.

5.3.3 Display

Users can set the display ratio of the waveforms in “Display” panel.

Table 5-4

No.	Description	Note
1	**Display Ratio**	UA/UB/UC: the Display Ratio for the output voltage waveforms of phase A/B/C
		IA/IB/IC: the Display Ratio for the output current waveforms of phase A/B/C
		Udc: the Display Ratio for the voltage waveform of DC-BUS
2	**Debug Display**	User can enter the Debug display panel when check this option. *(**Note:** this mode is used for debugging before leaving the factory. Do not use it without permission)*

3	Save Waveform	The ZGX will start saving waveform files when check this option (***Note:*** *Checked by default before leaving the factory, please do not change without permission.*)
4	Dark Mode	The software display colors will switch when check this option.
5	SET	Click the "SET" button, and the parameters set will take effect.
6	HOME	Click the "HOME" button to return to the HOME main interface

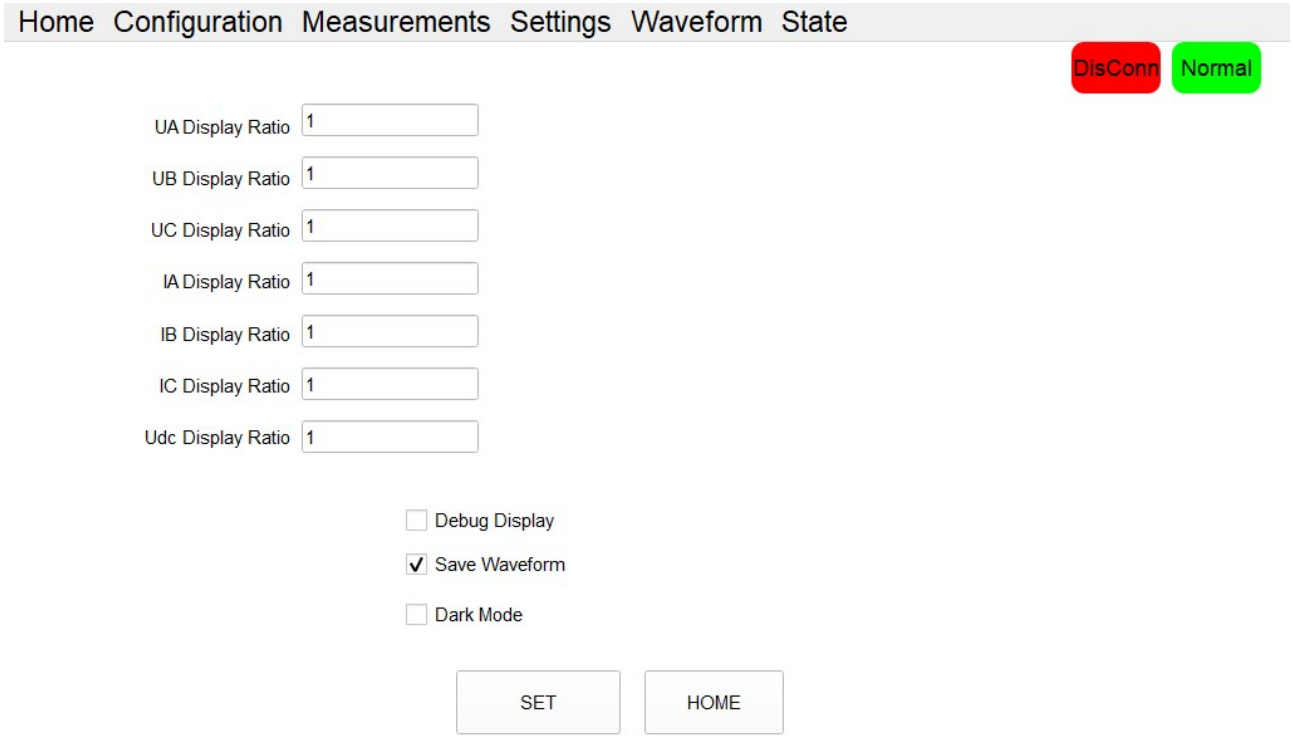

Figure 5-3-4

5.4 Measurements

"Measurements" including Standard Measurements and Harmonic Analysis (Figure 5-4-1).

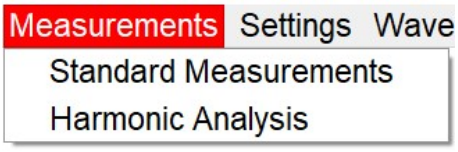

Figure 5-4-1

5.4.1 Standard Measurements

Users can check the input/output measurements and temperature measurements on the " Standard Measurements " panel.

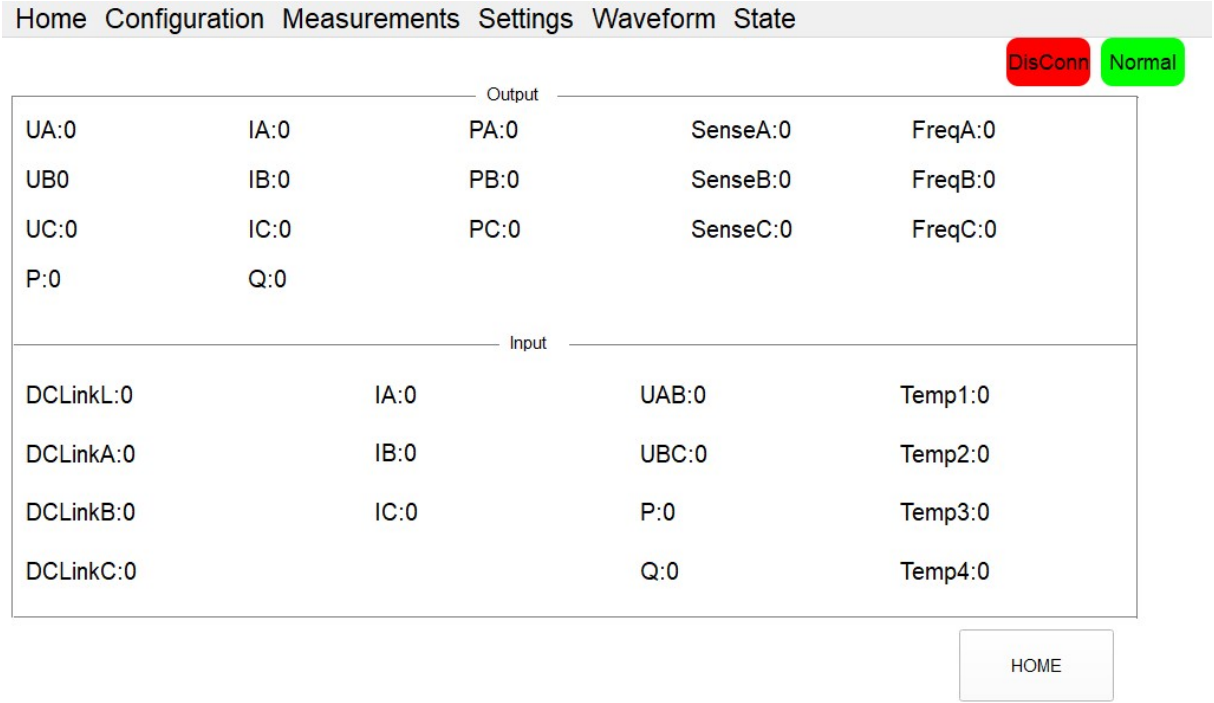

Figure 5-4-2

Table 5-5

No.	Description	Note
1	**Output Measurement**	Including: output voltage of phase A/B/C (UA/UB/UC), output current phase A/B/C (IA/IB/IC), output power of phase A/B/C (PA/PB/PC), output frequency of phase A/B/C (FreqA/B/C), Output active/reactive power (P/Q), remote sense voltage of phase A/B/C (SenseA/B/C)
2	**Input Measurement**	Including: DC bus voltage of input (DCLinkL), DC-bus voltage of phase A/B/C (DCLinkA/B/C), input current of phase A/B/C (IA/IB/IC), input voltage (UAB, UBC), input active/reactive power (P/Q)
3	**Temperature Measurement**	Temperature measurement, displaying the temperature of four heat sinks inside the ZGX
4	**HOME**	Click the "HOME" button to return to the HOME main interface

5.4.2 Harmonic Analysis

Users can measure the output voltage/current harmonics on the "Harmonic Analysis" panel (Figure 5-4-3).

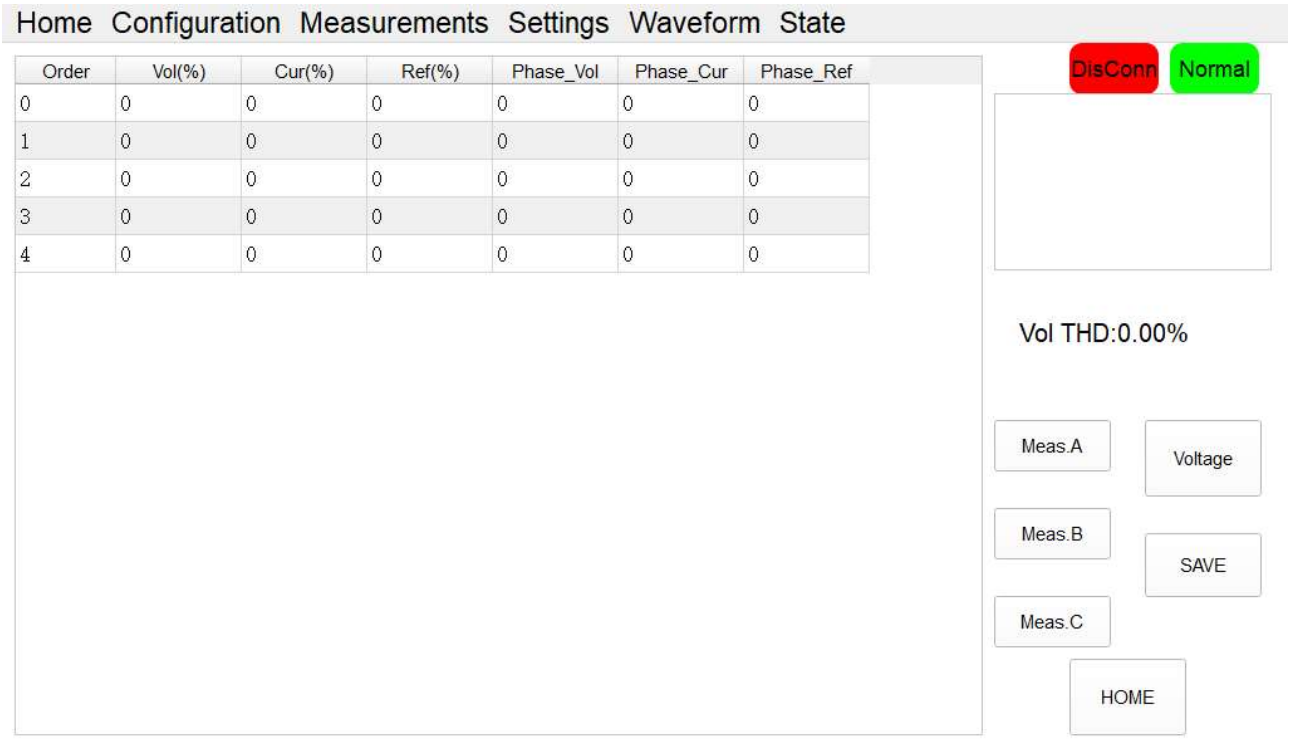

Figure 5-4-3 Harmonic Measure ------ Local Software

Table 5-6

No.	Description	Note
1	**Data Dispaly**	Display harmonic order, Vol(%)-output voltage harmonic content, Cur(%)-output current harmonic content, Ref(%)-reference harmonic content, Phase_Vol-voltage harmonic phase, Phase_Cur-current harmonic phase, Phase-Ref(%)-reference phase
2	**Vol/Cur THD: 0.00%**	Display the output voltage or current THD measurement value
3	**Meas.A/B/C**	Measure phase A/B/C by clicking on different buttons
4	**Voltage/Current**	The analysis output current/voltage can be switched by clicking “Voltage/Current”
5	**SAVE**	Click "SAVE" to save the measurement data
6	**HOME**	Click the "HOME" button to return to the HOME main interface

5.5 Settings

"Settings" including AC Settings, DC Settings, LOAD Settings, List Mode (Figure 5-5-1); Each panel includes multiple modes.

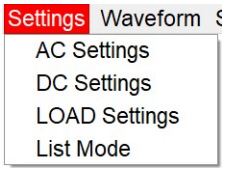

Figure 5-5-1

Figure 5-5-2

The functions of the 5 buttons on the right side of the panel are shown in Table 5-7:

Table 5-7

No.	Description	Note
1	POWER ON/POWER OFF	Used for start or stop the input of ZGX
2	OUTPUT ON/OUTPUT OFF	Used for start or stop the output of ZGX
3	RESET	Click “RESET”, reset the ZGX
4	WAV.ON/WAV.OFF	Click "WAVE ON/OFF" and the software will start/stop displaying the waveform
5	HOME	Click the "HOME" button to return to the HOME main interface

5.5.1 AC Settings

"AC Settings" including Standard, Sequence, Harmonic and Inter-harmonic modes.

5.5.1.1 Standard

Users can set a single work step. Select the output mode as AC or AC+DC and control mode as STD on HOME panel. Click "Settings" → "AC Settings" → "Standard". (Figure 5-5-1-1).

Table 5-8

No.	Note
1	The set parameters include: output frequency, output three-phase voltage, output three-phase phase angle, output three-phase current limit, and output three-phase power limit.
2	When selecting AC+DC mode in the output mode on the HOME panel, the three-phase DC offset component can be set
3	When selecting the line impedance simulation function on the "System" panel, the line output impedance parameters can be set: inductance L and resistance R.
4	SET: Click the "SET" button to apply the set parameters.

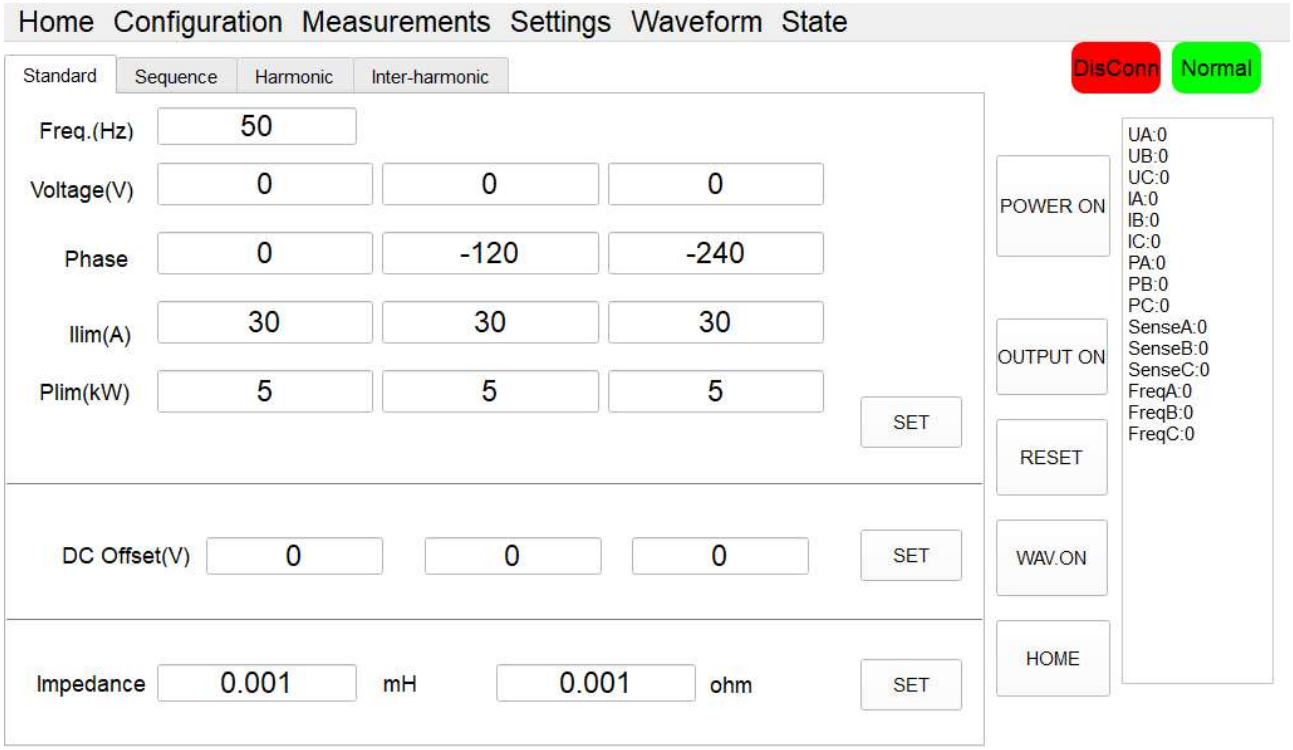

Figure 5-5-1-1 AC Settings ------ Standard

5.5.1.2 Sequence

Users can set complex combinations of multiple work steps. Select the output mode as AC or AC+DC and control mode as SEQ on HOME panel. Click "Settings" → "AC Settings" → "Sequence". (Figure 5-5-1-2).

Table 5-9

No.	Note	
1	Setting parameters of each step	Ampl.A/Ampl.B/Ampl.C: output voltage of phase A/B/C
		Phase A/Phase B/Phase C: output phase angle of phase A/B/C
		F (Hz): output frequency
		Ramp (ms): The ramp time to switch from the last step to the current step
		Duration (ms): Current step duration
2	SET: Click the "SET" button to apply the set parameters.	
3	CLS: Click the "CLS" button to clear the set parameters	
4	DEL: Click the "DEL" button to delete the step	
5	INC: Click the "INC" button to add a step	
6	SAVE: Click the "SAVE" button to save the set test parameter file (.txt format, default saved in the seq_data folder)	
7	IMPORT: Click the "IMPORT" button to import the saved test parameter file (.txt format, default saved in the seq_data folder)	

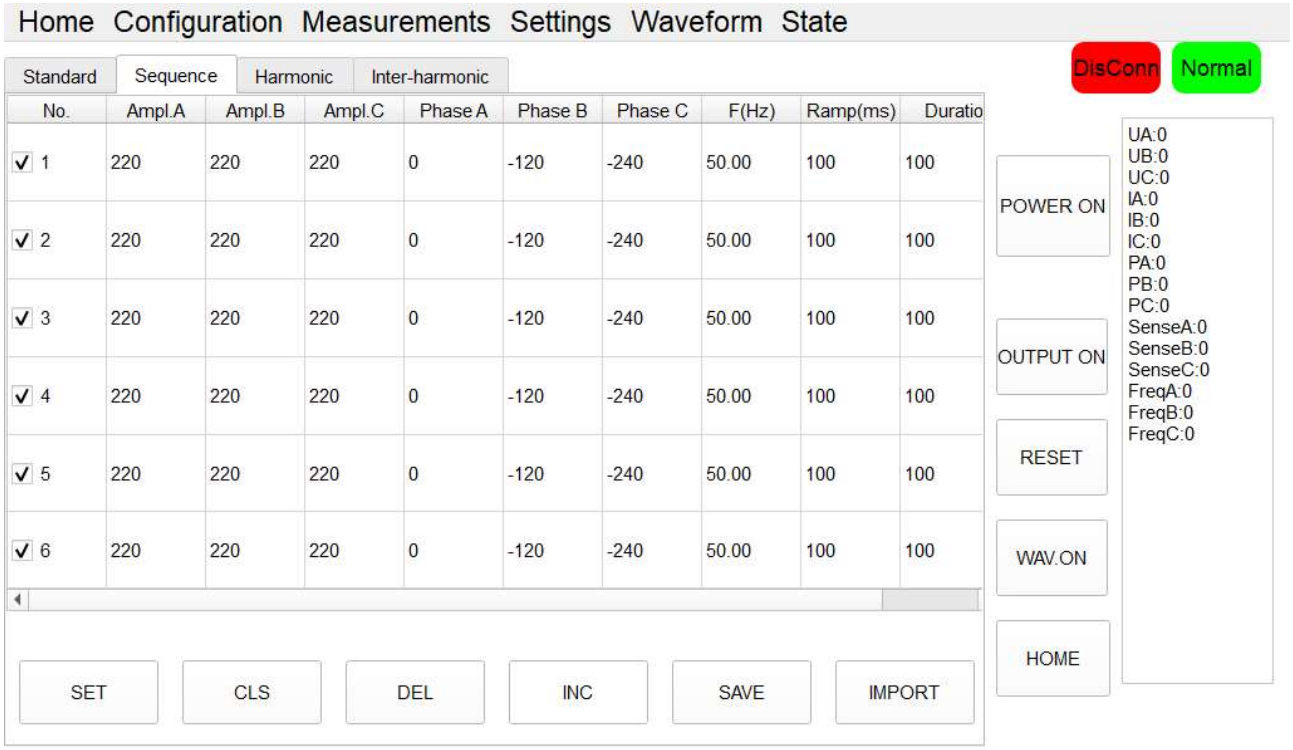

Figure 5-5-1-2 AC Settings ------ Sequence

5.5.1.3 Harmonic

ZGX has harmonic simulation function. Up to 100th harmonics waveform generation. Click "Settings" → "AC Settings" → "Harmonic" to enter the harmonic editing panel.

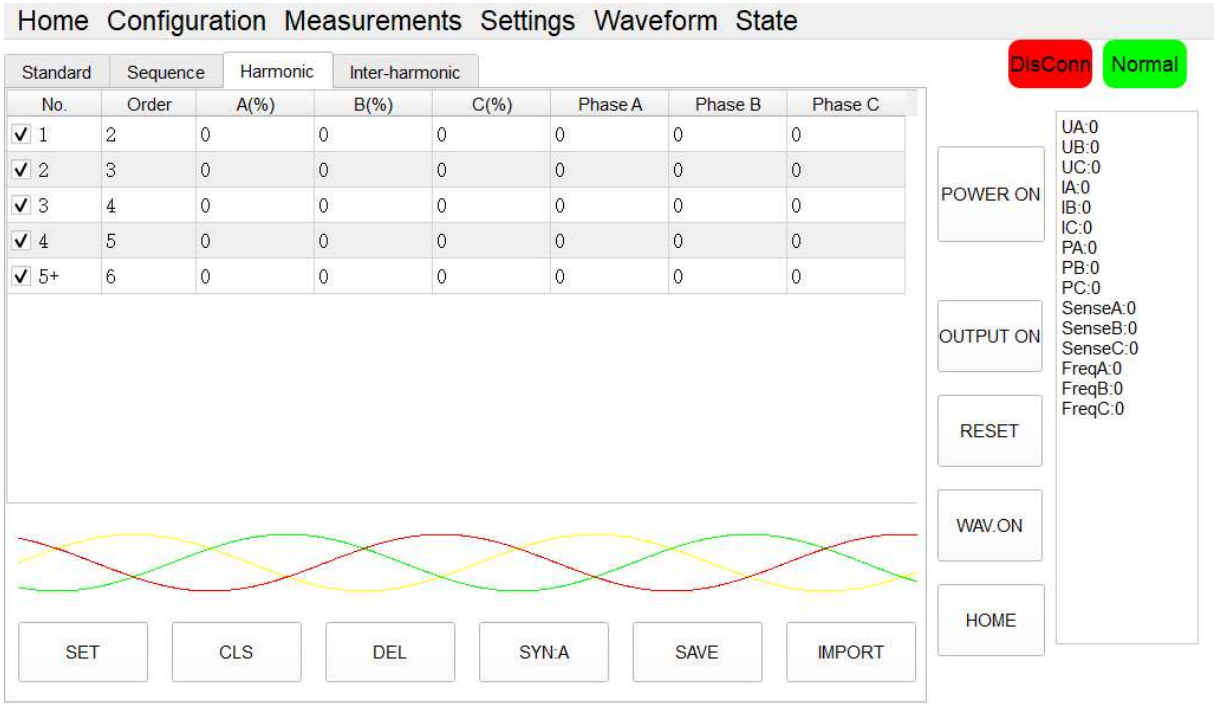

Figure 5-5-1-3 AC Settings ------ Harmonic

Table 5-10

No.	Note
1	set parameters including harmonic order, harmonic content, and harmonic phase angle.
2	SET: Click the "SET" button to apply the set parameters.
3	CLS: Click the "CLS" button to clear the set parameters
4	DEL: Click the "DEL" button to delete the step
5	SYN:A Click the "SYN: A" button to copy the parameters of phase A settings to phases B and phase C
6	SAVE: Click the "SAVE" button to save the set test parameter file (.txt format)
7	IMPORT: Click the "IMPORT" button to import the saved test parameter file or the build-in waveform (.txt format)
8	Waveform Display: Simulated waveforms can be displayed below the panel

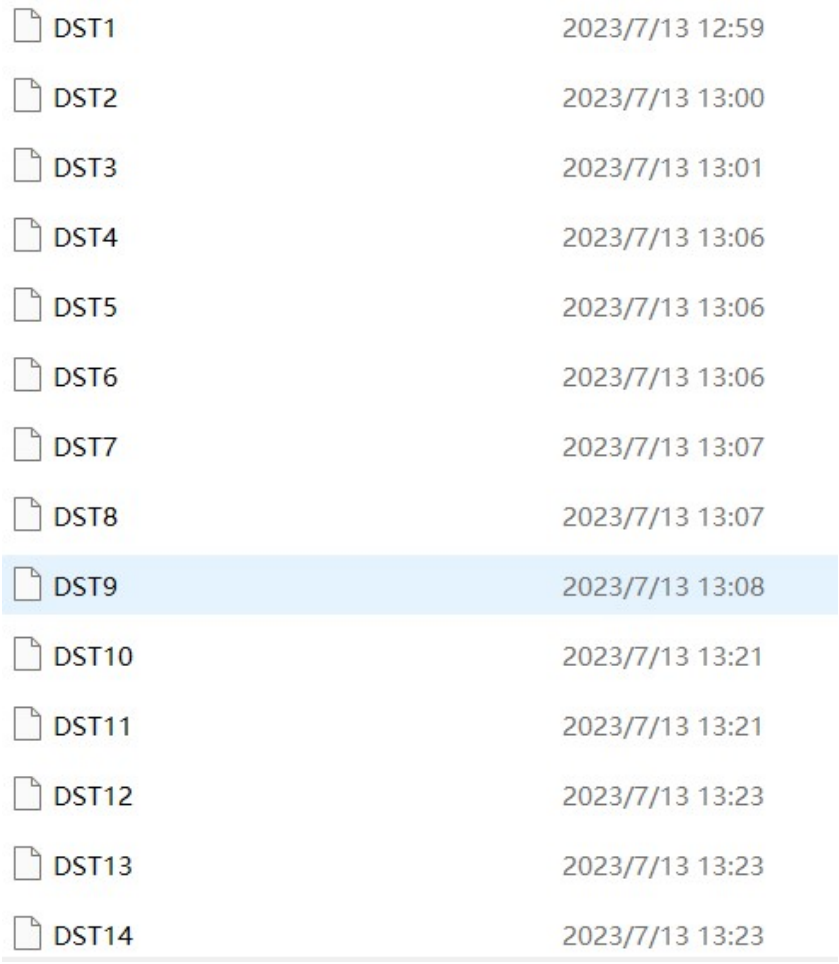

Figure 5-5-1-4 Built-in harmonic waveform files

5.5.1.4 Inter-harmonic

ZGX has inter harmonic simulation function. Click "Settings" → "AC Settings" → "Inter-harmonic" to enter the inter-harmonic editing panel. Set parameters including inter-harmonic frequency, content, and phase angle. Click the "SET" button to apply the set parameters.

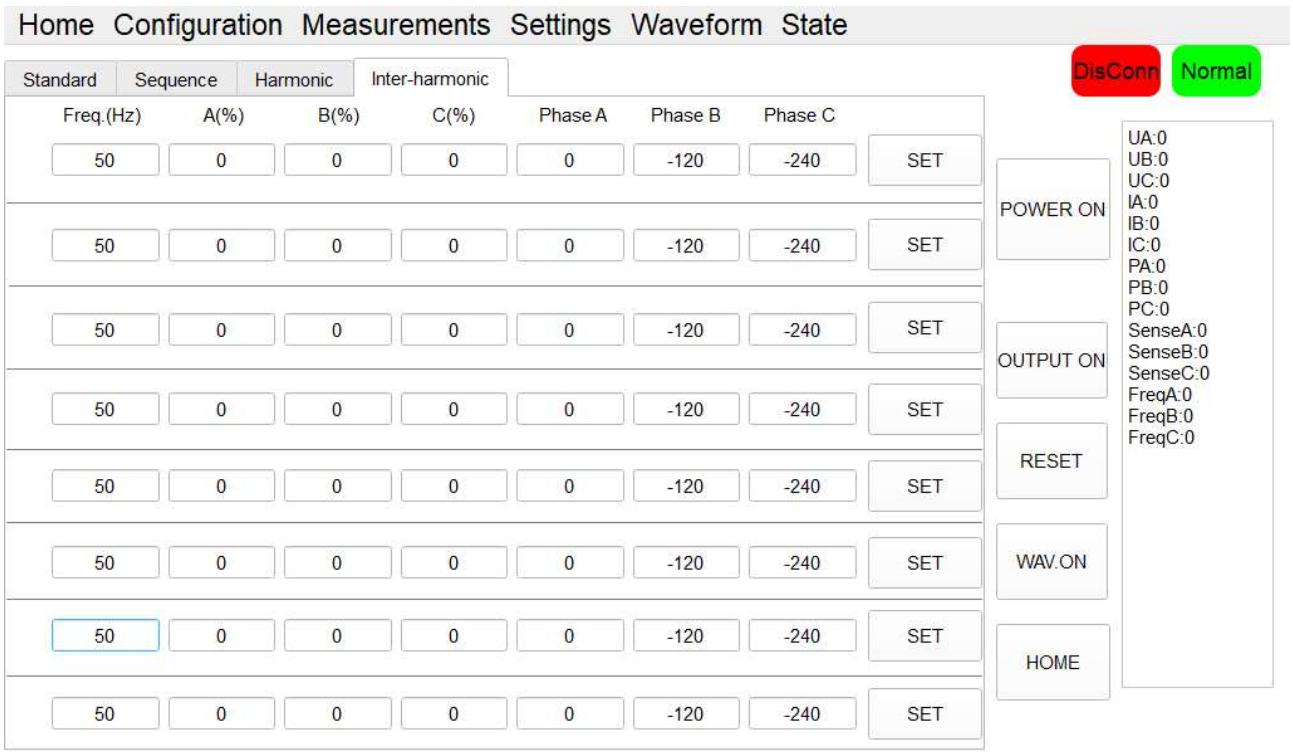

Figure 5-5-1-5 AC Settings ------ Inter-harmonic

5.5.2 DC Settings

"DC Settings" including Standard and Sequence modes.

5.5.2.1 Standard

Users can set a single work step. Select the output mode as DC and control mode as STD on HOME panel. Click "Settings" → "DC Settings" → "Standard". (Figure 5-5-2-1).

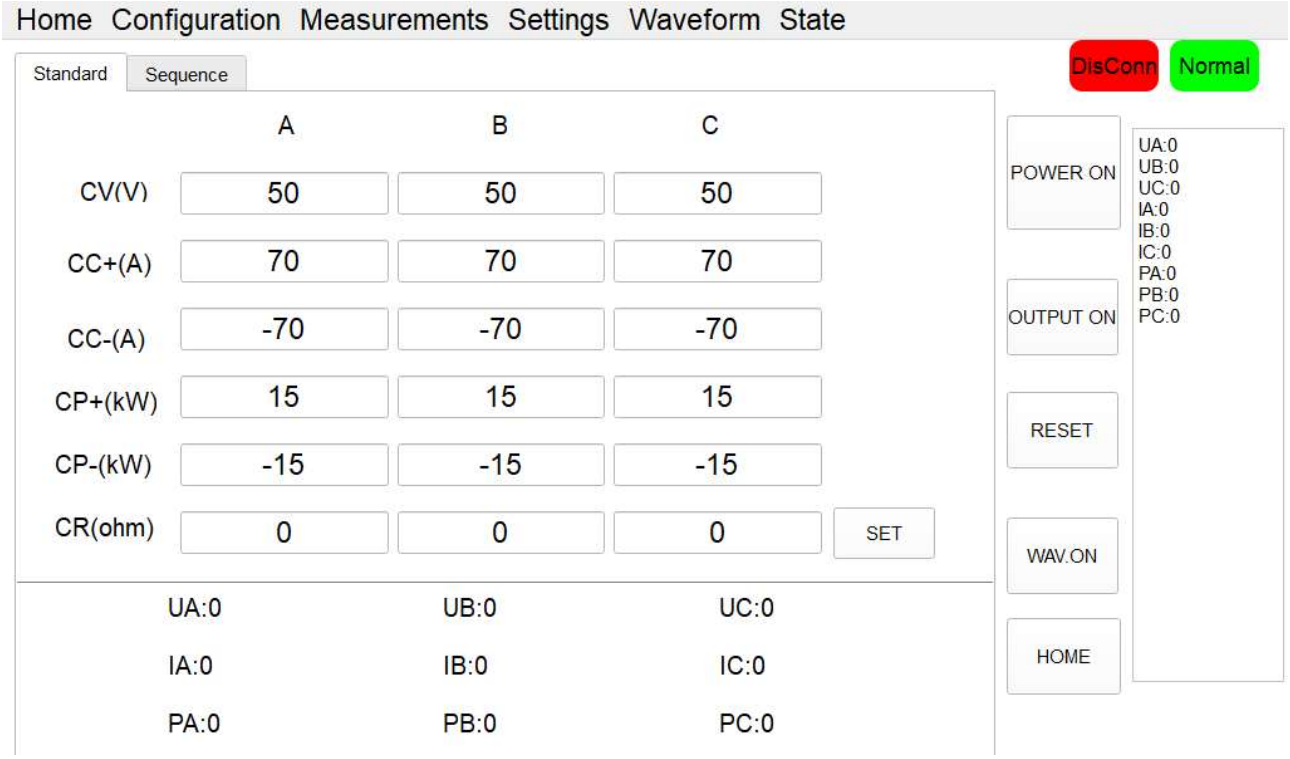

Figure 5-5-2-1 DC Settings ------ Standard

Table 5-11

No.	Note	
1	Setting parameters	CV(V): output voltage
		CC+(A): output current upper limit value
		CC-(A): output current lower limit value
		CP+(kW): output power upper limit value
		CP-(kW): output power lower limit value
		CR: Internal resistance value
2	SET: Click the "SET" button to apply the set parameters.	
3	Real time measurement display: Real time display the DC output voltage (UA/UB/UC), DC output current (IA/IB/IC), DC output power (PA/PB/PC)	

Note: "A/B/C" represents the three channels corresponding to the three phases.

5.5.2.2 Sequence

Users can set complex combinations of multiple work steps. Select the output mode as DC and control mode as SEQ on HOME panel. Click "Settings" → "DC Settings" → "Sequence". (Figure 5-5-2-2).

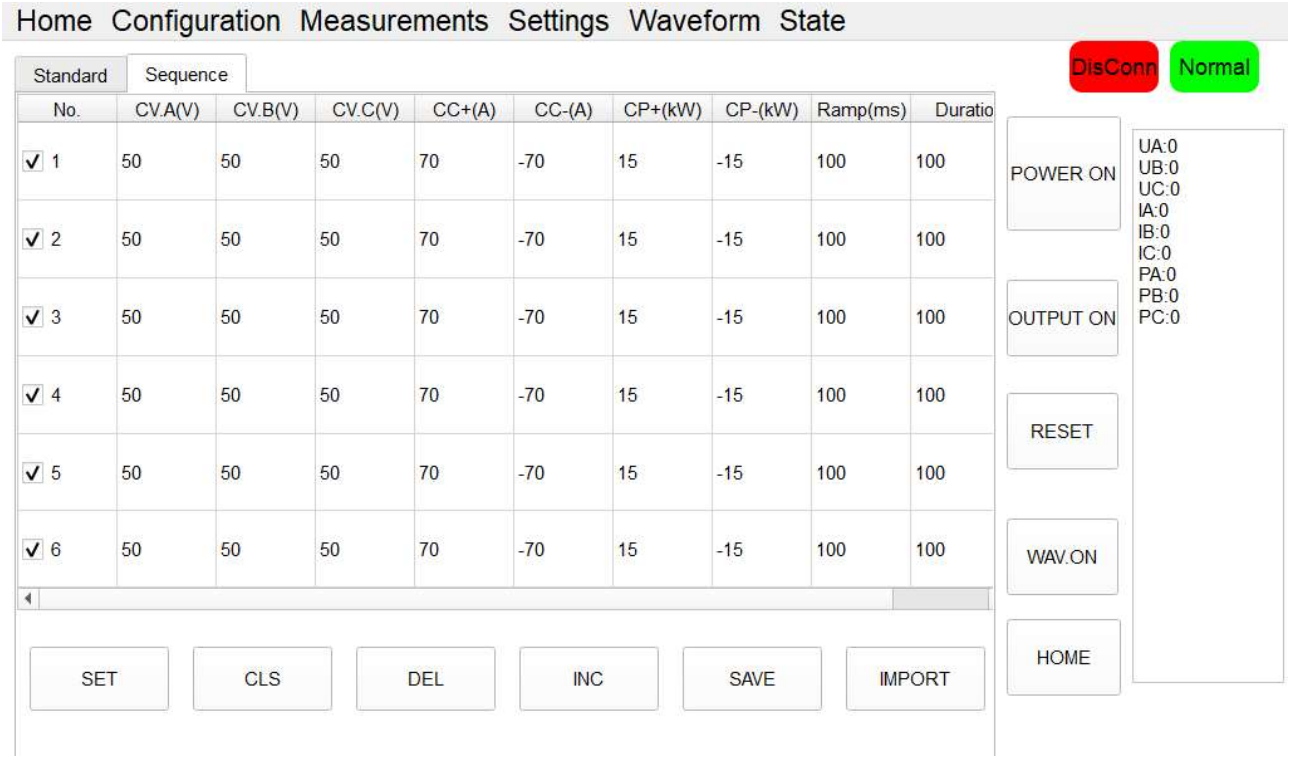

Figure 5-5-2-2 DC Settings ------ Sequence

Table 5-12

No.	Note	
1	Setting parameters of each step	CV.A(V) / CV.B(V) / CV.C(V): output voltage
		CC+(A) / CC-(A): output current upper/lower limit value
		CP+(kW) / CP-(kW): output power upper/lower limit value
		CR: Internal resistance value
		Ramp (ms): The ramp time to switch from the last step to the current step
		Duration (ms): Current step duration
2	SET: Click the "SET" button to apply the set parameters.	
3	CLS: Click the "CLS" button to clear the set parameters	
4	DEL: Click the "DEL" button to delete the step	
5	INC: Click the "INC" button to add a step	
6	SAVE: Click the "SAVE" button to save the set test parameter file (.txt format)	
7	IMPORT: Click the "IMPORT" button to import the saved test parameter file (.txt format)	

5.5.3 Load Settings

The "Load Settings" including SEQ-CC, SEQ-CP, SEQ-CR, E-LOAD and CF rectifier modes.

5.5.3.1 SEQ-CC

SEQ-CC mode used to simulate sinusoidal current, Constant current CC is available to adjust load current, phase angle can be set from 90°to -90° simulating the voltage and current conditions under inductive and capacitive loads.

Users can set complex combinations of multiple work steps. Select the load mode as CC and control mode as SEQ on HOME panel. Click "Settings" → "Load Settings" → "SEQ-CC". (Figure 5-5-3-1).

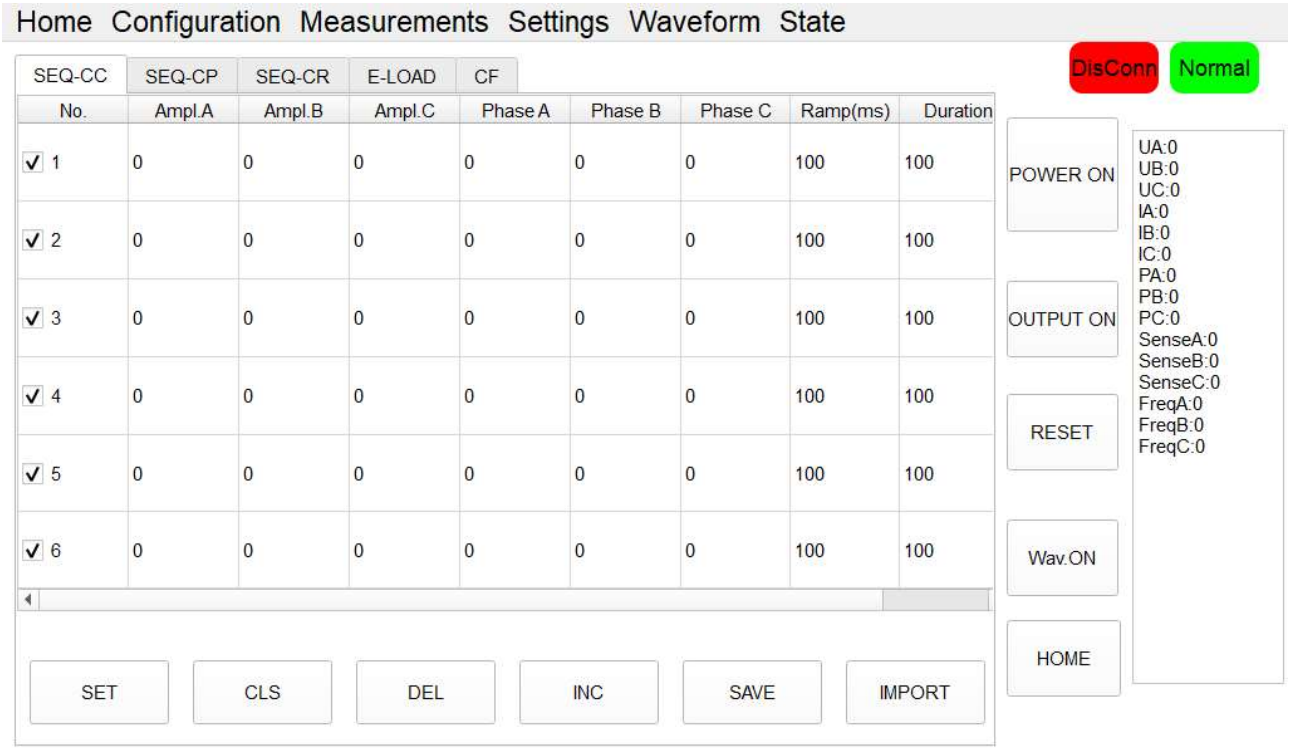

Figure 5-5-3-1 Load Test ------ SEQ-CC mode

Table 5-13

No.	Note	
1	Setting parameters of each step	Ampl.A/Ampl.B/Ampl.C: AC current of phase A/B/C
		Phase A/Phase B/Phase C: AC current phase angle of phase A/B/C
		Ramp (ms): The ramp time to switch from the last step to the current step
		Duration (ms): Current step duration
2	SET: Click the "SET" button to apply the set parameters.	
3	CLS: Click the "CLS" button to clear the set parameters	
4	DEL: Click the "DEL" button to delete the step	
5	INC: Click the "INC" button to add a step	
6	SAVE: Click the "SAVE" button to save the set test parameter file (.txt format)	
7	IMPORT: Click the "IMPORT" button to import the saved test parameter file (.txt format)	

"SEQ-CC" can also be used in conjunction with "CF" to simulate non-linear loads.

Select the Load mode as CC and check the "CF Enable" on the HOME panel. Set the basic operating parameters in SEQ-CC mode, and then overlay the CF value in CF mode (setting range: 1.414~3).

5.5.3.2 SEQ-CP

SEQ-CP mode used to simulate sinusoidal current, Constant power CP is available to adjust load power, phase angle can be set from 90°to -90° simulating the voltage and current conditions under inductive and capacitive loads.

Users can set complex combinations of multiple work steps. Select the load mode as CP and control mode as SEQ on HOME panel. Click " Settings" → "Load Settings" → "SEQ-CP". (Figure 5-5-3-2).

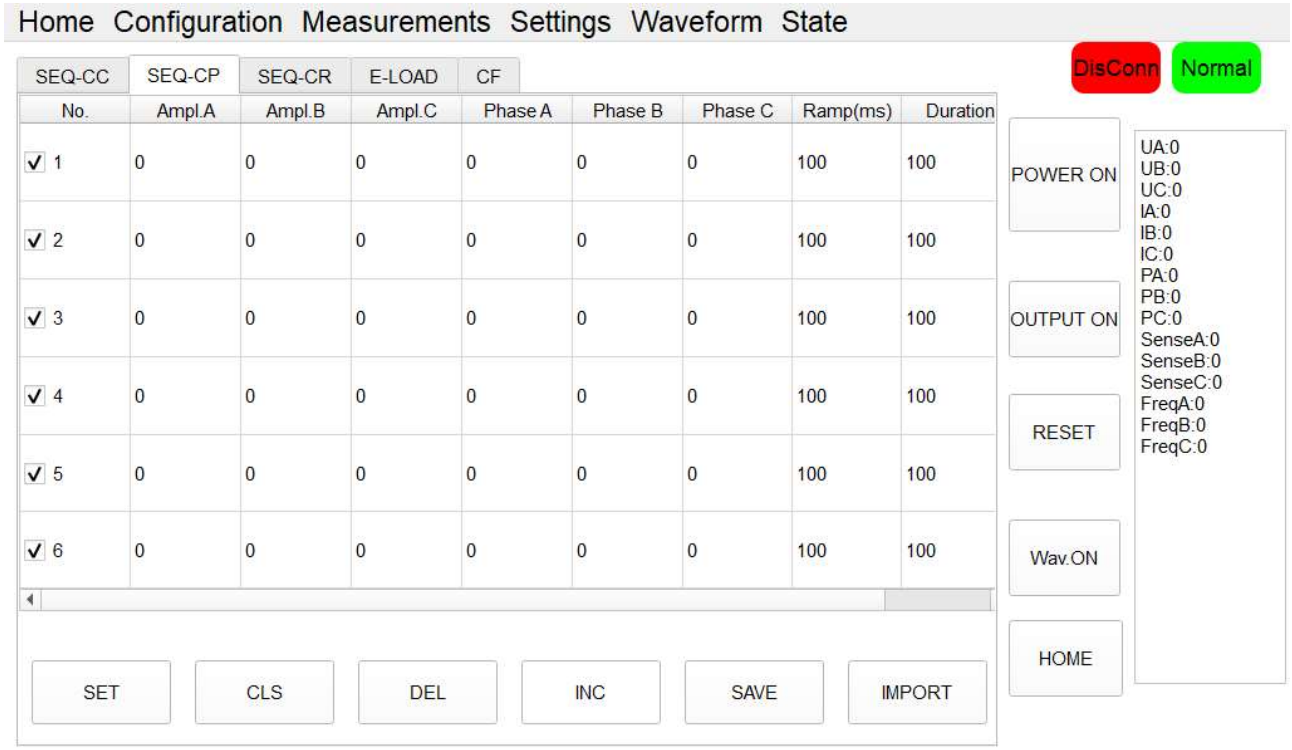

Figure 5-5-3-2 Load Settings ------ SEQ-CP

Table 5-14

No.	Note	
1	Setting parameters of each step	Ampl.A/Ampl.B/Ampl.C: AC power of phase A/B/C
		Phase A/Phase B/Phase C: AC power phase angle of phase A/B/C
		Ramp (ms): The ramp time to switch from the last step to the current step
		Duration (ms): Current step duration
2	SET: Click the "SET" button to apply the set parameters.	
3	CLS: Click the "CLS" button to clear the set parameters	
4	DEL: Click the "DEL" button to delete the step	
5	INC: Click the "INC" button to add a step	

6	SAVE: Click the "SAVE" button to save the set test parameter file (.txt format)
7	IMPORT: Click the "IMPORT" button to import the saved test parameter file (.txt format)

“SEQ-CP” can also be used in conjunction with “CF” to simulate non-linear loads.

Select the Load mode as CP and check the “CF Enable” on the HOME panel. Set the basic operating parameters in SEQ-CP mode, and then overlay the CF value in CF mode (setting range: 1.414~3).

5.5.3.3 SEQ-CR

SEQ-CR mode is used to simulate three-phase resistive loads. Users can set complex combinations of multiple work steps. Select the load mode as CR and control mode as SEQ on HOME panel. Click " Settings" → "Load Settings" → "SEQ-CR". (Figure 5-5-3-3), the three-phase resistance parameters can be set through the panel and can realize the program of resistance sequence.

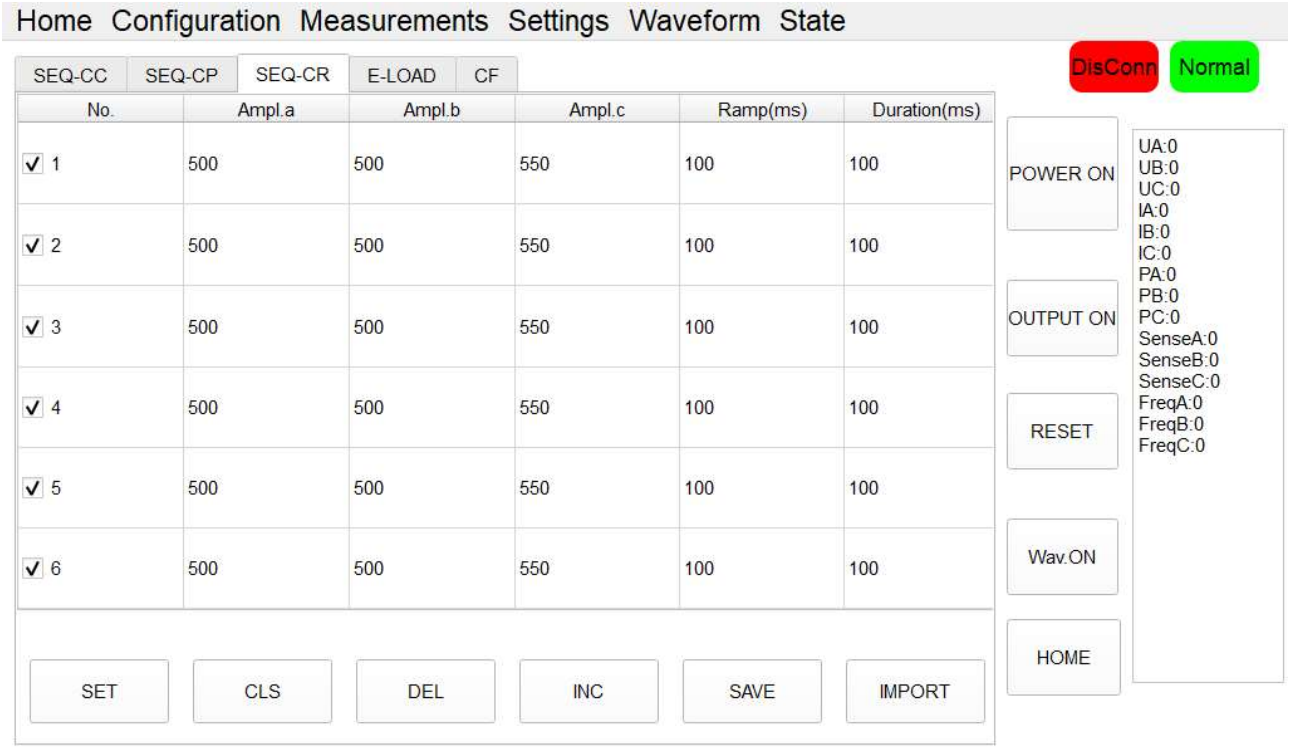

Figure 5-5-3-3 Load Settings ------ SEQ-CR

Table 5-15

No.	Note	
1	Setting parameters of each step	Ampl.A/Ampl.B/Ampl.C: resistance of phase A/B/C
		Ramp (ms): The ramp time to switch from the last step to the current step
		Duration (ms): Current step duration
2	SET: Click the "SET" button to apply the set parameters.	
3	CLS: Click the "CLS" button to clear the set parameters	
4	DEL: Click the "DEL" button to delete the step	

5	INC: Click the "INC" button to add a step
6	SAVE: Click the "SAVE" button to save the set test parameter file (.txt format)
7	IMPORT: Click the "IMPORT" button to import the saved test parameter file (.txt format)

5.5.3.4 E-LOAD

The ZGX series provides RLC load simulation function and RCD non-linear load simulation function. Select the operation mode as E-LOAD and Load mode as RLC on HOME panel. Click "Settings" → "Load Settings" → "E-LOAD". (Figure 5-5-3-4). Users can choose different circuit topologies (including 12 RLC load simulation topologies and 4 RCD load simulation topologies), and set three-phase R, L, C, R2, and R3 values separately.

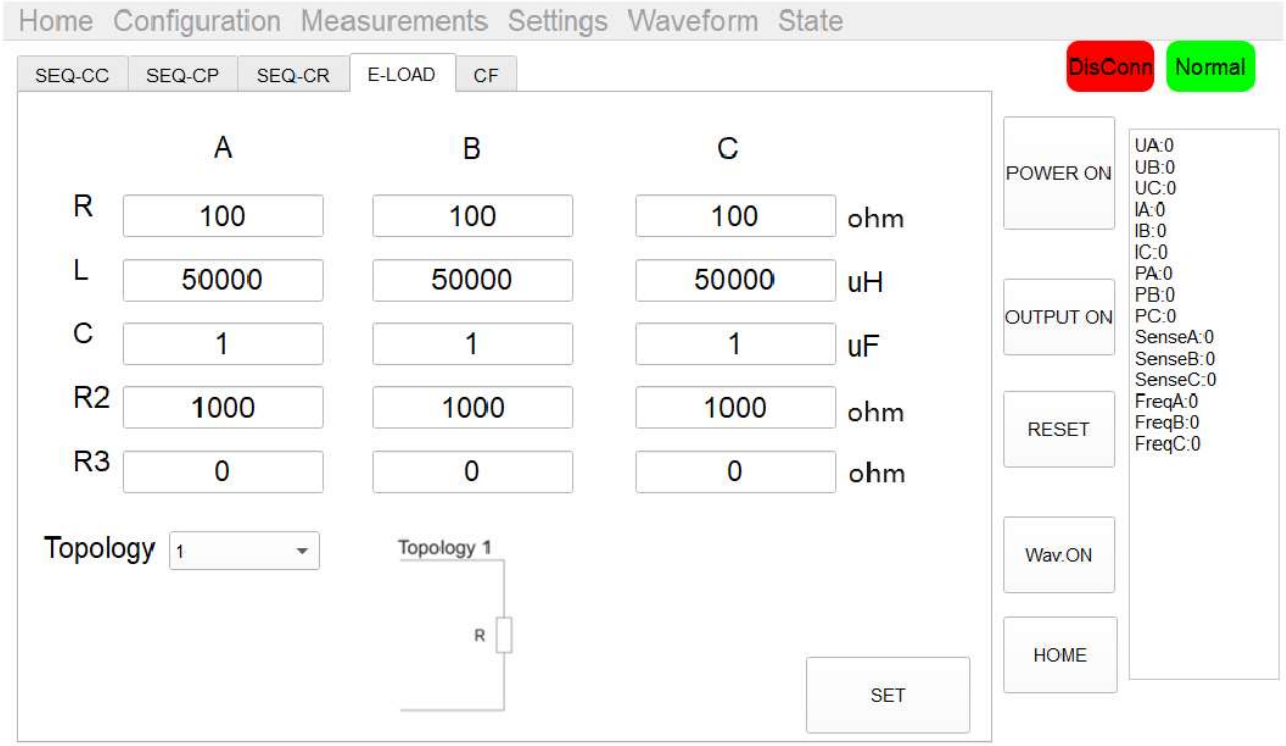

Figure 5-5-3-4 Load Settings ------ E-LOAD

Table 5-16

No.	Note
1	Circuit topologies: including 12 RLC load simulation topologies and 4 RCD load simulation topologies
2	Parameter settings: R, L, C, R2, R3 of phase A/B/C can be set separately
3	SET: Click the "SET" button to apply the set parameters.

5.5.3.5 CF

CF mode (Rectifier mode) can be used to simulate non-linear loads. Select the load mode as CC or CP and check the “CF Enable” box on HOME panel. Set the basic operating parameters in SEQ-CC or SEQ-CP mode, and then overlay the CF value in CF mode (setting range: 1.414~3).

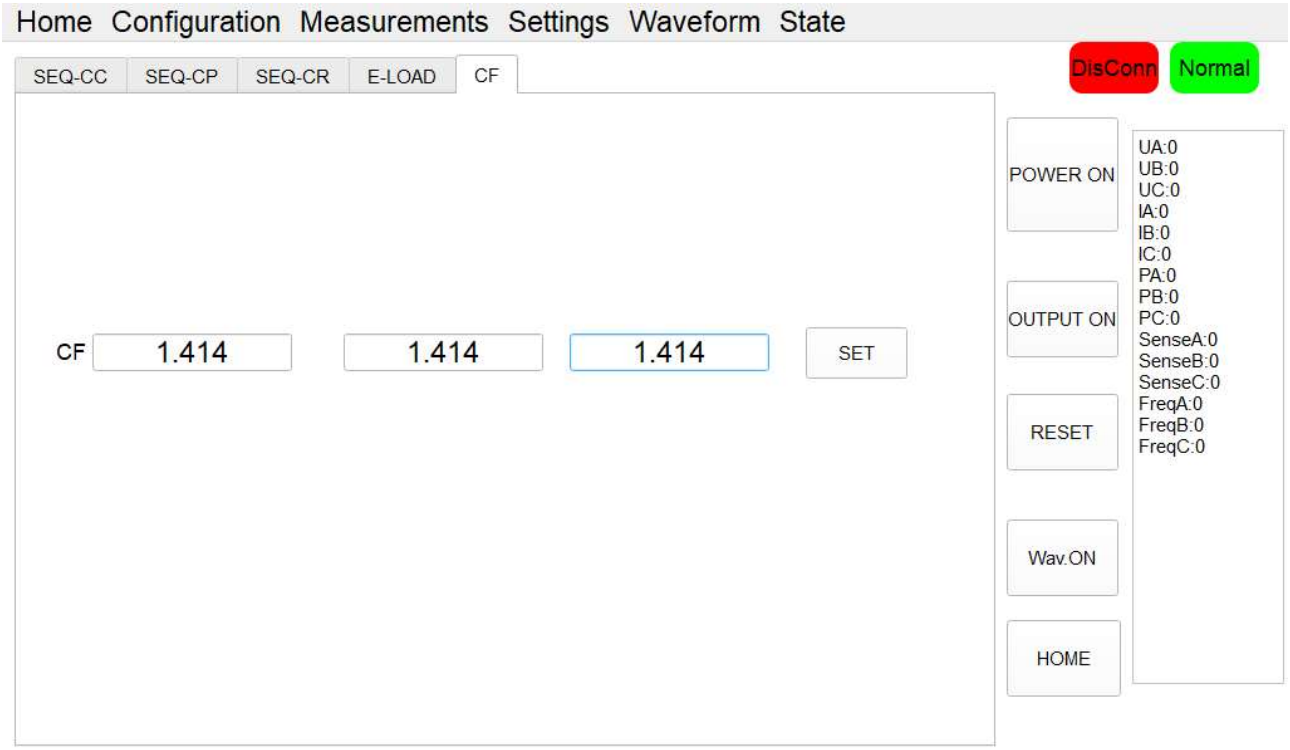

Figure 5-5-3-5 Load Settings ------ CF

5.5.4 List Mode

Click "Settings" → "List Mode", user can manually set more complex combinations of testing commands. In addition, users can also use the SCPI instructions provided in Chapter 7. After importing the test commands file into the software, click "SET" → "POWER ON" → "OUTPUT ON", and the ZGX will start running according to the imported test instructions.

Table 5-17

No.	Note
1	SET: Click the "SET" button to apply the set parameters.
2	CLS: Click the "CLS" button to clear the set parameters
3	DEL: Click the "DEL" button to delete the step
4	INC: click the “INC: button to add a new command. **Note:** After clicking the "INC" button, a new panel will pop up, including: AC SET (Figure 5-5-4-2), Harm SET (Figure 5-5-4-4), Inter-harm SET (Figure 5-5-4-5), and DC SET (Figure 5-5-4-6).
5	SAVE: Click the "SAVE" button to save the set test parameter file (.txt format)
6	IMPORT: Click the "IMPORT" button to import the saved test parameter file (.txt format)

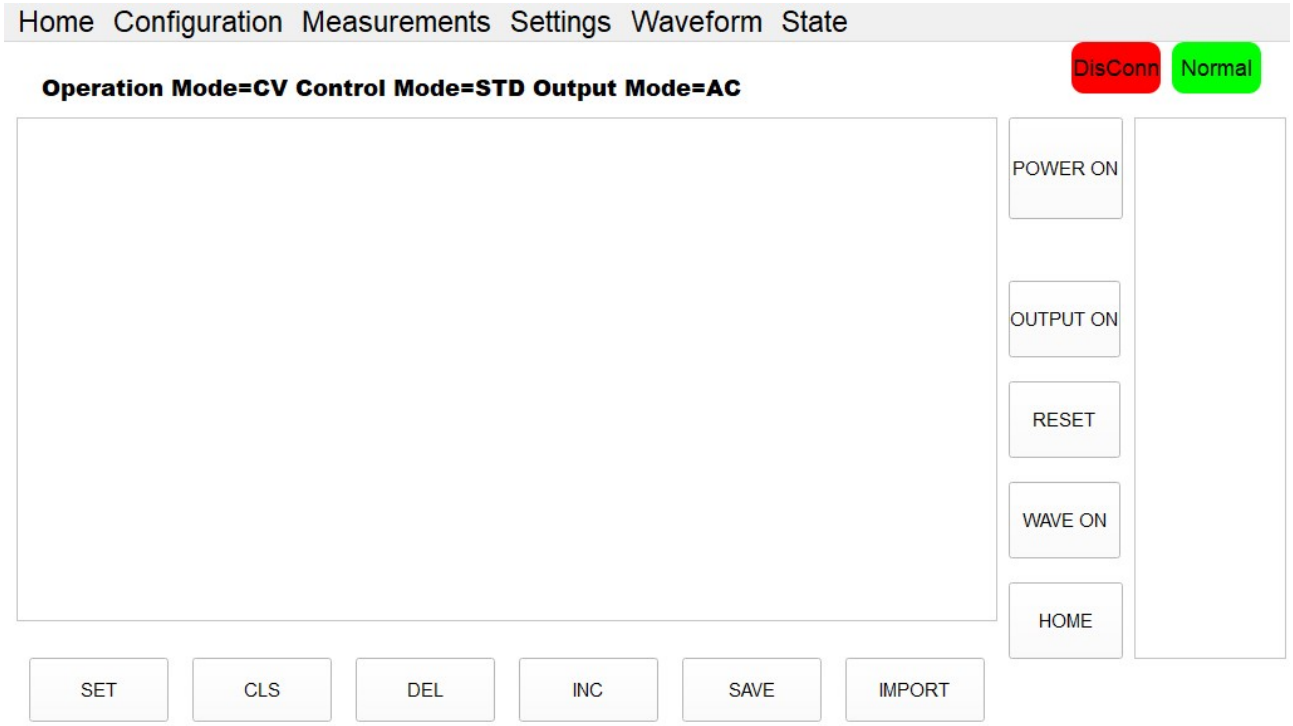

Figure 5-5-4-1 List Mode

5.5.4.1 List Mode ------ AC Settings

After clicking the "INC" button, a new panel will pop up, AC Settings panel as Figure 5-5-4-2.

Table 5-18

No.	Note	
1	Parameters can be set for each command	Ampl.A/Ampl.B/Ampl.C: output voltage of phase A/B/C
		Phase A/Phase B/Phase C: output phase angle of phase A/B/C
		Freq (Hz): output frequency
		Ramp (ms): The ramp time to switch from the last step to the current step
		Duration (ms): Current step duration
		Offset A/Offset B/Offset C: DC component superimposed on AC output
2	TRIG ANGLE (Figure 5-5-4-3)	The ON/PFF phase angle of a phase A/B/C phase. **Note:** The power system refers to the Duration time firstly by default, and then refers to the on/off phase angle.
3	Mode (Figure 5-5-4-3)	Load mode selection: CV/CC/CP/CR. The command will only run effectively when the selected mode on this panel is same as the HOME panel
4	Loop (Figure 5-5-4-3)	**Unselect:** Indicates that the current instruction is only run once
		LOOPBegin: Indicates starting the loop from the current command. The number below

		represents the total number of cycles.
		LOOPEnd: Indicates the current command is the end of the loop. The number below represents the total number of cycles.
5	Output enable check box	After checking this box, the current command can run normally. **Note:** The commands that are not checked will not run.
6	Ok	Click the "Ok" button to generate a new command
7	Cancel	Click the "Cancel" button to cancel

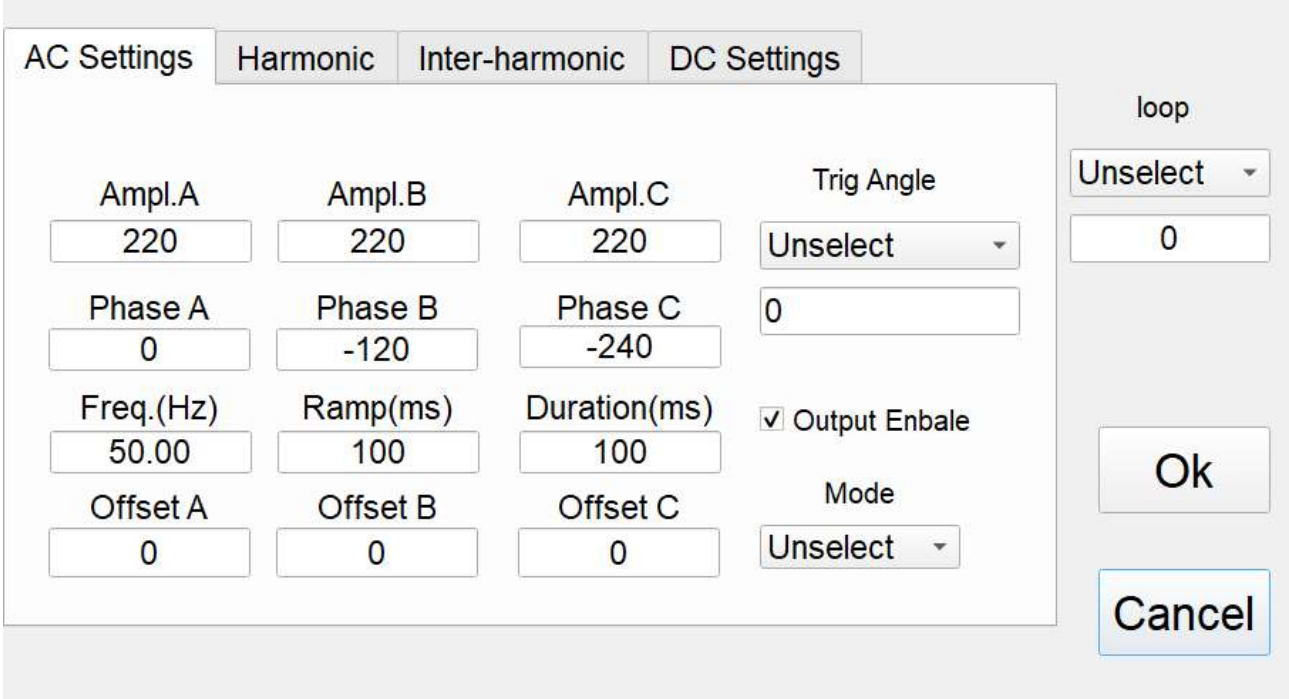

Figure 5-5-4-2 List Mode ------ AC Settings

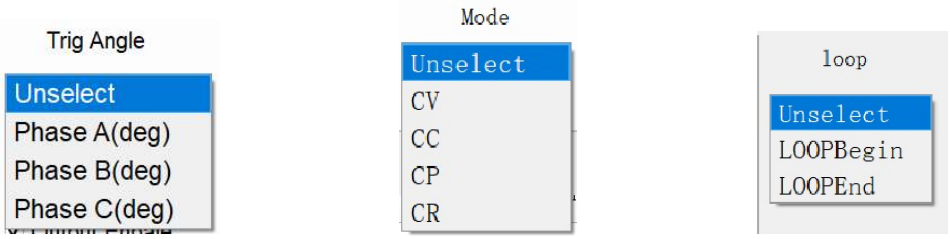

Figure 5-5-4-3

5.5.4.2 List Mode ------ Harmonic

After clicking the "INC" button, a new panel will pop up, Harmonic as Figure 5-5-4-4. Firstly, set the basic operating parameters (such as output voltage, frequency, etc.) in the "AC Settings", then click "Harmonic" to set the harmonic parameters. Then click "Ok" to generate command.

Table 5-19

No.	Note	
1	Parameters can be set for each command	Order: harmonic order
		Ramp (ms): The ramp time to switch from the last step to the current step
		Duration (ms): Current step duration
		Phase A/B/C: harmonic phase angle of phase A/B/C
		Ampl(%) A/B/C: harmonic amplitude of phase A/B/C
2	Loop	**Unselect:** Indicates that the current instruction is only run once
		LOOPBegin: Indicates starting the loop from the current command. The number below represents the total number of cycles.
		LOOPEnd: Indicates the current command is the end of the loop. The number below represents the total number of cycles.
3	Ok	Click the "Ok" button to generate a new command
4	Cancel	Click the "Cancel" button to cancel

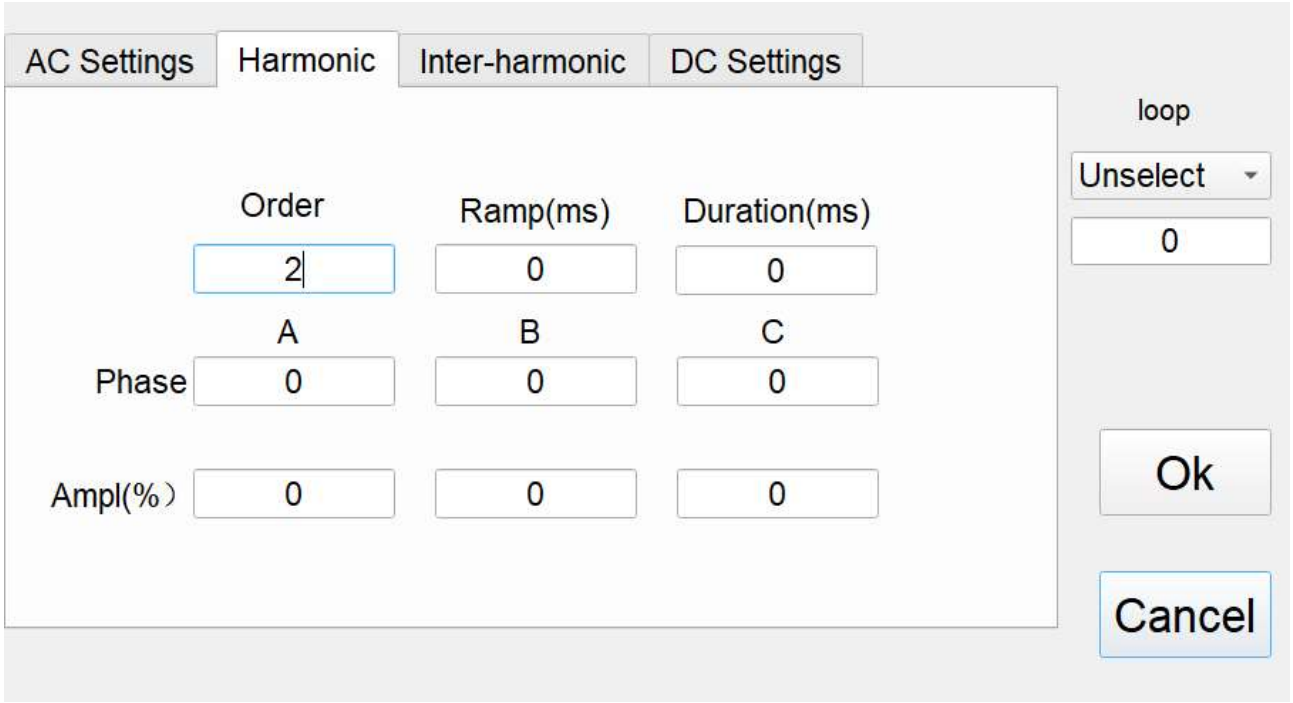

Figure 5-5-4-4 List Mode ------ Harmonic

5.5.4.3 List Mode ------ Inter-harmonic

After clicking the "INC" button, a new panel will pop up, Inter-harmonic as Figure 5-5-4-5. Firstly, set the basic operating parameters (such as output voltage, frequency, etc.) in the "AC Settings", then click "Inter-harmonic" to set the inter-harmonic parameters. Then click "Ok" to generate command.

Table 5-20

No.	Note	
1	Parameters can be set for each command	Freq (Hz): inter-harmonic frequency
		Ramp (ms): The ramp time to switch from the last step to the current step
		Duration (ms): Current step duration
		Phase A/B/C: inter-harmonic phase angle of phase A/B/C
		Ampl(%) A/B/C: inter-harmonic amplitude of phase A/B/C
2	CH1/2/3/4/5/6/7/8	Supports 8 different inter harmonic settings, and users can choose different settings according to testing requirements
3	Loop	**Unselect:** Indicates that the current instruction is only run once
		LOOPBegin: Indicates starting the loop from the current command. The number below represents the total number of cycles.
		LOOPEnd: Indicates the current command is the end of the loop. The number below represents the total number of cycles.
4	Ok	Click the "Ok" button to generate a new command
5	Cancel	Click the "Cancel" button to cancel

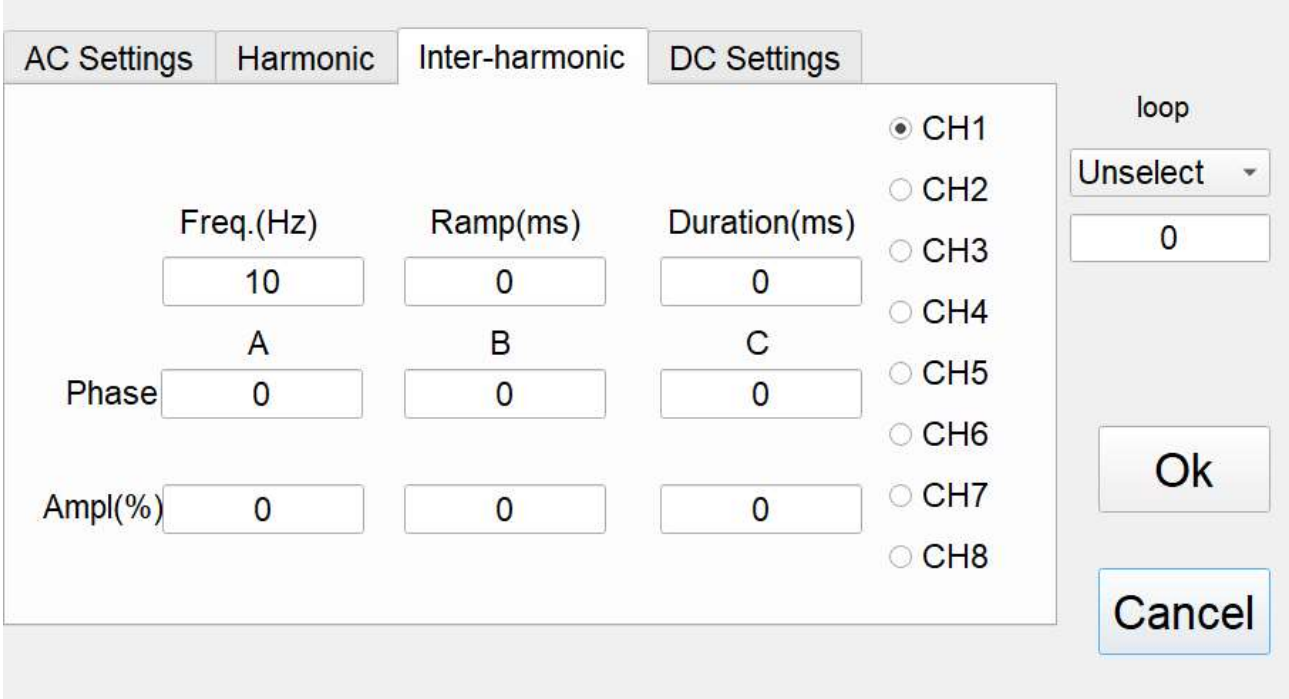

Figure 5-5-4-5 List Mode ------ Inter-harmonic

5.5.4.4 List Mode ------ DC Settings

After clicking the "INC" button, a new panel will pop up, DC Settings panel as Figure 5-5-4-6.

Table 5-21

No.	Note	
1	Parameters can be set for each command	CV.A/CV.B/CV.C(V): output voltage of channel A/B/C
		CC+(A): output current upper limit value
		CC-(A): output current lower limit value
		CP+(kW): output power upper limit value
		CP-(kW): output power lower limit value
		CR: Internal resistance value
		Ramp (ms): The ramp time to switch from the last step to the current step
		Duration (ms): Current step duration
2	Loop	**Unselect:** Indicates that the current instruction is only run once
		LOOPBegin: Indicates starting the loop from the current command. The number below represents the total number of cycles.
		LOOPEnd: Indicates the current command is the end of the loop. The number below represents the total number of cycles.
3	Ok	Click the "Ok" button to generate a new command
4	Cancel	Click the "Cancel" button to cancel

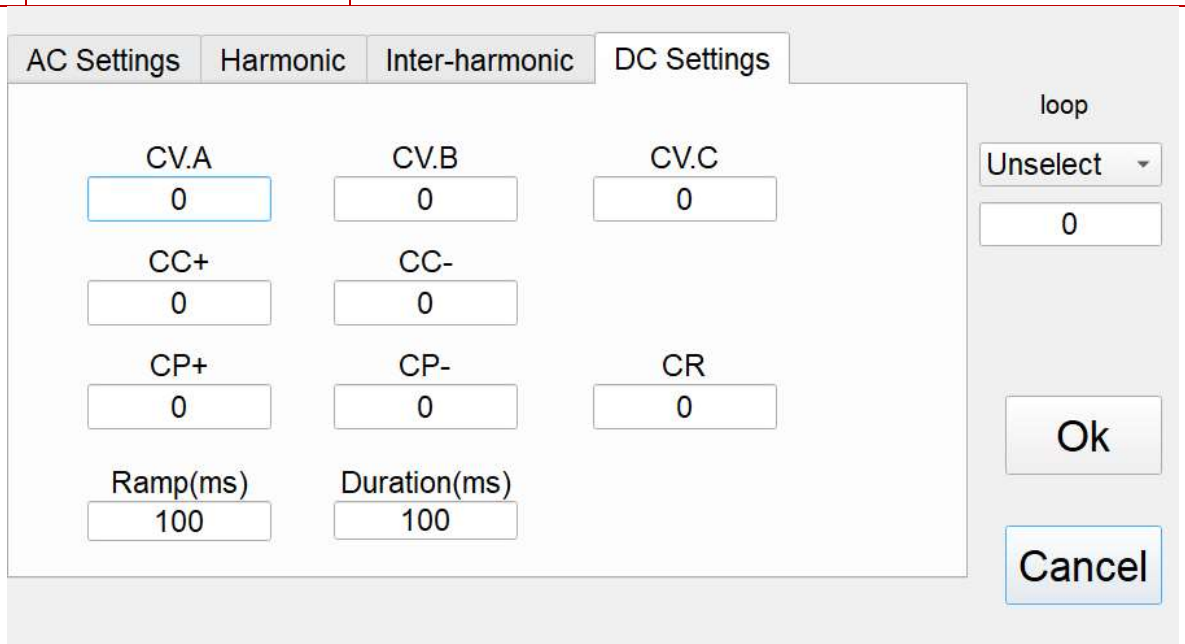

Figure 5-5-4-6 List Mode ------ DC Settings

5.6 Wave

Click the "WAVE" to enter the Show wave panel (real-time waveform browsing panel, Figure 5-6-1). The GUI software can monitor the real-time output three-phase voltage/current waveform and DC bus voltage waveform. Users can individually or simultaneously select the waveforms.

- UA/UB/UC: output voltage of phase A/B/C
- IA/IB/IC: output current of phase A/B/C
- Udc: DC bus voltage

Figure 5-6-1

5.7 State

Click "State" to enter the status query interface (Figure 5-7-1). User can view the running status and fault words on this panel.

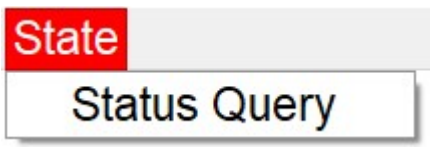

Figure 5-7-1

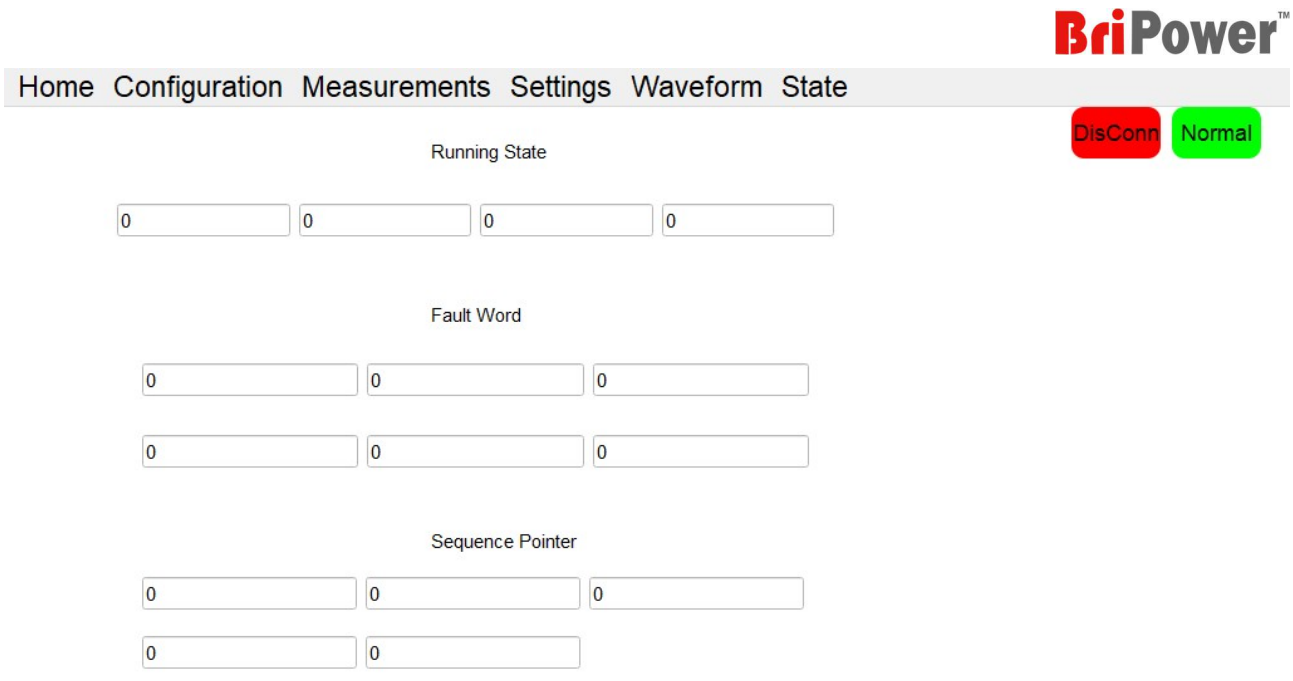
BriPower
Home Configuration Measurements Settings Waveform State
DisConn
Normal
Running State
0 0 0 0
Fault Word
0 0 0
0 0 0
Sequence Pointer
0 0 0
0 0

Figure 5-7-2

Chapter 6 Equipment Maintenance and Repair

6.1 Equipment Maintenance

Please note the maintenance environment of equipment. Bridge Technology has no liability for failures caused by breaking equipment rules.

6.1.1 Equipment Operating Environment

- The equipment is used indoors, and the operating temperature is not higher than 40 ° C and not lower than 0 ° C.
- The temperature of equipment storage is not higher than 85 ° C and not lower than -25 ° C.
- The equipment should be installed indoors with a maximum relative humidity of 20 to 90% RH (no condensation).
- To avoid corrosion of electrical components, the equipment should be isolated from harmful gases such as acids and alkalis which damages the insulation.
- No violent vibrations and shocks during equipment installation.
- The equipment should be kept away from flammable and explosive substances.
- There should be no strong electromagnetic field interference around the equipment.

6.1.2 Equipment maintenance

- No dust accumulation on the equipment and the ground must be clean.
- Cleaning: To prevent dust or moisture which affects the performance of the equipment, keep the surface clean and dry. Please use a soft, lint-free cleaning cloth to clean the outside. Do not use any cleaner.

6.2 Equipment Repair

Please note the maintenance environment of equipment. Bridge Technology has no liability for failures caused by breaking equipment rules.

6.2.1 Equipment Self-Test

- Whether inlet/outlet and terminal block of the equipment are connected.
- Whether inlet/outlet lines of the equipment are damaged or exposed, and with good insulation.
- Whether the ground wire is good, no looseness, and not overlapping with other metals.
- Whether it sounds normal or not excessively heated of the wiring when the equipment is running.

CAUTIOUS

Do not disassemble the equipment. If there is any problem, please contact the agent or Bridge Technology. Bridge Technology has no liability for equipment failure caused by self-assembly.

6.2.2 Maintenance Service

If the purchased equipment failure during the warranty period, Bridge Technology will repair the equipment according to the specific information provided by the customer.

6.2.3 Equipment Returns

If the failure is confirmed by itself rather than the connection problem, please return the power supply to Bridge Technology to repair.

- Please attach a note to the packing, indicating the specific description of the failure, model, and owner of the power supply.
- Please place the power supply in the original load carriers, properly fill the cushioning material, and ensure that the packing box is firm.

Chapter 7 Programming

7.1 Command Format

The parameter data types, parameters and the value range and formats of the programming commands are introduced in this Chapter. The user shall carefully read the content before developing the control operations.

7.1.1 Parameters Data Type

No.	Parameters Data Type	Effective Parameters
1	**<boolean>**	1 or 0
2	**<NRf1...n>**	Floating Point, 0/positive/negative floating points
3	**<NRf>**	Floating Point, 0/positive/negative floating points
4	**<string>**	Character strings

7.1.2 Command Parameters/Return Valve Units

No.	Physical Qty.	Unit
1	**Voltage**	V (Volt)
2	**Current**	A (Ampere)
3	**Active Power**	KW (Kilowatt)
4	**Reactive Power**	KVA (Kilovolt-ampere)
5	**Time**	mS (Millisecond)

7.1.3 Command Format

The command set of the ZGX series are divided into the following two command formats:

- **<*>command characters<?>**

  e.g., *IDN? or Remote?

- **Command characters_<value>**

  e.g., POWER 1 or SET: VOLT 100.0

7.2 Command Sets

The parameter data types, parameters and the value range and formats of the programming commands are introduced in this Chapter. The user shall carefully read the content before developing the control operations.

(1) Common Commands

Commands	Return Value	Description
*IDN	“BriPower, ZGX15”	Return the information of equipment
*RST	None	Fault Reset
*FAULT?	No Faults: “NULL” Faulty: “Fault Code”	
POWER	ON/OFF	Turn ON/OFF the switch of grid side.
OUTPUT	ON/OFF	Enable/Disable the output of power supply
MODE:SRC	0/1/2	0: STD 1: SEQ 2: ATI
MODE:ACDC	0/1/2	0: AC 1: AC+DC 2: DC
MODE:VCL	0/1/2	0: CV 1: CC 2: E-LOAD Mode
MODE:CF	0/1	1: Enable CF setting value 0: Block CF settings
MODE:LD	1/2/4/8	1: CC 2: CP 4: CR 8: CE/RLC
RLC:SEL	1~16	When simulating RLC/RCD loads, the circuit topologies can be selected
STAT:POWER?	1/0	Return status of switch of grid side 1: ON 0: OFF
STAT:OUPUT?	1/0	Return status of output of power supply 1: ON 0: OFF
STAT:FAULT?	1/0	1: Faulty 0: No Faults
STAT: READY?	1/0	1: Standby 0: Not Standby
PARA:OCP <NRf>	<NRf>	Set the value of Over Current Protection
PARA:OVP <NRf>	<NRf>	Set the value of Over Voltage Protection

PARA:OLP <NRf>	<NRf>	Set the undervoltage protection value, used in E-LOAD mode
PARA:ILIM <NRf>	<NRf>	Set the limit value of output current
PARA:URAMP	<NRf>	Set the ramp rate of output voltage, used in STD mode
PARA:IRAMP <NRf>	<NRf>	Set the ramp rate of output current, used in STD mode

(2) Measurements Commands

Commands	Return Value	Description
MEAS:HEART?	<NRf>	
MEAS:UA?	<NRf>	RMS AC output voltage of phase A. Unit: V
MEAS:UB?	<NRf>	RMS AC output voltage of phase B. Unit: V
MEAS:UC?	<NRf>	RMS AC output voltage of phase C. Unit: V
MEAS:IA?	<NRf>	RMS AC output current of phase A. Unit: A
MEAS:IB?	<NRf>	RMS AC output current of phase B. Unit: A
MEAS:IC?	<NRf>	RMS AC output current of phase C. Unit: A
MEAS:PA?	<NRf>	Output power of phase A. Unit: kW
MEAS:PB?	<NRf>	Output power of phase B. Unit: kW
MEAS:PC?	<NRf>	Output power of phase C. Unit: kW
MEAS:URA?	<NRf>	Remote sense output voltage of phase A. Unit: V
MEAS:URB?	<NRf>	Remote sense output voltage of phase B. Unit: V
MEAS:URC?	<NRf>	Remote sense output voltage of phase C. Unit: V
MEAS:FREQA?	<NRf>	Output frequency of phase A. Unit: Hz
MEAS:FREQB?	<NRf>	Output frequency of phase B. Unit: Hz
MEAS:FREQC?	<NRf>	Output frequency of phase C. Unit: Hz
MEAS:OUTP?	<NRf>	Total output power. Unit: kW
MEAS:OUTQ?	<NRf>	Total output reactive power. Unit: kvar
MEAS:VDCA?	<NRf>	DC output voltage of phase A (channel A). Unit: V
MEAS:VDCB?	<NRf>	DC output voltage of phase B (channel B). Unit: V
MEAS:VDCC?	<NRf>	DC output voltage of phase C (channel C). Unit: V
MEAS:IDCA?	<NRf>	DC output voltage of phase A (channel A). Unit: V
MEAS:IDCB?	<NRf>	DC output voltage of phase B (channel B). Unit: V
MEAS:IDCC?	<NRf>	DC output voltage of phase C (channel C). Unit: V

(3) AC Settings Commands

Commands	Return Value	Description
ACSET:FREQ	0~1000.00	Set the output frequency
ACSET:UA	<NRf>	Set the output voltage of phase A. Unit: V
ACSET:UB	<NRf>	Set the output voltage of phase B. Unit: V
ACSET:UC	<NRf>	Set the output voltage of phase C. Unit: V
ACSET:PHASEA	<NRf>	Set the phase angle of phase A. Unit: °
ACSET:PHASEB	<NRf>	Set the phase angle of phase B. Unit: °
ACSET:PHASEC	<NRf>	Set the phase angle of phase C. Unit: °
ACSET:ILIMA	<NRf>	Set the output current limit value of phase A. Unit: A
ACSET:ILIMB	<NRf>	Set the output current limit value of phase B. Unit: A
ACSET:ILIMC	<NRf>	Set the output current limit value of phase C. Unit: A
ACSET:PLIMA	<NRf>	Set the output power limit value of phase A. Unit: kW
ACSET:PLIMB	<NRf>	Set the output power limit value of phase B. Unit: kW
ACSET:PLIMC	<NRf>	Set the output power limit value of phase C. Unit: kW
ACSET:OFFSETA	<NRf>	Set the DC offset voltage of phase A. Unit: V
ACSET:OFFSETB	<NRf>	Set the DC offset voltage of phase B. Unit: V
ACSET:OFFSETC	<NRf>	Set the DC offset voltage of phase C. Unit: V
ACSET:XL	0~50000	Set the internal inductance. Unit: uH
ACSET:XR	0~50000	Set the internal resistance. Unit: mΩ

(4) DC Settings Commands

Commands	Return Value	Description
DCSET#:U	<NRf>	Set the DC output voltage. Unit: V
DCSET#:I+	<NRf>	Set the DC output positive current limit value. Unit: A
DCSET#:I-	<NRf>	Set the DC output negative current limit value. Unit: A
DCSET#:P+	<NRf>	Set the DC output positive power limit value. Unit: kW
DCSET#:P-	<NRf>	Set the DC output negative power limit value. Unit: kW
DCSET#:R	<NRf>	Set the output internal resistance. Unit: Ω

Note: "#=0" represents phase A. "#=1" represents phase B. "#=2" represents phase C.

(5) CF Settings Commands

Commands	Return Value	Description
CF:A	1.414~5	Set the CF value of phase A
CF:B	1.414~5	Set the CF value of phase B
CF:C	1.414~5	Set the CF value of phase C

(6) CE Settings Commands (E-LOAD RLC/RCD Mode)

Commands	Return Value	Description
CE#:R	0.1~5000 Ω	
CE#:L	1~50000 uH	
CE#:C	1~50000 uF	
CE#:R2	0.1~5000 Ω	
CE#:R3	0.1~5000 Ω	

Note: "#=0" represents phase A. "#=1" represents phase B. "#=2" represents phase C.

(7) Harmonic Settings Commands

Commands	Return Value	Description
HARM###:KA	<NRf>	Set the harmonic content of phase A. Unit: %
HARM###:KB	<NRf>	Set the harmonic content of phase B. Unit: %
HARM###:KC	<NRf>	Set the harmonic content of phase C. Unit: %
HARM###:PHASEA	<NRf>	Set the harmonic phase angle of phase A. Unit: °
HARM###:PHASEB	<NRf>	Set the harmonic phase angle of phase B. Unit: °
HARM###:PHASEC	<NRf>	Set the harmonic phase angle of phase C. Unit: °

Note: "###=002~100" represents 2rd~100th harmonics.

(8) Inter-Harmonic Settings Commands

Commands	Return Value	Description
IHARM#:FREQ	0~5000.00	Set the inter-harmonic frequency
IHARM#:KA	<NRf>	Set the inter-harmonic content of phase A. Unit: %
IHARM#:KB	<NRf>	Set the inter-harmonic content of phase B. Unit: %

IHARM#:KC	<NRf>	Set the inter-harmonic content of phase C. Unit: %
IHARM#:PHASEA	<NRf>	Set the inter-harmonic phase angle of phase A. Unit: °
IHARM#:PHASEB	<NRf>	Set the inter-harmonic phase angle of phase B. Unit: °
IHARM#:PHASEC	<NRf>	Set the inter-harmonic phase angle of phase C. Unit: °

Note: "#=0~7" represents the channels of inter-harmonic.

(9) LIST Mode Settings Commands

Commands	Return Value	Description
LIST:CMD EXE		Execution Sequence
LIST:CMD CLS		Reset Sequence
LIST:CMD DEL		Delete Sequence
LIST:COUNT?		Query how many sequences are set
LIST:RUN?		Queries the number of times the EXE command has been executed.
LIST:DATA001?		Query the first row of sequence data
LIST:DATAXXX?		Query the XXXth row of sequence data

7.3 Examples

(1) Set the AC output (up to 100 steps can be set)

- **Commands:**

  LIST:DATA001 AMP 220,220,220;PHASE 0,-120,-240;FREQ 50;OFFSET 0,0,0;RAMP 1000;Duration 1000;

- **Description:**

  Set three-phase voltage of 220V L-N, phase angles of 0, -120 °, -240 °, and frequency of 50Hz. The DC offset is 0V, with the Ramp time of 1 second, the duration of 1 second.

(2) Set the DC output

- **Commands:**

  LIST:DATA001 DCV 100,200,300;DCC 10,5;DCP 1.5,2.0;DCR 0;RAMP 1000;Duration 1000;

- **Description:**

  Set the DC voltage of phase A to 100V, DC voltage of phase B to 200V, and DC voltage of phase C to 300V; Positive current limit of 10A, negative current limit of 5A, positive power limit of 1.5kW, negative power limit of 2kW, internal resistance of 0 ohms.

(3) Set the Harmonic

- **Commands:**

  LIST:DATA001 HARM 5; PHASE 0,0,0;AMP 30,30,30;RAMP 1000;Duration 1000;

- **Description:**

  Set the 5th harmonic, 30% for phase A, 30% for phase B, and 30% for phase C. Ramp time 1000ms, duration 1000ms. To achieve the effect of harmonic gradually increasing or decreasing.

(4) Set the Inter-Harmonic

- **Commands:**

  LIST:DATA001 IHARM 0; FREQ 100;PHASE 0,0,0;AMP 30,30,30;RAMP 100;Duration 100;

  LIST:DATA002 IHARM 0; FREQ 5000;PHASE 0,0,0;AMP 30,30,30;RAMP 50000;Duration 1000;

- **Description:**

  Set two steps to achieve inter harmonic frequency sweep.

  Step 1: Set channel 1, with inter-harmonic frequency of 100Hz and each phase's content of 30%;

  Step 2: Set the inter harmonic frequency changes from 100Hz to 5000Hz in 50s.

(5) Set the start of the loop (LOOPB)

- **Commands:**

  LIST:DATA001 LOOPB; DCV 100,100,100;DCC 10,10;DCP 10,10;DCR 0;RAMP 1000;Duration 1000

- **Description:**

  Set the loop starts.

(6) Set the end of the loop and the number of loops (LOOPE)

- **Commands 1:**

  LIST:DATA003 LOOPE 5; DCV 50,50,50;DCC 10,10;DCP 10,10;DCR 0;RAMP 1000;Duration 1000

- **Description 1:**

  After the sequence execution ends at 3, it will return to the sequence marked with LOOPB and repeat 5 times

- **Commands 2:**

  LIST:DATA001 LOOPB;AMP 220,220,220;PHASE 0,-120,-240;FREQ 50;RAMP 1000;Duration 1000;

  LIST:DATA002 AMP 0,0,0;PHASE 0,-120,-240;FREQ 50;RAMP 0;Duration 200;

  LIST:DATA003 AMP 220,220,220;PHASE 0,-120,-240;FREQ 50;RAMP 0;Duration 2000;

  LIST:DATA004 AMP 110,110,110;PHASE 0,-120,-240;FREQ 50;RAMP 0;Duration 500;

  LIST:DATA005 LOOPE 9; AMP 220,220,220;PHASE 0,-120,-240;FREQ 50;RAMP 0;Duration 2000;

- **Description 2:**

  5 steps simulate a voltage drop to 0, recovery, then a drop to 50%, then recovery, using a cyclic command to achieve repeat execution 10 times.

* **Note:** Can be set to loop 50000 times. And it supports nested loops, up to 16 layers.

(7) Jump to next step when the phase angle is XXX degrees (COND_PHASE1, COND_PHASE2, COND_PHASE3)

- **Commands:**

  LIST:DATA001 AMP 220,220,220;PHASE 0,-120,-240;FREQ 50;OFFSET 0,0,0;RAMP 1000;Duration 1000;

  COND_PHASE1 90;

- **Description:**

  Set to jump to the next step when the phase angle of phase A is 90°.

(8) When setting the AC sequence, user need to add the mode identification when choose the CC/CP/CR mode in load mode.

- **Commands:**

  LIST:DATA001 CC;AMP 10,10,10;PHASE 0,0,0;RAMP 1000;Duration 1000;

  LIST:DATA001 CP;AMP 5,5,5;PHASE 0,0,0;RAMP 1000;Duration 1000;

  LIST:DATA001 CR;AMP 20,20,20; RAMP 1000;Duration 1000;

- **Description:**

  When setting the AC sequence, user need to add the mode identification when choose the CC/CP/CR mode in load mode.

* **Note:** If the mode identification in the steps does not match the mode in the HOME - MODE, the parameters set by the sequence will not be executed.

(9) Set the Ramp Time

- **Commands:**

  Ramp 100;

- **Description:**

  Set the Ramp Time to 100ms

(10) Set the Duration Time

- **Commands:**

  Duration 100;

- **Description:**

  Set the Duration Time to 100ms

(11) Output enable identification (OUTEN)

- **Commands:**

  OUTEN 0/1;

- **Description:**

  Set the output enable 0 or 1; if the output enable is 0 when the current step is executed, the output pulse will be blocked.

* **Note:** It will effective only when " Enable Phase-shifting" is checked in the “Configuration” – “System”.

(12) Query information

*IDN

BriPower, ZGX15

(13) Set the protection value

PARA:OVP 300

PARA:OVP?

300.00

PARA:OCP 225

PARA:OCP?

225.00

(14) Set the hardware limits value

PARA:ILIM 30

PARA:ILIM?

30.00

(15) Check status

STAT:FAULT?

0 //No faults

STAT:READY?

1 //the unit is in standby status

STAT?

0 0 0 1

(16) Inquire Measurements

MEAS:UA?;MEAS:UB?;MEAS:UC?

220.00; 220.00;220.00;

(17) Power on in standard mode

MODE:VCL 0

MODE:SRC 0

STAT:READY?

1

ACSET 50,220,220,220,0,-120,-240,30,30,30,5,5,5,0,0

POWER ON

STAT:POWER?

1

OUTPUT ON

STAT:OUTPUT?

1

MEAS:UA?

220.00

(18) Power on in sequence mode

MODE:VCL 0

MODE:SRC 1

STAT:READY?

1

LIST:CMD CLS *// Clear the sequence commands that may be executing normally*

LIST:CMD DEL *// Delet the previously set sequence commands*

LIST:DATA001 AMP 220,220,220;PHASE 0,-120,-240;FREQ 50;OFFSET 0,0,0;RAMP 1000;Duration 1000;

LIST:DATA002 AMP 110,110,110;PHASE 0,-120,-240;FREQ 50;OFFSET 0,0,0;RAMP 1000;Duration 1000;

LIST:COUNT? *// Queries how many sequences are currently set*

2

LIST:CMD EXE *// Execute the sequence, if the output is not started, wait for the output to start before starting execution*

POWER ON *//Power on*

```
STAT:POWER?          // Check if the power on is successful
        1
OUTPUT ON            // Output on
STAT:OUTPUT?         // Check if the output on is successful
    1
 MEAS:UA?            // Query the voltage measurement of phase A
    220.00
 MEAS:UA?
    110.00
```