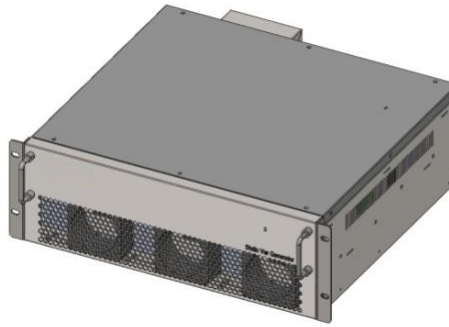
Sinexcel

SVG15/30

User's Manual



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Data Version:A00

Filing Date: 21- Feb-2020

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Safety Precautions

This Manual describes installation and operation of SVG 30kvar system.

Please read this Manual before installation, and read all safety precautions in this Manual carefully.

400V SVG must be commissioned and maintained by the engineer designated by the manufacturer or its agent. Otherwise, it might endanger the personal safety and result in equipment failure. SVG damage caused thereby is beyond the warranty scope.

400V SVG is only for commercial/industrial purpose and cannot be used as a life support equipment and relevant equipment.

This product is Class-A SVG device and might have radio interference when being used for saving residential electricity.

Normative References

This equipment meets CE 73/23 & 93/68 (low voltage safety) , 89/336 (EMC), and the EMC standards (C-Tick) of Austrilia and New Zealand:

See Chapter VII *Product Specifications* for the details.

Please install the equipment according to requirements stated above and use the accessaries appointed by the manufacturer.

User Serviceable Parts

The maintenance of the internal parts of the equipment shall be conducted upon some tools by professional personnel. All compoments and parts that are kept in the protected containers and must be opened by tools, are user nonserviceable.

This SVG fully meets the equipment's safety standards in working zone.

There is dangerous voltage with SVG but that only maintenance personnel can access.

As the components with dangerous voltage has protective cap which must be opened by tools, thus the possibility of touching dangerous high voltage is very small.

There is no any danger when you operate the equipment according to relevant regulations and the procedures specifed in the manual.

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Contents

Chapter I Overview

1.1 Product description

SVG15/30 is mainly used for dynamic reactive power compensation of 400V low voltage distribution network; the compensation capacity of single module is 15/30kvar; it could output the compensating current with controllable amplitude and phase position to improve power factor.

1.2 Technical parameters

Table 1-1 Environmental characteristics

Environmental characteristic	Unit	SVG15/30
Noise (1 m)	dB	<65dB
Altitude	m	<1500m; if the altitude is above 1500m, derating according to GB/T3859.2
Relative humidity	%	5%～95%, no condensation
Operating temperature	℃	-10～40
SVG storage/transportation temperature	℃	-20～70

Table 1-2 SVG15/30 AC input (mains supply)

Parameters of electricity system	Unit	SVG15/30
Rated voltage of AC input line	Vac	400V
Range of input phase voltage	Vac	138V～265V
Input frequency	Hz	50/60Hz
Range of input frequency	Hz	45Hz～62Hz

Table 1-3 Overall efficiency and ventilation quantity

	Unit	SVG15/30
Overall efficiency	%	>97
ventilation quantity	CFM	240CFM

Table 1-4 SVG mechanical characteristics

Mechanical characteristics	SVG15/30
Weight	36 kg
Mechanical dimension (W*D*H)	500*560*190mm (Rack-mounted) 500*191*585mm (Wall-mounted)
Color	Galvalume coated plate, natural color
Protection level, IEC (60529)	IP20

Table 1-5 European and international standard

Items	Standards
General safety requirements for SVG use and operation area	EN 50178:1997/IEC 50178:1997
	IEC 61000_6_2(1999)/CISPR11,GROUP1,CLASSA
SVG performance requirements	EN 50091-3/IEC 62040-3/AS 62040-3(VFI SS 111)
SVG EMC requirements	EN 61000_6_2(2005)/EN55011,GROUP1,CALSSA

Chapter II System Installation

2.1 Installing dimension

Parallel connection of multiple rack-mounted modules, installation of single power module and wall-mounted installation are available.

The heat-dissipating method is intelligent air cooling; the air duct of rack-mounted module is equipped with the front air inlet and rear air outlet; the air duct of wall-mounted module is equipped with the bottom air inlet and top air outlet; the overall dimension and installing dimension are shown in Figure 2-1 respectively:

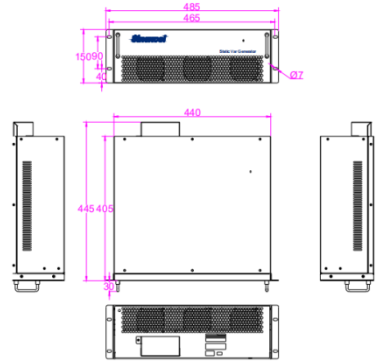

Figure 2-1-1 SVG15/30 rack-mounted LED

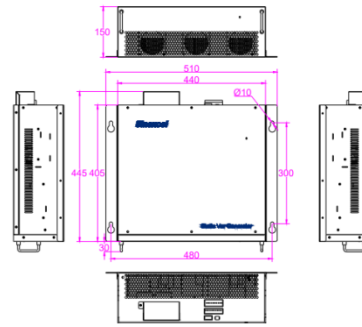

Figure 2-1-2 SVG15/30 wall-mounted LED

2.2 System wiring

For SVG15/30 single module, 3-phase power cable, N cable, PE wire and external CT wire shall be used for wiring and installation. See Figure 2-2 for the details about overall frame diagram. For 3P3W system, the CTs can be only put on phase A and phase C for current detection, while 3P4W system need both three phase CTs.

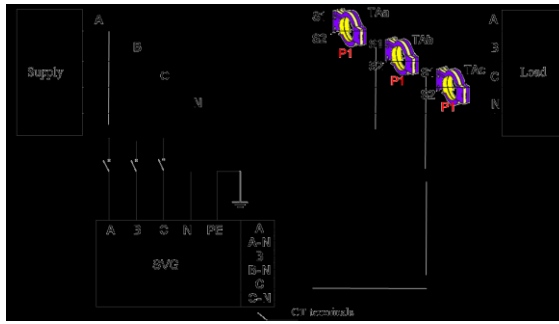

Figure 2-2-1 Wiring of single power module (3-phase 4-wire system)

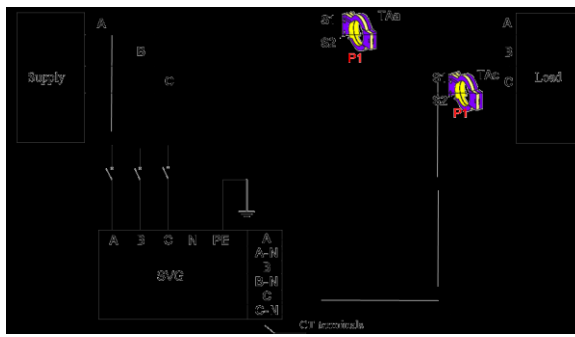

Figure2-2-2 Wiring of single power module (3-phase 3-wire system)

2.3 Selection for power distribution interfaces and wire diameters

During field wiring, the user only need to select the suitable wire for the fixed wiring terminal according to the power requirement; Figure 2-3 shows the wiring method of each terminal. Refer to the model selection table 2-1 recommended by Sinexcel for selection of the wire diameter of SVG15/30 A/B/C/N/PE power cables.

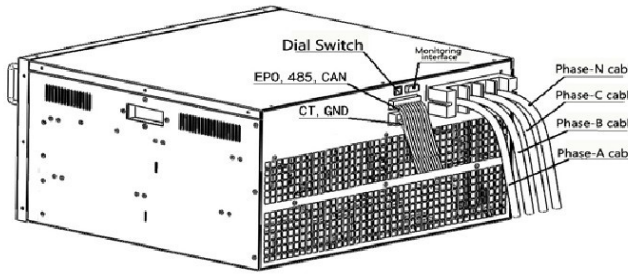

Figure 2-3 Wiring diagram of SVG single power module

External wiring terminals of SVG are shown as follows.

- Input A – 400V A-phase input terminal for yellow cable
- Input B – 400V B-phase input terminal for green cable
- Input C – 400V C-phase input terminal for red cable
- N- neutral input terminal
- PE—ground terminal; as the metal enclosure is used in the system, the system must be grounded through the terminal to avoid any accident endangering personal safety.
- The allowable maximum current of CT wiring terminal strip is 5A.

Note: Large monitoring system is the integrated monitoring system used externally in multiple parallel connections; wiring terminals EPO and 485 are used as the communication cable for the centralized monitoring system in parallel connection of multiple devices; the dip switch is used by the monitoring system to identify the settings of each device and monitor the working condition of each module; these terminals aren't used in operation of single module.

2.4 Selection of the current transformer

2.4.1 Precision requirements of the current transformer

As an external component of SVG15/30, the current transformer plays a key role for compensation precision of the system in normal operation of SVG15/30; the precision of an external current transformer shall be level 0.2 (closed) or above level 0.5 (split); if a lower precision is selected, the compensation precision of SVG15/30 may be affected.

2.4.2 Ratio selection of the current transformer

In the model of SVG15/30 the allowable minimum value of ratio of external CT is 150:5; the allowable maximum value is 10000:5; the ratio may be set between such two limits according to the actual CT; the suitability is wider. The ratio of CT shall be selected according to the current of actual load; generally, 1.5 times of maximum current occurred in operation shall be selected; and the suitable allowance may be reserved. After such configuration, SVG15/30 will have more precise reactive power compensation to realize ideal compensation of client terminal. For example: The maximum load current of client terminal is 1000A, the value between1500:5 and 2000:5 shall be selected to ensure precise measurement.

Note: As an optional part, the current transformer has split and closed types for your selection. The split CT is installed easily, while the closed CT must be installed when power cut occurs in the client terminal. Sinexcel can offer the split CT. In selection of a CT, the ratio of CT shall be the allowable value of SVG15/30; prior to startup, inspect whether the ratio of external CT of SVG15/30 is in conformity with that of actual CT or not.

2.4.3 Connection of the current transformer

A CT cable of SVG15/30 is manufactured as an optional part. It is recommended to select a shielded twisted pair as a CT cable, respectively consisting of three groups of cables, i.e. yellow + black, green + black and red + black. Each group has 2 cables which are twisted together to form a CT cable. When an external CT is connected, the yellow twisted cable shall be connected with A-phase, the green twisted cable shall be connected with B-phase, and the red twisted cable shall be connected with C-phase. The yellow twisted cable is exampled to explain the connection: The yellow cable is connected with terminal S1 of CT1 and the black cable is connected with terminal S2 of CT1 to ensure consistent direction of the current through CT; otherwise, the compensation effect cannot be realized. Figure 2-4 is the schematic diagram of CT and signal interfaces. Specification selection of CT cables mainly depends on the length of cables.

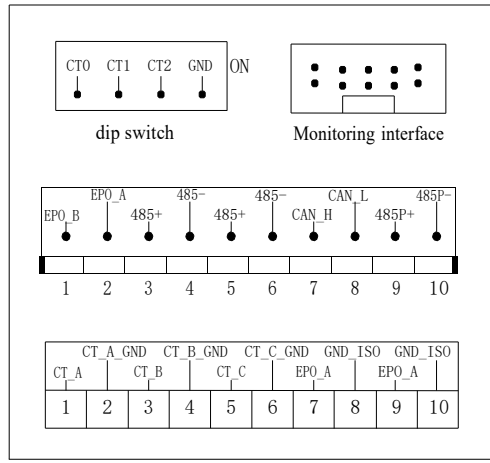

Figure 2-4 Interfaces of external CT terminal strip

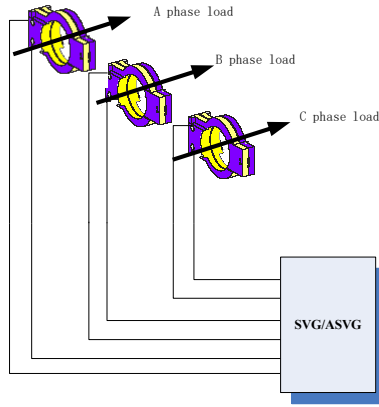

Figure 2-5 CT installing direction diagram

Table 2-1 Model selection table

Rated current	45A
Power cable	A/B/C/N: 35mm^2 PE: 16 mm^2 recommended
CT cable	Below 15m: RVVSP 2×2.5 mm^2; 15m-30m: RVVSP 2×4 mm^2; above 30m: Please contact us.
Ratio range of CT	150/5~10000/5
Rated current of air switch	100A
Remark	If there is some requirement about the temperature of cable, the specification of cable shall be added

2.4.4 Parallel operation system

In case of parallel operation of multiple power modules, 485+ and 485- shall be respectively connected in parallel, and GND_ISO also shall be connected among the modules used for parallel operation; a 120 Ohm resistance shall be connected in series between 485+ and 485- of the top device and the bottom device in case of parallel operation of multiple modules.

If centralized monitoring is required, only connect the large monitoring system and the monitoring interface shown in Figure 2-4.

Two connection methods are available for EPO:

For one method, large monitoring system is used; at this moment, only connect the emergency stop

2.4.5 Connection of the current transformer

Button and the emergency stop button interface on the large monitoring system and then respectively connect EPO_A and GND_ISO of the modules connected in parallel.

For the other method, the large monitoring system isn't used; at this moment, only connect the emergency stop button with EPO_A and EPO_B shown in Figure 2-4 to realize emergency stop.

In parallel operation, the device number of each module connected in parallel shall be set via the dip switch shown in Figure 2-4; the dip switch has 4 digits, but its valid digits go between the 1st-3rddigit, and the 4th digit is reserved by the manufacturer.

The relation between dip switch and device number is expressed by binary system, as shown in Table 2-2: ("1" indicates "on", and "0" indicates "off").

Table 2-2 Description of dip switch

CT2	CT1	CT0	Device number
0	0	0	1
0	0	1	2
0	1	0	3
0	1	1	4
1	0	0	5
1	0	1	6
1	1	0	7
1	1	1	8

Chapter III Monitoring Module

3.1 7inch HMI centralized control

7-inch LCD monitor is adopted for centralized monitoring and debugging of LED models, including the rack-mounted and wall-mounted modules. Monitor will enter the main interface after startup as shown in figure 3-1. It displays the "PF" at grid side and load side, as well as current date, time and operating status, including stop, operation and alarm. Click the button at the top right of the interface and choose the button "Info.", monitor will enter "Info" interface, as shown in figure 3-2. User may enter other interfaces by clicking the buttons at the top right. If necessary, the user may log in the system in the name of Administrator to view or change the configuration information of SVG15/30. See table 3-1 and table 3-2 for detailed menu information.

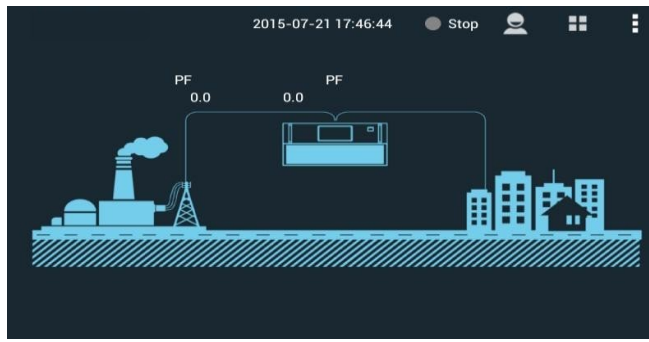

Figure 3-1 Main interface

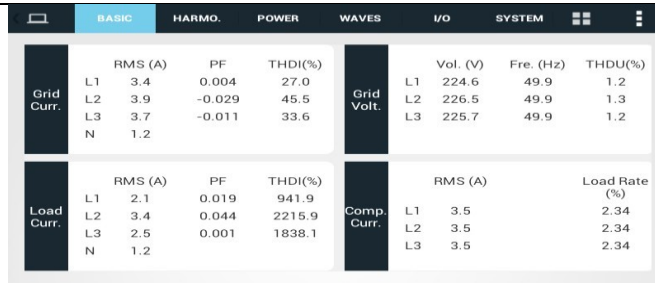

Figure 3-2 Information interface

Note: All settings of SVG15/30 may be operated via LCD; and display setting of LCD shall be operated by our product engineer or a trained professional.

Table 3-1 Menu information description of SVG15/30

Option	Menu items	Description and meaning
Info.	Grid Voltage	View the valid value of current phase voltage
	Comp. Current	View the phase current of current system compensation
	Grid Current	View the phase current of current power grid
	Load Current	View the phase current of current load
	Grid PF	View the power factor in the side of current power grid
	Load PF	View the power factor in the side of load current
Status	Alarm Code	Display the current fault information
	Operation Status	Normal: normal operation of SVG; stop: SVG is standby; fault: SVG is faulted
Settings	CT Ratio	Set the ratio of external CT, such as 600:5.
	Total Capacity	Set the capacity of actual system
	CT Location	CT is installed in the side of power grid or the side of load
	Power ON Mode	Set manual or automatic startup mode
	Network Config.	0: 3-phase and 3-wire; 1: 3-phase and 4-wire
	Comp. Rate	Used for debugging by the manufacturer; the user need not to set otherwise
	Target PF	Set the desired power factor
	Operation Mode	Reactive, unbalanced and self-aging
	Controller Para.	The parameters reserved by the manufacturer; the user need not to set otherwise
Power ON/OFF	Send out startup, shutdown, clear failure, reset, return and other commands	

Table 3-2 Menu information description of SVG15/30

Option	Menu items		Description and meaning
Voltage	Voltage (V)		Phase voltage
	Frequency (Hz)		Frequency
	THDU (%)		Harmonic voltage
	Wave		Phase voltage wave
Current	Load current (A)	Current (A)	Load phase current
		Power factor (%)	Load phase current THDi
		THDI（%）	THDI
		Wave	current wave of load phase
	Compensation current (A)	Current (A)	System compensation phase current
		Load rate (%)	Proportion of the compensation current in the rated output current
		Wave	Compensation phase current wave
	Grid current (A)	Grid current（A）	RMS of phase A/B/C grid current
		PF	PF at grid side
		THDI（%）	THDI of phase A/B/C grid current
		Waveform	Waveform of grid and load current of phase A/B/C
Harmonic analysis	Grid THDI（%）		THDI of phase A/B/C grid current
	Load THDI（%）		THDI of phase A/B/C Load current
	THDU（%）Phase voltage THDU (%) and wave		Harmonic of electric voltage and THDU column diagram
	The bar chart		At grid and Load
IO/temperature	Node 1, 2, 3		temperature display of phase A/B/C Inverter

Option	Menu items		Description and meaning
setup	System	Operation Mode	reactive power, reactive power and unbalanced load, Aging model(customer not selected)
		CT Ratio	Set external CT Ratio, e.g. 600:5 etc
		CT location	At either source side or load side
		Ext. passive Filter	Reserve function
		Comp Mode	Intelligent compensation, Successive compensation mode or full compensation mode
		single Harmonics comp. setup	Compensate harmonics ranged between 2nd and 11th and their compensation rate
		Quantity	Set the number of device in parallel
		Total capacity	Set the total capacity of the system
	Monitor	Local address	Address of each module in the system
		LCD contrast	Adjust LCD contrast
		Time	Set time and date
		Baud rate	9600bps or 19200bps
		Language	Set the language
	Commu-nication setting	background communication address	Monitoring.
		The background communication baud rate	The number of changes of the carrier unit of time

Option	Menu items		Description and meaning
		communication protocol	MODBUS protocol, TCP/IP
		IP address	The same with the computer IP address setting
		Gateway IP	With the computer network management of IP address setting the same
		The subnet mask	The same with the computer on the subnet mask address setting
Alarm	Active alarm		Serial No., name and start time of active alarm
	History alarm		Serial No., name and start/end time of alarm
Power ON/OFF	Manual		In this mode, press the button to power on the device
	Auto		In this mode, the device shall be automatically powered on after the recovery of power supply.
	Erase the fault		alarm reset

3.2 Electrification steps

After fixing the device, please confirm electrical connection of SVG15/30 is completed or not; SVG15/30 may be electrified after completing the following electrical connection.

1. Confirm all input distribution switches of SVG15/30 are disconnected completely and marked with warning signs to prevent others from operating.
2. Confirm 3-phase wiring terminal of SVG15/30 is connected properly, the CT is corresponding with all phases, and all connections meet the installation standard to avoid electric shock hazard.
3. The protective ground and other necessary ground cables are connected with PE of SVG15/30 to avoid any danger caused by electrification of the enclosure.

3.2.1 Startup steps

After completing the safety inspection for electrification, the engineer debugs it to be in normal condition, and then it may be started as follows.

1. Connect the connecting switch between mains supply and SVG.
2. After normal electrification, provided that SVG is set with "Automatic Startup", when the startup condition is satisfied, the system will send out the startup command automatically to start up; provided that SVG is set with "Manual Startup", the user may send out the startup command to start up the system by clicking the startup icon in the on/off interface of LCD after a while of electrification (it takes a while for the system to build up voltage).

3.2.2 Shutdown steps

There are two shutdown methods. One is to directly disconnect the disconnecting switch between SVG and mains supply. This mode is a full shutdown mode. That is, the system is not electrified, and relevant maintenance for the system can be carried out. The other is to conduct shutdown by clicking the shutdown button in on/off interface of LCD. In this shutdown mode, only the operation of power component is closed in the system. Since the system bus and auxiliary power supply are still electrified, the relevant control system is in a standby state. Therefore, maintenance or cabinet opening are not allowed in this mode.

3.2.3 Automatic startup

After electrifying SVG, two startup modes are available, i.e. manual and automatic mode. Such two modes may be set through the monitoring system or backstage. If SVG is set with automatic startup, SVG will be started automatically after electrification.

3.3 Fault information

Table 3-3 Fault information description of SVG

Fault type	Fault decoding	Description
Short fault of the inverter	0X01	The over current of IGBT will activate alarm. For example: The bridge arm is short-circuited.
The fault of auxiliary power supply	0X03	The voltage of auxiliary power supply is lower than the set value. When the valid value is within 8us in case of the fault of auxiliary power supply, CPLD will directly block IGBT trigger pulse.
Over temperature of the inverter	0X06	When the temperature of the base plate, the inverter will stop operating.
Ratio setting fault of CT	0X07	If the current is more than 1.5 times of rated current of CT, the phase sequence of CT is reversed
Overload fault of the inverter	0X08	The output current is more than 150% of rated current
System fault	0X09	DC bus voltage is abnormal
Reading fault of local capacity	0X10	The local capacity is not 22.5A(15kvar)/45A(30kvar)
EPO fault	0X11	Report EPO fault
Abnormal input frequency	0X0A	AC input frequency is out of 45Hz-62Hz (50Hz 45~55; 60Hz 55~62Hz)
Abnormal input voltage	0X0B	The input phase voltage is out of 138V~265V.

Software version fault	0X0D	DSP software isn't matched with CPLD software
Parameter setting fault of the controller	0X0F	The side of CT source; and the capacity of parallel operation is more than that of single device The local capacity is more than the capacity of parallel operation The local capacity is not 22.5A(15kvar)/45A(30kvar) The input voltage level is not 380V

3.4 Trouble shooting

Device failures can be divided as follows:

1. Failure caused by user's wrong operation: If CT cable is connected reversely, phase sequence of power line is reverse or reference setting is wrong, observe whether this kind of failure can be found during startup commissioning. If the compensation effect is poor but there is no warning information, please contact our product engineer.
2. If warning information is given, please contact Sinexcel product engineer directly.
3. If no response after electrification, please contact Sinexcel product engineer directly.

Chapter IV WIFI interface operation

The standard model of Sinexcel 15/30 Static Var Generator does not contain large monitoring module. WIFI is used for device commissioning and parameter review. As for ordinary use site, it can be used after connecting power cables and CT. The specific operation steps are as follows:

(1) Close disconnecting switch between power grid and Static Var Generator to electrify the machine.

(2) Turn on WIFI of mobile phone, tablet and PC and add the hotspot. The hotspot name is “PQ+6 random letters” (e.g.: PQ42a076), as shown in Fig. 4-1. The initial password of the hotspot is 08080808.

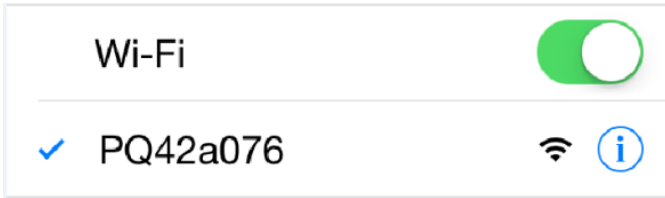

Fig. 4-1 WIFI hotspot of Sinexcel SVG

(3) Open the browser and enter “192.168.1.1” in “Address Search”, as shown in Fig.4-2. Click “Search” to enter the login interface.

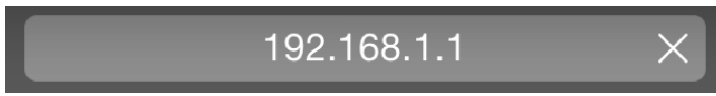

Fig. 4-2 Enter IP address

(4) In the login interface, enter “admin” in “username” and enter “08080808” in “password”, as shown in Fig.4-3. Click “Login”.

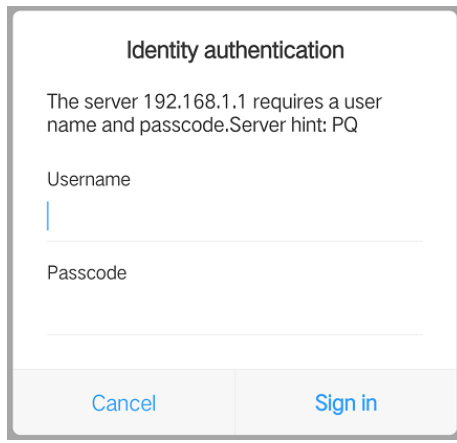

Fig. 4-3 Enter login name and password

(5) After WIFI connection, enter the operation interface to review power grid voltage, power grid current, load current, compensation current and other data, as shown in Fig. 4-4. Refer to Table 4-1 for detailed menu information.

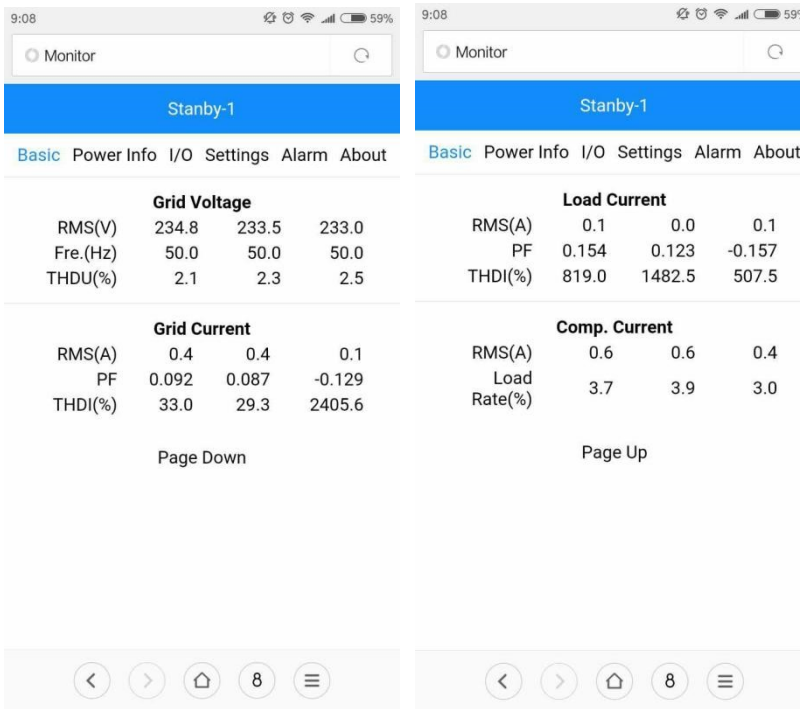

Fig. 4-4 Monitoring interface

In “Setting” menu, you can review “Compensation rate”, “Operation mode”, “Salve quantity” and “Total capacity” etc., as shown in Fig.4-5. In the last page, you can review “Description of some parameters setting”, as shown in Fig. 4-6. Different function combinations refer to different meanings and have different priorities. For example, Q+B means that SVG compensates reactive power first, three-phase imbalance second. Auto-aging mode customers cannot select it and use it based on SVG delivery. As for operation mode, SVG has been set upon delivery. So, customers do not need to set it again.

Click “Start” in the setting menu and click “OK”. When the page will display “monitoring sending succeeded! return”, “Start” command can be sent successfully, as shown in Fig. 4-7.

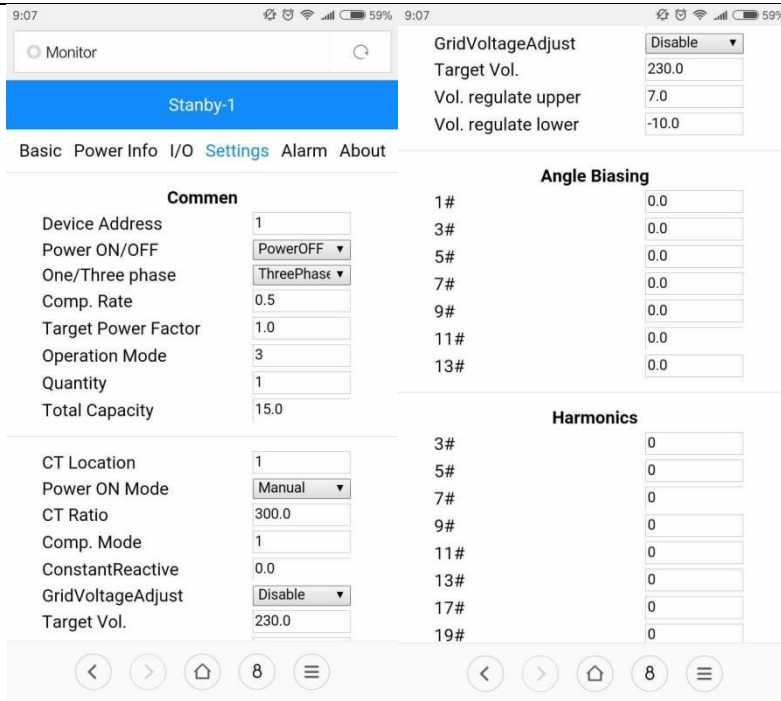

Fig.4-5 Setting interface

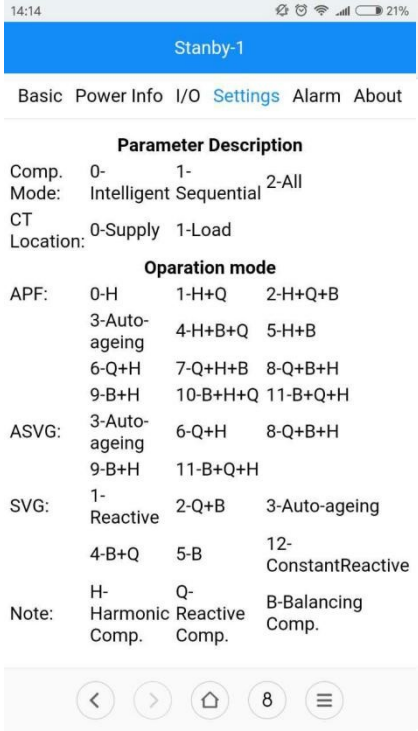

Fig. 4-6 Description of some parameter setting

Fig.4-7 Interface of monitoring sending success

INSTALLATION LOG