Sinexcel

PWS1-500KTL-NA

Grid-Support Utility-Interactive Energy Storage Inverter

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User's Manual

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Applicable to: PWS1-500KTL-NA

Shenzhen Sinexcel Electric Co., Ltd. (“Sinexcel”) provides its customers with all-around technical support. Users can contact Sinexcel’s local office or customer service center or directly contact Sinexcel Headquarters.

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Chapter I Overview

1.1 Model definition

This section introduces product model definition in this user's manual, as shown in Fig. 1-1:

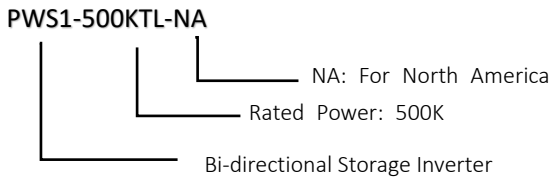


Fig.1-1 Product model definition

For example

PWS1-500KTL-NA: 500KW Bi-directional storage inverter without isolation transformer

1.2 Symbolic interpretation

Danger

This instruction indicates that there is a safety risk during operation. If this kind of warning information is not followed, it will directly result in a serious human casualty accident.

Warning

This instruction indicates that there is a potential risk during operation. If this kind of warning information is not followed, it might result in a serious human casualty accident.

Attention

This instruction indicates that there is a potential risk during operation. If this kind of warning information is not followed, it might result in device damage.

1.3 System application

As shown in Fig.1-2, energy storing power generation system is composed of battery, the storage inverter and AC distribution unit. Batteries are input to the storage inverter after series-parallel connection of batteries. The storage inverter outputs it to

AC distribution unit. It operates in different modes according to the need.

The storage inverter plays a core role in the whole system and is characterized with high conversion efficiency, wide range input voltage, rapid on/off-grid switching and convenient maintenance. It has a complete protection function (such as islanding protection, DC overvoltage protection, AC overvoltage-under-voltage protection, over-frequency/under-frequency protection, inverted sequence protection and output overload protection) and can meet on/off-grid operation requirements. The input side of the storage inverter can be 1-Sting Configuration, 4-Sting Configuration and 8-Sting Configuration.

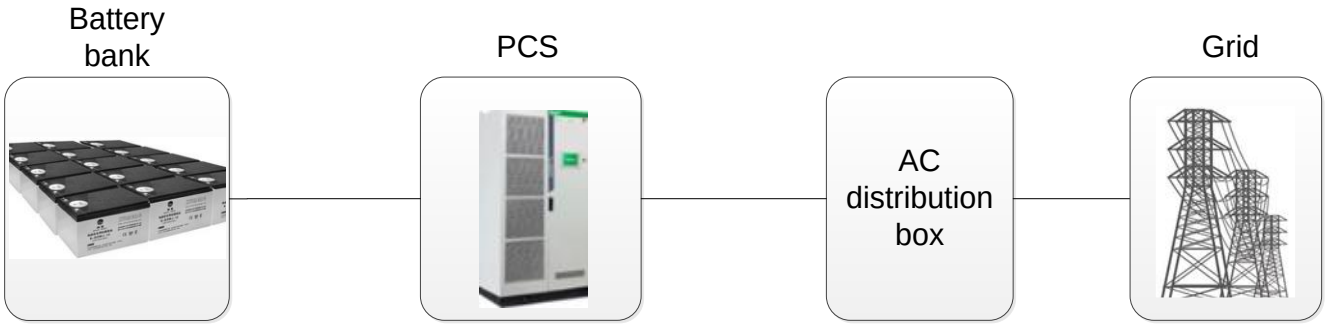


Fig.1-2 Energy storing system diagram

Attention

- PWS1-500KTL- NA storage inverter is without an isolation transformer.
- **An External Transformer IS required to be deployed between the inverter and the Utility Power Grid.**
- The External Transformer shall be compliant to the following conditions:

  Comply with ANSI C57.12.50-1981(R1998) or ANSI/UL1561

  Capacity shall be 500KVA

  The primary voltage and secondary voltage shall be - Grid Voltage (480V in US, et al):400V

  Be Isolated transformer

1.4 Safety instructions

This user's manual is about installation and use of Sinexcel PWS1-500KTL-NA storage inverter without transformer.

Before installation, please read this user's manual carefully.

The storage inverter must be commissioned and maintained by the engineers designated by the manufacturer or the authorized service partner. Otherwise, it might endanger personal safety and result in device fault. Any damage against the device caused thereby shall not be within the warranty scope.

The storage inverter is only used for commercial/industrial purposes, and it cannot be used as an energy saving device related to life support device.

Danger

Any contact with copper bar, contactor and terminal inside the device or connected with the loop of power grid might result in burning or fatal electric shock.

- Don't touch any terminal and conductor connected with the loop of power grid.
- Pay attention to any instruction and safety documents about power on-grid.

Warning

There might be an electric shock risk inside the device!

- Any operation related to this device will be conducted by professionals.
- Pay attention to the safety precautions listed in safety instruction and installation documents.
- Pay attention to the safety precautions listed in user's manual and other documents.

Warning—large leakage current

- Before connecting input power supply, please ensure that the grounding is reliable.
- The device grounding must comply with the local electric codes.

Warning

When storage battery is connected to storage inverter, there is DC voltage at input port. Please pay attention to it during operation.

Warning

- Don't touch electric parts within 15 minutes after power outage!
- There is dangerous energy in capacitance storage. Don't touch device terminal, contactor and cooper bar and other electric parts within 15 minutes after disconnecting all device power supplies.

Attention

- All maintenance and preservation inside the device require using tools and shall be conducted by trained personnel. The components behind the protective cover plate which are opened by tools cannot be maintained by users.
  Please read this user's manual before operation.

1.5 Precautions

1.5.1 Personnel requirements

The storage inverter is only commissioned and maintained by the engineers designated by the manufacturer or the authorized service partner. Otherwise, it might endanger personal safety and result in device fault. Any damage against the device caused thereby shall not be within the warranty scope.

1.5.2 Equipment use scope

The storage inverter is only used for commercial/industrial purposes, and it cannot be used as an energy saving device related to life support device.

1.5.3 Cabinet label

Cabinet label contains important information for safe operation of cabinet. Don’t tear it up or damage it. S

Ensure that the cabinet label is clear and readable. If it is damaged or obscure, please replace it immediately.

1.5.4 Description

To facilitate users to use this manual more conveniently, a lot of pictures have been provided in the manual. The pictures can be only used for explanative and schematic purposes. As for product details, the real product shall prevail.

Chapter II Introduction to Modules

2.1 Overall dimension of PCS-AC module

Fig.2-1 is a diagram for overall dimension of PCS-AC module case and installation hole.

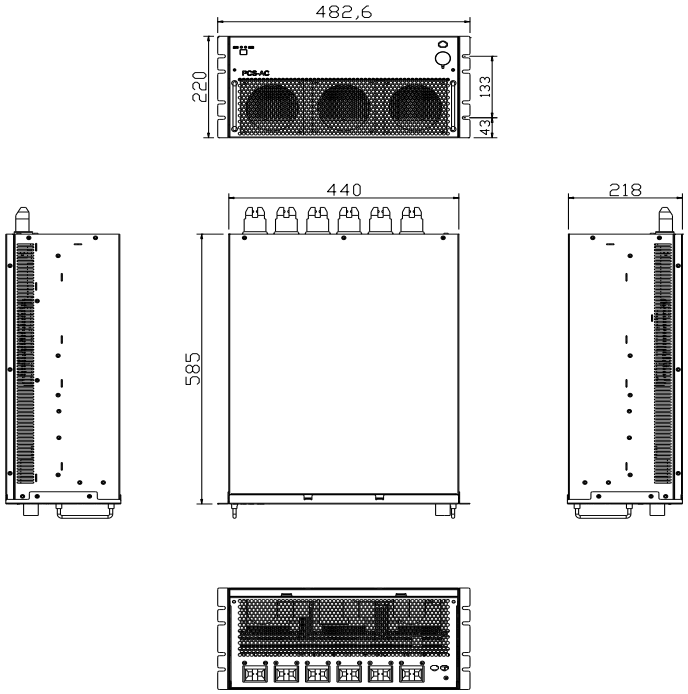
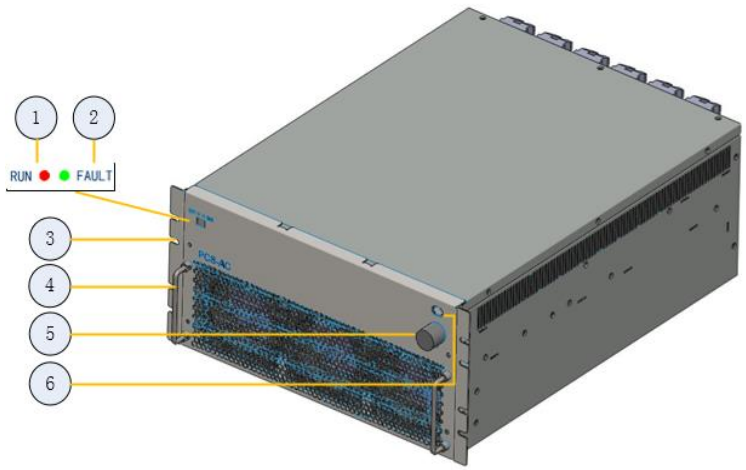


Fig.2-1 Overall dimension and installation diagram for PCS-AC module

Fig. 2-2 is 3D view for front panel of PCS-AC module.



Position	Description
1	Normal indicator light
2	Fault indicator light
3	Hanger
4	Handle
5	Communication cable
6	Power supply cable

Fig. 2-2 Front 3D view for PCS-AC module

Warning

- The handle on the front panel of the module cannot bear the load.

The front panel of PCS-AC module has two LED lights, namely one green (Normal) light and one red (Alarm) light. When the device is in standby state, the green light (Normal) flickers once every 1s. When the device is in sleep state, green and red lights are off. When the device is in normal operation, the green light (Normal) is always on. When the device has a fault warning, the red light (Alarm) will be always on or flicker.

Chapter III Introduction to System

3.1 System composition

PWS1-500KTL-NA storage inverter is composed of 8 PCS-AC modules. The modules identify master-slave systems through the dial-up codes on the panel. #1 is a master system, while other modules track the master system. The storage inverter cabinet is equipped with lightning protector, AC/DC breaker. Fig.3-1 and 3-2 is a topological graph for its composition and structure.

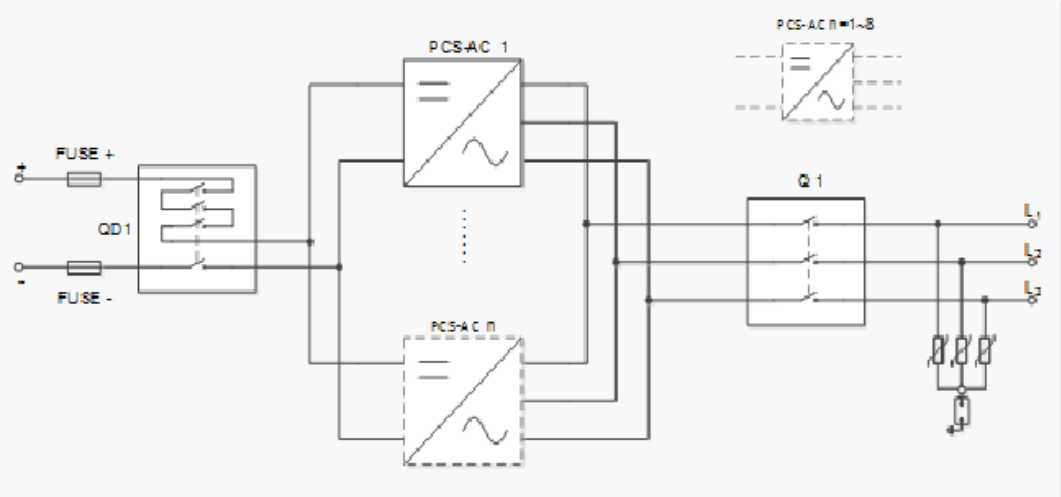


Fig.3-1 Topological graph for storage inverter with 1-Sting Configuration

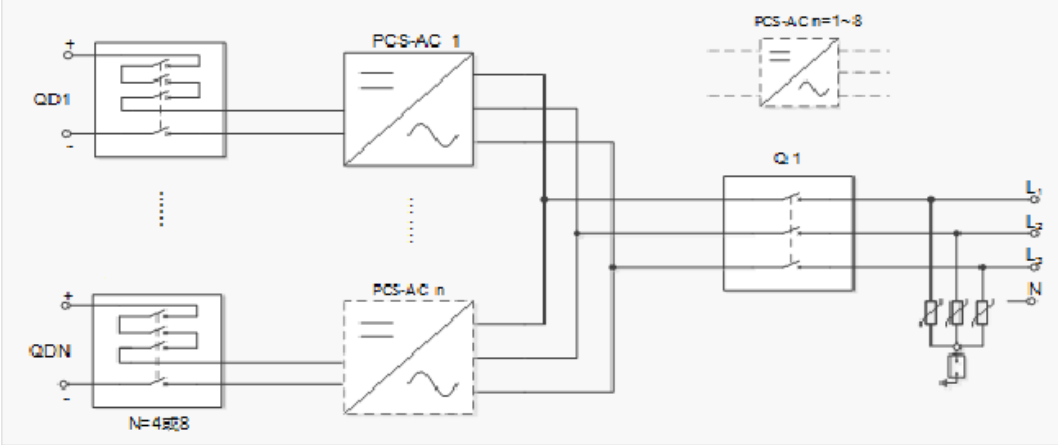


Fig.3-2 Topological graph for storage inverter with 4/8-Sting Configuration

Main composition of PWS1-500KTL-NA. The storage inverter cabinet is shown in Table.3-1.

Table 3-1 Main composition of the storage inverter cabinet

Serial No.	Name	Quantity	Remark
1	Cabinet	1 plane	The cabinet is equipped with distribution components.
2	PCS-AC module	8 set(s)	
3	Power Management Unit	1 set	It is installed in the cabinet door.

3.2 Technical parameters

Table 3-2 is detailed parameters for storage inverter.

Table 3-2 Technical parameters

Product Model		PWS1-500KTL-NA
DC Input - BATTERY		
Battery Voltage Range		630V~900V
DC Max Current(Total)		873A
Quantity of Battery Strings		1/4/8
1-String Configuration	Max Current per String	873A
	Max Power per String	550kW
4-String Configuration	Max Current per String	218A
	Max Power per String	137.5kW
8-String Configuration	Max Current per String	109A
	Max Power per String	68.75kW
AC Grid-interactive mode		
Rated Output Power		500kW
AC Max Power		550kVA
Rated Voltage		400V
Voltage Range		±15%
Rated Frequency		60Hz(59.5Hz~60.5Hz)

AC Rated Current	760A
AC Max Current	836A
Output THDi	≤3%
Power Factor	0~0.8 leading or lagging
AC Stand-alone mode	
Voltage	400V
Voltage adjustable range	±10%
Frequency	60Hz(59.5Hz~60.5Hz)
Output THDu	≤2%（Linear load）
System	
CEC Efficiency	97%
Wiring Mode	3-Phase 3-Wire
Isolation Mode	Non-isolation
Cooling	Forced air cooling
Noise	70dB
Ambient Temperature.	-20℃~50℃
Protection	IP20 / NEMA1
Max Elevation	3000m
Humidity Range	0~95% (No condensation)
Size (W*H*D)	1100mm*2160mm*800mm
Weight	600kg
COMMUNICATION	
Display	Touch Screen
Communication Protocol	Modbus TCP/IP, Modbus RTU
Communication Socket	Ethernet, RS485, CAN
Grid-Support Functions	
H/LVRT	Yes
H/LFRT	Yes
Ramp Rate	Yes
Fixed PF	Yes
Volt-Watt	Yes
Volt-Var	Yes
Freq-Watt	Yes
Grid-Support Function Accuracy	
Voltage	1%
Current	1%
(Volt-Watt)Active Power	10%
(Volt-Var)Reactive Power	6%
Frequency	0.02Hz
PF	0.01

3.3 Dimension

The dimension of the storage inverter is shown in Fig.3-3. Cabinet width: 1100mm, height: 2,160mm (without ring); depth: 800mm.

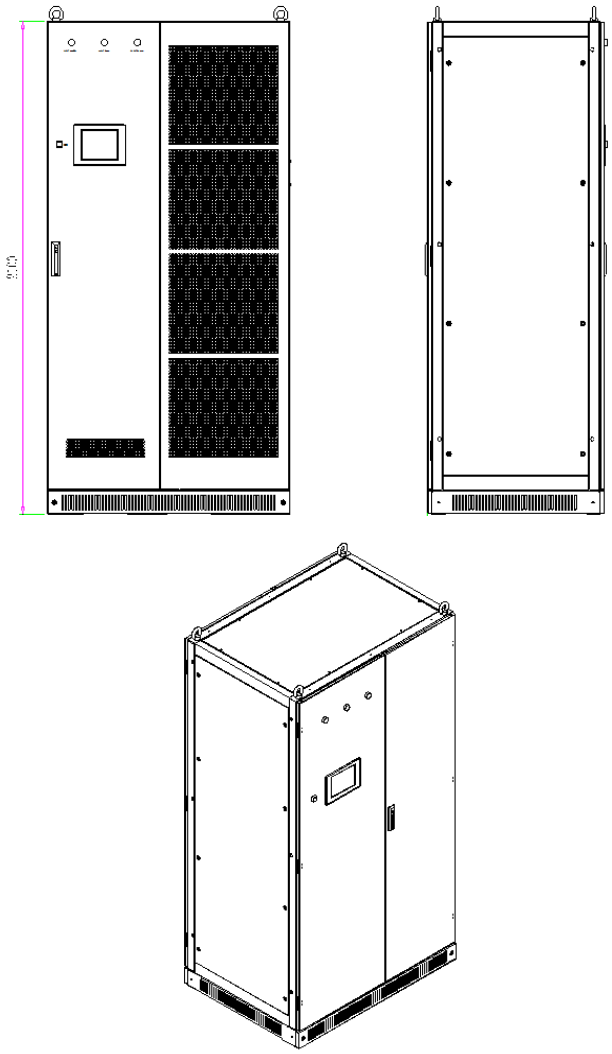


Fig. 3-3 Overall dimension of storage inverter

3.4 Appearance description

The appearance of the storage inverter is shown in Fig.3-4. Screen body is mainly composed of touch screen, normal indicator light, alarm indicator light and emergency shutdown button etc.

Position	Description
1	Power indicator light
2	Fault indicator light
3	Normal indicator light
4	Emergency shutdown button
5	Touch screen

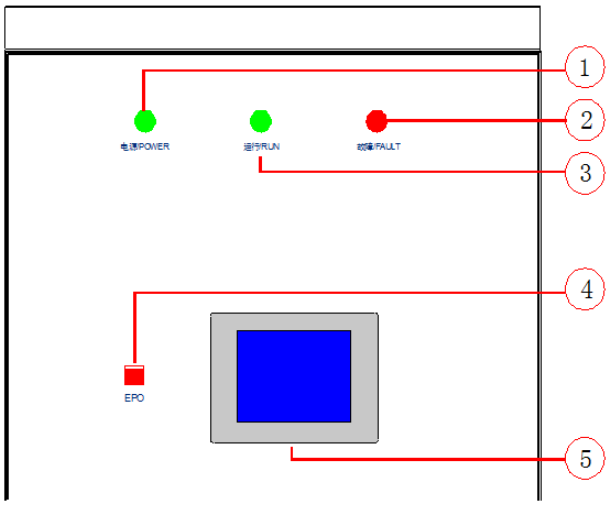


Fig. 3-4 Appearance diagram for PWS1-500KTL-NA storage inverter

Chapter IV Device Installation

4.1 Transport and storage

Cabinet and module of the storage inverter are packed together in the packing cases. During device transport and storage, pay attention to the logo on the packing case.

The storage inverter is modularly designed so as to facilitate device positioning and transport. The selection of storing position should ensure that:

- There is no corrosive gas around it.
- There are over-wetting and high-temperature sources.
- It is not a dusty environment.
- It complies with the firefighting requirements.

Attention

- During cabinet transport and storage, stacking is not allowed. The device top cannot be placed with other articles.
- The cabinet should be placed vertically at forward direction. Don't keep it upright place it horizontally.

4.2 Removal

When removing the module of the storage inverter which is not unpacked from packing case, a forklift can be used to remove the whole case.

Users can lift the device bottom with a forklift or remove the cabinet of single the storage inverter through the lifting hole on its top with a crane. It can be transported alone. Refer to Fig. 4-1.

Fig.4-1 Moving method for storage inverter

Warning

- Before the cabinet is moved, please ensure that the module is fixed stably.

4.3 Open-case inspection

4.3.1 Overview

Before installation of storage inverter, open-case inspection needs to be conducted. The inspection includes the following:

- Check whether the items in the package are consistent with real items.
- Check whether the data of product nameplate is consistent with the contract, including product model, rated capacity and voltage grade.
- Check whether the ex-factory documents and accessories are complete.
- Check whether the module of the storage inverter is deformed.
- Check whether the inverter cabinet is deformed, paint peeling or loose.

4.3.2 Packing list

Refer Table 4-1 for packing list of cabinet of storage inverter:

Table 4-1 Packing list of cabinet of storage inverter

Serial No.	Item	Quantity	Remark
1	User's manual	1 copy	May not be attached after January 2018
2	Dimension and foundation installation diagram	1 copy	
3	Schematic diagram	1 copy	
4	External terminal diagram	1 copy	
5	Certificate of quality	1 copy	

4.4 Installation requirements

4.4.1 Environment requirements

- It is installed indoor. Direct sunshine, rain and ponding should be avoided.
- The installation environment is clean. The air should not contain lots of dust.
- The installation position should not be shaky.
- Environment temperature should be -20~55℃. (The software conducts de-rating for 45℃ above.)
- The installation position is convenient for observing touch screen.

4.4.2 Ground requirements

The cabinet of the storage inverter needs to be installed on the flat ground. The ground for installation should be greater than 1,000kg/ m^2.

4.4.3 Ventilation

The cooling mode of the storage inverter is forced air-cooling. Every module has an independent heat dissipation channel. The module heat dissipation mode is air inlet in the front and air outlet in the rear. The cold air is inhaled from the mesh openings of front door of the cabinet. After heat absorption, the hot air is discharged from the mesh openings of rear door of the cabinet.

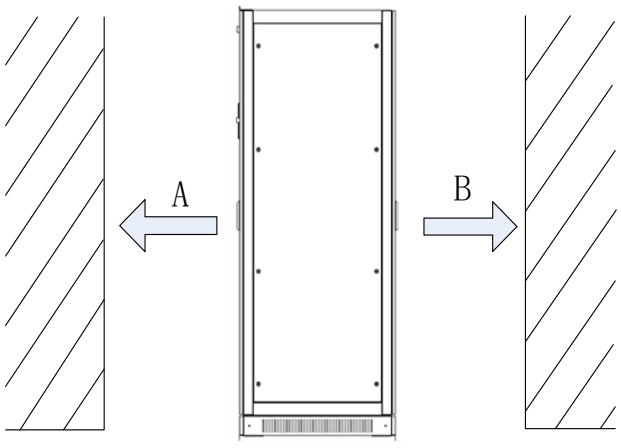
To ensure the quality of air inlet, please carry out installation according to the operation space requirement in 4.4.4, and a proper space should be reserved for air inlet and outlet. A blower is required to be installed in the machine room so as to ensure that the heat emitted from the storage inverter can be discharged outside the machine room.

Attention

At the rear of the cabinet, heat dissipation and ventilation equipment needs to be installed so as to ensure that the heat emitted from the storage inverter can be discharged outside the machine room.

4.4.4 Operation space

The installation space of the storage inverter should have a proper distance from its peripheral walls so as to ensure that the machine door can be opened and closed conveniently and there will be sufficient space for module insertion and extraction, normal heat dissipation and user's operation.



Position	Description
A	≥1,000mm, ensure that the front door of the cabinet can be fully opened. There is sufficient space for cold air to enter. Users can conveniently insert and extract the module and operate the breaker.
B	≥1,000mm, ensure that the rear door of the cabinet can be fully opened. Ventilation and heat dissipation should be ensured. Users can have sufficient space for maintenance.

Fig. 4-2 Installation space of storage inverter

4.4.5 Other requirements

1) Waterproofing

The protection grade of the cabinet of the storage inverter is IP20. It is only installed and used in a dry and clean room. Water leakage in room should be avoided so as to prevent the storage inverter from being damaged.

2) Rat-proofing

After wiring, fireproofing mud should be used to seal inlet and outlet holes so as to meet the rat-proofing requirement.

4.5 Cabinet installation

After the cabinet is removed to the installation position of energy storing deice with a forklift or a tool. Fine adjust the cabinet and remove it to the designed position, open the internal door of cabinet, use M13 screw to fix the cabinet, as shown in Fig.4-3.

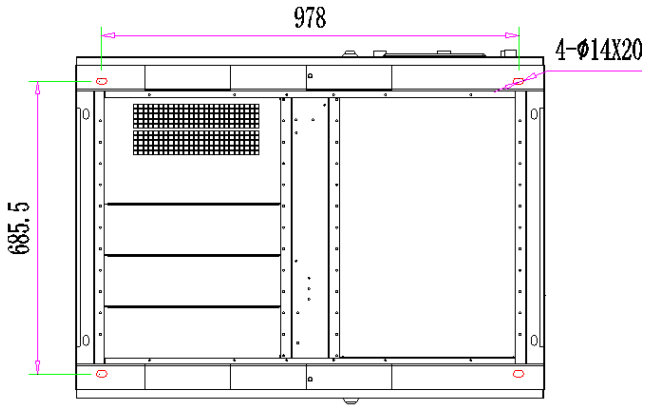


Fig.4-3. Diagram for cabinet base

When the cabinet needs to be fixed on the steel channel, Φ14 holes can be made in the steel channel. Fix the cabinet to the steel channel with screws, as shown in Fig.4-4.

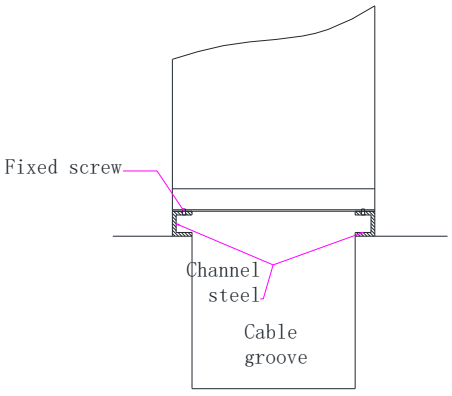


Fig. 4-4 Fix the cabinet to the steel channel

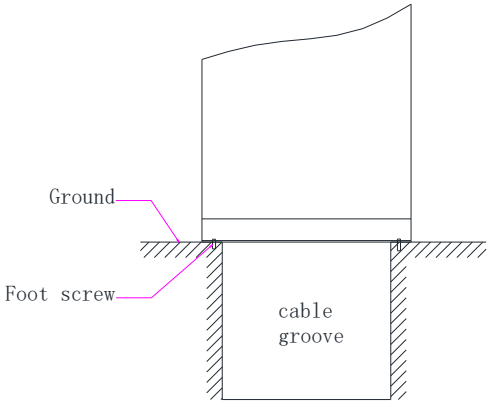


Fig.4-5 Fix the cabinet to the concrete floor

When the cabinet is fixed to the concrete floor, make holes on the floor and fix the cabinet to the concrete floor with expansion screws, as shown in Fig.4-5.

4.6 Electrical connection

4.6.1 Input requirement

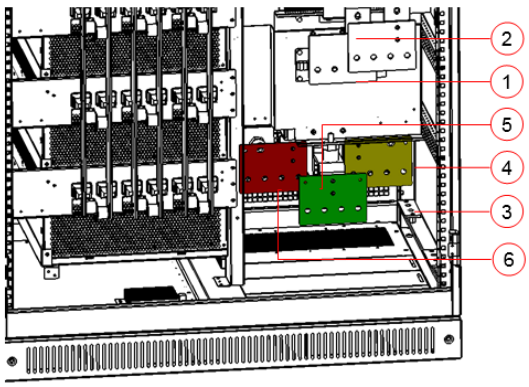
DC voltage of the storage inverter should be within the input scope, or the storage inverter will be unable to operate. When configuring serial quantity of batteries, the maximum charging voltage and minimum discharging voltage should be fully considered. For details, please consult our technical personnel.

4.6.2 Output requirement

The output of the storage inverter is 3-phase. When designing energy storing system, the storage inverter has been equipped without an isolation transformer, the voltage of its output side can directly be connected to the low-voltage power grid.

4.6.3 Wiring

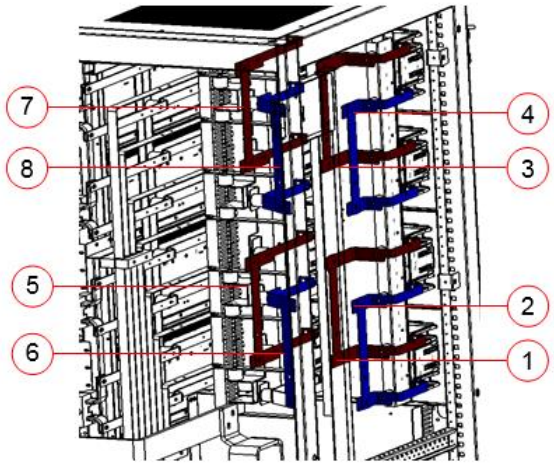
The cables fall into the cable trough via the wire holes at the base. Open the front door and dismantle the internal door to display wiring the cooper bars. Refer to Fig.4-6, Fig.4-7 and Fig. 4-8 for main view of cabinet's front door. As for wiring requirements, single cables or multiple cables with proper wire diameter should be selected (image update). It is suggested that the current in 1mm^2 wire should be ≤3A.



Position	Description
1	Battery input positive pole
2	Battery input negative pole
3	PE
4	AC output A phase
5	AC output B phase
6	AC output C phase

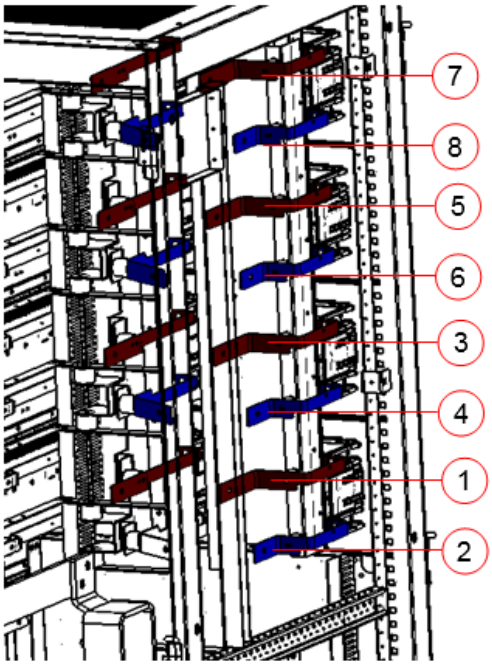
Fig. 4-6 PWS1-500KTL-NA with 1-Sting Configuration cabinet wiring copper bars

Position	Description
1	1 Battery input positive pole
2	1 Battery input negative pole
3	2 Battery input positive pole
4	2 Battery input negative pole
5	3 Battery input positive pole
6	3 Battery input negative pole



7	4 Battery input positive pole
8	4 Battery input negative pole

Fig. 4-7 PWS1-500KTL-NA with 4-Sting Configuration cabinet wiring copper bars



Position	Description
1	1 Battery input positive pole
2	1 Battery input negative pole
3	2 Battery input positive pole
4	2 Battery input negative pole
5	3 Battery input positive pole
6	3 Battery input negative pole
7	4 Battery input positive pole
8	4 Battery input negative pole
Remark	The copper bars on the left are fifth DC-Sting to the eighth DC-Sting from the bottom to the top

Fig. 4-8 PWS1-500KTL-NA with 8-Sting Configuration cabinet wiring copper bars

4.6.4 System grounding

The modules in the storage inverter realize grounding connection with the cabinet through hangers. As for cabinet grounding, the cabinet bottom is installed with grounded cooper bars. During wiring, refer to the following table for cable diameter. The grounding resistance should be less than 4Ω.

Rated power	PE line section recommendation
500kW	≥35 mm²

Warning

Cabinet and module need to be grounded reliably!

4.6.5 DC side wiring

1) Use a multi-meter to measure the voltage of storage battery port, and ensure that the voltage is within input voltage range of storage inverter.

2) Disconnect DC switch at previous level. Wiring operation can be conducted after using a multi-meter to measure and confirm that there is no voltage between positive and negative poles of DC input.

3) Connect the positive pole of storage battery to “DC+”.

4) Connect the negative pole of storage battery to “DC-”.

5) Confirm wiring firmness.

Danger

Disconnect DC distribution switch and ensure that there is no dangerous voltage in the system during wiring.

Attention

The positive and negative poles of batteries cannot be connected inversely. Before wiring, a multi-meter needs to be used for measurement.

4.6.6 AC side wiring

1) Use a phase-sequence meter for measurement, and ensure that the phase consequence of wires should be a positive consequence.

2) Disconnect AC output distribution switch at back level in storage inverter.

3) Use a multi-meter to measure and ensure that the cables connected to the terminals are electrically neutral.

4) During on-grid, A/B/C phases of AC output distribution switch of power grid.

If on/off-grid switching is to be achieved, extra power distribution unit and wires need to be added.

5) Confirm wiring firmness.

Warning

Ensure that there is no dangerous voltage at connection points during wiring.

Attention

All wires are connected to the wiring terminals externally from the wiring holes at the bottom of storage inverter. After wiring, fireproofing mud should be used to seal the wiring holes.

4.6.7 Wiring of terminal block

Except power cable connection in the whole storage inverter, there are also auxiliary power connection, input and output of some node signals. All of them are led to the terminal block with cluster cables in the cabinet. The port definition of external wiring for terminal block is shown in Fig.4-9

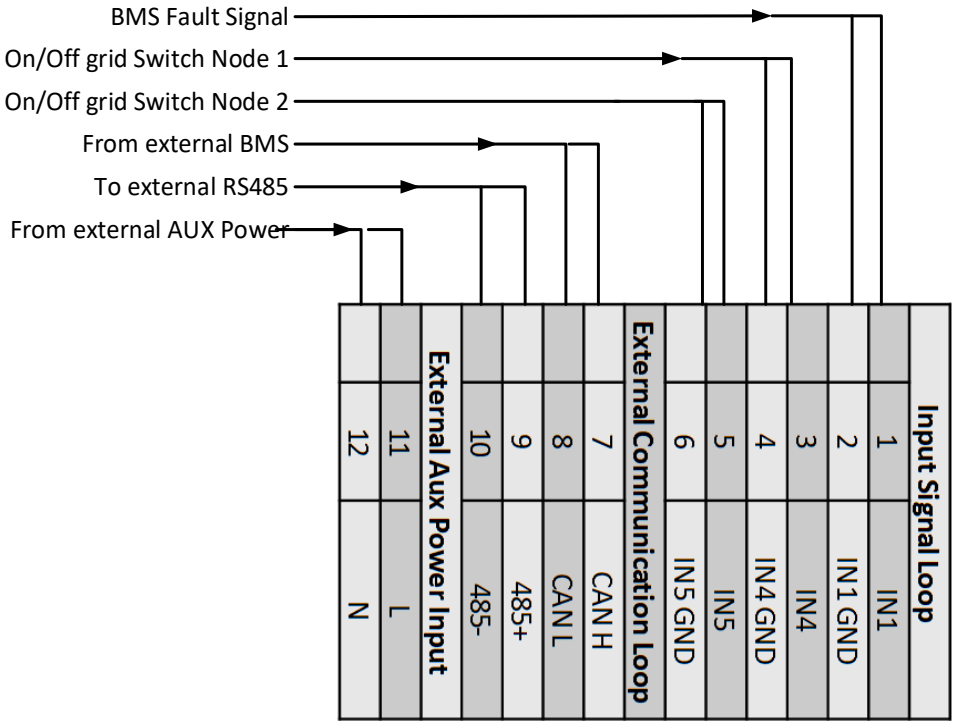


Fig. 4-9 Definition of terminal strip ports

4.7 Check after installation

After installation of storage inverter, inspection is conducted after the installation:

1) The device should be placed and installed reasonably, meeting safe distance requirements.

2) Wiring should be correct at one time. Lower leading wire and ground screen are in good connection. The constructor is required to inspect the grounding resistance.

3) Compare ex-factory main wiring diagram and site wiring. Check whether there is any difference and judge whether such difference will affect the safe operation of energy storing system.

Chapter V Commissioning and Operation

5.1 Operation state

After external wiring of the storage inverter is completed, and wiring is fully checked, close the breaker in AC side. The storage inverter can be switched in different modes under the conditions in Fig.5-1.

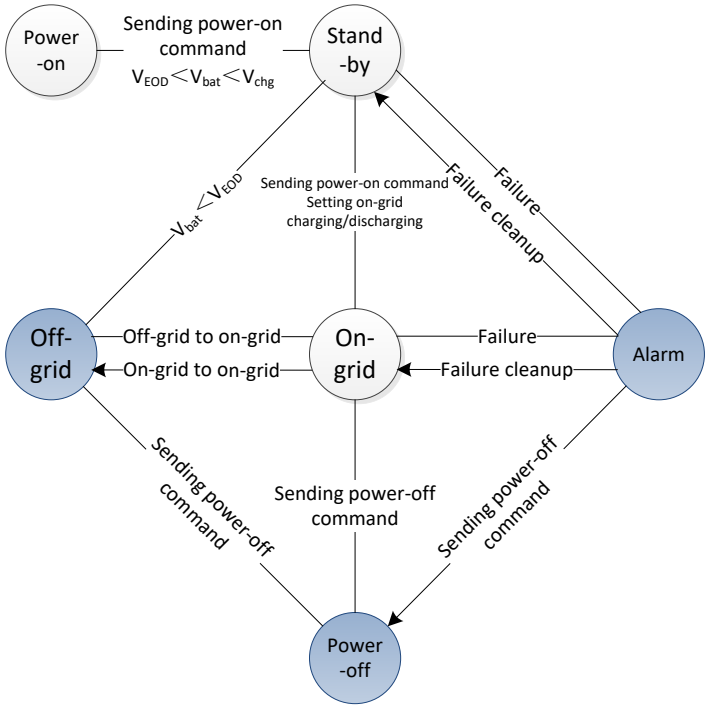


Fig.5-1 Operation state diagram for storage inverter

Refer to Table 5-1 for operation state of storage inverter.

Table 5-1 Operation state of storage inverter

Operation state	Conditions	State indication
Standby	DC switch is closed, AC switch is closed, and the device has no fault.	RUN green light flickers quickly, and the module green light flickers quickly.
On-grid	The device does not alarm, on-grid mode is set, and the device receives startup command.	RUN green light is always on, and the module green light is always on.
Off-grid	The device does not alarm, off-grid mode is set, and the device receives startup command.	RUN green light is always on, and the module green light is always on.
Alarm	Any fault information	Main monitoring red light is always on, the module red light is always on or flickers, and the buzzer makes an alarm.
Shutdown	The device receives shutdown command.	RUN green light flickers slowly, and the module green light flickers slowly.

5.1.1 Automatic startup

In automatic startup, the storage inverter system will automatically inspect and judge startup conditions. If the system function is normal and it meets the system setting conditions, it will start automatically. If the voltage of power grid is too low or high, the frequency is abnormal, DC voltage is too low or high, the storage inverter will make an alarm, shut down automatically and stop providing power outside.

After meeting the following conditions, the storage inverter will restart automatically, and the output is recovered.

- DC voltage is normal.
- The voltage of power grid is normal in on-grid mode, or there is no voltage of power grid in off-grid mode.
- Operation mode setting is correct.
- There is no other alarm fault.

If automatic startup is not set in storage inverter, users can start the device by hands through touch panel.

5.2 Startup and shutdown

The storage inverter must be installed completely and commissioned by engineers. External power switches have been closed, and then startup steps can be conducted.

5.2.1 Check before startup

Before startup, check the device according to the following steps:

1) Visually inspect and ensure that no damage sign is in external part of the module, and DC breaker and AC breaker are at “OFF” position.

2) Complete installation according to Chapter IV, and check whether DC input wiring and AC output wiring in the storage inverter are normal, and the grounding is good.

3) Check whether battery voltage is normal.

4) Check whether phase voltage and wire voltage in power grid side are in the normal range, and record the voltage.

5.2.2 Startup steps

These startup steps are applicable to the circumstance that the storage inverter system is in outage state and can be started. Operation steps are as follows:

1) Close output switch of battery cabinet and connect power supply to DC port of the device.

2) Close DC breaker. Green indicator light flickers in green. After about 10s, the red indicator light is always on in red. At this moment, LCD will indicate the warning information such as “under-voltage of power grid” and “abnormal power grid frequency”. If step 2 and step 3 are conducted before the red light is always on, the flickering in red will not appear.

3) Set monitoring parameter to control operation mode. See setting information in 6.2.

4) After step 3 is conducted, return to “main wiring diagram” On HMI and start DC/AC modules.

5) According to the current operation mode setting and DC input, the host will automatically operate and display.

5.2.3 Shutdown steps

During normal operation of storage inverter, the following steps can be conducted if shutdown is required.

1) On HMI, return to “main wiring diagram”, and click AC/DC module to “shut down”.

2) Normally, main monitoring indicator light flickers in green for about 30s.

3) Disconnect DC breaker(s).

4) Disconnect AC breaker.

As for above operation process, it has been shut down after step 2 is conducted. The power components stop operating in system, and BUS bar and auxiliary power supply in system still exist for a long time. Therefore, relevant control system is still in standby state. In this state, device setting and maintenance are not allowed. After step 4 is conducted, the storage inverter is in a shutdown state, and the internal connector bars are electrically neutral in system. After the internal capacitance in modules fully discharges, relevant maintenance and setting can be conducted.

5.2.4 Emergency Power Off

When the storage inverter system is abnormal, press the emergency shutdown button “EPO” on the cabinet door and then conduct steps 3~5 in 5.2.3.

Warning

- To prevent personal injury, please use a multi-meter to measure the voltage at input terminal if case maintenance or opening is conducted. After ensuring that there is no mains supply, relevant operation can be conducted!
- After about 15 minutes, the upper cover plate can be opened after DC BUS bar capacitance fully discharges (refer to warning label on module case surface).

Chapter VI Operation Control Display Panel

6.1 Operation instructions

Operation control can be conducted via HMI (human-computer interface). This section introduces the HMI display content and settable parameters.

6.1.1 Main monitoring startup

After auxiliary power of the storage inverter is connected, THE HMI is on. At this moment, an initializing interface will appear. It shows that the system is booting. After system booting, the interface will disappear.

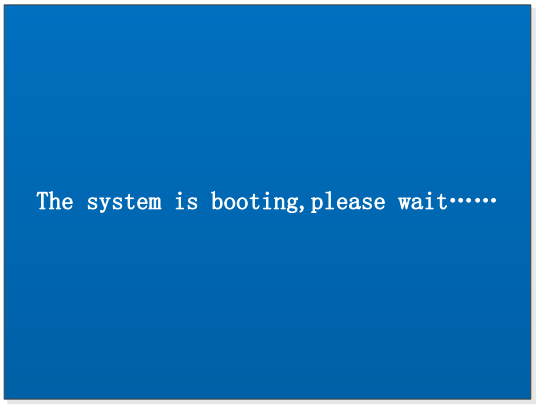


Fig. 6-1 Initializing

6.2 Home

After initializing, the home page is shown. On the main wiring diagram, system AC/DC voltage and current, general system status can be seen.

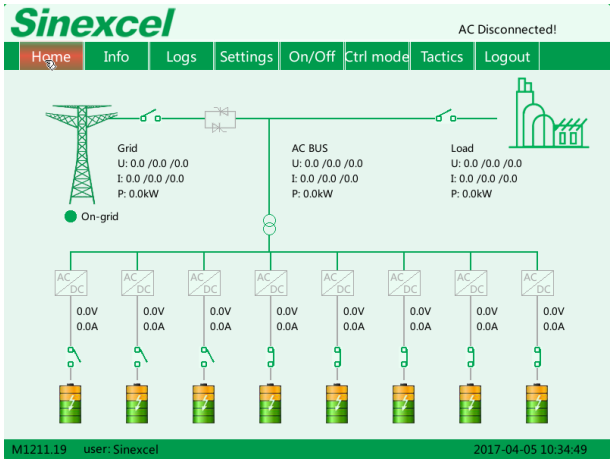


Fig. 6-2 main wiring diagram

6.3 Information

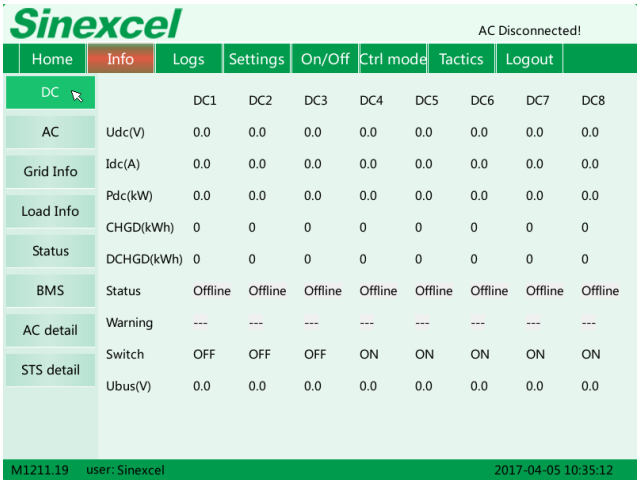


Fig. 6-3 System information

In the Info pages, administrators can obtain the overview of the entire system operation parameters.

6.4 Logs

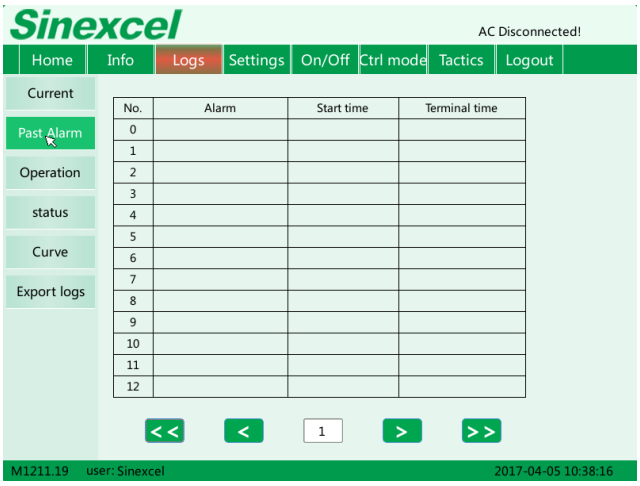


Fig. 6-4 Logs

In logs page, users can review current alarm, past alarm, operation record, status record of the system, and operation curves.

6.5 Settings

6.5.1 Local

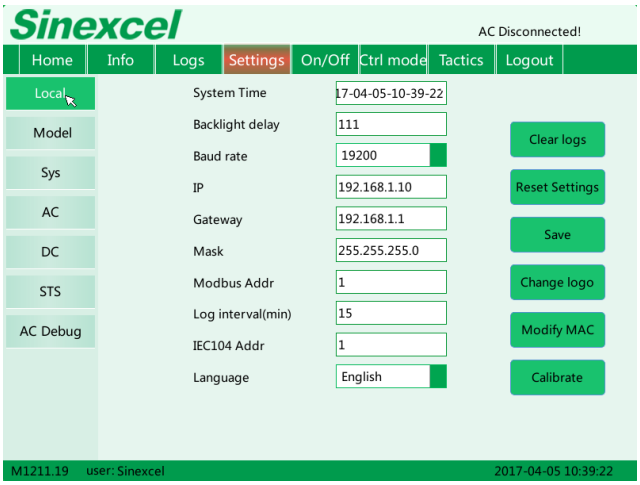


Fig. 6-5 Local settings

In this page, system time, communication baud rate and IP address, etc. can be set.

6.5.2 Model

This page is reserved for other models.

6.5.3 System

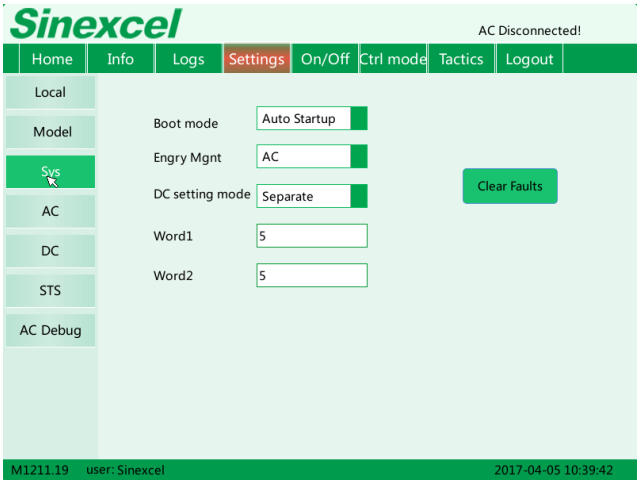


Fig. 6-6 System parameter interface

Boot mode: default set “manual”.

Energy Management mode: please set it as “AC”. If “DC” is set according to the actual demand, set “charging and discharging current” and “charging and discharging power” in DC parameter

DC setting mode: reserved function for special models.

Word1/2: reserved function for diagnosis.

6.5.4 AC settings

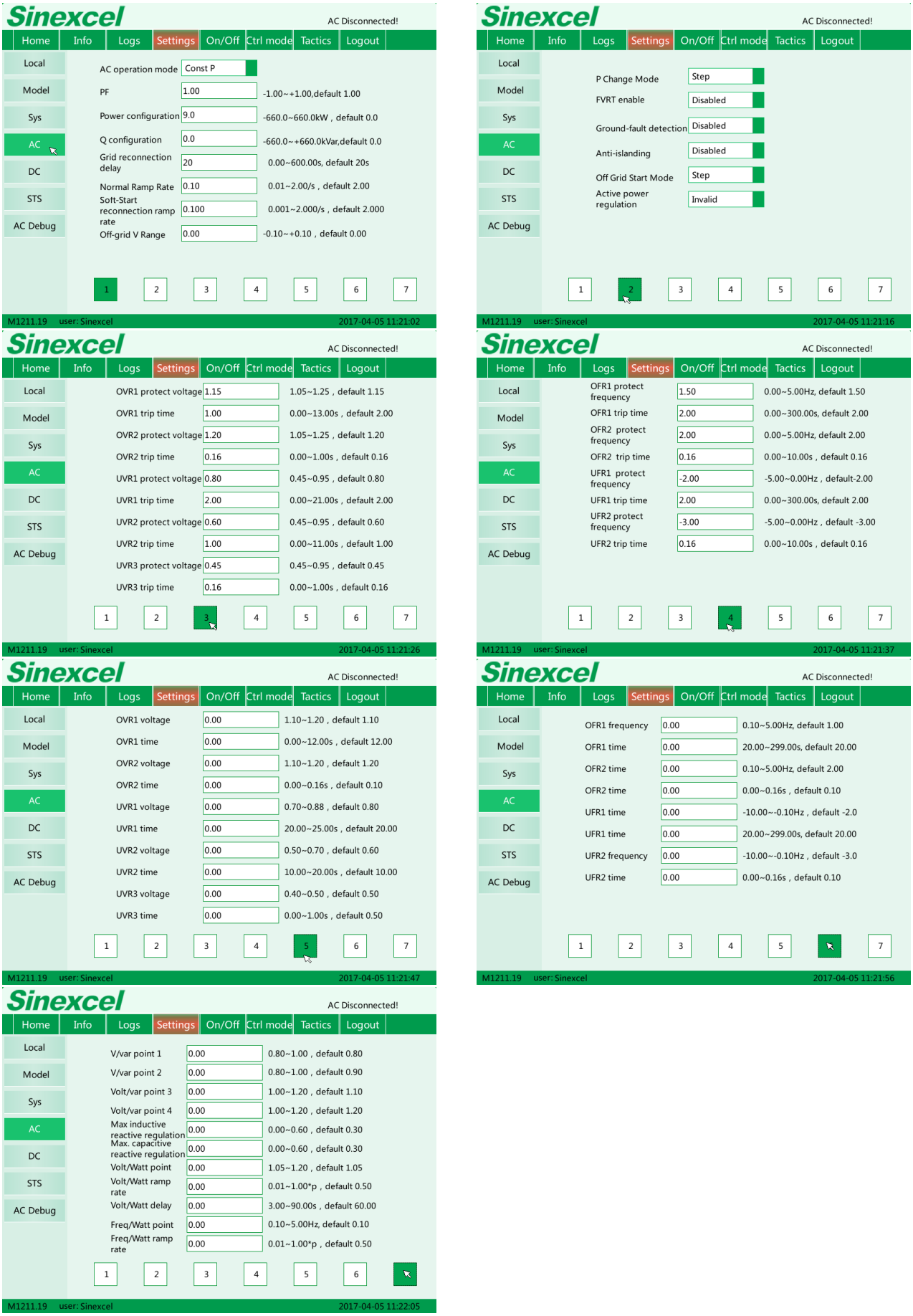


Fig. 6-7 AC settings

AC operation mode: to set the operation mode, constant power or constant inactive power.
PF: set to regulate the PF of the entire storage system
Power configuration: Set to regulate the power of the storage system
Q configuration: Set to regulate the inactive power of the storage system
Grid reconnection delay: please keep the default configuration.
Normal ramp rate: please keep the default configuration. This function will apply when set power changes. The default value is 2 rated power per second, which means within 0.5 seconds the system can runs to full output.
Soft-Start/Reconnection ramp rate: please keep the default configuration. This function will apply when system suspend happens caused by utility voltage abnormal, and reconnect after utility restore normal. The default value is 2, twice of rated power per second, which means within 0.5 seconds the system restores to full output.
Off-grid V range: to regulate the off-grid output voltage.
P Change mode: to set the power change pattern, step-to-top, or ramp-rise.
Ground-fault detection: enable or disable ground-fault detection.
Anti-Islanding: enable or disable anti-islanding function. For more information, please refer to UL1741 Supplement A or other similar rules about Utility-Interactive Distribute Generators .
Off grid start mode: Can be set as step-to-top, or ramp-rise.
Active power regulation: enable or disable active power regulation.

6.5.4.1 FVRT

FVRT: frequency/voltage ride-through, this function can be enabled or disabled, for more information, please refer to UL1741 Supplement A or other similar rules about Utility-Interactive Distribute Generators .
O/UVR* protect voltage: to set the over/under voltage ride though protect voltages.
O/UVR* trip time: to set the over/under voltage ride though trip times.
O/UFR* protect frequency: to set the over/under frequency ride though protect frequencies.
O/UFR* trip time: to set the over/under frequency ride though trip times.

6.5.4.2 Volt/Var

Volt/Var regulation is only available when enabled. In Volt/Var mode, the Q configuration is disabled.
Volt/Var point: to set the Volt/Var switch point.
When the actual voltage between Volt/Var point 1 and 2, the capacitive inactive power will be increased.
When the actual voltage between Volt/Var point 3 and 4, the inductive inactive power will be increased.
For more information, please refer to UL1741 Supplement A or other similar rules about Utility-Interactive Distribute Generators .
Max inductive reactive regulation: to set the maximum inductive reactive power regulation.
Max capacitive reactive regulation: to set the maximum capacitive reactive power regulation.

6.5.4.3 Volt/Watt

Volt/Watt regulation is only available when activated and operating in discharge mode. When the actual voltage is above the point, the active power will be regulated with the ramp rate. The ramp rate is defined as multiple of set active power per 1% of rated voltage that above the Volt/Watt point.

Volt/Watt point: to set the Volt/Watt trigger threshold.
Volt/Watt ramp rate: to set the ramp rate when Volt/Watt is triggered.
Volt/Watt delay: to set the output power restore time delay after the utility voltage restores normal.

6.5.4.4 Freq/Watt

Available when activated and operating in discharge mode. When the actual frequency is above the point,

the active power will be regulated with the ramp rate. The ramp rate is defined as multiple of set active power per hertz that above the above the Freq/Watt point.

Freq/Watt point: to set the Freq/Watt trigger threshold.

Freq/Watt ramp rate: to set the ramp rate when Freq/Watt is triggered

6.5.5 DC settings

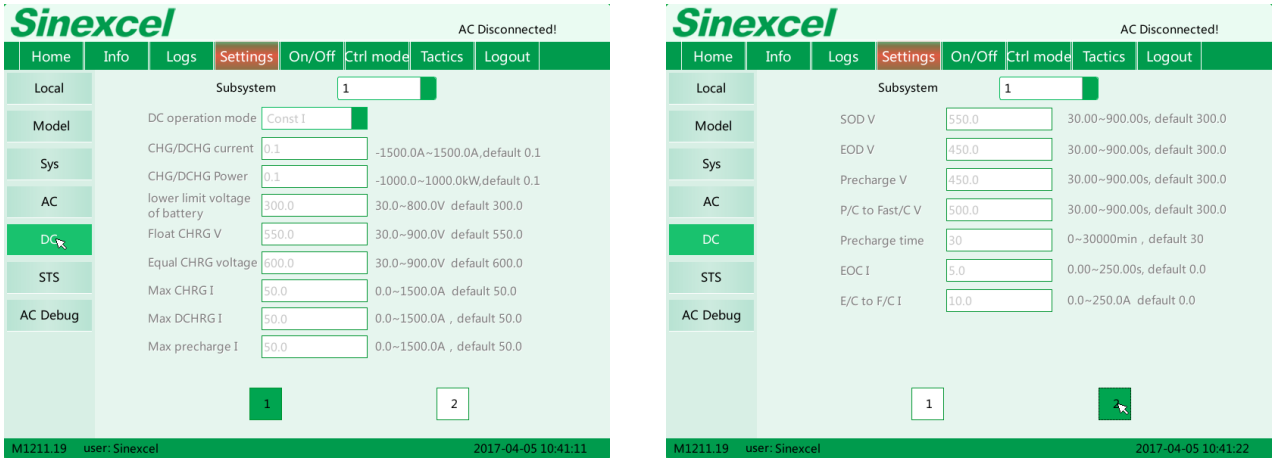


Fig. 6-8 DC settings

DC operation mode: please set it as “auto”.

CHG/ DCRG current: Set charging or discharging current within the rated power according to the actual demand. (Available only after “energy dispatching mode” in “system parameter” is set as “DC dispatching”, and DC operation mode is set as “constant I mode”.)

CHRG/ DCHRG power: Set charging and discharging power within the rated power page according to the actual demand. (It is valid only after “energy dispatching mode” in “system parameter” is set as “DC dispatching”, and DC operation mode is set as “constant P mode”.)

EOD V of Batt: Prioritize the setting according to the manufacturer’s recommendation. Conduct setting according to the following data in case of manufacturer’s data cannot be obtained:

Set 2V lead battery according to 1.67~1.80V* number of batteries in series;

set 3.2V lithium batteries according to 2.70~2.75V* number of batteries in series.

Float CHRG V: Prioritize the setting according to the manufacturer’s recommendation. Conduct setting according to the following data when manufacturer’s data cannot be obtained: Set 2V lead batteries according to 2.20~2.27V* number of batteries in series; set 3.2V lithium batteries according to 3.60~3.70V* number of batteries in series. Keep consistent with the equalizing voltage of battery.

Equal CHRG V: Prioritize the setting according to the manufacturer’s recommendation. Conduct setting according to the following data when manufacturer’s data cannot be obtained: Set 2V lead battery according to 2.20~2.27V* number of batteries in series; set 3.2V lithium batteries according to 3.60~3.70V* number of batteries in series.

E/C to F/C I: Prioritize the setting according to the manufacturer’s recommendation. Set 2V lead batteries according to 0.02C~0.05C in case of manufacturer’s data cannot be obtained. Other connection types can be set as 1A.

Max. CHRG I: Set 50K as 100A, set 100K as 200A and set 150K as 300A.

Max. DCHRG I: Set 50K as 100A, set 100K as 200A and set 150K as 300A.

Max. Precharge I: Set 50K as 100A, set 100K as 200A and set 150K as 300A.

DCHRG Inception Voltage: Conduct setting according to EOD voltage when there are no special

requirements.

DCHRG End Voltage: Conduct setting according to EOD voltage when there are no special requirements.

Precharge V: Conduct setting according to EOD voltage when there are no special requirements.

Precharge to Quick Charge Voltage: Conduct setting according to EOD voltage when there are no special requirements.

Precharge Time: Conduct setting according to client's requirement. When the client does not require pre-charge function, set it as 1min.

Precharge Max. I: Conduct setting according to client's requirement. When the client does not require pre-charge function, set it as 10A.

Charge Cutoff Current: keep the default value.

6.5.6 AC Debug

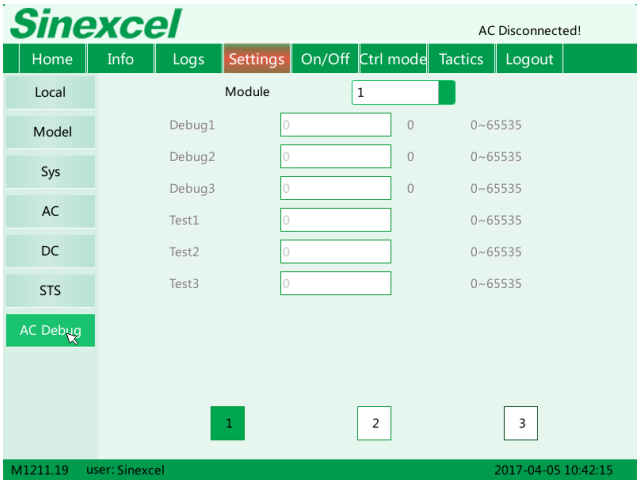


Fig. 6-9 Parameter diagnosis interface

Reserved function for diagnosis.

6.6 On/Off

Enter "On/Off" interface to conduct manual startup and shutdown operation in this interface.

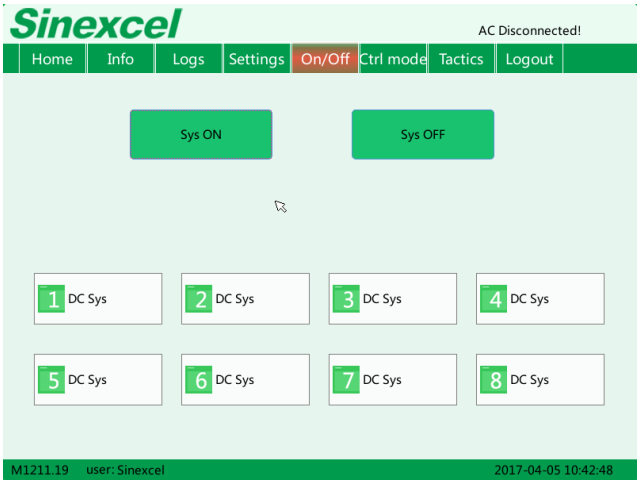


Fig. 6-10 On/Off

After parameters are set and startup condition is met, machine startup and shutdown can be operated via

“Sys ON” and “Sys OFF”.

6.7 Control mode

Enter “ctrl mode”. It includes “Local manual”, “Local auto”, “Remote control” and “Lock out” functions.

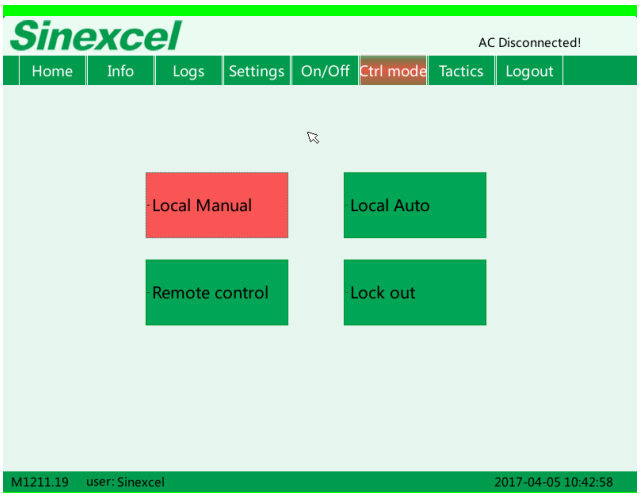


Fig. 6-11 Control mode

Local manual: Set parameters on the monitoring screen to control machine operation.
Local auto: It is used with “local auto”. Under this mode, monitor and maintain the current parameter setting (unchangeable), and operate according to the period for “local auto”—power configuration.
Remote control: Under this mode, monitor and maintain the current parameter setting. The parameter setting can be changed by remote control.
Lock out: Under this mode, monitor and maintain the current parameter setting. The parameter setting cannot be changed by remote control.
In case of no special requirements, please set it as “local manual” mode.

6.8 Tactics

6.8.1 Local strategy

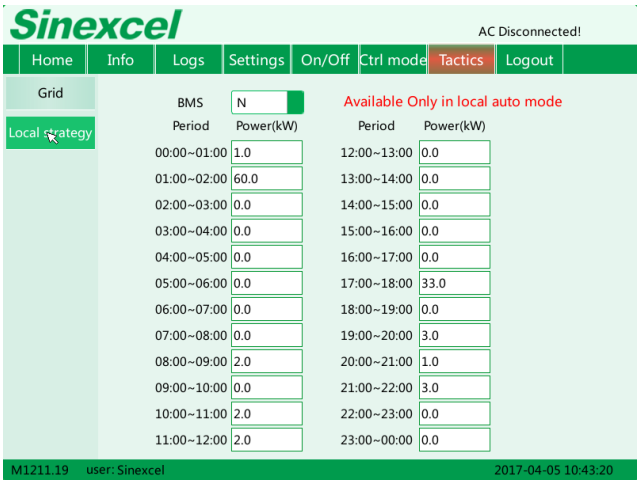


Fig. 6-12 Local strategy

Enter local strategy. Set operation power for different periods according to demand strategy. This function is only valid in “local auto” mode under the “control mode”.

6.9 Log in/out

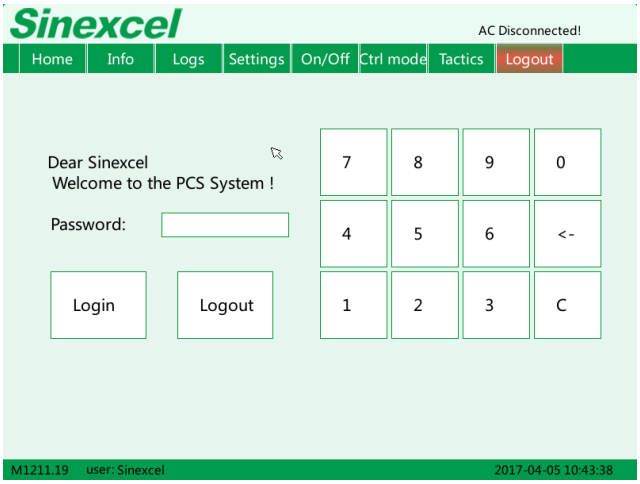


Fig. 6-13 Login page

Click “login/out” to enter login page, enter login password 123456789 and obtain administrator authority.

Chapter VII Communication Mode

7.1 Communication interface

The storage inverter supports Modbus protocol, adopts RS485 and Ethernet communication interface and facilitates users to conduct background monitoring for the storage inverter and realize remote signaling, remote metering and remote regulating of storage inverter.

7.1.1 RS485 serial port

The front door of the storage inverter is embedded with touch screen Management Unit. User interface can be seen at its back. In particular, the position number of RS485 communication interface in the monitoring panel is J23. It is led to terminal strip ports 9 and 10. Users can transfer serial port signal to the one which can be processed by PC via interface converter (such as RS485 transferred to 232). The storage inverter is commissioned alone via background software. It can read operation and warning information. Corresponding setting, startup and shutdown operations can be conducted.

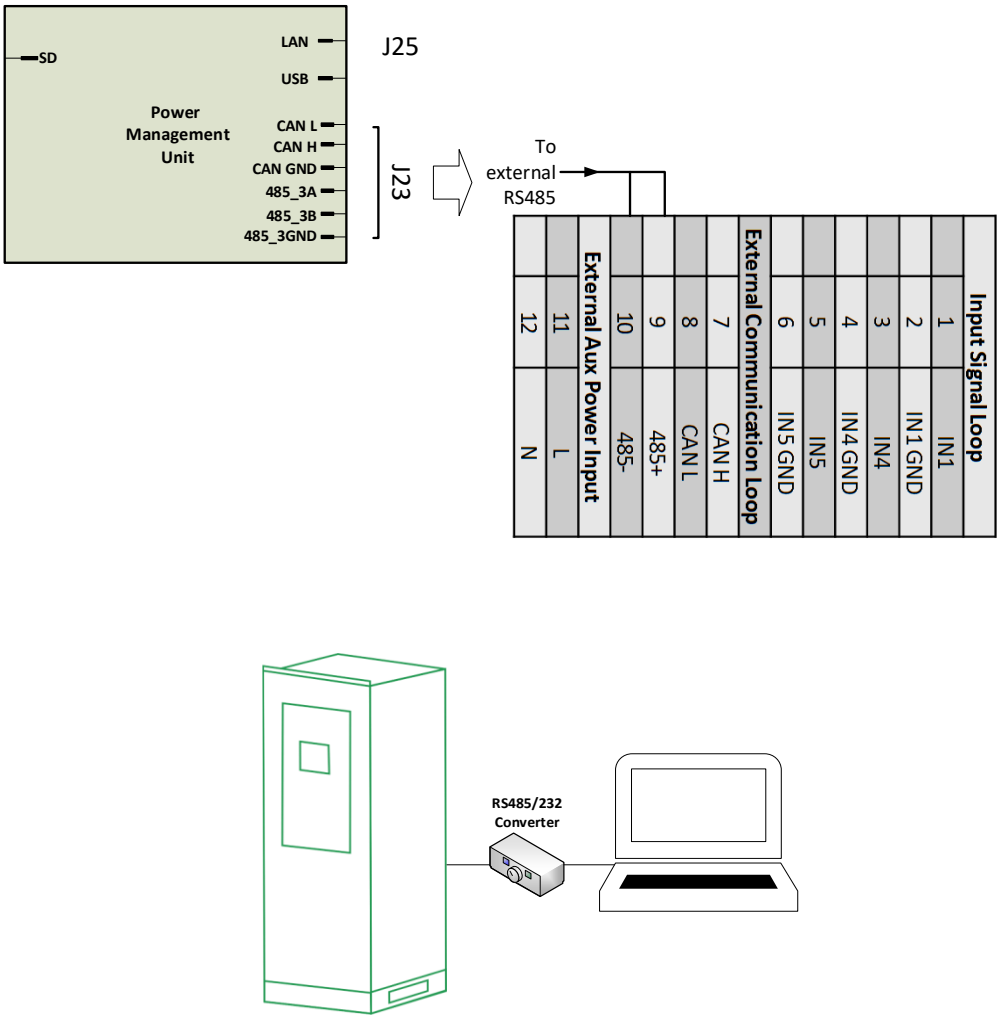


Fig. 7-1 PC conducts monitoring via RS485

7.1.2 Ethernet port

The monitoring panel integrates Ethernet port with position numbered as RJ25. It supports Modbus TCP/IP protocol and has its own IP address like a PC. Ethernet connection requires a switch, and fixed IP needs to be set. Connecting cables are twisted pair (namely network cable). The internet ports of multiple The storage inverter are connected to the switch, and the switch is connected to remote control computer. The state of the storage inverter can be monitored and controlled in real time by setting IP address and port number in the monitoring computer.

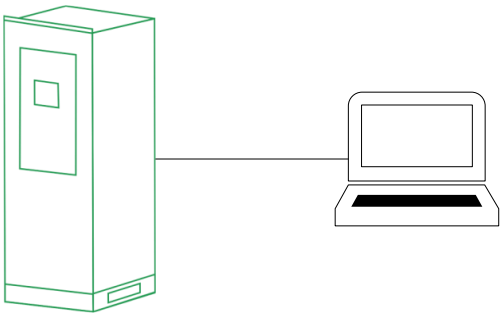


Fig. 7-2 Ethernet communication scheme for single storage inverter

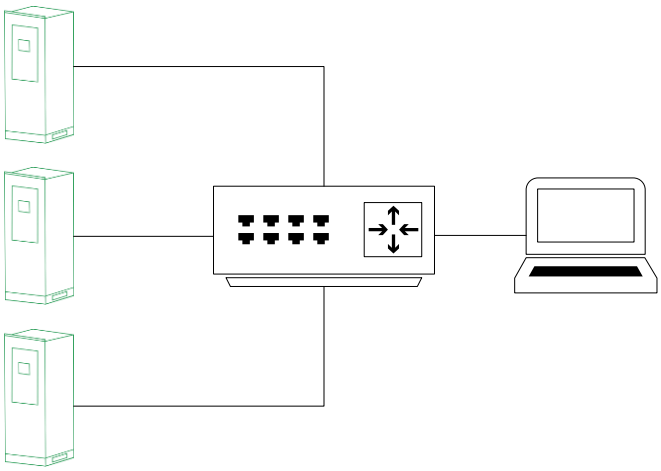


Fig. 7-23 Ethernet communication scheme for multiple storage inverters

7.1.3 Communication with BMS

The inverter communicates with battery management unit (BMS) to monitor battery state information, give an alarm and provide fault protection for battery according to the battery state and improve the safety of storage battery. It supports CAN communication. In particular, the position number of CAN communication interface in the monitoring panel is J23. It is led to terminal strip ports 7 and 8.

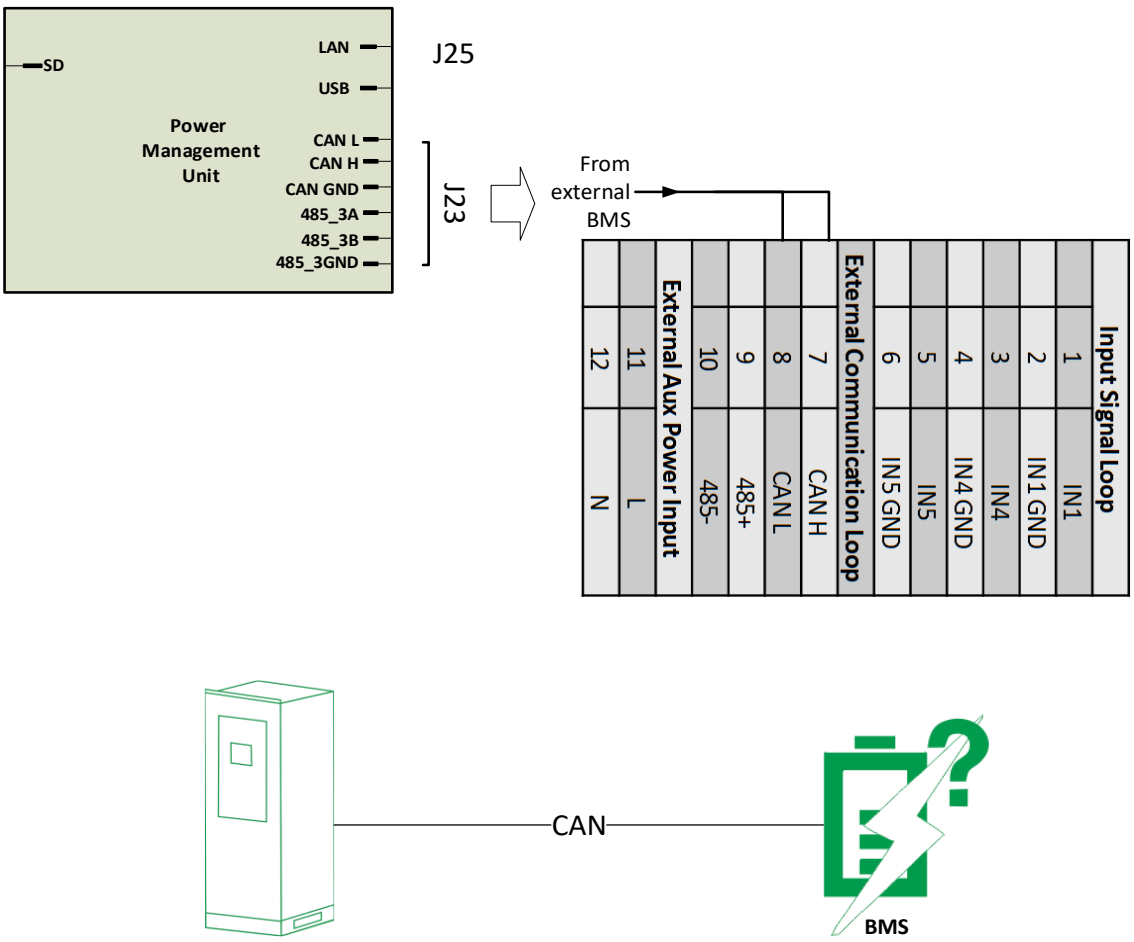


Fig.7-4 Energy storing inverter and BMS communication

7.2 Monitoring system structure

Background monitoring system can operate and control the storage inverter via computer network. This has provided great convenience for learning about the operation of energy storing station. The overall structure diagram for monitoring system is shown in Fig.7-5.

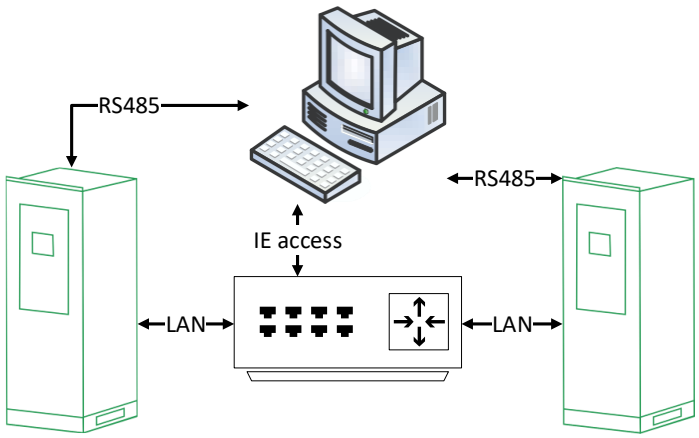


Fig.7-5 Structure diagram for background monitoring system

Chapter VIII Maintenane and Preservation

8.1 Operation environment requirements

Device operation environment must comply with the operation environment required for the device:

- Allowable environment temperature: -20~50℃
- Allowable relative humidity: 0~95% (non-condensing)
- Allowable maximum elevation: 3,000m

Note: When exceeding the maximum elevation, the storage inverter will have de-rating output. Please consult customer service center for specific de-rating coefficient.

8.2 Electrical and fixed connection inspection

After being put into operation, conduct regular inspection on device’s electrical and fixed part connection. Such inspection is advisably conducted every three months. Record for each inspection should be made.

- Cabinet grounding connection;
- Module grounding connection;
- Electrical connection for DC input;
- Electrical connection for AC input;
- Electrical connection for auxiliary power supply;
- Electrical connection for communication cables.
- AC/DC switch, SPD and fan.
- Access monitored fault information.

8.3 Clearing and cleaning

Before the device is put into operation, the dust and sundries in its cooper bars, terminals and mesh openings should be cleaned.

After the device is put into operation, the dust in machine room should be cleaned regularly. Check whether the ventilating and air exhaust facilities in machine room are normal. They are advisably cleaned once every three months.

Appendixes

Appendix 1: Fault information of storage inverter

Table 9-1 presents the visible fault types of storage inverter. From this table, users can simply and quickly identify the system faults from the fault types displayed on touch screen. In multiple module parallel system, the warning information interface will indicate the number of fault slaves and fault type.

Table 9-1 Fault information

Fault type	Description
Overvoltage of power grid	The voltage of power grid is higher than the set upper limit. After faults are recovered, restart the storage inverter.
Overvoltage of power grid	The voltage of power grid is lower than the set lower limit. After faults are recovered, restart the storage inverter.
Inverted sequence of power grid	The phase sequence of AC power grid is inverse.
Abnormality of power grid frequency	Power grid frequency exceeds the set scope. After faults are recovered, restart the storage inverter.
Islanding of storage inverter	There is islanding in storage inverter.
Overvoltage of DC input	Overvoltage of DC input is higher than the upper limit. After faults are recovered, restart the storage inverter.
Low DC voltage	Overvoltage of DC input is lower than the lower limit. After faults are recovered, restart the storage inverter.
Abnormality of BUS bar voltage	DC BUS bar voltage is too high or low, which results in system shutdown. After faults are recovered, restart the storage inverter.
Abnormality of balanced circuit	BUS bar voltage is imbalanced *(internal fault information)*
Soft start fault	Soft start fault *(internal fault information)*
Emergency shutdown	EPO action, emergency shutdown
Over-temperature of inverter	The temperature of inverter radiator is too high.
Fan fault	At least one cooling fan has faults.
Monitoring parameter setting fault	Monitoring parameter setting is incorrect. Please modify the setting.

Appendix 2: Quality assurance and after-sales service

1) Quality assurance

If there are fault products during warranty period, users should provide relevant certificates for purchased products. Shenzhen Sinexcel Electric Co., Ltd. (“Sinexcel”) will provide free maintenance or replace it with a new product.

2) Disposal of claim products

The replaced nonconforming products will be disposed by Sinexcel. Users should properly store the claim products. As for the products requiring repair, users should give reasonable and sufficient time. We apologize for any inconvenience caused to you.

3) In case of any of the following circumstances, Sinexcel will not offer any quality assurance:

- Transport damage;
- The device is operated under the environment conditions beyond this user’s manual or in severe condition.
- The device is incorrectly installed, refitted or used.

- Users dismantle or assemble the device or system parts at will.
- It is beyond the warranty period.
- Product damage is caused by emergencies or natural disasters.

If customers require maintenance for the product faults above, our company will offer paid maintenance services after being judged by customer service department.

Installation Records