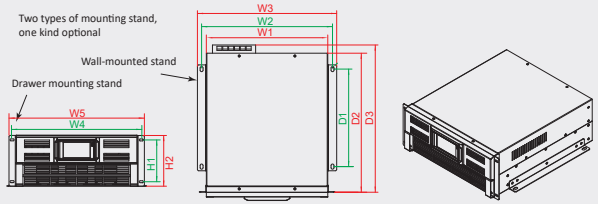
Fastron
Electronics

Fast One

Fastron SVG series

Instruction Manual for Static Var Generator

Alternative selection of LCD



Fastron Electronics
Fast One

Precautions before use

Safety Precautions
This manual deals with the installation and use of SVG equipment. Please make sure to read this manual before installation.
Warning – current leakage
Before connecting the input power, ground the SVG device reliably. The grounding of the device must comply with the electrical code.
User-maintainable device
All internal maintenance and repair work on SVG equipment requires the use of professional tools and should be performed by personnel who have received relevant professional training. All devices that require professional tools to open the protective cover are user-unmaintainable devices. The equipment fully meets the safety requirements of the equipment in the operating area. Components with hazardous voltages can only be accessed after the protective cover is opened, and non-maintenance personnel cannot reach it. If you follow the general rules and follow the procedures recommended in this manual, there will be no danger.
Dust Care
Select whether to install the air filter according to the site environment. If the dust is large, install it. If you install an air filter, clean the air filter regularly to ensure smooth ventilation. The recommended cleaning frequency is 1 time per month.

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1. Stand-alone system

1.1 Introduction

Because each site where the equipment is installed has its own particularity, the installation steps are not described here in detail and only for the installation personnel to provide guidance of the general installation steps and methods, the specific installation by the installation staff according to the specific circumstances of the site selection, wiring and other processing.

1.2 initial inspections

Before the installation, you need to check the following:

(1). visually inspect the exterior of the SVG equipment for shipping damage. If it is damaged, notify the carrier immediately.

(2). Check the equipment label attached to the side wall of the SVG equipment. The label indicates the model number and other major parameters of the product to confirm the correctness of the equipment.

1.3 Installation position

This equipment is designed for indoor installation and needs to be installed in a clean and ventilated environment. If the temperature is high in the summer, it is necessary to install an indoor exhaust fan to prevent the room temperature from increasing and cause the equipment to malfunction. In an environment with more dust, an air filter should be installed to ensure that the dust level and ambient temperature meet the specifications of the product. The inside of the device is provided with a forced air cooling by a fan. The cold air must enter the SVG device through the front grille of the device. The hot air is excluded from the rear air grille. Do not block the air inlet and outlet of the device.

Note:

If the equipment is installed in a standard cabinet, select cabinets that can be ventilated both at the front and rear doors.

If you do not need to install the equipment immediately, you need to store the equipment indoors to prevent unnecessary loss due to high humidity or excessive temperature.

In order to extend the service life of the equipment, the installation location of the equipment should be guaranteed:

There is enough space for operation and wiring is convenient;

Good ventilation, meet the heat dissipation requirements;

No corrosive gas around, no over-humid and high temperature source;

Non-dutiful environment;

Meets fire protection requirements.

1.4 Installing Power Cables

Warning - Professional Installation

The operation of the equipment must be installed by qualified professional engineers according to the instructions in this manual.

Warning

Before wiring the equipment, make sure that the switch between the input power supply and the mains power distribution of the equipment is in a disconnected state. At the same time, an eye-catching warning sign should be made at this switch to prevent others from operating the switch.

When wiring the equipment design, the environmental conditions should be taken into account while following the instructions in this section and the electrical wiring regulations. Before connecting the power cables (A, B, C, N), make sure that the equipment is reliably grounded (PE wire). Failure to ground as required may cause electromagnetic interference, which may result in serious electric shock and fire hazard.

Table 1.1 Wiring Cable Requirements

Voltage level 380V±20%									
Rated current / capacity	25A	50A	75A	100A	150A	200A	250A	300A	350
Copper wire diameter mm2	10	16	35	50	70	95	120	150	185

Note: APF is rated in current units and SVG is in kvar units. Conversion relationship 1kvar≈1.5A.

Note:
(1). the current of the neutral cable may exceed the rated current, normally that is 1.732In. The system is designed according to 3In;
(2). Protection ground wire: The shortest wiring path must be used when connecting the cabinet and the main grounding system. The cross-sectional area of the ground wire should be selected according to the AC power failure level, cable length, and type of protection. According to AS/IEC 60950-1, 50ASVG, the cross-sectional area of the equipment can be taken as 16mm2; after the equipment is fully positioned, connect the power cord according to the following steps:
(1). Make sure that all input switches of the equipment are completely disconnected, and warning signs are placed on these switches, so as to prevent others to operate on the switch;
(2) open the safety cover of the device, showing the power terminals;
(3). First, connect the PE terminal of the grounding point of the equipment to the protection ground of the system, and then connect all other phase wires.
Note: The ground wire and midline wire connections must comply with local and national regulations.
(4). Reassemble the safety cover after wiring.
1.5 Installation of transformer cable
The transformer input terminals are located at the terminals of the equipment. Refer to Chapter 3 Installation Wiring Diagrams for wiring terminal locations. The secondary side of the transformer should be connected to the terminals provided by the equipment in order. The equipment has a definite requirement for the direction of the transformer. For details, please refer to the sixth chapter of the first parts of the current transformer.
(1). When using a stand-alone system, the position of the transformer can be selected as the load side or the Electricity grid side, and the load point of the transformer is positive, as shown in Figure 1.2;
(2). When using a parallel system, the transformer position can only be installed on the load side. If the load side does not allow, you can use two sets of transformers to separately detect the Electricity grid and equipment output to synthesize the load-side current vector. For details, see Chapter 6 Options, Section 1 Current Transformers.

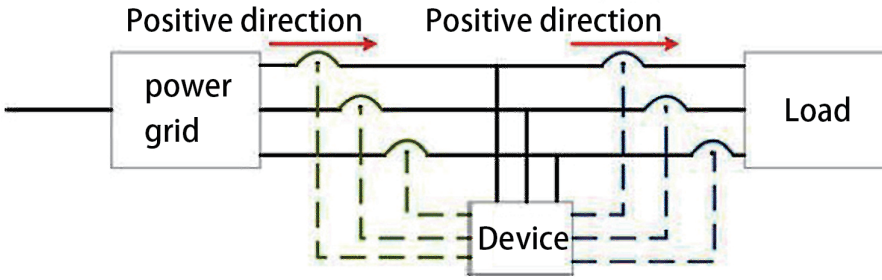


Figure 1.2 diagram of the direction of mutual inductor

1.6 PC monitoring module wiring
Stand-alone systems may require additional connections to enable devices to communicate with personal computers, or remotely control functions, depending on the specific requirements of different sites. These functions can be accomplished through a user communication interface (RS485) located on the device´ s terminals. Refer to Chapter 3 Installation Wiring Diagrams for specific wiring terminal locations and wiring connections.

2. Parallel machine system

2.1 Overview

The installation of the parallel system should be performed according to the installation procedure of the stand-alone system and the requirements of this chapter.

2.2 Installation

The installation of the parallel system is basically the same as that of the stand-alone system. The following sections only describe the differences between the parallel system and the stand-alone system. Place the stand-alone units side by side, as shown in Figure 2.1. In theory, the number of SVG devices connected in parallel is not limited, but in practical applications, due to the accuracy of the detection circuit in the system and other aspects. In this case, the recommended number of customers to be connected in parallel is not more than 6 units, which can better coordinate the work between the SVGs.

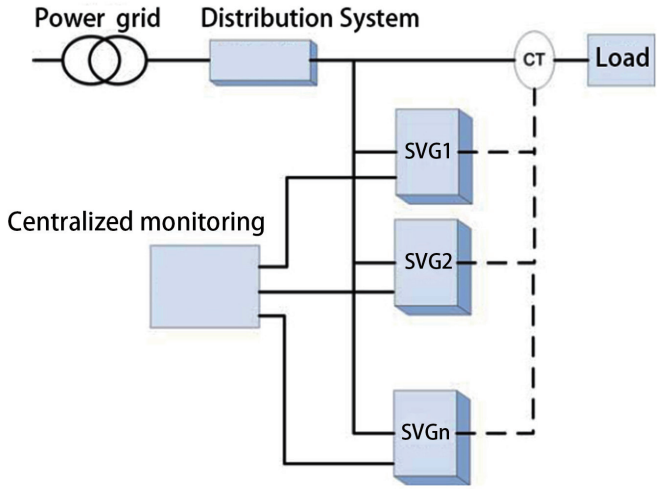


Figure 2.1 Parallel System Installation Diagram

2.3 Power cables and wiring

The power cable wiring is similar to that of the stand-alone system. The length and specifications of each stand-alone power cable should be the same.

Note

Pay attention to the wire diameter at the junction when wiring.

2.4 Parallel machine features

(1). The SVG module of the parallel system is exactly the same as the stand-alone system in terms of hardware and software, and the parallel machine number and local ID are set through a single HMI touch screen;

(2). each parallel module communicates with each other to coordinate work to ensure the best compensation effect;

(3). the connection of the parallel control cable is simple and improves the maintainability of the system;

(4). The transformer short-circuit terminal can be selected in the selection part to ensure that the module can be continuously and electrically disassembled in case of failure, so that the replacement and maintenance are convenient and fast.

2.5 Parallel machine requirements

A plurality of stand-alone system is connected in parallel to form a large active power filtering system. In order to ensure the same degree of use of each stand-alone system, the following requirements must be met when paralleling:

(1).All stand-alone machines must have the same capacity and use the same model of the same manufacturer;

(2). All stand-alone machines´ outputs are connected to a common output;

(3). Wiring must be in compliance with relevant regulations.

3. Installation wiring diagram

3.1 Overview

This section will detail the installation dimensions of the SVG module to facilitate the user´ s targeted fixed installation. At the same time, the installation terminals and wiring diagrams will be listed in detail.

3.2 Installation dimensions

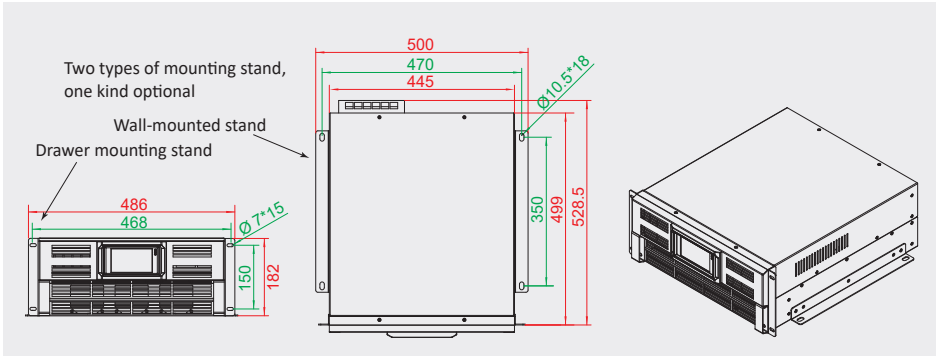


Figure 3.1 shows the 25kvar ,30kvar ,35kvar SVG Cabinet dimensions and mounting holes

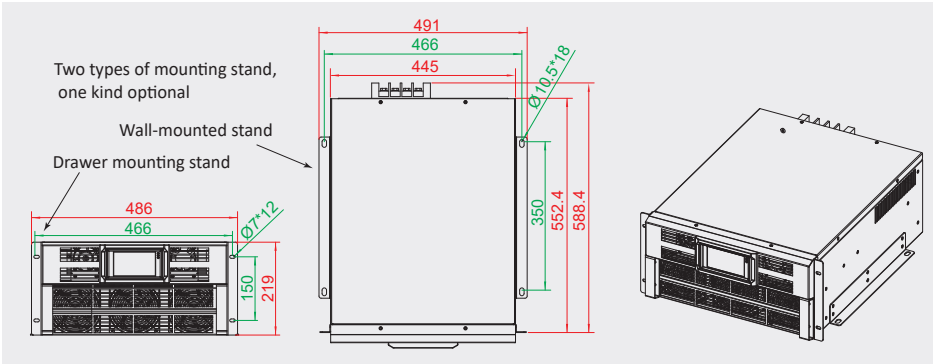


Figure 3.2 shows the 50kvar, 75kvar SVG Cabinet dimensions and mounting holes

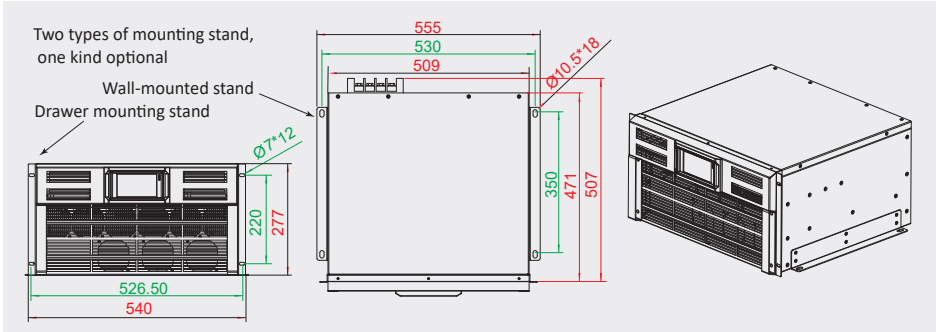


Figure 3.3 shows the 100kvar SVG Cabinet dimensions and mounting holes

3.3 wire installation

The power terminal protection cover should be removed from the device before connecting the power cable. After removing the power terminal protection cover, the 50A SVG terminal is shown in Figure 3.3.

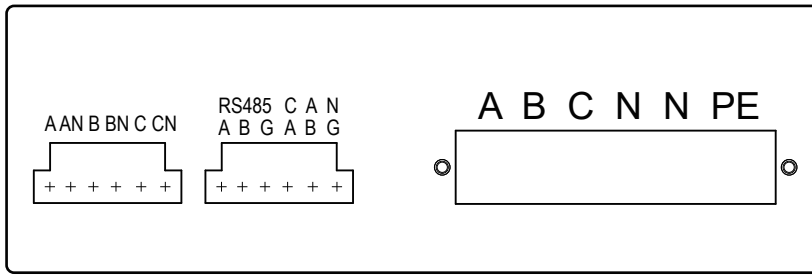
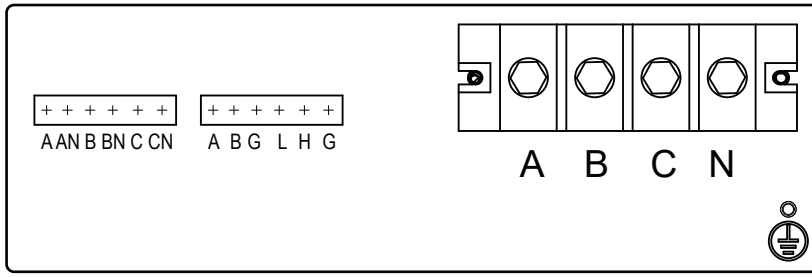


Figure 3.3 25kvar, 30kvar, 35kvar,SVG Terminal Blocks



50kvar, 75kvar, 100kvar, SVG Terminal Blocks

(1). RS485 communication terminal: It is convenient for users to use a computer to realize remote control when communicating with a computer. In the parallel system, this terminal is used for centralized monitoring of communications. According to the silk screen, RS485+(A), RS485-(B), GND are from left to right. RS485+(A) of all parallel modules in the parallel system is connected together, RS485-(B) is connected together, GND is connected together, and then it is connected with centralized monitoring;

(2). CAN communication is reserved during stand-alone operation. In a parallel system, this communication terminal is used for communication between modules and coordinates work to ensure maximum efficiency compensation. The CAN-H terminals of all the parallel modules in the parallel system are connected together, the CAN-L terminals are connected together, and the connection sequence is connected according to the screen printing;

(3). Warning

Before connecting the CT line, if there is a detection current passing through the middle of the transformer, it must be ensured that the output terminal of the transformer secondary side is shorted, and the secondary side of the transformer is not allowed to open to avoid personal injury.

The transformer terminal block is a 6-position terminal that is connected to the secondary output terminal of the external CT. The maximum allowable current is 5A. The corresponding meaning and wiring of the 6 connection points are shown in Table 3.1:

Identification	Description
A	Connected to S1 of phase A CT
AN	Connected to S2 of phase A CT
B	Connected to S1 of phase B CT
BN	Connected to S2 of phase B CT
C	Connected to S1 of phase C CT
CN	Connected to S2 of phase C CT

Table 3.1 Transformer Terminal List

For the specific installation of the external CT, please refer to Chapter 6, Option 1 Current Transformer;
(4). the rightmost side is the power connection terminal, from left to right:
A: Power grid Phase A input terminal
B:Power grid Phase B input terminal
C: Power grid Phase C output terminal
N: Neutral input (when considering three-phase four-wire, N-line current is more likely to exist, 50A module leaves 2 terminals)
E: the system grounding terminal, because the equipment is a metal shell, in order to prevent a personal safety accident, the system must be connected to the earth by this terminal before the system is opened.

4. Running and operation steps
4.1 Overview
The SVG module can be additionally equipped with a touch screen, which can be set through the touch screen. For specific set and operations, refer to Chapter 5 Operation Control Display Panel.
4.2 start-up and shutdown of equipment
Warning
After the equipment is installed, it must be commissioned by a professional engineer before closing the external power switch and performing the SVG startup procedure.
(1). Power on
Make sure that the power terminal´ s safety cover is tightened before closing the external power switch.
Warning
When the external input power switch is closed, the SVG output terminals are powered. If there is a load connected to the output terminal of the SVG device, check if the power supply to the load is safe. If the load is not yet ready to receive power, be sure to completely isolate the load from the SVG output terminals. After closing the switch between the power grid and the SVG device, the touch screen of the SVG device will be activated. After about 10 seconds, the SVG device will work normally.
(2). Shutdown
There are two ways to shut down, one is to directly disconnect the switch between the SVG equipment and the power grid, referred to as ″full shutdown mode″ , that is, there is no voltage at the output port of the SVG equipment. There is no electricity in the system. At this time, relevant maintenance work of the system can be performed.
Warning
In order to prevent personal injury, if the safety cover plate of the power connection terminal needs to be opened after the equipment is completely shut down for maintenance or other operations, use a multimeter to measure the voltage at the input terminal to ensure that power grid is connected before the relevant operations are carried out! If it is necessary to open the upper cover plate, please turn it off completely for 5 minutes before turning it on again after discharging the DC bus capacitor completely.
Another way is to operate the shutdown button on the touch screen interface. This shutdown mode only shuts down the operation of the power devices in the system, but because the system´ s DC bus and auxiliary power supply are still powered, therefore, the relevant control systems are in a ready state. Under this condition, no maintenance work is required for the whole equipment, so as to avoid adult injury.
4.3 Automatic Restart of the Device
After an abnormality in the outside world, the SVG device will automatically shut down, but it will not shut down completely, that is, the output of compensation current will be prohibited. When the abnormality is restored, the following conditions are met and the SVG device will restart automatically to restore the output without human intervention.
(1). Power grid voltage and frequency are all normal;
(2). the delay time for automatic start-up has arrived;
(3). There is no fault on the whole machine.
4.4 Automatic operation mode of equipment
When the SVG device is running in the manual operation mode, the device needs to be manually powered on for the first time since the device is powered on. The entire device has a self-starting function after self-recovery. It is only when the power is turned on for the first time. SVG equipment can also be set to automatic operation mode, that is, no matter when the whole machine is powered on, without any manual operation, the whole machine will start automatically. In this case, if you need to manually shut down, you need to change the whole operation mode to manual operation first, and then click the stop button to stop.

5. Operation Control Display Panel (Optional)

5.1 Introduction

The man-machine interface uses a touch screen to display voltage, current, fault information, operation shutdown information, Electricity grid current distortion rate, and power factor in real time. It also provides historical alarm record inquiries and provides a reliable basis for fault diagnosis. The user can perform corresponding operation commands through the touch screen display interface, such as querying historical fault information, querying spectrum charts, and so on.

5.2 The main interface

The main interface shows three-phase Electricity grid phase voltage, load current, compensation current, Electricity grid current, Electricity grid current THD, and power factor, as shown in Figure 5.1.

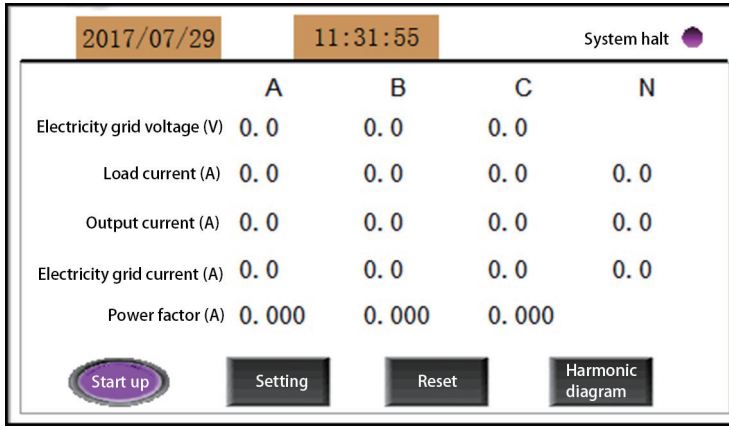


Figure 5.1 HMI main interface

There are 4 buttons, start button, setup button, reset button, and harmonic diagram button. The function description of each button is as follows:

Start Stop Button: This button is a status switchable button that shows the status of the operation.

Setup button: Set the function and parameters of the module.

Reset button: reset the fault.

Harmonic Chart Button: Electricity grid Current Harmonic Spectrum View Button

Start stop operation button: Click the start button, the interface as shown in Figure 5.2 will appear, click ″OK″, the whole machine starts. Click the stop button and the interface as shown in Figure 5.3 will be displayed. Click OK to stop the entire machine.

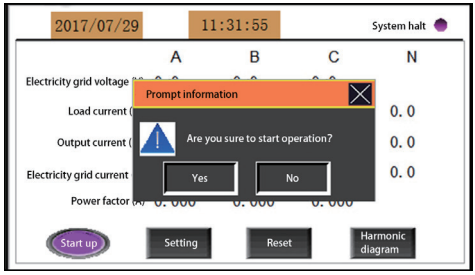


Figure 5.2 Click Start Button

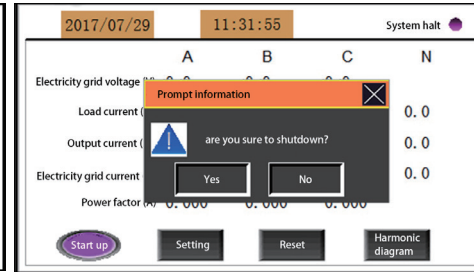


Figure 5.3 Click Stop Button

5.3 Setting interface

Clicking the setting button will show the interface shown in Figure 5.4. This interface contains four information: parameter setting, factory debugging, fault information and historical information.

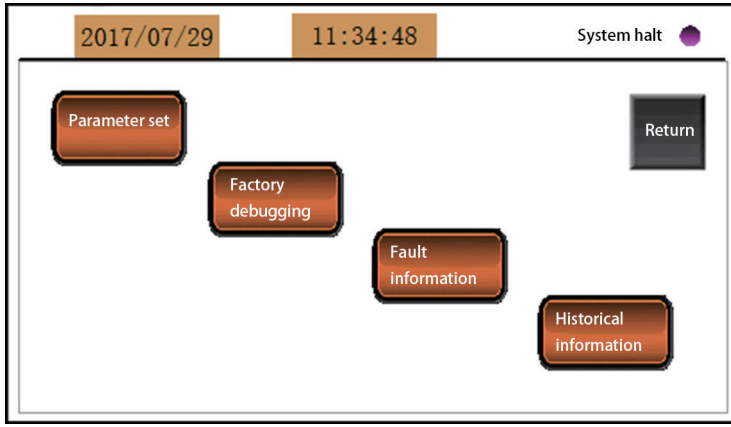


Figure 5.4 Set interface

5.3.1 Parameter Setting

Click the parameter setting button, the interface will display as shown in Figure 5.5 system parameter setting interface.

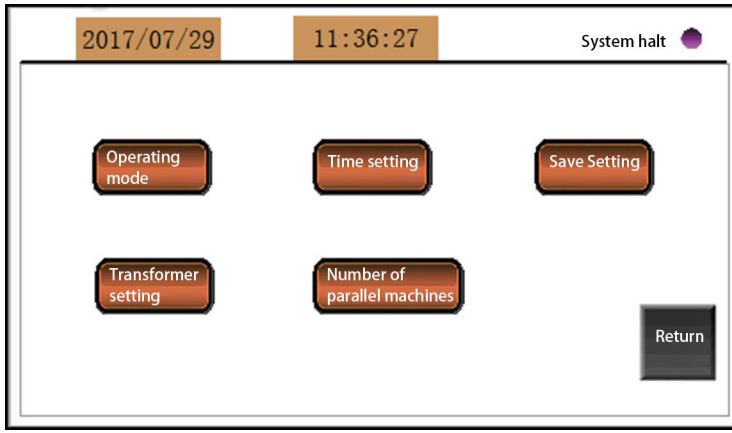


Figure 5.5 System Parameter Setting Screen

(1). Operation mode

Clicking the Run Mode button allows manual or automatic mode selection, as shown in Figure 5.6.

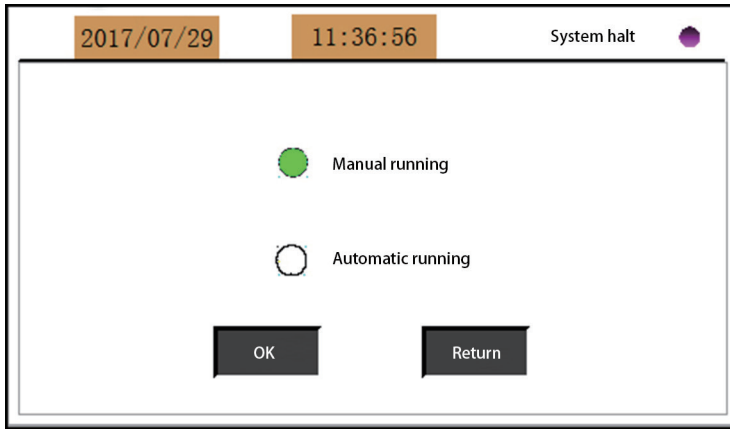


Figure 5.6 Operation Mode Setting Interface

(2). Time setting

Calibrate the display date and time.

(3). Save setting

Click the Save Set button to save the above four set. The device will use this saved parameter to run when it is powered on again.

(4). Transformer setting

Click on the transformer set button, the interface will appear as shown in Figure 5.7.

Set transformer ratio, transformer position and transformer installation method in this interface.

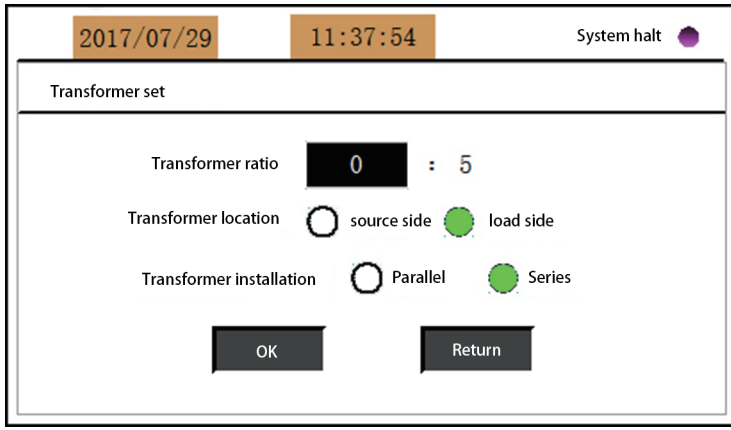


Figure 5.7 Transformer Setting Interface

(5). Number of parallel machines

Click the number of parallel machines and the interface will appear as shown in Figure 5.8.

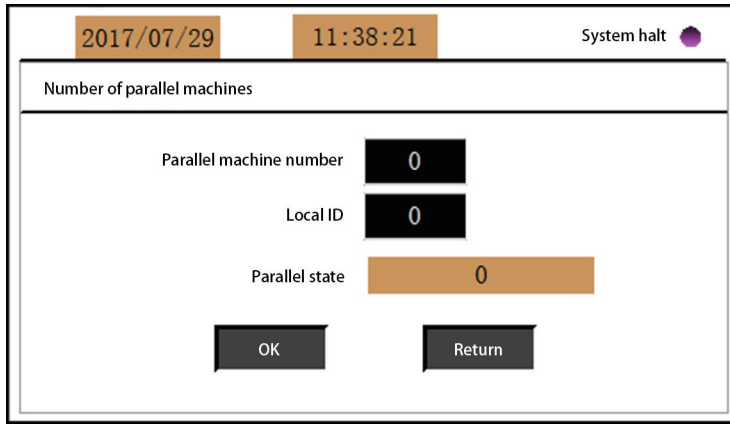


Figure 5.8 Parallel Set Interface

In this interface, set the number of parallel machines and configure the ID of the corresponding cabinet device.

5.3.2 Factory Debug Set

Non-professional engineers cannot operate the factory commissioning parameter entry.

5.3.3 Fault Information

Click the fault information button, the interface will display the current fault, as shown in Figure 5.9. When a fault occurs, the corresponding indicator will change from green to orange.

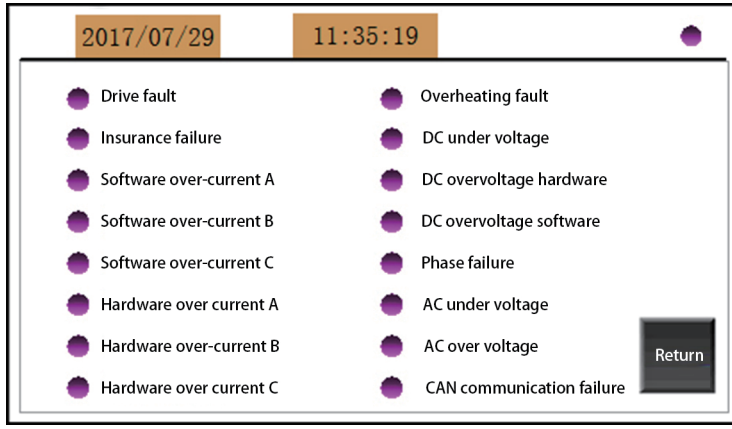


Figure 5.9 Fault Information Interface

Various fault information descriptions are listed in Table 5.1:

The type of fault	Description
Drive fault	The device cannot be restarted on its own due to a special cause of the system driver failure
Insurance fault	The device fuse is damaged and the device cannot be restored
Software overvoltage A\B\C	The output current of the corresponding phase of the equipment is greater than 1.2 times the rated current and can be restored on its own
Hardware over current A\B\C	The corresponding phase output current spike of the equipment is higher than a certain value and can be restored on its own
Overheating fault	Excessively high temperature IGBT die can recover itself
DC under voltage	DC bus under voltage fault can recover on its own
DC overvoltage software / hardware	The DC bus voltage is too high and it can recover on its own
Phase fault	The lack of input on the AC input terminal is not allowed to recover on its own
AC under voltage	AC input voltage less than 0.85 Un can recover on its own
AC overvoltage	If the AC input voltage is higher than 1.15 Un, it can be recovered by itself.
CAN communication fault	Communication failure between devices (used in parallel machine system) can be recovered by itself.

Table 5.1 List of Fault Information

Note

When the device has a drive failure or an insurance failure, contact the manufacturer or agent and do not operate it by you

5.3.4 Historical Information

Click the history information button, the interface will display as shown in Figure 5.10.

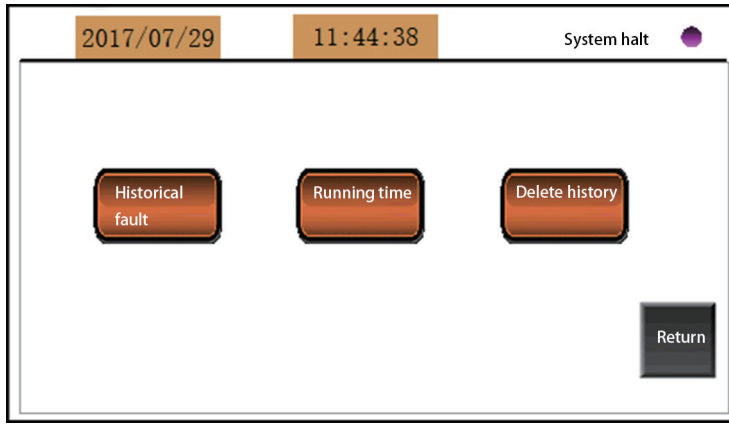


Figure 5.10 Historical Information Interface

(1) Click the historical fault button to query the latest 500 pieces of fault information in this interface. the fault information records the fault type and occurrence time so as to facilitate maintenance personnel to locate system faults and carry out corresponding maintenance. As shown in figure 5.11;

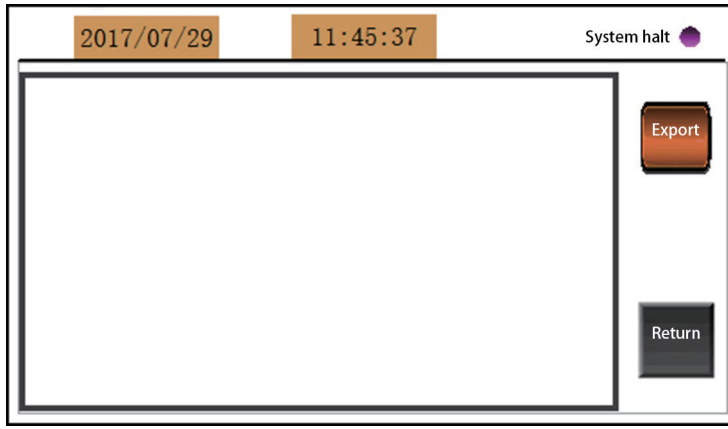


Figure 5.11 Historical fault record interface

Click the Run Time button to query the cumulative running time of the equipment and the continuous running time, as shown in Figure 5.12;

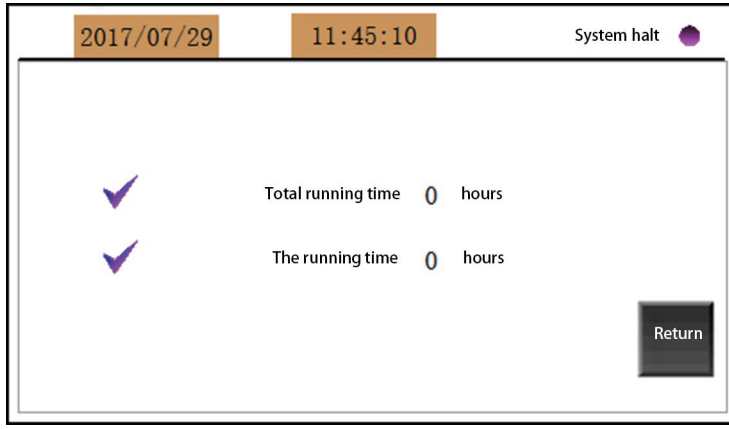


Figure 5.12 Device Running Time Statistics Interface

(3). Click the delete history information button to clear the history fault record.

5.4 Reset Operation

The reset only works when the device is stopped. The reset button is invalid at other times.

5.5 Spectrum Query

Click the Spectrum Query button. The interface as shown in Figure 5.13 will appear on the display interface. Through this interface, you can view the 3-25 harmonic content of the Electricity grid current in real time.

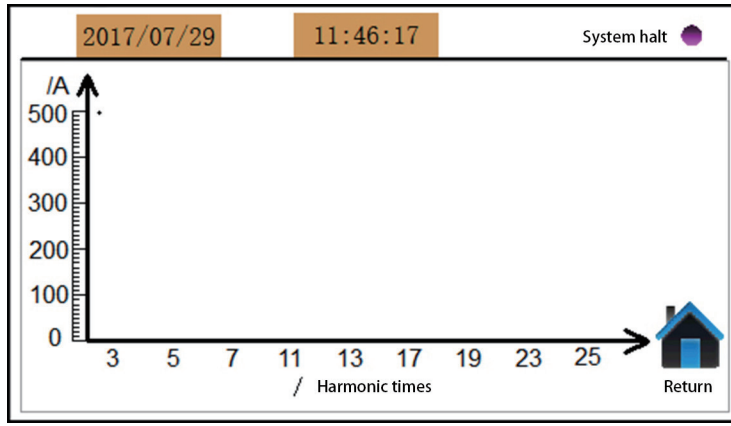


Figure 5.13 Spectrum display interface

6. Optional accessories

6.1 Current Transformers

As an extremely important external component, the current transformer plays a key role in the normal operation of the equipment, so the selection of the external current transformer is very important. In SVG equipment models, the external CT allows a minimum ratio of 100:5 and a maximum ratio of 5000:5. Between these two gears, the corresponding setting of the transformation ratio can be used according to the actually used CT, and the fitness degree is relatively wide.

6.1.1 Selection of Transformer

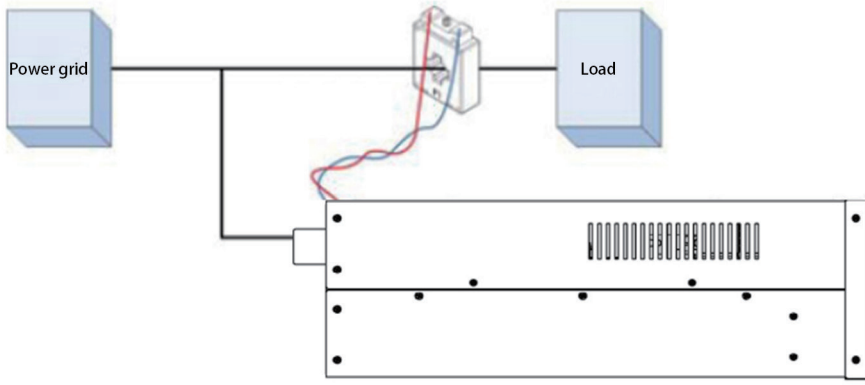
Customer Information

In the purchase of CT, it is the best to make corresponding choices according to the actual load capacity, and the margin can be appropriately left. This way, SVG equipment can perform harmonic compensation with higher accuracy to make the compensation effect more ideal. However, the CT ratio must be within the allowable range of the device. Before starting, check whether the CT ratio setting on the touch screen is consistent with the actual CT ratio of the external device. If they are inconsistent, the equipment will not work properly and will not achieve a certain compensation effect. The accuracy of the external transformer is above 0.2 (closed type) or 0.5 (open type). If a lower precision transformer is selected, the compensation accuracy and compensation effect of the equipment will be affected. External CT Three-phase four-wire system must use three transformers, which are installed on phase A, B and C respectively. In the three-phase three-wire system, at least two transformers should be used and installed in any two phases. This should be stated in advance with the manufacturer.

As an option, the current transformer can be either open or closed. The open CT is slightly more expensive, but it is easier to install. The installation of closed CT must be installed on the condition of client power failure.

6.1.2 Transformer wiring

The SVG device recommends that the external CT be connected to the load side, that is, the CT is installed between the SVG device and the load. The specific wiring is shown in Figure 6.1.



6.1 transformer load side schematic view of the installation

If the CT is installed on the load side but there is a large capacitor on the load side, the following three installation options are available, as shown in Figure 6.2, Figure 6.3 and Figure 6.4.

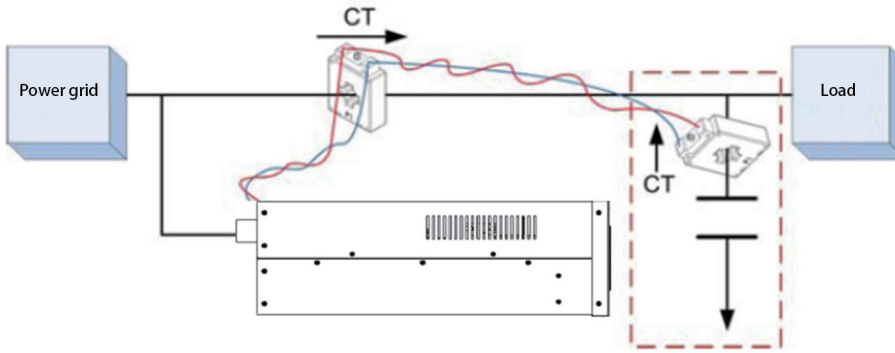


Figure 6.2 load side has large capacitor, transformer installation load side mode 1

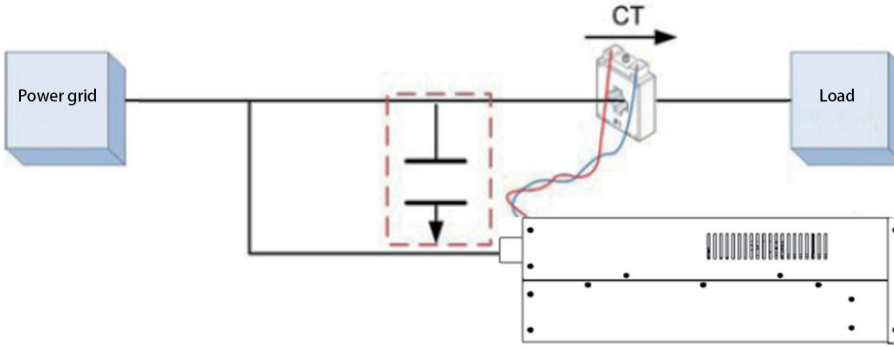


Figure 6.3 load side has large capacitor, transformer installation load side mode 2

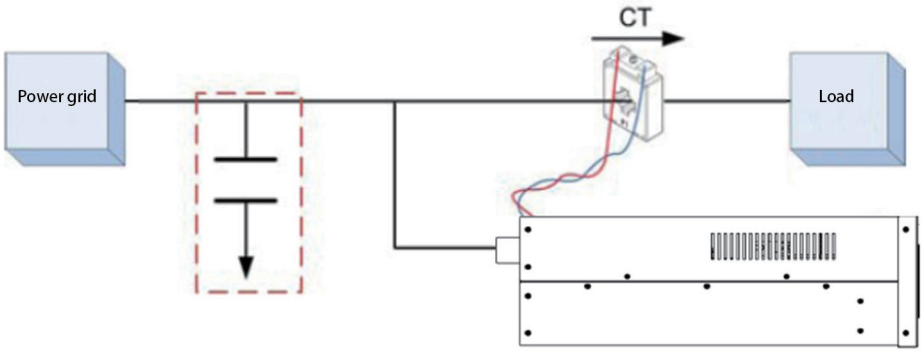


Figure 6.4 load side has large capacitor, transformer installation load side mode 3

If the user side cannot install the CT conveniently on the load side, three CTs can be installed on the three phases of the source side A, B, and C, as shown in Figure 6.5. The direction of the arrow is the positive direction of the transformer.

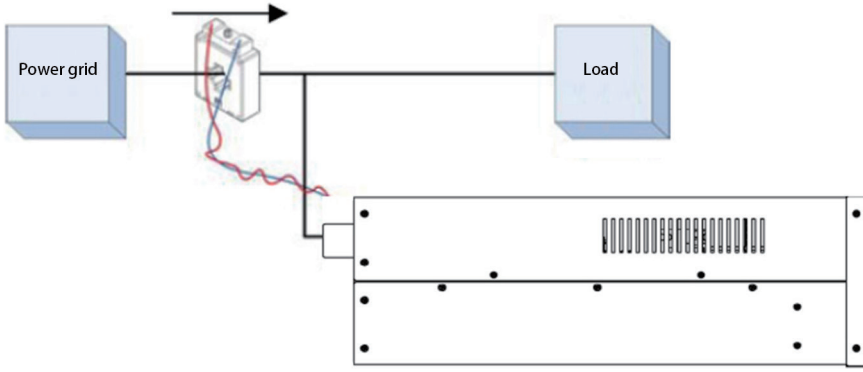


Figure 6.5 Transformer installed on the source side

the transformer is installed on the source side, but when there are large capacitors on the load side, there are three CT installation methods can be choose, as shown in Figure 6.6, Figure 6.7, and Figure 6.8.

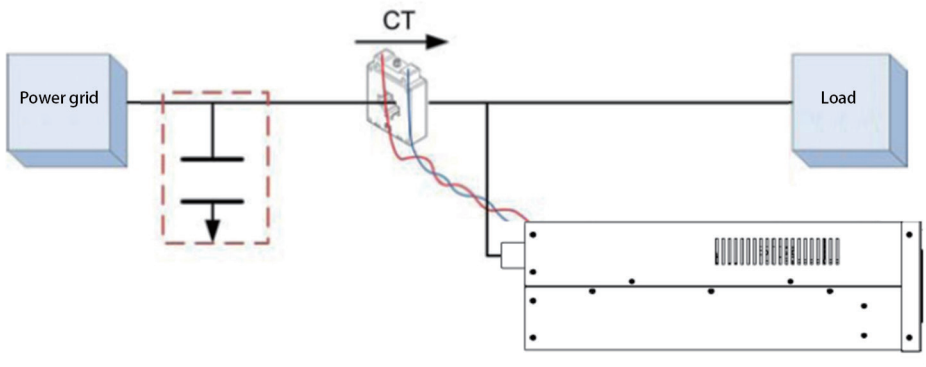


Figure 6.6 load side has large capacitor, transformer installation source side mode 1

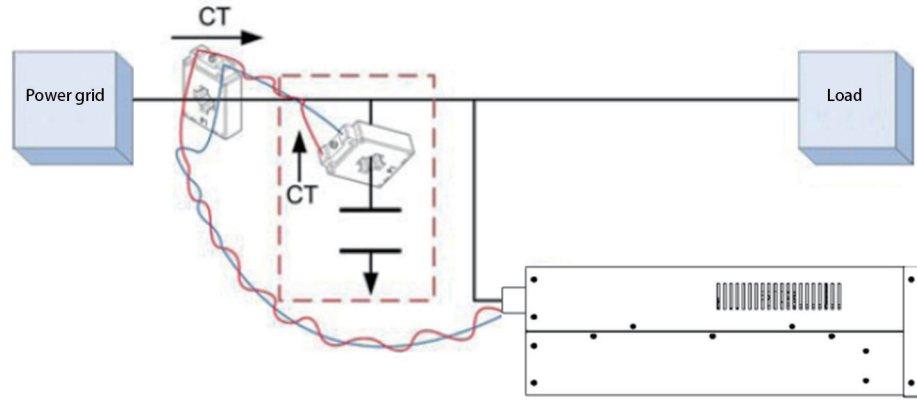


Figure 6.7 load side has large capacitor, transformer installation source side mode 2

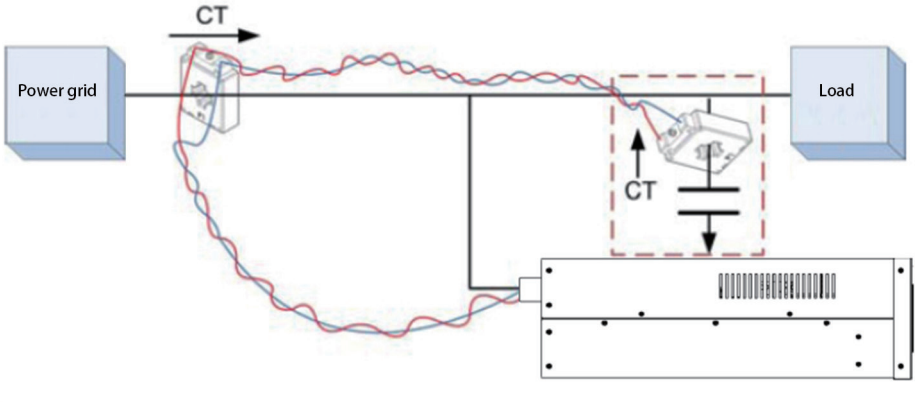


Figure 6.8 load side has large capacitor, transformer installation source side mode 3

Note

In all cases where vector combination of two transformers is required, it must be used current transformers with the same ratio and accuracy. When using a parallel machine system, the transformers can be connected in series or in parallel. The series mode diagram is shown in Figure 6.9, and the parallel mode is shown in Figure 6.10.

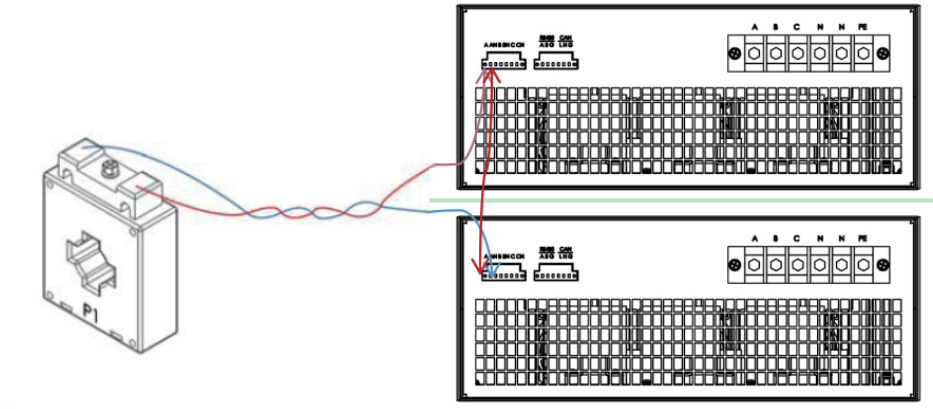


Figure 6.9 series connection of transformers in parallel system

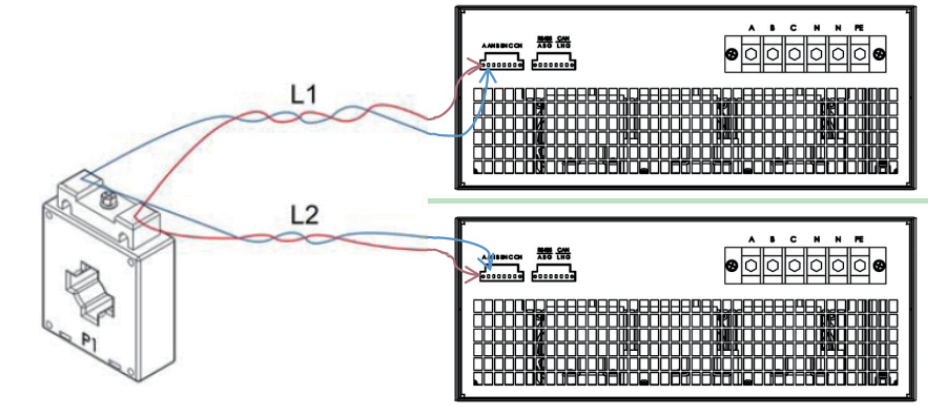


Figure 6.10 parallel connection of transformers in parallel system

Transformer parallel connection method:

When transformers are connected in parallel, the lengths of L1 and L2 lines must be exactly the same so that the output current of each SVG module is averaged.

Note

When transformers are connected in parallel or in series, it is necessary to set the parallel and serial set of the transformer connection parameters through the HMI.

In a parallel system, transformers are not allowed to adopt the source side detection method. The transformer must be installed on the load side, as shown in Figure 6.11.

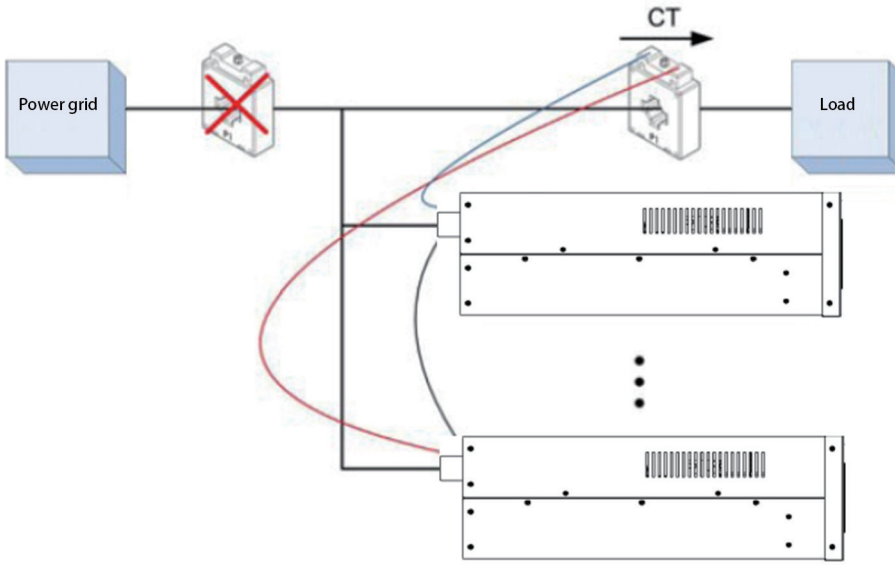


Figure 6.11 load side of transformer installation of parallel system

If the current transformer cannot be installed between the equipment and the load, two sets of current transformers with uniform ratios are allowed to be installed. One set is installed on the Electricity grid side and the other set is installed on the output side of the parallel system. The two output terminals of the same phase CT are paralleled together again and then installed on the transformer input terminal of the equipment.
As shown in Figure 6.12. The direction of the arrow indicates the positive direction of the transformer.

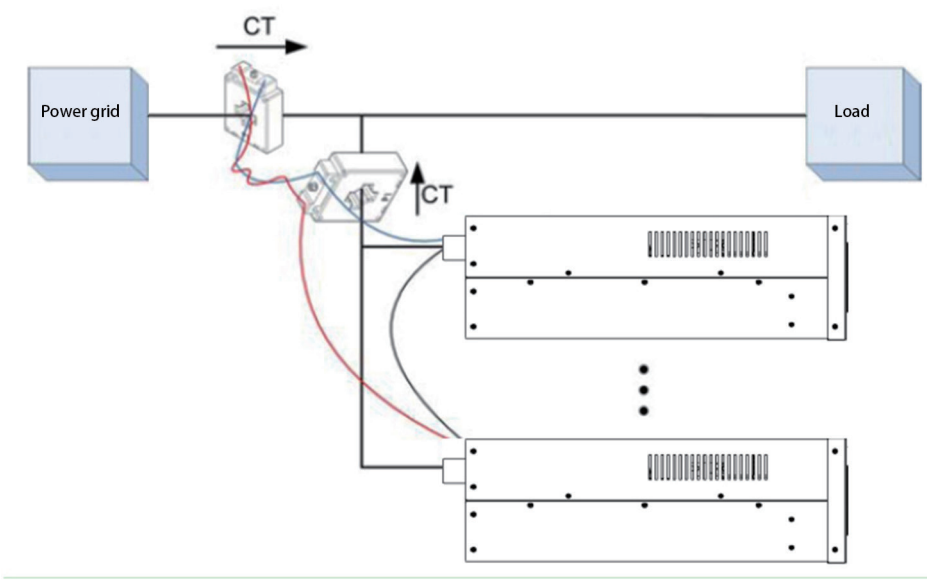


Figure 6.12 source side of transformer installation in parallel system

6.2 CT secondary short-circuit terminals

External CT before CT is connected to the system, if there is a measurement current passing through the CT, the CT′ s secondary terminal must be short-circuited.

As shown in Figure 6.13, this short-circuit terminal can be disconnected only after the secondary cable of the CT is connected to the corresponding terminal of the SVG. The short-circuit device is not provided by factory. Users are requested to configure this short-circuit device by themselves before accessing CT terminals. Make sure that before connecting the CT to the system, make sure that both ends of the three-phase CT′ s secondary side are short-circuited and connected to the PE side of the SVG to ensure the safety of construction and operation personnel.

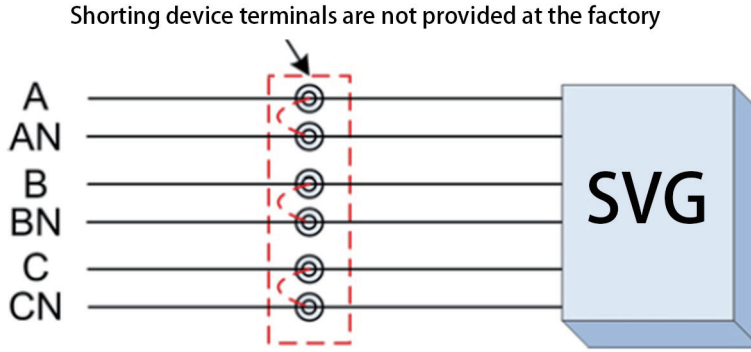


Figure 6.13 schematic diagram of transformer output short-circuit terminal

6.3 Background Monitoring

SVG module supports Modbus standard protocol and adopts RS485 communication interface. When using a stand-alone system, this interface can be used as an auxiliary function for communication with a computer. In a parallel system, this port is used for centralized monitoring. The background monitoring software is a remote control software, which is used when the client performs remote monitoring. It is not shipped with this software. Monitoring software supports user-independent development, such as the development of specific parameters that can be used to contact the manufacturer for standard protocol addresses.

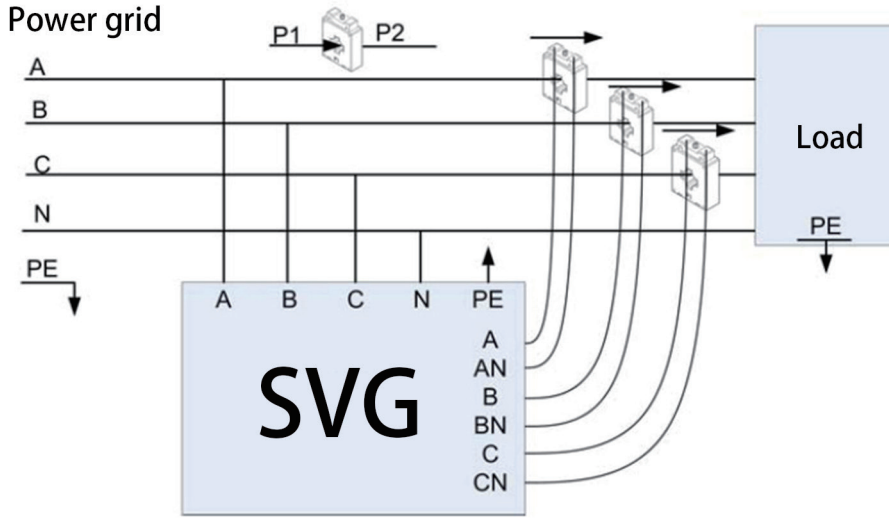
7. Product specifications

Environmental characteristics	Units	25A, 50A, 75A, 100A SVG
Noise (within 1 meter)	dB	60
Altitude	M	<1500m, more than 1500m derating according to GB/T3859.2
Relative humidity	-	5%~95% no condensation
Working temperature	° C	0-45
Storage temperature	° C	-15~70

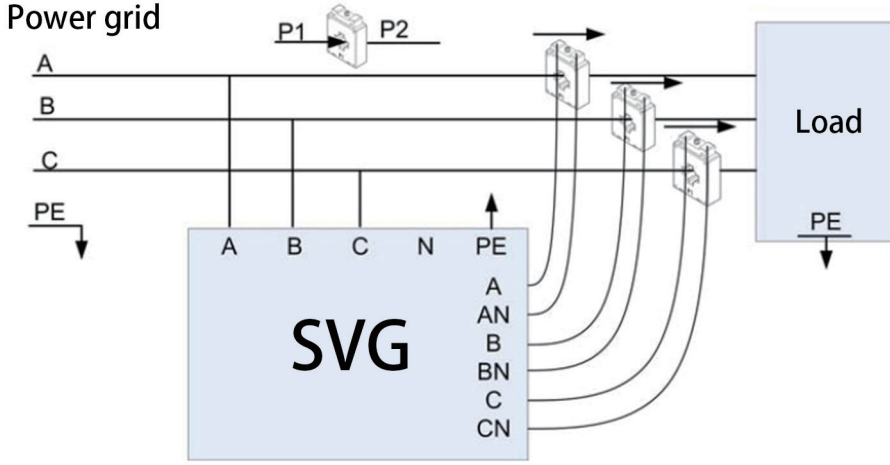
Table 7.1 Product Environmental Characteristics

Name	Unit	25A, 50A, 75A, 100A SVG
Rated AC input	V	Line Voltage: 380(1±15%), Phase Volt-age: 220(1±15%)
Frequency	Hz	50±5
Machine efficiency	%	Greater than 97%
Protection class IEC (60529)	N/A	IP20

Table 7.2 Product Features



Appendix I Main Line Connection Diagram of Three-phase Four-wire System



Appendix II Main Line Connection Diagram of Three-phase Three-wire System

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