# User's Manual

## 50K/100K Bi-directional Hybrid Storage Inverter



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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:





For example:

P2-100K: 100kW Bi-directional Hybrid Storage Inverter

#### 1.2 Symbolic interpretation

| 4 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. |
| <b>Warning</b>  |
| 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.      |
| <b>Attention</b>  |

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 or PV, storage inverter and AC distribution unit. Batteries or PV are input to the storage inverter after series-parallel connection of unit. Storage inverter outputs it to AC distribution unit. It operates in different modes according to the need.

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 storage inverter is single route input, its output side is set with an isolation transformer, and it can conduct low-voltage on-grid.





The battery bank can be accumulator or lithium battery, but the mixed use of different kinds of batteries is forbidden. The DC voltage must be higher than the required lowest value, otherwise the PCS will not operate normally.

|   | A Danger   |
|---|--|
| • | There is deadly high voltage between the anode and cathode of battery bank, and make sure the disconnection between the battery bank and PCS when servicing the equipment. |



- The frame of photovoltaic array should be ground connection to make sure the safety of operating personnel.
- When the photovoltaic array is exposed to light, it supplies a DC voltage to the PCS.



• To be in compliance EN61000-3-11, the product shall be connected only to a supply of the system impedance: |Zsys| =0.191 ohms or less. Before connect the product to public power network, please consult your local power supply authority to ensure the power network meet above requirement.



- Ensure all wiring is correctly selected and erected in accordance with AS 3000 wiring regulation.
- Make sure the neutral conductor of the Grid and load via stand-alone port shall not interrupt.
- Make sure the neutral conductor of the Grid and load shall be bonding to earth via earth bar.





## 1.4 Operation model

The Bi-directional Hybrid Storage inverter can operate in on-grid model and off-grid model. When the inverter works in on-grid model, it can trace the amplitude and phase of grid voltage faultlessly. And if the DC source is

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battery, the Bi-directional inverter can transfer energy form grid to batteries. When the inverter works in off-grid model, the output is fixed amplitude and frequency voltage.

#### 1.5 Safety instructions

This user's manual is about installation and use of 50KW/100KW storage inverter.

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

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.

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



• Before connecting input power supply, please ensure that the grounding is reliable.

• The device grounding must comply with the local electric codes.



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

#### operation.



- 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.



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.

#### 1.6 **Precautions**

#### 1.6.1 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.

#### 1.6.2 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.

#### 1.6.3 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.

#### 1.6.4 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

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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          |  |
| 1        | indicator light |  |
| 2        | Fault indicator |  |
|          | light           |  |
| 3        | Hanger          |  |
| 4        | Handle          |  |
| 5        | Communication   |  |
|          | cable           |  |
| 6        | Power supply    |  |
| 5        | cable           |  |

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

2 Chapter II Introduction to PCS-AC, PCS-DC and STS Modules

## 2.2 Overall dimension of PCS-DC module

Fig.2-3 is a diagram for overall dimension of PCS-DC module case and installation hole.



Fig. 2-3 Overall dimension and installation diagram for PCS-DC module

Fig. 2-4 is 3D view for front panel of PCS-DC module.



Fig. 2-4 Front 3D view for PCS-DC module

| Position | Description     |  |
|----------|-----------------|--|
| 1        | Normal          |  |
|          | indicator light |  |
| 2        | Fault indicator |  |
| 2        | light           |  |
| 3        | Hanger          |  |
| 4        | Handle          |  |
| E        | Communication   |  |
| 5        | cable           |  |
| 6        | Power supply    |  |
| 0        | cable           |  |



• 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

50K/100K Bi-directional Hybrid Storage Inverter is composed of 1 or multiple set(s) of PCS-DC and 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 Bi-directional Hybrid Storage Inverter cabinet is equipped with lightning protector, AC/DC breaker and distribution units. If on/off-grid switching is to be achieved, extra power distribution unit (STS) needs to be added. Fig.3-1 is a topological graph for its composition and structure.



Fig.3-1 Topological graph for Bi-directional Hybrid Storage Inverter

## Main composition of Bi-directional Hybrid Storage Inverter cabinet is shown in Fig.3-1.

| Table 3-1 Main composition of Bi-directi | onal Hybrid Storage Inverter cabinet |
|--|--------------------------------------|
|--|--------------------------------------|

| Serial<br>No. | Name    | Quantity      | Remark  |
|---------------|---------|---------------|---|
| 1             | Cabinet | plane         | The cabinet is equipped with distribution components. |
| 2             | PCS-AC  | 1~2<br>set(s) | 50KW 1 set; 100KW 2 sets;                             |
| 3             | PCS -DC | 1~2<br>set(s) | 50KW 1 set; 100KW 2 sets;                             |

| 4 | Isolation transformer | 1 set |                                      |
|---|-----------------------|-------|--------------------------------------|
| 5 | Power Management Unit | 1 set | It is installed in the cabinet door. |

## 3.2 Technical parameters

Table 3-2 is detailed parameters for Bi-directional Hybrid Storage Inverter.

Table 3-2 Technical parameters

| parameters                                 | 50K            | 100K           |
|--|----------------|----------------|
| PV input quantities:                       |                |                |
| Vmax PV                                    | 900 d.c. V     | 900 d.c. V     |
| PV input operating voltage range           | 520~900 d.c. V | 520~900 d.c. V |
| Maximum operating PV input current         | 192 d.c. A     | 384 d.c. A     |
| Isc PV                                     | 225 d.c. A     | 450 d.c. A     |
| Max inverter backfeed current to the array | 5A             | 5A             |
| a.c. output quantities                     |                |                |
| Voltage (nominal)                          | 400 a.c. V     | 400 a.c. V     |
| Current (maximum continuous)               | 72 a.c. A      | 144 a.c. A     |
| Current (inrush)                           | 86 a.c. A      | 172 a.c. A     |
| Frequency (nominal)                        | 50/60 Hz       | 50/60 Hz       |
| Power (maximum continuous)                 | 50000 W        | 100000 W       |
| Power factor range                         | ±0.8           | ±0.8           |
| Maximum output fault current               | 200 a.c. A     | 400 a.c. A     |
| Maximum output overcurrent protection      | 86 a.c. A      | 172 a.c. A     |
| a.c. input quantities                      |                |                |
| Voltage (nominal)                          | 400 a.c. V     | 400 a.c. V     |
| Current (maximum continuous)               | 151 a.c. A     | 303 a.c. A     |
| Current (inrush)                           | 181 a.c. A     | 363 a.c. A     |
| Frequency                                  | 50/60 Hz       | 50/60 Hz       |
| d.c. input (other than PV) quantities      |                |                |
| Voltage (range)                            | 250~520 d.c. V | 250~520 d.c. V |
| Nominal battery voltage                    | 450 d.c. V     | 450 d.c. V     |
| Current (maximum continuous)               | 130 d.c. A     | 260 d.c. A     |
| d.c. output quantities                     |                |                |
| Voltage                                    | 250~520d.c. V  | 250~520 d.c. V |
| Nominal battery voltage                    | 450 d.c. V     | 450 d.c. V     |
| Current (maximum continuous)               | 130 d.c. A     | 260 d.c. A     |

| Protective class                          | I     | Ι     |
|---|-------|-------|
| Ingress protection (IP) rating per part 1 | IP 20 | IP 20 |

Note: (1) If DC voltage exceeds 520V, it might cause PV input to fail to operate at the best MPPT point.

### 3.3 Overall dimension

The overall dimension of Bi-directional Hybrid Storage Inverter is shown in Fig.3-2. Cabinet width: 800mm, height: 2,160mm (without ring); depth: 800mm.



Fig. 3-2 Overall dimension of Bi-directional Hybrid Storage Inverter

## 3.4 Description

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

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| Position | Description                  |  |
|----------|------------------------------|--|
| 1        | Power indicator<br>light     |  |
| 2        | Fault indicator light        |  |
| 3        | Normal indicator<br>light    |  |
| 4        | Emergency<br>shutdown button |  |

8 Chapter III Introduction to System

Fig. 3-3 Appearance diagram for Bi-directional Hybrid Storage Inverter

Taking 100K as an example: After opening the front door, the internal plane layout is shown in Fig.3-4. Main components include module, AC/DC breaker and lightning protector.

Fig.3-4 Internal plane layout diagram for Bi-directional Hybrid Storage Inverter



| Position | Description                                      |
|----------|--|
| 1        | PCS-DC (1~2 module(s))<br>PCS-AC (1~2 module(s)) |
| 2        | PV DC switch                                     |
| 3        | Battery switch                                   |
| 4        | AC breaker (load)                                |

Touch screen

5

## Chapter IV Device Installation

## 4.1 Transport and storage

Cabinet and module of Bi-directional Hybrid Storage Inverter are packed separately in the packing cases. That is, multiple modules and a cabinet packed separately in the packing cases. During device transport and storage, pay attention to the logo on the packing case.

Bi-directional Hybrid 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.



- During transport and storage, three modules can be stacked at most.
- The front of module packing case (the side with "Bi-directional Hybrid Storage Inverter" printed) should be placed upwards. Keep it upright.
- 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 Bi-directional Hybrid 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 Bi-directional Hybrid 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 Bi-directional Hybrid Storage Inverter



## 4.3 Open-case inspection

#### 4.3.1 Overview

Before installation of Bi-directional Hybrid Storage Inverter, open-case inspection needs to be conducted. The inspection includes the following:

- Check whether the items in the packing 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 Bi-directional Hybrid 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:

| Serial<br>No. | Name  | Quantity | Remark |
|---------------|---|----------|--------|
| 1             | User's manual   | 1 сору   |        |
| 2             | Overall dimension and foundation installation diagram | 1 сору   |        |
| 3             | Schematic diagram                                     | 1 сору   |        |
| 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°C.
- The installation position is convenient for observing touch screen.

#### 4.4.2 Ground requirements

The cabinet of Bi-directional Hybrid Storage Inverter needs to be installed on the flat ground. The ground for installation should be greater than 1,000kg/m<sup>2</sup>.

#### 4.4.3 Ventilation

The cooling mode of Bi-directional Hybrid 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 Bi-directional Hybrid Storage Inverter can be discharged outside the machine room.



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 Bi-directional Hybrid Storage Inverter can be discharged outside the machine room.

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#### 4.4.4 Operation space

The installation space of Bi-directional Hybrid 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.



Fig. 4-3 Installation space of Bi-directional Hybrid Storage Inverter

#### 4.4.5 Other requirements

#### 1) Waterproofing

The protection grade of the cabinet of Bi-directional Hybrid 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 Bi-directional Hybrid 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 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.4-4.



Fig.4-4. Diagram for cabinet base

When the cabinet needs to be fixed on the steel channel,  $\Phi$ 14 holes can be made in the steel channel. Fix the cabinet to the steel channel with screws, as shown in Fig.4-5.



Fig. 4-5 Fix the cabinet to the steel channel Fig.4-6 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.4-6.

## 4.6 Electrical connection

#### 4.6.1 Input requirement

DC voltage of Bi-directional Hybrid Storage Inverter should be within the input scope, or the Bi-directional Hybrid 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 regirement

The output of Bi-directional Hybrid Storage Inverter is 3-phase and 4-wire. When designing energy storing system, the Bi-directional Hybrid Storage Inverter has been equipped with an isolation transformer, the voltage of its output side can directly be connected to the low-voltage power grid.

#### 4.6.3 Wiring mode

The Bi-directional Hybrid Storage Inverter adopts the wiring mode of lower inlet and outlet. 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.4-9 and Fig. 4-10 for main view of cabinet's front door. As for wiring requirements, single cables or multiple cables with proper wire diameter should be selected. It is suggested that the current in  $1 \text{mm}^2$  wire should be  $\leq 3A$ .



| Position | Description   |  |  |  |  |
|----------|---------------|--|--|--|--|
| 1        | PV DC input   |  |  |  |  |
| 1        | positive pole |  |  |  |  |
| 2        | PV DC input   |  |  |  |  |
| £        | negative pole |  |  |  |  |
| r        | Battery input |  |  |  |  |
| 5        | positive pole |  |  |  |  |
| Δ        | Battery input |  |  |  |  |
| -1       | negative pole |  |  |  |  |
| 5        | PE            |  |  |  |  |

| 6 | AC output A phase |
|---|-------------------|
| 7 | AC output B phase |
| 8 | AC output C phase |
| 9 | N bar             |

Note: The bolt is M8 with a hole diameter of 8mm.



Fig. 4-6 PWG2-50K cabinet wiring copper bars

Note: The bolt is M8 with a hole diameter of



#### 4.6.4 System grounding

The modules in Bi-directional Hybrid 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  $4\Omega$ .

| Batad power | PE line section                   |     |
|-------------|-----------------------------------|-----|
|             | recommendation (mm <sup>2</sup> ) |     |
| 50K         | ≥16                               |     |
| 100K        | ≥25                               |     |
|             | <u> </u> Warni                    | ing |

Cabinet and module need to be grounded reliably!

1) Use a multi-meter to measure the voltage of PV and battery port, and ensure that the voltage is within input voltage range of Bi-directional Hybrid 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 PV battery pack to "DC+" of DC input of Q1 switch.

4) Connect the negative pole of PV battery pack to "DC-" of DC input of Q1 switch.

5) Connect the positive pole of storage battery to "DC+" of DC input of Q2 switch.

6) Connect the negative pole of storage battery to "DC-" of DC input of Q2 switch.

7) Confirm wiring firmness.



Disconnect DC distribution isolation 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.

#### 4.6.5 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 distribution switch Q3 at back level in Bi-directional Hybrid 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 distribution switch Q3 of power grid and PE are respectively connected to A/B/C phases of power grid and PE.

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

5) Confirm wiring firmness.



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



All wires are connected to the wiring terminals externally from the wiring holes at the bottom of Bi-directional Hybrid Storage Inverter. After wiring, fireproofing mud should be used to seal the wiring holes.

#### 4.6.6 Wiring of terminal strips

Except power cable connection in the whole Bi-directional Hybrid Storage Inverter, there are also auxiliary power connection, input and output of some node signals. All of them are led to the terminal strips with cluster cables in the cabinet. The port definition of external wiring for terminal strips is shown in Fig.4-10.



Fig. 4-8 Definition of terminal strip ports



The BMS shall have at least one output dry contact connected to "BMS Fault Singnal" In case of battery over-temperature. The BMS shall send trip command to 50K/100K via the dry contact named "BMS Fault Signal"

## 4.7 Check after installation

After installation of Bi-directional Hybrid 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 Bi-directional Hybrid Storage Inverter is completed, and wiring is fully checked, connect auxiliary power and close the breaker in AC side. The Bi-directional Hybrid Storage Inverter can be switched in different modes under the conditions in Fig.5-1.



Fig.5-1 Operation state diagram for Bi-directional Hybrid Storage Inverter

Refer to Table 5-1 for operation state of Bi-directional Hybrid Storage Inverter.

| Operation<br>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                                    |

| Table 5-1 O | peration state | of Bi-directiona | l Hvbrid Stor | age Inverter |
|-------------|----------------|------------------|---------------|--------------|
|             | p 0. a c. 0    |                  |               | age ee.      |

|          |                                       | 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 Bi-directional Hybrid 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 Bi-directional Hybrid Storage Inverter will make an alarm, shut down automatically and stop providing power outside.

After meeting the following conditions, the Bi-directional Hybrid 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 Bi-directional Hybrid Storage Inverter, users can start the device by hands through touch panel.

### 5.2 Startup and shutdown

Bi-directional Hybrid 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 and AC breakers are at "OFF" position.

2) Complete installation according to Chapter IV, and check whether DC input wiring and AC output wiring in Bi-directional Hybrid 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 Bi-directional Hybrid 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 Q1. 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 LCD 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 Bi-directional Hybrid Storage Inverter, the following steps can be conducted if shutdown is required.

1) On LCD, 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 Q1.
- 4) Disconnect AC breaker Q3.

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 Bi-directional Hybrid 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 shutdown

When the Bi-directional Hybrid 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.



- 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

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warning label on module case surface).

## Chapter VI Operation Control Display Panel

### 6.1 Operation instructions

This section introduces LCD display content and settable parameters. Relevant operation control can be conducted via human-computer interface.

LCD display interface can provide 800×600 pixel graphic display, display warning information in real time, provide historical warning records for user's query and offer a reliable basis for fault diagnosis. Through LCD display interface, users can conduct various operation commands, conveniently browse input, output, operation parameters and waveforms and timely obtain current storage inverter state and warning information. LCD can also display the version information of system control software and internal monitoring software.



#### 6.1.1 Main interface of monitoring startup

After auxiliary power of storage inverter is connected, LCD is on. At this moment, a startup interface will appear, as shown in Fig.6-1. It shows that the system is booting. After system booting, the interface will disappear.



Fig.6-1 Welcome interface for startup

#### 6.1.2 Interface of main wiring diagram

After startup, enter the interface of main wiring diagram as shown in Fig. 6-2. Under the main wiring interface,



system AC/DC voltage and current, system charging and discharging and operation state can be seen.

Fig.6-2 Interface of main wiring diagram

#### 6.1.3 Login interface

| Dear Service e<br>Welcome to t | engineer<br>he PCS System ! | 7 | 8 | 9 | 0  |
|--------------------------------|-----------------------------|---|---|---|----|
| Password:                      |                             | 4 | 5 | 6 | <. |
| Login                          | Logout                      | 1 | 2 | 3 | c  |

display information includes "main wiring diagram", "system information" and "event records". Users can use such information to learn about current operation status, historical operation data and fault records, as shown in Fig. 6-3.

Fig.6-3 Login interface

Click "login/out" to enter login interface, enter login password 123456789 and enter main interface of super client. In the main interface of super client,

#### 6.1.4 System information interface

| Home      | Info    | Logs     | Settings | On/Off | Ctrl mode | Tactics | Logout |
|-----------|---------|----------|----------|--------|-----------|---------|--------|
| DC        | Uab(V)  |          |          | 405.0  | Pa(kW)    |         | -0.04  |
| AC        | Ubc(V)  |          |          | 403.8  | Pb(kW)    |         | 0.02   |
|           | Uca(V)  |          |          | 402.4  | Pc(kW)    |         | 0.18   |
| Status    | Ia(A)   |          | -        | 2.7    | Qa(kVar)  |         | 0.63   |
| BMS       | Ib(A)   |          | L.       | 2.0    | Qb(kVar)  |         | 0.46   |
| C datail  | Ic(A)   |          |          | 3.0    | Qc(kVar)  |         | 0.67   |
| ic detail | F(Hz)   |          |          | 49.99  | Sa(kVA)   |         | 0.63   |
| C detail  | charge  | d(kWh)   |          | 326    | Sb(kVA)   |         | 0.47   |
|           | dischar | ged(kWh) |          | 100    | Sc(kVA)   |         | 0.70   |
|           | PFa     |          |          | 0.04   | P(kW)     |         | 0.16   |
|           | PFb     |          | 1        | 0.06   | Q(kVar)   |         | 1.76   |
|           | PFc     |          |          | 0.25   | S(kVA)    |         | 1.80   |

After login, users can review system AC/DC operation state, power grid, load, module state, battery state and warning information under system information, as shown in Fig.6-4.

Fig.6-4 System information interface

### 6.1.5 Interface of event records

| Current    | No. | Alarm                     | Start time          | Terminal time |
|------------|-----|---------------------------|---------------------|---------------|
| Past Alarm | 0   | DC #1 BMS fault           | 2017-08-15 15:26:24 |               |
|            | 1   | AC #1 BMS fault or Switch | 2017-08-15 15:23:25 |               |
| Operation  | 2   | DC #1 Bus L/V             | 2017-08-15 15:14:24 |               |
|            | 3   |                           |                     |               |
| status     | 4   |                           |                     |               |
|            | 5   |                           |                     |               |
| Curve      | 6   |                           |                     |               |
|            | 7   |                           |                     |               |
|            | 8   |                           |                     |               |
|            | 9   |                           |                     |               |
|            | 10  |                           |                     |               |
|            | 11  |                           |                     |               |
|            | 12  |                           |                     |               |

Fig.6-5 Interface of event records

In event records, users can review current alarm, history alarm, operation record and state record in the system, as shown in Fig.6-5.

## 6.2 Setting information

Setting interface includes "system setting", "startup and shutdown" and "control mode" interfaces. Default values (in gray) have been set for general parameters upon delivery. Some parameters can be set according to actual situation and this manual.

#### 6.2.1 Monitoring parameter interface

| Home    | Info Logs Sett    | tings On/Off Ctrl | mode Tactics   | Logout   |
|---------|-------------------|-------------------|----------------|----------|
| Local   | System Time       | 17-08-15-15-27-00 | BMS Timeout(s) | 0        |
| Model   | Backlight delay   | 60                | Remote Timeout | 0        |
| Ger     | Baud rate         | 9600              |                |          |
| sys     | Ib                | 192.168.1.10      |                |          |
| AC      | Gateway           | 192.168.1.1       | Reset          | Settings |
| DC      | Mask              | 255.255.255.0     |                |          |
| C Debug | Modbus Addr       | 1                 |                |          |
| C Debug | Log interval(min) | 15                | _              | _        |
| c Debug | IEC104 Addr       | 1                 | Modi           | fy MAC   |
|         | BMS type          | JUWEI             | Cali           | brate    |
|         | BMS               | Enabled           | Seree          | onshots  |
|         | Language          | English           | Street         |          |

Enter "communication parameter" option. In this interface, site of storage inverter, Baud rate and IP address can be set. It is used for setting in case of background and system station level monitoring and communication, as shown in Fig.6-6.

Fig.6-6 Interface of control state

#### 6.2.2 System parameter interface

Enter "system parameter". Main setting parameter items include "boot mode", "on/off-grid mode" and "energy dispatching mode", as shown in Fig. 6-7.

| Home      | Info      | Log <sup>3</sup> S | us<br>ettings | On/Off      | Ctrl mode | Tactics | Logout          |
|-----------|-----------|--------------------|---------------|-------------|-----------|---------|-----------------|
| Local     |           |                    |               |             |           |         |                 |
| Model     |           | Boot mode          | Mann          | iual Startu |           |         |                 |
| Sys       |           | Engry Mgnt         | DC            |             |           | -       |                 |
| AC        |           | DC setting mo      | de ALL        |             |           | Cle     | ar Faults       |
| DC        |           | Word1              | 10            |             |           |         |                 |
| AC Debug  |           | Word2              | 10            |             |           |         |                 |
| DC Debug  |           |                    |               |             |           |         |                 |
|           |           |                    |               |             |           |         |                 |
|           |           |                    |               |             |           |         |                 |
|           |           |                    |               |             |           |         |                 |
| 41312.5 u | ser: Serv | ice engineer       |               |             |           |         | 2017-08-15 15:2 |

Fig.6-7 System parameter interface

Boot mode: please set it as "manual boot".

Off/on-grid mode" : As for on-grid operation, close AC breaker Q2 and set "on-grid mode" ; as for offgrid operation, disconnect AC breaker Q2 and set "off-grid mode".

Energy dispatching mode: please set it as "AC dispatching". If "DC dispatching" is set according to the actual need, set "charging and discharging current" and "charging and discharging power" in DC parameter, as shown in 6.2.4.

#### 6.2.3AC parameter interface

| Local |                                 |         |   |  |  |  |
|-------|---------------------------------|---------|---|--|--|--|
| cocar | AC operation mode               | Const Q |   |  |  |  |
| Model | PF                              | 1.00    | -1.00~+1.00, default 1.00                                   |  |  |  |
| Sys   | Power configuration             | 50.0    | -660.0~660.0kW, default 0.0                                 |  |  |  |
| AC    | Q configuration                 | 0.0     | -660.0~+660.0kVar, default 0.0<br>0.00~600.00s, default 20s |  |  |  |
| DC    | Grid reconnection<br>delay      | 20      |   |  |  |  |
|       | Normal Ramp Rate                | 2.00    | 0.01~2.00/s, default 2.00                                   |  |  |  |
| Debug | Soft-Start<br>reconnection ramp | 2.000   | 0.001~2.000/s, default 2.000                                |  |  |  |
| Debug | rate<br>Off-grid V Range        | 0.00    | -0.10~+0.10, default 0.00                                   |  |  |  |
|       |                                 |         |   |  |  |  |
|       |                                 | _       |   |  |  |  |
|       | 1 2                             | 3 4     | 5 6 7   |  |  |  |

Fig.6-8 AC parameter interface

Enter "AC parameter" . Main setting parameter items include "inverter control mode", "active power setting" and "reactive power setting", as shown in Fig. 6-8.

Inverter control mode: please set it as "constant reactive power".

Active power setting: Set active power within the rated power of the machine according to the actual need.

Reactive power setting: Set reactive power within the rated power of the machine according to the actual need.

#### 6.2.4DC parameter interface



Enter "DC parameter. As shown in Fig. 6-9, main parameter settings are introduced as follows.

Fig.6-9 DC parameter interface

DC Work Mode: please set it as "auto".

EOD V of Batt: 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 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 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.

Equa 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 C: Prioritize the setting according to the manufacturer' s recommendation. Set 2V lead batteries according to 0.02C~0.05C when manufacturer' s data cannot be obtained. Other connection types can be set as 1A.

Max. CHRG C: Set 50K machine as 130A, set 100K machine as 260A.

Max. DCHRG C: Set 50K machine as 130A, set 100K machine as 260A.

Max. Precharge C: Set 50K machine as 130A, set 100K machine as 260A.

CHRG/ DCHRG P: Set charging and discharging power within the rated power of the machine according to the actual need. (It is valid only after "energy dispatching mode" in "system parameter" is set as "DC dispatching", and DC work mode is set as "constant power mode".)

CHRG/ DCHRG C: Set charging and discharging current within the rated power of the machine according to the actual need. (It is valid only after "energy dispatching mode" in "system parameter" is set as "DC dispatching", and DC work mode is set as "constant current mode".)

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

Charge Cutoff Current: Adopt default value.

6.2.5Parameter diagnosis interface

|            |             |          | B        |                |          |           |            |          |
|------------|-------------|----------|----------|----------------|----------|-----------|------------|----------|
| Home       | Info        | Logs     | Settings | On/Off         | Ctrl mod | le Tactic | s Logout   |          |
| Local      |             |          | Module   |                | 1        |           |            |          |
| Model      |             | Debug1   | [        | 39453          | 0        | 0         | ~65535     |          |
| Sys        |             | Debug2   |          | 39620<br>39486 | 0        | 2 0       | ~65535     |          |
| AC         |             | Test1    | [        | 0              |          | 0         | ~65535     |          |
| DC         |             | Test2    | 6        | 0              |          | 0         | ~65535     |          |
| AC Debug   |             | Test3    |          | 0              |          | 0         | ~65535     |          |
| DC Debug   |             |          |          |                |          |           |            |          |
|            |             |          |          |                |          |           |            |          |
|            |             |          |          |                |          |           |            |          |
| M1312.5 us | er: Service | engineer |          |                |          |           | 2017-08-15 | 15:27:38 |

Fig.6-10 Parameter diagnosis interface

Enter "system diagnosis". It includes "AC debug" and "DC debug" interfaces which are used by maintenance engineer to check machine operation status or faults, as shown in Fig. 6-10.

#### 6.2.6Local strategy interface

| lome       | Info Logs !    | Settings  | On/Off Ctrl mode | actics   | Logout |
|------------|----------------|-----------|------------------|----------|--------|
| Grid       | Period         | Power(kW) | Period           | Power(kW | )      |
| l strategy | 0~0:30 {00:00~ | -660.0    | 0~06:30 (06:00~  | 0.0      | ]      |
|            | 0~01:00 (00:30 | 0.0       | 0~07:00 {06:30~  | 0.0      |        |
|            | 0~01:30 {01:00 | 0.0       | 0~07:30 (07:00~  | 0.0      |        |
|            | 0~02:00 (01:30 | 0.0       | 0~08:00 {07:30~  | 0.0      |        |
|            | 0~02:30 {02:00 | 0.0       | 0-08:30 (08:00-  | 0.0      |        |
|            | 0~03:00 (02:30 | 0.0       | 0~09:00 (08:30~  | 0.0      | ]      |
|            | 0~03:30 (03:00 | 0.0       | 0~09:30 {09:00~  | 0.0      | ]      |
|            | 0~04:00 (03:30 | 0.0       | 0~10:00 (09:30~  | 0.0      | ]      |
|            | 0~04:30 (04:00 | 0.0       | 0~10:30 (10:00~  | 0.0      | ]      |
|            | 0~05:00 (04:30 | 0.0       | 0~11:00 (10:30-  | 0.0      | ]      |
|            | 0~05:30 {05:00 | 0.0       | 0~11:30 (11:00~  | 0.0      | ]      |
|            | 0~06:00 {05:30 | 0.0       | 0~12:00 (11:30~  | 0.0      | ]      |

Fig.6-11 Local strategy interface

Enter "local strategy". Set operation power for different periods according to demand strategy. This function is only valid in "local auto" mode under the interface of "control mode", as shown in Fig. 6-11.

#### 6.2.7Control state interface

Enter "control state". It includes "local manual", "local auto", "remote control" and "lock" interfaces, as shown in Fig. 6-12.



Local auto: It is used with "local strategy". Under this mode, monitor and maintain the current parameter setting (unchangeable), and operate according to the period for "local strategy" —power configuration.

Remote control: Under this mode, monitor and maintain the current parameter setting. The parameter setting can be changed by remote control. Lock: 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.

Local manual: Set parameters on the monitoring screen to control machine operation.

#### 6.2.8Startup and shutdown interface

Enter "startup and shutdown" interface to conduct manual startup and shutdown operation in this interface, as shown in Fig. 6-13.

|         |             |            | B        |        |           |         |            |          |
|---------|-------------|------------|----------|--------|-----------|---------|------------|----------|
| Home    | Info        | Logs       | Settings | On/Off | Ctrl mode | Tactics | Logout     |          |
|         |             | Sys ON     |          |        | Sys C     | YFF     |            |          |
|         |             |            |          |        |           |         |            |          |
|         |             |            |          |        |           |         |            |          |
| M1312.5 | user: Servi | e engineer |          |        |           |         | 2017-08-15 | 15:28:53 |

After parameters are set and startup condition is met, machine startup and shutdown can be operated via "Sys ON" and "Sys OFF".

Fig.6-13 Startup and shutdown interface

## **Chapter VII Communication Mode**

### 7.1Communication interface

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

#### 7.1.1 RS485 serial port

The front door of 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 J25. 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 storage inverter are connected to the switch, and the switch is connected to remote control computer. The state of 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 Storage 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

### 8.1Operation environment requirements

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

- Allowable environment temperature: -20~55°C
- Allowable relative humidity: 0~95% (non-condensing)
- Allowable maximum elevation: 3,000m

Note: When exceeding the maximum elevation, the Bi-directional Hybrid Storage Inverter will have de-rating output. Please consult customer service center for specific de-rating coefficient.

## 8.2Electrical 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.

### 8.3Clearing 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 Bi-directional Hybrid Storage Inverter

Table 9-1 presents the visible fault types of Bi-directional Hybrid 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.

| 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 Bi-directional Hybrid Storage Inverter.            |  |  |  |  |  |
| Overvoltage of power grid                              | The voltage of power grid is lower than the set lower limit. After faults are recovered, restart the Bi-directional Hybrid Storage Inverter.             |  |  |  |  |  |
| Inverted sequence of power grid                        | The phase sequence of AC power grid is inverse.  |  |  |  |  |  |
| Abnormality of power grid<br>frequency                 | Power grid frequency exceeds the set scope. After faults are recovered, restart the Bi-directional Hybrid Storage Inverter.                              |  |  |  |  |  |
| Islanding of Bi-directional Hybrid<br>Storage Inverter | There is islanding in Bi-directional Hybrid Storage Inverter.  |  |  |  |  |  |
| Overvoltage of DC input                                | Overvoltage of DC input is higher than the upper limit. After faults are recovered, restart the Bi-directional Hybrid Storage Inverter.                  |  |  |  |  |  |
| Low DC voltage   | Overvoltage of DC input is lower than the lower limit. After faults are recovered, restart the Bi-directional Hybrid 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 Bi-directional Hybrid 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.  |  |  |  |  |  |

Table 9-1 Fault information

## 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. Manufacturer will provide free maintenance or replace it with a new product.

2) Disposal of claim products

The replaced nonconforming products will be disposed by manufacturer. 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, manufacturer 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 departmen