# TXMPPT48200/MMC(D)1 MPPT Solar Power System User Manual

# Safety Precautions

To reduce the chance of accident, please read the safety precautions very carefully before operation. The "Caution, Note, Warning, Danger" in this book and on the product do not represent all the safety points to be observed, and are only supplement to various safety points. Therefore, the installation and operation personnel must receive strict training and master the correct operations and all the safety points before operation.

When operating the products, the operation personnel must observe the safety rules in the industry, the general safety points and special safety instructions specified in this book.

## Statement

This is the A-class product, in the living environment, this product may cause radio interference. In this case, the user may need to take measures for its interference.

## Electrical Safety

**High-voltage**

**Danger**

Some components of this outdoor solar power system are with high-voltage while the power system is running. Direct contact or indirect contact through the wet objects with these components will be fatal.

Observe safety rules in the industry when installing the power supply system. The installation personnel must be licensed to operate DC high voltage and AC power.

In operation, the installation personnel are not allowed to wear conductive objects, such as watches, bracelets, bangles and rings.

When you spot the cabinet with water or moisture, turn off the power immediately. In moist environment, precautions must be taken to keep moisture out of the power supply system.

'Prohibit' warning label must be attached to the switches and buttons that are not permitted to operate during installation.

**Danger**

High voltage operation may cause a fire or electric shock. The connection and wiring of AC cables must be in compliance with the local rules and regulations. Only those who are licensed to operate high voltage and AC power can perform high voltage operations.

**Danger**

Electric shock hazard is present in outdoor power system operation. Non-professionals shall not operate or maintain the outdoor power system.

**Tools**

**Warning**

In high voltage and AC power operation, specialized tools must be used.

**Thunderstorm**

**Danger**

Never operate on high voltage, AC, iron tower or mast in the thunderstorm.

In thunderstorms, a strong electromagnetic field will be generated in the air. Therefore the equipment should be well earthed in time to avoid damage by lightning strikes.

**ESD**

**Note**

The static electricity generated by the human body will damage the static sensitive elements on PCBs, such as large-scale ICs. Before touching the equipment such as plug-in board, PCB or IC chip, wear an ESD wrist strap to prevent body static from damaging the sensitive components. The other end of the ESD wrist strap must be well earthed.

**Short circuit**

**Danger**

During operation, never short the positive and negative poles of the DC distribution unit of the outdoor power system, or the non-earth pole of the outdoor power system and the earth. The power supply system is a constant-voltage DC power device; short circuit will result in equipment burning and endanger human safety.

Check the polarity of the cable and connection terminal when performing DC live operations.

As the operation space in the DC distribution unit is very tight, please carefully select the operation space.

Never wear a watch, bracelet, bangle, ring, or other conductive objects during operation.

Use insulated tools during operation.

In live operation, keep the arm, wrist and hand tense to avoid an accident owing to large movement of the human body or tool, when the tool slips.

**Reverse connection**

**Warning**

Never reverse-connect the AC input live line and neutral line, or else the system will be damaged.

Never reverse-connect the positive pole (+) and negative pole (-) of the battery cable, or else the system will be damaged.

Check the polarity of the cable and connection terminal when performing DC live operations.

As the operation space in the DC distribution unit is very tight, please carefully select the operation space.

Never wear a watch, bracelet, bangle, ring, or other conductive objects during operation.

Use insulated tools during operation.

In live operation, keep the arm, wrist and hand tense to avoid an accident owing to large movement of the human body or tool, when the tool slips.

**Interconnection**

**Warning**

Never connect the input positive poles of the different solar modules, or else the system will be damaged.

**Warning**

Never connect the input negative poles of the different solar modules, or else the system will be damaged.

The positive poles of the four routes of solar photovoltaic array input in the solar power system cannot be connected together.

The negative poles of the four routes of solar photovoltaic array input in the solar power system cannot be connected together.

**Battery**

**Danger**

Before battery operations, read the safety precautions of battery transportation and correct connection method of the battery.

**Warning**

If the user configures the batteries, the battery installation and maintenance must comply with the safety standard.

Non-standard battery operation is dangerous. Be careful when operating to prevent short circuit of the battery or the overflow and drain of the electrolyte. The overflow of the electrolyte will lead potential threats to the devices, which may corrode the metal objects and circuit boards and may cause equipment damage and circuit board short.

Pay attention to the following items when carrying out the battery installation and operation.

1. Never wear a watch, bracelet, bangle, ring, or other conductive objects during operation.
2. Use special insulated tools.
3. Use an eye protector, and take preventive measures.
4. Use rubber gloves, and wear an apron to prevent overflow of the electrolyte.
5. In the moving process, always keep the positive electrode of the battery upside, non-inverted, tilted.

# Load Low Voltage Disconnection (LLVD) And Battery Protection

This solar power system has load low voltage disconnection (LLVD) function, and it can distinguish the priority load and non-priority load. The battery has not the LVD function, but has battery protection function.

LLVD is AC power failure of the solar power system, when the power is supplied by the battery, and the battery voltage drops to 46.6V, (the LLVD voltage can be set, see LVD parameters in *4.11.2 Battery Settings* for the setting methods), the solar power system will cut off the non- priority load (also called secondary load) automatically to ensure longer support to the priority load. The battery protection is as when the battery voltage drops to 45.6V (the battery protection voltage can be set, see LVD parameters in *4.11.2 Battery Settings* for the setting methods), the solar power system will cut off the priority load automatically to avoid shortening the battery life owing to the excessive discharge of the battery. At this time the battery is to maintain the power supply to the monitoring.

The factory setting is enabling the battery protection (LVD2) and LLVD (LVD1) function, which means that if power outage lasts for a long time or the power supply system fails, there might be load disconnection and battery protection. Users should classify the loads and connect the non- priority loads to LLVD routes to enable the LLVD function. For priority loads, you should connect them to the battery protection routes to ensure reliability of the power supply.

The method of disabling the battery protection function is:

Set 'LVD2 Enable' item in the battery parameters of the controller to 'N'. Refer to *LVD parameters* in *4.11.2 Battery Settings* for setting method.

**Note**

The advantage of enabling the battery protection is protecting the batteries from over-discharge when the battery voltage is low. The disadvantage is that when the battery voltage drops to a certain value, the battery will be disconnected, thus all the loads (including non-priority loads and priority loads) will be cut off.

The advantage of disabling the battery protection is prolonging the power supply of priority loads. The disadvantage is that software cannot protect the battery or prevent unwanted power failure due to misoperation or power system failure.

The priority load will be disconnected when the battery protection disconnection is operated manually, and the extreme care must be taken.

# Others

**Safety requirements**

**Note**

Use the same type of fuse to meet safety requirements when replacing the fuse.

**Sharp object**

**Warning**

When moving the equipment by hand, wear protective gloves to avoid injury by sharp object.

**Power cables**

**Note**

Please verify the cable labels before connection.

**Signal cables**

**Note**

The signal cables should be routed at least 10mm away from the power cables.

**Explanation**

**Note**

To meet the environmental protection requirements, the bus bar of this product uses tin or passivation processes, long-term use may darken the surface of the bus bar, but will not affect its performance and using.

# Contents

# Chapter 1 Overview

SHW48200/MMC1 MPPT solar power system (hereinafter referred as solar power system) is a solar power system for outdoors.

This chapter introduces the model description, composition & configuration, technical parameters, operating theory and features of the solar power system.

## 1.1 Model Description

There are two models of the solar power system: SHW48200/MMC1 and SHW48200/MMD1. The former one is without heating function, the latter one is with the heating function, and the rest parts of the two are totally same. The model description is given in Figure 1-1.

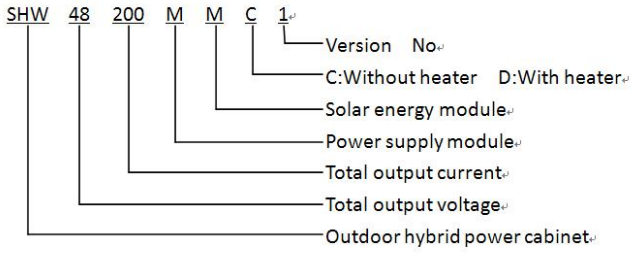



*Figure 1-1 Model description*

## 1.2 Composition And Configuration

**Composition**

The solar power system is composed of a cabinet, a heat exchanger, a controller, a solar module which is also called photovoltaic (PV) module, rectifiers, power distribution unit and fans .

The structure of the solar power system is shown in Figure 1-2. Compared with SHW48200/MMC1, there is a heater in the heat exchanger of SHW48200/MMD1, which is used to heat the cabinet when the temperature is low to ensure the normal running of every part under low temperature environment.

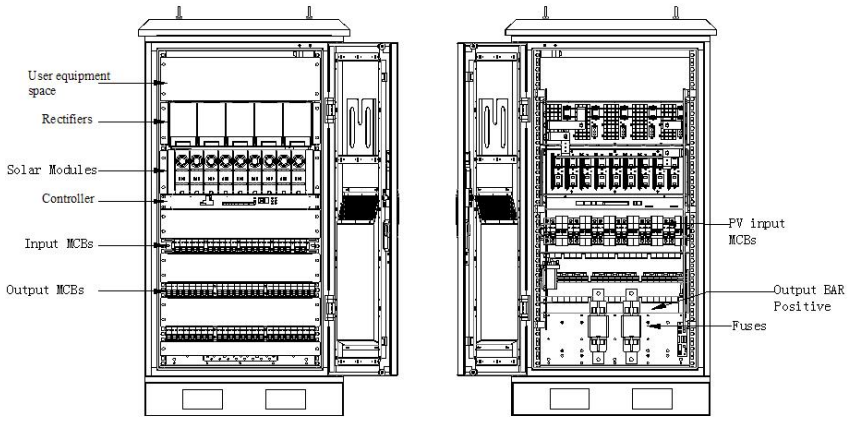



*Figure 1-2 Structure diagram*

**Configuration**

The configuration of the solar power system is given in Table 1-1.

*Table 1-2 Configuration*

| Component | | Configuration | |
|---|---|---|---|
| Solar power system | Controller | 1 set | |
| | Solar module: S48-3000 rectifier R48-3200 or R48-3200E | Standard configuration: 4solar modules, 5 rectifiers;<br>Optional configuration: 1 ~ 9 solar modules, 1 ~ 5 rectifiers | |
| Distribution unit | AC distribution | SPD | SPD at AC side: |
| | | 1 route of input MCB: 1 × 63A/4P | |
| | DC distribution | SPD | SPD at DC side |
| | | Solar power | 4 routes of input MCBs: 4 × 63A/2P |
| | | Battery | 2 routes of battery input fuses: 2 × 300A/120kA |
| | | Load output | Priority load: 3 routes,<br>Non-priority load:5 routes, |
| User equipment space | | Height: 2U, width: 19inches | |
| Thermal control unit | | 1fans, 1 heat exchanger | |
| Others | | Door sensor: 1 temperature sensor | |

## 1.3 Technical Parameters

The technical parameters of the solar power system are given in Table 1-2.

*Table 1-3 Technical parameters*

| Parameter category | Parameter | Description | |
|---|---|---|---|
| Environmental | Operating temperature | -20°C ~ +45°C (SHW48200/MMC1);<br>-40°C ~ +45°C (SHW48200/MMD1) | |
| | Storage temperature | -40°C ~ +70°C | |
| | Relative humidity | 5%RH ~ 90%RH | |
| | Altitude | ≤ 2000m (derating is necessary) | |
| | Others | No conductive dust or erosive gases. No possibility of explosion | |
| AC input | AC input system | 3-phase 5-wire | |
| | Rated input phase voltage | Line voltage 380Vac | |
| | Input voltage range | 85Vac ~ 290Vac | |
| | Input AC voltage frequency | 45Hz ~ 65Hz | |
| | Max. input current | ≤ 55A (single phase) | |
| | Power factor | ≥ 0.99 | |
| Solar input | Rated input voltage | 68Vdc | |
| | Input voltage range | 60Vdc ~ 150Vdc | |
| | Max. input current | ≤ 62A (single route) | |
| DC output | Output DC voltage range | 42Vdc ~ 58Vdc | |
| | Output DC voltage | 54.0V | |
| | Output DC current | 0 ~ 200A | |
| | Efficiency | ≥ 89%, pure electric mode (R48-3200); ≥ 95%, pure electric mode (R48-3200E);<br>≥ 96%, pure light mode | |
| Mechanical | Dimensions (mm) | Cabinet | 600 (W) × 600 (D) × 1200 (H) |
| | | User equipment space | Height:2U; width:19inches |
| | | Solar module S48-3000 | 42 (1U W) × 285.3 (D, excluding the LOGO) × 133.5 (3U H) |
| | | Rectifier R48-3200 or R48-3200E | 85.3 (2U W) × 287 (D, excluding the LOGO) × 132.3 (3U H) |
| | Weight (kg) | Solar module S48-3000 | 3 |
| | | Rectifier R48-3200 or R48-3200E | 3.5 |

## 1.4 Features

*Table 1-4 Features*

| Features | Description |
|---|---|
| Module characteristic | The solar module has maximum power point tracking function. The maximum power point tracking accuracy is over 99.5% |
| | The rectifier uses active power factor compensation technology, the power factor value is up to 0.99 |
| | The normal working range of the AC input voltage is 85Vac ~ 290Vac |
| | The normal working range of the solar input voltage is 60Vdc ~ 150Vdc |
| | The maximum efficiency of rectifier is over 91% (R48-3200). The maximum efficiency of rectifier is over 96% (R48-3200E) |
| | The maximum efficiency of the solar module is over 98% |
| | The solar module and the rectifier are with high power density |
| Module characteristic | The solar module and the rectifier use the plug-and-play technique. It takes less than one minute to replace the solar module and rectifier |
| | The solar module and the rectifier have output over-voltage protection function, including hardware over-voltage protection and software over-voltage protection. The software over-voltage protection mode has two options: the first time over-voltage lockout mode, the fourth time over-voltage lockout mode |
| Battery management | Perfect battery management: with battery protection, can achieve temperature compensation, automatic voltage regulating, stepless current limiting, battery capacity calculation, automatic boost/float conversion, online battery test functions and so on |
| Wind, light, electricity / diesel complementary management | Perfect light/electricity complementary management function, which can achieve the priority of the solar power, and maximize the use of the solar energy;<br>Perfect diesel generator (DG) management function, which can achieve timing and with automatic start-stop;<br>Perfect wind energy input management function, which can realize the wind energy input over-voltage protection |
| Power statistic | Load electricity consumption, solar power generated energy, mains generated energy, DG generated energy, wind turbine generated energy;<br>Battery discharge, battery charge |
| Data record | 90 days record of historical data, the historical data can be uploaded.<br>200 records of history alarm;<br>10 groups of battery test data |
| Alarm function | Perfect fault protection and fault alarm functions |
| Network design | Providing one RS232 port, dry contact and other communication portsfor network flexibility;<br>Enabling proximal end software upgrade and unattended |
| Humanized operation interface | LCD is designed with 15 degrees angle, which is more intuitional and convenient for the user's operation.<br>Query the operating parameters, statistics, and historical alarms of the system through the LCD.<br>Control the system manually through the LCD |
| Lightning Protection | Perfect AC and DC side lightning protection design |
| Energy-saving design | The system, in addition to the sleep energy-saving function of the rectifier , also supports and gives priority to the use of solar energy input to the load, make full use of solar energy and wind energy, to achieve the energy saving to reduce greenhouse gas emissions |
| Outdoor type | The system protection level is up to IP55, can be used outdoors. The system is compact and easy to install |
| System | All the equipment in the system support the maintenance at the front |
| System | The system uses rectifier sleep technology, dual steady state contactor, low-power shunt and fan speed adjustable technology, the system has more prominent energy-saving function |
| | The optional AC heater makes the system work in low temperature reliably |
| Remote monitoring | The Modem configured with GPRS function can realize remote monitoring through providing data to the Internet server |

## 1.5 Operating Theory

Through the solar modules, the solar battery array transforms the solar energy into -48V DC power, which is then gathered into the DC distribution; at the same time, the AC power enters into the rectifiers, and will be rectified and transformed into -48V DC power which is then gathered into the DC distribution. Meanwhile, the -48V DC power current outputted by the wind energy is gathered into the DC distribution. The outputs of the solar modules and the

rectifiers gather together with the input of the wind energy, and then they are provided for the communication equipment by multiple accesses.

1. Under normal circumstances, the power system operating is connected in parallel with float charge (FC) state, that means the rectifier, solar module, wind energy input, load, battery work in parallel; the solar module, rectifier and wind energy not only provide power for the communication equipment, but also provide FC current for the battery. The wind energy is as an auxiliary energy input.

2. Under normal circumstances, the solar energy and the AC mains provide power normally. The solar modules provide current for the system output loads and battery. If the output power of solar modules cannot meet all the loads, the rectifiers will provide additional power to maintain the normal running of the communication equipment.

3. When the output of AC mains is off, the rectifiers stop working, but the solar energy provides power normally. The solar modules provide current for the system output loads and the batteries. If the output power of solar modules cannot meet all the loads, the battery provides additional power to maintain the normal running of the communication equipment.

4. When the output of AC mains is off, the rectifiers stop working, and the solar modules cannot provide power normally, the battery provides power for the output load of the system to maintain the normal running of the communication equipment. When the battery discharges for some time, meeting the conditions to start the DG, the controller sends out DG staring signal. When the DG works normally, it can provide AC input power for the rectifiers again, the rectifiers re-supply power for the communications equipment and charge the battery to make up for the consumed power. When the DG reaches the conditions to stop, the controller sends out stop signal, the DG stops working.

The controller uses centralized monitoring to manage the solar power distribution, AC mains power distribution, wind power distribution, DC power distribution, DG functions. Meanwhile it receives the running information of rectifiers and solar modules through the CAN communication mode, and conduct corresponding control. The controller also has the monitoring functions of battery management, LLVD protection, battery protection, signal acquisition and alarms, and can carry out background communications. The controller can also be connected to the local computer in RS232 mode.

# Chapter 2 Installation

This chapter introduces installation, cable connection and the installation of the battery temperature sensor of the solar power system. Strictly follow the instructions in this chapter to carry out installation and cable connection.

## 2.1 Safety Regulations

Certain components in this solar power system have high voltage and large current. To ensure personnel safety, always follow the instructions below:

1. Only the trained personnel with adequate knowledge of the solar power system shall carry out the installation. The *Safety Precautions* listed before the *Contents* of this manual and local safety rules in force shall be adhered to during installation.

2. All auxiliary power connected to the bus bars of the solar power system must comply with the SELV requirements defined in EN50178 or the DVC-A circuit requirements defined in EN62109.

3. To avoid electric shock, do not conduct any operation or maintenance within the solar power system under thunderstorm or humid weather.

4. Make sure that the solar power system is powered off before any operations can be carried out within the system.

5. The power cables should be routed and protected properly, so that the cables are kept away from the operation and maintenance personnel.

6. After installation and test, lock the cabinet and keep the key by relevant principals.

7. Before power-on of the solar power system, both the earth cable and the output positive pole must be grounded reliably, and the battery of the load must be connected to the solar power system.

8. The output end of the solar power system has dangerous energy. It is prohibited to operate or touch the live output end. It is prohibited to short the output negative, the output positive or the enclosure.

## 2.2 Preparation

**Unpacking inspection**

The equipment should be unpacked and inspected after it arrives at the installation site. The inspection shall be done by representatives of both the user and company.

To inspect the equipment, you should open the packing case, take out the packing list and check against the packing list that the equipment is correct and complete. Make sure that the equipment is delivered intact.

**Preparing cables**

The cable should be selected in accordance with relevant electrical industry standards.

It is recommended to use the RVVZ cables. The cables should reach at least +70°C temperature durability. Select the CSAs of the AC cables according to Table 2-1.

*Table 2-1 AC cable CSA selection*

| Connector | Specifications | Cable CSA |
|---|---|---|
| AC input MCB | 1 × 63A/4P MCB, 4 H-pipe terminals | The min. CSA is 6mm$^2$; the max. CSA is 16mm$^2$ |
| AC input grounding | One piece M6 grounding screw | The min. CSA should not be less than min. CSA of the phase line and 10mm$^2$ copper cable; the max. CSA is 25mm$^2$ |
| Note: With cable length shorter than 30m, the CSA calculation should be based on the current density of 2.5A/mm$^2$ | | |

The CSA of DC cable depends on the current flowing through the cables and the allowable voltage drop.

Select the solar input cable CSA according to Table 2-2. Select the battery cable CSA according to Table 2-3. Select the load cable CSA according to Table 2-4.

*Table 2-2 CSA selection of solar input, wind input cables*

| Solar input, wind input MCBs rated current | Max. input current | Min. cable CSA | Max. cable length (volt drop: 0.5V) | Max. cable CSA | Max. cable length (volt drop: 0.5V, with max. CSA) |
|---|---|---|---|---|---|
| 63A | 50A | 10mm$^2$ | 4.1m | 25mm$^2$ | 14.25m |

*Table 2-3 CSA selection of battery cables*

| Battery fuse rated current | Max. battery current | Cable CSA | Max. length (voltage drop: 0.5V) |
|---|---|---|---|
| 2 × 300A | 300A | 50mm$^2$ | 4.9m |
| Note:<br>1. The specs are applicable at ambient temperature of 25°C. If the temperature is too high, the CSA of the cables should be increased.<br>2. The battery cable should reach at least +90°C heat durability. It is recommended to use double-insulated copper-core flame-retardant cable as battery cable<br>3. The system is defined to connect with two groups of batteries, if only one group of battery is connected, the battery charge current should be less than 300A (when connected to a fuse only). If the user has only one group of battery and the charge current is greater than 300A, it is required to use short chip to short the two fuses of the two groups of batteries.<br>4. Battery fuse specifications: rated voltage 500Vac, rated current 300A, rated breaking capacity of 120kA | | | |

*Table 2-4 Load cable CSA selection*

| Branch rated current | Max. output current | Min. cable CSA | Max. cable length (volt drop: 0.5V, with min. CSA) | Max. cable CSA | Max. cable length (volt drop: 0.5V, with max. CSA) |
|---|---|---|---|---|---|
| 63A | 50A | 10mm$^2$ | 5.7m | 16mm$^2$ | 9.7m |
| 32A | 16A | 6mm$^2$ | 14m | 16mm$^2$ | 29m |
| 16A | 10A | 6mm$^2$ | 17m | 16mm$^2$ | 47m |
| 10A | 5A | 6mm$^2$ | 34m | 16mm$^2$ | 91m |
| Note: The specs are applicable at ambient temperature of 25°C. If the temperature is too high, the CSA of the cable should be increased | | | | | |

The CSA of the system earth cable should be the same as that of the largest power distribution cable and not less than 10mm$^2$. The earth terminal of the earth busbar is M8 screw.

**Preparing tools**

The installation tools are given in table 2-5. The tools must be insulated and ESD-proof processed before they are used.

*Table 2-5 Installation tools*

| Tool | Specification | | Tool | Specification |
|---|---|---|---|---|
| Combination wrench (hatch, club) | Wrench set (10#, 13#, 16#, 18#, 21#) | | Box wrench | 16 mm$^2$ |
| Adjustable wrench | 200mm | | Cross head screwdriver | 100 mm$^2$, 200 mm$^2$ |
| Electrician diagonal pliers | 150mm | | Slotted screwdriver | 100 mm$^2$, 200 mm$^2$ |
| Electrician sharp nose pliers | 150mm | | Wire cutters | Maximum 300 mm$^2$ |
| Steel tape | 5m | | Hydraulic-pressure compaction pincher | Maximum 300 mm$^2$ |
| Electric knife | Normal type | | Digital multimeter | Three and a half bit digital display |
| Gradienter | Normal type | | Impact electric drill | With Φ14 impact aiguille |
| Blinkers | Anti-splash | | Power socket | With 5m cable |
| Fireproof mud | Delivered in the accessory | | Safety shoes | Puncture protection, insulation |
| Antirust paint | Delivered in the accessory | | Hammer | - |

**Preparing shielding metal pipe**

It is recommend to use metal pipe on the AC input cables and other cables to realize shielding and protection. It is recommended to use plastic coated metal pipe. The size of the metal pipes should be determined by the actual number and size of the cable.

# 2.3 Mechanical Installation

## 2.3.1 Installing Cabinet

The solar power system must be fixed and installed in the cement floor.

1. Determine the installation position

It is recommended to determine the installation position according to the clearance requirements given in Table 2-6.

*Table 2-6 Installation clearances*

| | Front | Top | Left | Right |
|---|---|---|---|---|
| Clearances | 750mm | 100mm | 100mm | 100mm |

2. Install expansion pipes

By referring to Figure 2-1, drill the installation holes on the plane, use Φ14 drill to drill 70mm deep mounting holes at the marked positions, remove the dust form the holes, mount the expansion pipes into the holes.

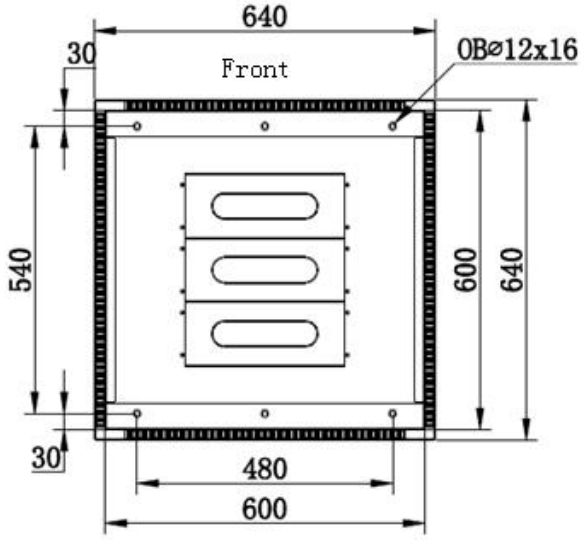



*Figure 2-1 Installation size of the cabinet base (unit: mm)*

3. Fix the cabinet

Move the cabinet to the installation position. Make the installation holes on the base coincide with those drilled on the plane. Screw the M10 bolt to fix the cabinet.

After fixed, the cabinet should stand firmly no matter how it is shaken.

## 2.3.2 Opening And Closing Cabinet Door

You need to open and close the cabinet door during installation, operation and service of the solar power system.

The procedures for opening and closing the cabinet door are as follows:

1. Insert the key into the keyhole, and turn the key clockwise until the door handle pops up.

2. Turn the handle counter-clockwise 90°, as shown in Figure 2-2. Pull the handle until the door opens.

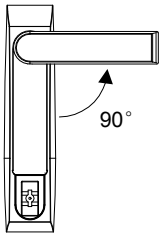



*Figure 2-2 Turning the handle*

*3. To close the door, restore the door stay bar to its original position and close the door; finally, turn the handle to its original position and press it down until a click is heard.*

### 2.3.3 Installing Rectifiers

**Note**

1. When installing the rectifier, hold the handle and push the rectifier into the slot gently, otherwise the slot might be damaged.
2. When the rectifier number is less than three, install the rectifiers from left to right.

1. Press the handle (see Figure 2-3) of the rectifier on the front panel, and the handle will pop out.

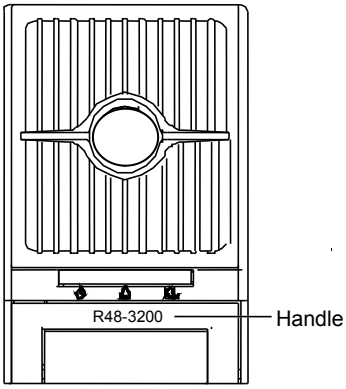



*Figure 2-3 Rectifier handle position*

2. Put the rectifier in the position shown in Figure 2-4.

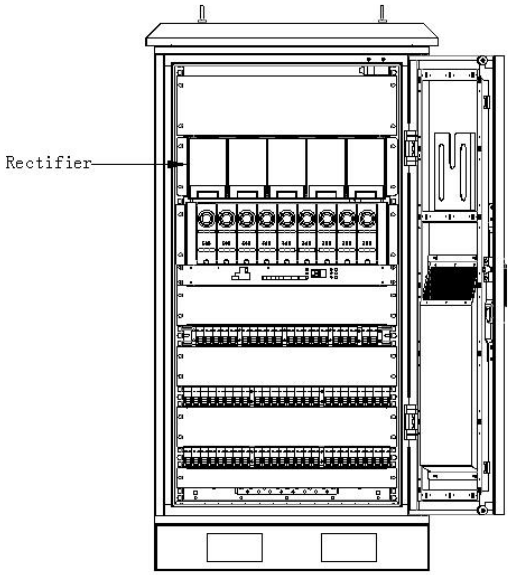



*Figure 2-4 Rectifier installation complete*

3. Push the rectifier completely into the cabinet, until it gets stuck.
4. Push the handle into the front panel to pop out the positioning pin and lock the rectifier to the cabinet.

The complete installation is shown in Figure 2-5.

### 2.3.4 Installing Solar Module

**Note**

1. When installing the solar modules, catch the handle of the solar module and push it into the installing slot, otherwise the position slot of the module will be damaged.
2. When the number of solar modules is less than four, install the solar modules from left to right.

Follow the following steps to install the solar modules.

1. Insert the solar module into the empty solar module installation slot.

2. Push the module into the frame, until it gets stuck.

3. Push the handle into the front panel, at this time, the positioning latch will fix into the positioning hole, tighten the fixing screws to fix the solar module to the frame (see Figure 2-5 for the handle and the positioning latch location).

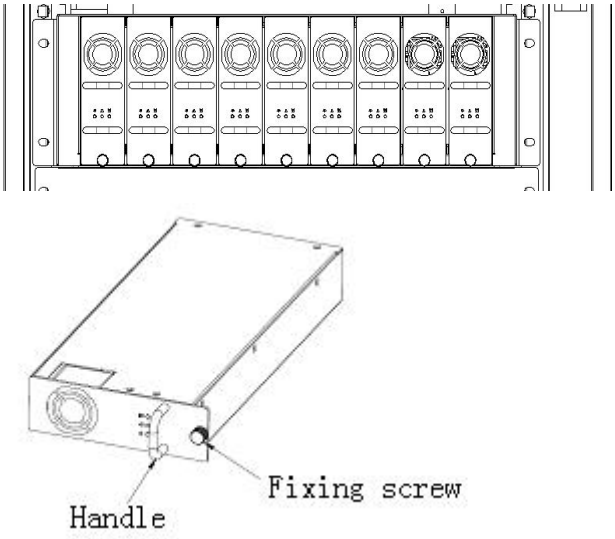



*Figure 2-5 Handle and positioning latch location*

## 2.4 Electrical Connection

It is recommended to route all cables in metal pipes, plastic-coated metal hoses advisably, to protect the cables. The metal pipes should be properly connected to the earth electrode outside the cabinet. It is recommended to use plastic coated metal pipe.

### 2.4.1 Rubber Cable Entry Hole

As shown in Figure 2-6, there are 16 black rubber cable entry holes of diameter 28mm on the bottom plate of the cabinet. The power cables of diameter 20mm can pass through the rubber cable entry holes.

Before connecting the cables, poke the rubber cable entry holes. After the cables are connected, you should use the fireproof mud to seal the rubber cable entry holes.

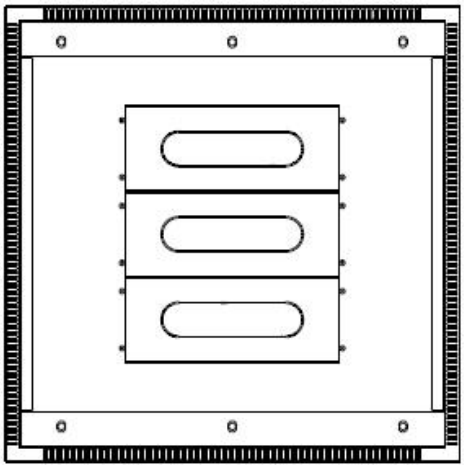


*Figure 2-6 Position of the rubber cable entry hole*

## 2.4.2 Connecting Power Cables

**Connecting earth cables**

The procedures for connecting earth cables are as follows:

1. Open the cabinet door.

2. Open the door of the power distribution unit; remove the power distribution unit cover. The power distribution unit cover position is shown in Figure 2-7.

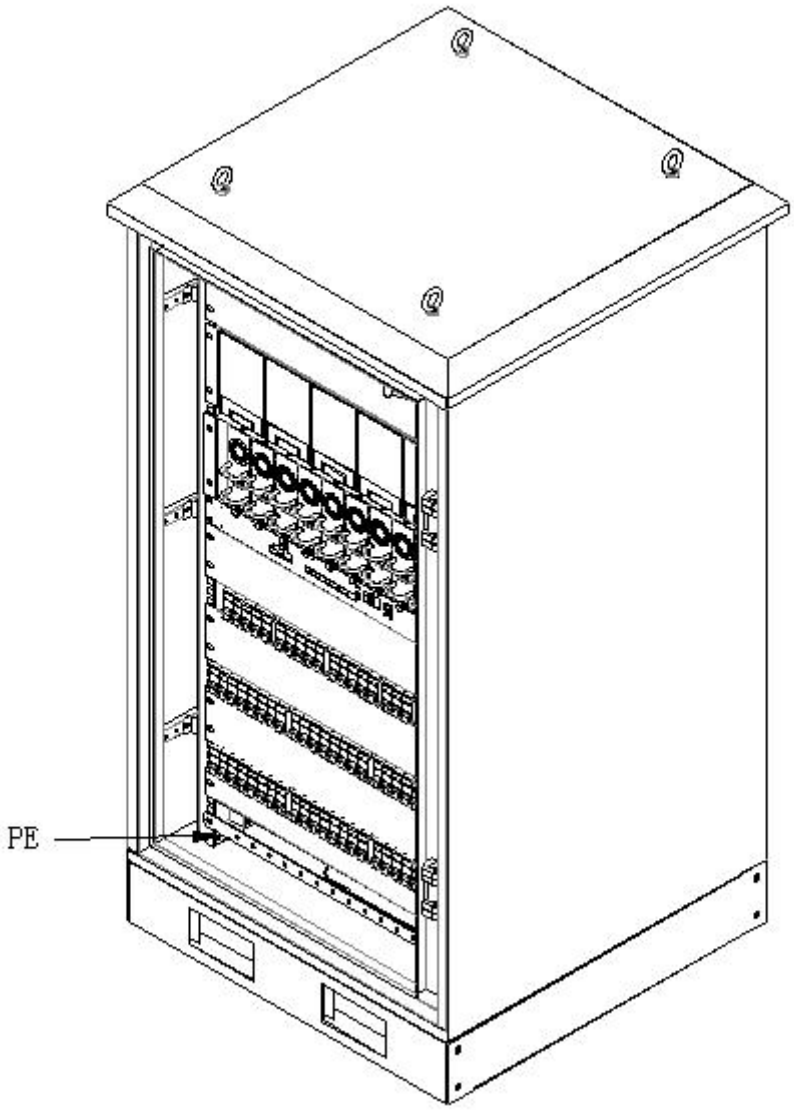



*Figure 2-7 Power distribution unit cover position*

3. Lead the earth cables into the cabinet through the rubber cable entry holes shown in Figure 2-7.

4. Connect one end of the earth cable to the earth terminal shown in Figure 2-7 and weld the other end to the earth metal electrode reliably.

5. The AC input cable and DC input cable must be laid separately to avoid the cables from overlapping. The distances between the AC input cable, DC input cable and the bare part of the system should be kept above 4mm respectively.

**Connecting AC input cables**

**Danger**

1. Before the electrical connection, all the switches should be off.

2. Only qualified personnel shall connect the AC input cables and solar module input cables.

**Note**

Reverse-connection of the AC input live line (L) and neutral line (N) is strictly prohibited, or the power system will be damaged.

Reverse-connection of the positive pole (+) and negative pole (-) of the battery cable is strictly prohibited, or the power system will be damaged.

Connect the AC input live line to the top terminals of the AC input MCB of the power distribution unit. For 3-phase live line, connect the AC input live line to the three terminals (label: L1, L2, L3) of the AC input MCB. For single-phase live line, connect the AC input live line to one terminal of the AC input MCB and short the three terminals with cables. Connect the AC input neutral line (N) to the top terminal (label: N) of the AC input MCB, as shown in Figure 2-8.

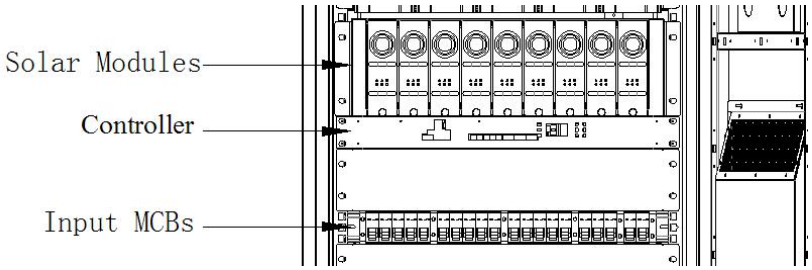



*Figure 2-8 AC input MCBs*

**Connecting solar input cables**

The system can sustain four routes of solar input, the negative poles are controlled by the four solar input MCBs, as shown in Figure 2-9. Each input circuit is equipped with a 63A input MCB and 16mm$^2$ maximum cable. The input MCBs are solar input MCB1 to MCB4 from left to right.

**Warning**

1. Connections of the positive (+) poles of the four solar input are strictly prohibited.
2. Connections of the negative (-) poles of the four solar input are strictly prohibited.
3. The positive (+) and negative (-) poles of the four solar input MCBs are prohibited to be grounded.

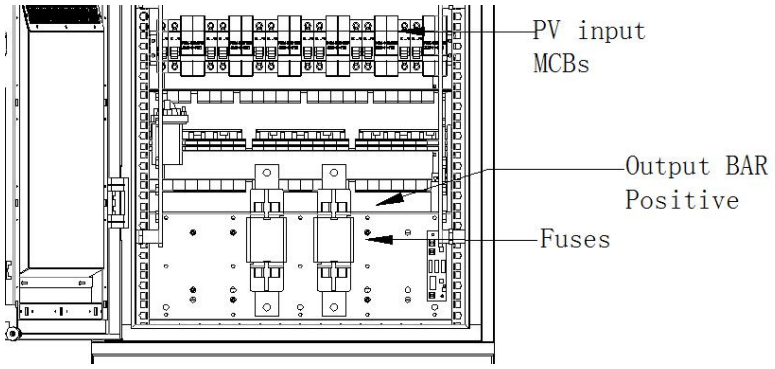



*Figure 2-9 System power distribution unit Front View*

**Connecting wind energy input cables and load output cables**

1. Load distribution scheme

The solar power system can connect 8 routes of loads, which are controlled separately with 8 load MCBs. The load MCBs on the power distribution unit are load MCB1 to load MCB8 from left to right.

Refer to Table 2-7 for the specifications of Load MCBs and the load cables.

*Table 2-7 Specifications of Load MCBs and the load cables*

| Load MCB | Load MCBs capacity | Load cable specification | Remark |
|---|---|---|---|
| Load MCBs | 63A | ≤ 16mm$^2$ | Load total output capacity of ≤ 52A |
| | 32A | ≤ 16mm$^2$ | Load total output capacity of ≤ 23.7A |
| | 16A | ≤ 16mm$^2$ | Load total output capacity of ≤ 13.7A |

When the total input power of the wind energy, solar energy and AC power cannot support the load, the battery will discharge. When the battery voltage drops to 46.5V (default value) through discharging, the system will disconnect the non-priority load automatically. When the battery voltage drops to 46.0V (default value) through discharging, the system will disconnect the priority load to avoid over-discharging of the battery. At this time, all the loads are cut off.

2. Connecting method of load output cables

Connect the negative cable of the load to the bottom of load MCB, connect the positive cable of the load to the DC positive bus bar, as shown in Figure 2-9.

**Connecting battery cables**

The system can sustain two groups of batteries that are protected by two 300A battery fuses, as shown in Figure 2-9. The CSA of the battery cable is not larger than 70mm$^2$.

Only if the system is connected with battery, it can be allowed to receive solar/wind energy inputs. After connecting all the cables and completing checking, first switch on the battery, when ensured that the battery is reliably connected to the system, it is allowed to switch on the solar input MCBs / wind energy input MCBs.

External battery circuit should be connected in series with a breaker, in the process of connecting the battery cables, to ensure that the breaker connected in series with the battery circuit is at disconnected state.

**Note**

1. Before connecting the battery cables, check to confirm that the polarities of the battery cables are correct, meanwhile disconnect the breaker connected in series with the external battery circuit.

2. After confirming that the battery polarities are correct, connect the cables corresponding to the battery positive to the positive bus bar, connect the cables corresponding to the battery negative to the negative battery ports corresponding to the two routes of fuses.

3. Check again to make sure that the two routes cables on positive bus bar and fuses are with the correct polarity.

**Warning**

1. The reversing connection or short circuit of the battery may lead to battery burning and other major failure, or even endanger personnel safety.

2. Only professionals are allowed to connecting the batteries.

Connecting method of the battery cables: connect the battery negative cable to the battery negative ends, the battery positive cables to the DC positive bus bar, as shown in Figure 2-9.

## 2.4.3 Connecting Signal Cables

**Ports**

All the signal cables should be connected to the M521S monitoring board of the power distribution unit, as shown in Figure 2-10. For port functions, refer to Table 2-8.

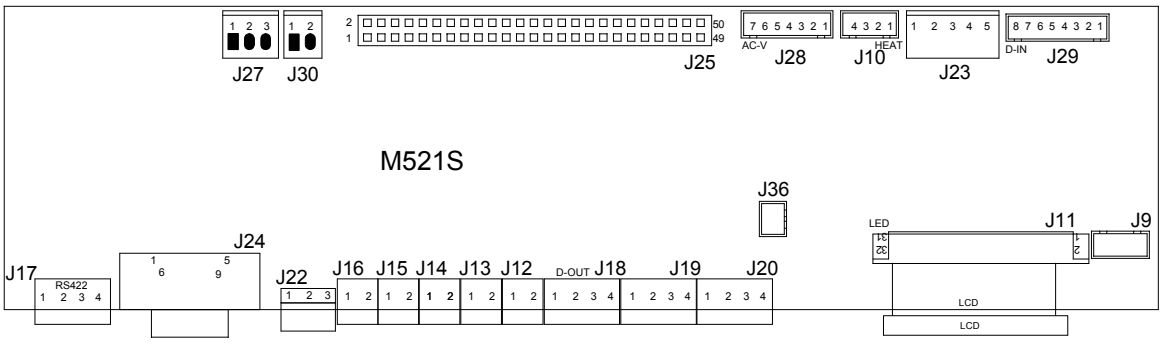



*Figure 2-10 M521S monitoring board*

*Table 2-8 Port functions*

| Port | Definition | Wiring description |
|---|---|---|
| J9 | LED control terminal | LED control |
| J10 | Heater control output terminal | Heater control |
| J11 | LCD interface terminal | LCD display module control |

| Port | Definition | Wiring description |
|---|---|---|
| J12 ~ J15 | DI5 ~ DI8 input terminal | Dry contact input |
| J16 | Battery mid-voltage terminal | Measuring the battery mid-voltage |
| J18 ~ J20 | DO1 ~ DO6 output terminal | Dry contact output |
| J22 | Current-type temperature sensor input terminal | Temperature sensor cable |
| J23 | Current-type temperature sensor input terminal | Temperature sensor cable |
| J24 | RS232 communication terminal | RS232 communication |
| J25 | System internal signal wiring terminal | System internal signal wiring |
| J27 | Power input terminal | 48V Power input |
| J28 | AC input terminal | AC voltage sampling input |
| J29 | DI1 ~ DI4 input terminals | Internal dry contact signal input |
| J30 | Busbar sampling terminal | -48V power busbar sampling |
| J36 | Reserved | - |

**Dry contacts**

The signal ports for the users are mainly on the front panel of the M521S monitoring board. These ports include RS232 communication port (silk-screen is RS232) and 6 pairs alarm output dry contacts (silk-screen are DO1, DO2, DO3, DO4, DO5, DO6). For the functions of the alarm output dry contacts, refer to Table 2-9. After peeling the signal cable, connect them to the corresponding dry contact, tighten the terminal screws.

*Table 2-9 Alarm output dry contact functions*

| Dry contact port | Definition | | Dry contact port | Definition |
|---|---|---|---|---|
| DO1 | AC mains failure | | DO2 | Module failure |
| DO3 | DC bus voltage low | | DO4 | Door alarm |
| DO5 | Fan, heater fault | | DO6 | Fan over-voltage |
| Note: When the dry contacts are disconnected, no alarm occurs; or else alarms occur | | | | |

## 2.5 Installing Battery Temperature Sensor

The solar power system provided one battery temperature sensor in accessories.The procedures for installing the battery temperature sensor are as follows:

1. Use the 3M double side adhesive tape pasted on the battery temperature sensor to paste the sensor onto the center of the upper-layer battery string.

2. Lead the cable connected to the battery temperature sensor to the solar power system, connect the 3-core connector of the cable to J22 terminal (see Table 2-8) on the M521S monitoring board, and confirm the connection firmly.

## 2.6 Installation Check

After installation of the solar power system, you should carry out the check procedures given in Table 2-10.

*Table 2-10 Installation check list*

| Check item | No. | Check content |
|---|---|---|
| Cabinet installation | 1 | Check that the cabinet is fixed horizontally, vertically and steadily |
| | 2 | Check that all bolts are tightened, especially those in electrical connections, that all bolts have plain washers and spring washers, and that the washers are not reversed |
| | 3 | Check that there are no unwanted materials inside the cabinet and clear up the unwanted materials |
| | 4 | Check that the cabinet paint is intact. If there are scratches, paint them immediately with antirust paint to prevent corrosion |
| | 5 | Clean up the cabinet |
| | 6 | Check that the door can be opened or closed freely, the locks are in good condition and the door stay bar is fixed |
| | 7 | Check the reserved space for the user’s equipment is equipped with fake panel. If not, install the fake panel in time |

| Check item | No. | Check content |
|---|---|---|
| Electrical connection | 1 | Check the correctness of all the MCBs, fuses and cables specifications |
| | 2 | Check the correctness of bus bar connections, input and output cable connection, and connection between the solar power system and the system grounding |
| | 3 | Check the correctness of the batteries number and connection, and battery strings polarities |
| | 4 | Check that all cables are firmly and reliably connected |
| | 5 | Measure the resistance value between the DC loop positive terminal and negative terminal, and phase-to-phase resistance value in the AC loop, make sure that there is no short circuit |
| | 6 | Check that the input positive and input negative poles of the solar module are isolated respectively |
| Electrical connection | 7 | Check that the positive and negative poles of the solar module input are not connected to earth |
| | 8 | Verify the firmness of the DC output and battery connections, and cable polarities |
| | 9 | Check that SPD earth wire and working earth wire are properly connected and reliably |
| | 10 | Check the communication cables of the controller. Check that the rectifiers are properly fixed |
| | 11 | Check that all SPD are properly connected, and all MCBs are open |
| | 12 | Check that the cables are tidy and the cable binding is normative |

# Chapter 3 Testing

This chapter introduces the testing after installation. Conduct the test in compliance with relevant safety rules

## 3.1 Startup

**Note**

1. Before test, inform the manufacturer representative.
2. Only trained electrical engineers shall conduct the test.
3. Remove any metal objects that may cause short circuit, including rings, watches and so on.

Watch out for hazardous voltage and avoid personnel injury and property loss. The power supply system must be properly earthed before power-on. Installation check (see Table 2-10) must be conducted before test. Before the initial charge to the battery, make sure the AC input MCBs (see Figure 2-9) and load MCBs (see Figure 2-10) are open, all equipment is installed in place.

Please check the following items on the solar system one by one.

**Startup preparations**

| Check item | OK | Comments |
|---|---|---|
| Check that all MCBs are open, the battery circuit is open. | | |
| Switch on the AC power, Measure the AC input voltage. Make sure the input voltage is within the rated range | | Umin = V |
| Before closing the solar input MCBs, measure with a voltmeter that each solar module input voltage, it is normal when the voltage is within 68Vdc ~ 150Vdc | | |
| Communication and alarm cables have been connected to the signal adapter board | | |
| Measure the solar input circuit voltage and wind energy input circuit voltage. Make sure the input voltages are within the rated ranges | | |
| Check that the temperature sensor has been correctly installed | | |
| If the batteries are connected, measure the voltage of the connection points of each battery with a voltmeter and make sure that the polarity is right. For a lead-acid battery with 24 cells, the measured value should be 2.0V ~ 2.1V/cell or 48V ~ 51V/battery. If the voltage of certain cell is lower than 2.0V, that cell must be replaced | | Umin = V |
| Check with an ohmmeter that there is no short circuit between the positive & negative busbars of the DC output, or between the positive & negative battery poles. (Note: Pull out all rectifiers before the check and restore them after the check) | | |
| Make sure that the positive and input negative of the solar module input are isolated respectively | | |
| Make sure that the positive and negative poles of the solar module input are not connected to earth | | |
| After passing the installation check and the preceding check, connect the battery circuit, wait at least 5 minutes after the controller is on, and make sure that no abnormal phenomenon occurs, if it is abnormal, switch off the battery circuit and check again | | |

After the battery circuit is connected, the controller starts to work and enters the language selection screen, press ▲ and ▼ to select language, press the **ENT** key to confirm language, 5 seconds later, the system will confirm the language automatically if the **ENT** key is not pressed.

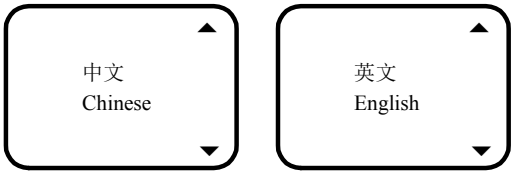



*Figure 3-1 Language selection screen*

After the language is confirmed, the controller enters the self-check, as shown in figure 3-2.

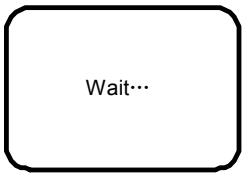



*Figure 3-2 Controller self-check screen*

The first screen of the main running screen is shown in Figure 3-3.

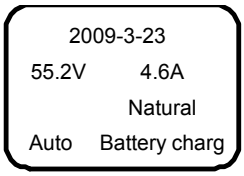



*Figure 3-3 Controller first screen*

Because the solar input MCBs and wind energy input MCBs have not been closed, it may display alarm screen.

**Startup**

| Check method | OK | Comments |
|---|---|---|
| Close system AC input MCBs (see 2-9), the green light on the rectifier will turn on and the fan begins to work. The controller displays the DC output voltage of the rectifier after a delay, The voltage is in the range of 48V ~ 58V (related to the battery voltage). Carry out the next step if there is no main input | | |
| Close the battery MCB | | |
| The controller starts work and displays the busbar voltage, the busbar voltage should be equal to the battery voltage | | |
| Close the solar input MCBs (see Figure 2-10) one by one, the solar module will start, see the following descriptions for the procedures | | |
| The solar module will start when the light is enough. The protection indicator (yellow ) will turn on in the process of the start, the start will finish after about 30s | | |
| Close the wind energy input MCBs (see Figure 2-10) one by one, you can view the wind output current through the controller when the system is working normally | | |
| Make sure that the DC busbar voltage is within 48V ~ 58V. Close the load MCBs (see Figure 2-10) one by one to connect the load, see the following descriptions for the procedures | | |

The start procedure of the solar module:

Close the battery input fuses, and close the solar input MCBs one by one.

Steps to connect load:

Measure and confirm that the busbar voltage is within the normal output range (48V ~ 58V), close one route of load MCB first, after the corresponding load device is started and into the normal working state, check whether the DC busbar voltage is still within the normal range. If yes, close another load MCB. If the DC positive busbar voltage is too low (less than 48V), after the battery is charged for a while, the DC positive busbar voltage is not less than 48V, continue to close the next route load output MCB. Follow this step, until all the output equipment enters the normal working state.

The capacity configuration of the wind energy module should be considered the maximum allowable battery charging current. The continuous high current outputted by the wind energy module will affect the battery life, Choose appropriate capacity of the wind energy module carefully.

## 3.2 Setting Basic Parameters

For the initial running of the solar power system, complete the system settings of the controller based on the actual configuration and user configured number of batteries, nominal capacity and charge limit point of the batteries, hybrid power operation and other function requirements. After that, the system operation information display and output control can be carried out normally.

For the method to change the parameter settings: **MAINMENU→Settings** (password: 1)→**Batt Settings→Basic Setting**, change the management mode to **Manual**, then return to the sub-menu of the parameter settings to set

parameters (except special descriptions). See *4.11 Setting System Parameters* for the specific methods to set parameters.

| Check item | ok | remark |
|---|---|---|
| Type of the system has been set in the factory, check whether the settings are consistent with the actual system, if not, make sure that the parameter setting is consistent with the system configuration | | |
| Set the controller based on the actual number of the battery groups, default value: 2 groups | | |
| Set the controller based on the actual capacity of the battery groups, default: 200Ah | | |
| Set the controller according to the requirements of the battery manufacturers. The range of the temperature compensation coefficient: 0 ~ 500mV /°C, default: 72mV /°C .If there is no temperature sensor, this item does not need to be set) | | |
| The wind machine over voltage disconnection voltage has been set at factory, check that the settings are consistent with the actual system, default: 57V | | |
| The priority load disconnection voltage has been set at factory, default: 45.6V. The non-priority load disconnection voltage has been set at factory, default: 46.6V | | |
| Set the controller. The charging current limit point range: $0.1C_{10}$ ~ $0.15C_{10}$, default value: $0.1C_{10}$ | | |
| Set the controller according to the voltage recommended by the battery supplier<br>Float voltage: 42V ~ boost voltage, default value: 54.0V; boost voltage: float voltage ~ 58V, default value: 56.6V<br>For free-boost battery, set the boost voltage 0.1V higher than the float charging voltage<br>Set the FC/BC voltage according to the user actual requirements.<br>FC voltage: 42V ~ FC voltage, default: 51.5V (rectifier)/54V (solar module)<br>BC voltage: FC voltage ~ 58V, default: 56V (rectifier)/56.4V (solar module)<br>Set the output voltage of the rectifier and solar module according to the *Note* below | | |
| Close the battery input fuses (see Figure 2-10), connect the battery to the circuit | | |
| Enter **Basic Setting**, set 'Sys Mode' to 'Auto' | | |

**Note**

1. When the FC voltage of the solar module is set to be higher than the voltage of the rectifier and the solar module has output capability, the system will use solar energy for priority and the power energy is for complementarities.

2. When the FC voltage of the solar module is set to be lower than the voltage of the rectifier, the system will use power energy for priority.

3. For the sake of saving energy, it is recommended to set the FC voltage of the solar module should be higher than the voltage of the rectifier. Set the voltage parameters according to the user actual requirements; consult the service personnel for the configuration method.

4. The mains input mode of the system only supports 'Grid' mode or 'DG' mode, not supports 'Grid + DG' mode.

## 3.3 Alarm Check And Operation Status Check

**Alarm check**

Check whether all function units can trigger the alarms and the alarms can be displayed on the controller.

| Check item | OK | Comments |
|---|---|---|
| Pull out one rectifier. The 'Rect N Com Failure' alarm should be triggered. Insert the rectifier, the alarm should disappear. Repeat the same procedures on other rectifiers. Note: Plug different modules for a certain interval of time, in order to avoid 'Rect Lost' alarm | | |
| Pulling out one solar module, it should have 'solar communication interrupted' alarm. Re-connect the solar module, the alarm should disappear. Check other solar modules in the same way | | |
| Disconnect the battery 1 MCB; it should have 'BattFuse 1 Fail' alarm. Close the MCB, the alarm should disappear. Use the same method to test the other battery MCBs | | |
| Disconnect one route of DC output branch with load; it should trigger 'Load N Failure' alarm. Connect the branch, the alarm should disappear. Use the same method to test other loads | | |
| Disconnect all battery MCBs, retaining only one rectifier, adjust the float voltage of the rectifier through the controller to make it lower than the alarm point, the system should give out 'DC Voltage Low' alarm | | |
| Rectifier works, set the battery management parameters of the controller to 'manual', enter the **Maintenance** menu, select the battery 'LVD' and confirm, the battery protection contactors should be disconnected, the controller shows 'Batt protection' alarm | | |

| Check item | OK | Comments |
|---|---|---|
| Unplug one AC SPD. The 'AC SPD fault' alarm should be triggered. Insert the AC SPD, the alarm should be cleared | | |
| Unplug a varistor of the DC SPD; the 'DC SPD Fault' alarm should be triggered. Insert the DC SPD varistor, the alarm should be cleared | | |

**Note**

1. When the preceding alarms are generated, the controller will display the corresponding alarms after about 3s. Refer to *4.9 Querying Alarms* for methods of querying alarms for methods of querying alarms.

2. When the solar module generates a communication fault which has not been handled within three days, the system will consider that the module is missing and report the alarm information.

3. In the case of continuous rain, if the solar module has not start three consecutive days, the system will consider that the module is missing and report the alarm information, you should distinguish.

**System operation status check**

There is no alarm when the system works normally. You can check whether the system is running normally through the controller.

For the parameter querying method of the controller, see *4.3 Querying System Main Information* and *4.4 Querying Rectifier Status*.

| Check item | OK | Comments |
|---|---|---|
| System Type: PS48300-3B/2900: 48V/SET, Sys Work Mode: AC + S + W | | |
| Check that the controller displays the correct AC voltage correctly | | |
| The error between the DC voltage shown on the controller and the actual voltage should not be larger than ±0.3V | | |
| The error between the battery current shown on the controller and the actual voltage should not be larger than 1% | | |
| Check the number of the rectifier through the controller. They should be consistent with the actual number | | |
| The number of solar module shown on the controller should be consistent with the actual installation number | | |
| The voltage, current, current limit of any rectifier shown on the controller should be consistent with the setting value and the actual value | | |
| The voltage, current, current limit of any solar module shown on the controller should be consistent with the setting value and the actual value | | |
| To the system equipped with temperature sensors, the battery and ambient temperature shown on the controller should be normal. Hold the temperature sensor probe by hand, the displayed temperature value changes | | |

## 3.4 Final Steps

| Check item | OK | Comments |
|---|---|---|
| Disconnect all testing equipment from the solar power system and make sure that materials irrelevant to the equipment have been all removed | | |
| Restore the solar power system to its original condition and close the cabinet door | | |
| Check and handover the equipment that the user has purchased | | |
| Note down all the taken operations, including time of the operation and name of the operator | | |
| fill the parameter table on the door | | |

If any defect is found in the power supply equipment, inform the personnel responsible for the contract.

If repair is needed, please fill in the FAILURE REPORT and send the report together with the defective unit to the customer service center for fault analysis.

# Chapter 4 Use Of The Controller

This chapter gives a brief introduction to the front panel and functional keys and a detailed introduction to LCD, access approach, and how to control system, query information and set parameter.

When the controller is switched on, the language selection screen will appear (the default language is Chinese), and then the module initializes itself internally. After finishing the initializing, it will display the front screen of the system information screen.

For the factory setting of the controller values and the menu structure of the controller, refer to *Appendix 4 Parameter Setting Of The Controller* and *Appendix 5 Structure Menu Of The Controller*.

## 4.1 Front Panel

The LCD, functional keys and indicators are located on the front panel of the controller, as shown in Figure 4-1.

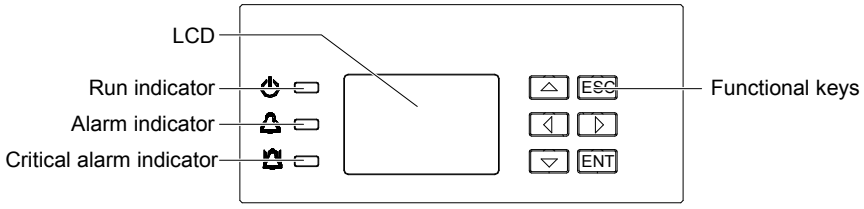



*Figure 4-1 Front panel of the controller*

The description of the indicators on the front panel is given in Table 4-1.

*Table 4-2 Controller indicator description*

| Indicator | Color | Normal state | Fault state | Fault cause |
|---|---|---|---|---|
| Run indicator | Green | On | Off | No operation power supply |
| Alarm indicator | Yellow | Off | On | There are observation alarms |
| Critical alarm indicator | Red | Off | On | There are major or critical alarms |

The controller uses a 128 × 64 LCD and a keypad with six keys. The interface language is Chinese/English optional (it can display 8 × 4 Chinese characters). The user's interface is simple and effective. The front panel of the controller is easy to disassemble and replace.

The functional key descriptions of controller are listed in Table 4-2.

*Table 4-3 Descriptions of functional keys*

| Key | Function |
|---|---|
| ESC | Return to the upper level menu. When the audible alarm tone is generated, press the **ESC** key to cancel the alert |
| ENT | Enter the lower level menu or confirm the menu operation. When changing or inputting parameters, press ENT to get into editing state. After any change is made, press the **ENT** key to validate the change |
| ▲ | Shift among parallel menus. For a character string, these two keys can be used to change the value |
| ▼ | |
| ◄ | Change values at a value setting interface. For a character string, these two keys can move the cursor left or right |
| ► | |

## 4.2 Main LCD Pages

The following LCD pages will be referred to in this chapter for many times. This section is a centralized introduction to the contents and accessing methods of these LCD pages.

### 4.2.1 System Information Page

When the controller is powered on, the language selection page will appear. There are two language options: Chinese/English. The default language is Chinese. You do not need to do any operation. If you want to select English, press ▲ and ▼ to English, and then press the ENT key to confirm. The controller initializes itself internally. After initialization, the first page of system information will appear.

The system information page shows the main information which is displayed on five pages. You can press ▲ or ▼ repeatedly to select different system information pages. The first system information page is shown in Figure 4-2. At this page, you may press ◄ and ► to adjust the LCD contrast (7-level). There will be a difference for the displayed actual value.

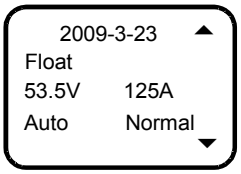



*Figure 4-2 First system information page*

1. When the monitoring unit is powered on, after the initialization of the system, the first system information screen appears. The first line displays the date and time alternately.

2. At the main menu screen, press the **ESC** key to enter the first system information screen.

3. If no operation is conducted on the M521S controller keypad for eight minutes, the LCD will return to the first system information screen. The time of that return will be recorded automatically, and can be queried through the host.

4. At any system information screen, press the **ESC** key to return to the first system information screen. Press the **ESC** key to enter product information screen, as shown in Figure 4-3. This screen displays the model, mode, of the controller, the software version and runtime. At the product information screen, you can press the **ESC** key, the **ENT** key, ▲ or ▼ to return to the first system information screen. There will be a difference for the displayed actual value.

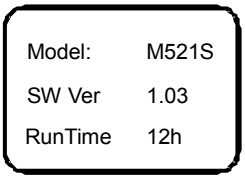



*Figure 4-3 Product information screen*

5. At the system information page, press and hold the **ESC** key and the **ENT** key at the same time for several seconds, the controller will be reset and restart.

### 4.2.2 Enter Password Screen

During the operation, the controller will prompt you to enter password before certain operation, as shown in Figure 4-4. Only the correct password will allow you to enter the screen you need.

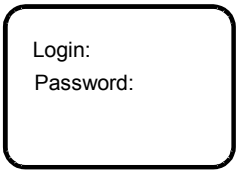



*Figure 4-4 Confirming password page*

To input the password, press the **ENT** key to edit, use ◄ or ►to modify numbers, and use ▲ or ▼ to move the cursor. After the input, press the **ENT** key to confirm. If the password is incorrect, the system will prompt 'Password incorrect'. Press the **ESC** key to return to **MAINMENU** screen.

The controller has three different password levels: user level (default: 1), engineer level (default: 2) and administrator level (default: 640275).

The user can use the correct password to enter the setting screen. During the continuous operation, there is no need to re-enter the password. But if the interval between two operations is more than 4 minutes, it s needed to re-enter the

password. Therefore, when the user wants to enter higher-level setting, you need to wait for 4 minutes. In these 4 minutes, the users should not conduct any operation. 4 minutes later, he can enter the higher-level password to enter higher-level setting screen. If the higher lever password is as the same as the lower lever password, after entering the password, the controller displays higher-level setting screen

### 4.2.3 MAINMENU Screen

The **MAINMENU** screen is the highest-level menu. At the sub-menus of this screen, you can query the settings, controls, rectifier information and alarm information of the system, as shown in Figure 4-5.

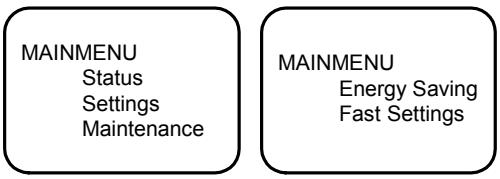



*Figure 4-5 MAINMENU screen*

1. At any system information screen, press the **ENT** key to enter the **MAINMENU** screen.

2. At any sub-menu of the **MAINMENU** screen, press the **ESC** key repeatedly to return to the higher-level menu, and ultimately to the **MAINMENU** screen.

3. Use ▲and▼ to select the sub-menu you want to enter, the selected sub-menu is indicated by cursor; press the **ENT** key to enter the corresponding sub-menu.

### 4.2.4 STATUS Screen

The **STATUS** page is a sub-menu of the Main Menu. It contains three sub-menus, including **Rectifiers**, **Active Alarm** and **History Alarm**, as shown in Figure 4-6.

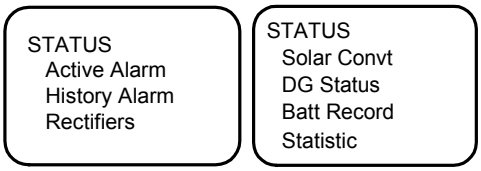



*Figure 4-6 STATUS screen*

1. In the main menu, press▲ and ▼ to select **STATUS** sub-menu, press the **ENT** key to confirm，then enter the STATUS screen.

2. Press the **ESC** key at any sub-menu of Running Information menu，the system will return to the first **STATUS** screen.

3. Press▲ and ▼ to select the sub-menu you want to enter, the selected sub-menu will be indicated by cursor, press the **ENT** key to enter the corresponding sub-menu.

4. If there is no content in the sub-menu, you cannot enter this sub-menu. For example: if there is no active alarm, you cannot enter the sub-menu Active Alarm.

### 4.2.5 Settings Screen

Displayed in two screens, the Settings screen is a sub-menu of the **MAINMENU**. It is divided into two screens to display. Under it, there are several sub-menu screens, which are used to set all the parameters of the power system. The **Settings** screen is protected by password; one can enter only by entering the correct password. Settings screen is shown in Figure 4-7.

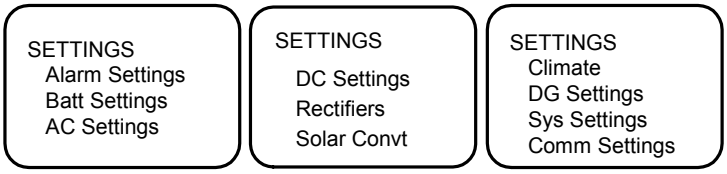



*Figure 4-7 Settings screen*

1. At the **MAINMENU** screen, press ▲ or ▼ to select the Settings menu, and press the **ENT** key to confirm, the system will then prompt you to input the password.

2. Input the correct password and press the **ENT** key to enter the Settings screen. Press ▲ or ▼ to scroll to the row you need.

Users with different password level have different authorities. See Table 4-3.

*Table 4-4 Password authorities*

| Level | Authority | default |
|---|---|---|
| User | Configuration of general parameters | 1 |
| Engineer | User's authority, plus resetting system, resetting password and modifying system type | 2 |
| Administrator | Engineer's authority, plus modifying password of all levels, alarm voice volume, browsing system parameters configured by host | 640275 |

### 4.2.6 Maintenance Screen

The **Maintenance** screen is a sub-menu of the **MAINMENU**. It is used to control the system in real time. You can enter the Maintenance screen after you input the correct password. For this menu, the user (default: 1), engineer and administrator passwords are the same, all users have the same authorities.

1. At the **MAINMENU** screen, press ▲ or ▼ to select the **Maintenance** menu, and press the **ENT** key to confirm.

2. Enter the correct password in the password confirmation screen; press the **ENT** key to confirm. If at this time 'battery parameters', 'basic parameters', 'management' has been set to 'Manual' (for the setting method, refer to *4.11.2 Battery Settings*), the controller will skip the following step 3 and go directly to the Maintenance screen. Otherwise, if the battery management is 'automatic', the controller enters into the Sys Mode screen shown in Figure 4-8.

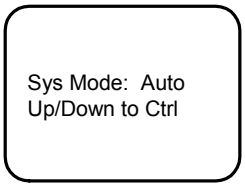



*Figure 4-8 Sys Mode screen*

3. Press the **ENT** key to set the Sys Mode in the Sys Mode screen, then press ◄ or ► to change the **Sys Mode** to 'manual' and press the **ENT** key to confirm, press the ▼ or ▲ to enter the **Maintenance** screen shown in Figure 4-9. Press ▲ and ▼ to scroll line by line.

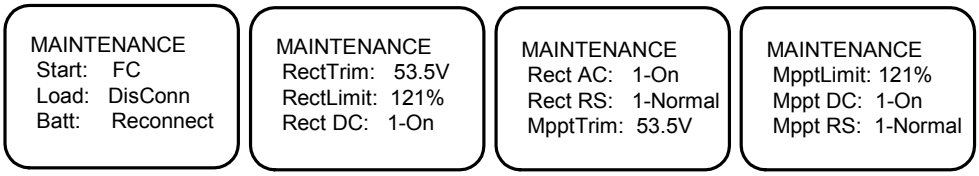



*Figure 4-9 Maintenance screen*

4. If some of the sampled value enters a special range (such as DC busbar undervoltage), the controller battery management mode may switch to 'Auto' by itself. The controller will return to the main menu screen and cannot continue to the Maintenance screen, this is normal.

### 4.2.7 Energy Saving Screen

The **Energy Saving** screen is a sub-menu of the **MAINMENU**, as shown in Figure 4-10. It is used to set rectifier energy parameters. The parameters in the following figure are set in the factory.

The Energy saving screen is a sub-menu of the **MAINMENU**, as shown in Figure 4-10. It is used to set rectifier energy parameters. The **Energy Saving** screen has password protection, one can enter it only by entering the correct engineer or administrator password, and the parameters in the following figure are set in the factory

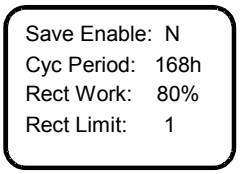



*Figure 4-10 Energy Saving screen*

1. At the **MAINMENU** screen, press ▲ or ▼ to select Energy Saving, and press the **ENT** key to confirm. The system will prompt you to input the password.

2. Input the correct the correct engineer or administrator password and press the **ENT** key to enter the **Energy saving** screen.

3. Use ▲ and ▼ to select the sub-item of energy-saving parameters to modify, the selected sub-item will be indicated by the cursor, press the **ENT** key to enter the corresponding sub-item modifying state.

### 4.2.8 Fast Settings Screen

The Fast Settings screen is a sub-menu of the **MAINMENU**, as shown in Figure 4-11. It is used to set **System Type** and **Sys Work Mode**. The **Fast Settings** screen has password protection; you can enter it only by entering the correct engineer or administrator password. The parameters in the figure are set in the factory.

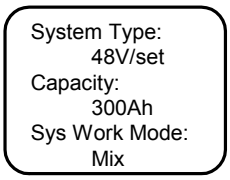



*Figure 4-11 Fast Settings screen*

1. At the **MAINMENU** screen, press ▲ or ▼ to select **Fast Settings,** and press the **ENT** key to confirm. The system will prompt you to input the password.

2. Input the correct engineer or administrator passwords and press the **ENT** key to enter the **Fast Settings** screen

## 4.3 Querying System Main Information

**DC, system operation state, battery state and energy management information**

At any system information screen, press ▲ or ▼ repeatedly to select the first system information screen. At other screens, press the **ESC** key repeatedly to return to the first system information screen. DC voltage and current, system operation state, battery state and battery management mode are displayed in the first system information screen, as shown in Figure 4-12.

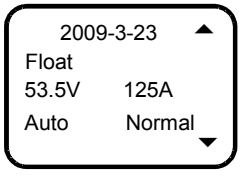



*Figure 4-12 First system information screen*

The date and time are displayed at the interval of two seconds. System operation state contains ‘No Alarm’ and ‘Alarm’. Energy management mode includes ‘Auto’ and ‘Manual’. Battery state includes ‘Float charge’, ‘Temp Comp’, ‘Boost charge’, ‘Cyclic Boost’, ‘Batt.’ ‘Test’, ‘ShortTest’ and ‘TimeTest’.

**Save state, output power and Cyc BC After information**

At the first system information screen, press ▼ to enter the following screen. The system will display the Save Stat, Sys Used and Cyc BC after information, as shown in Figure 4-13.

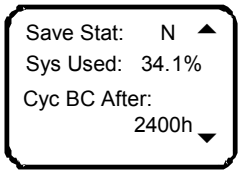



*Figure 4-13 Sys Used and Cyc BC After information screen*

The first line displays the save state. The second line displays the percentage between the output power and rated power of the rectifier. The lower line displays the BC prompt information, they will be different for different states of the system, including:

1. Prompt the time of the next Cyclic BC according to the battery state.

2. If BC is going on or prohibited, '---' will be prompted.

**AC Volt and Dev Temp**

At the first system information screen, press ▲ to display AC Volt and Dev Temp, as shown in Figure 4-14.

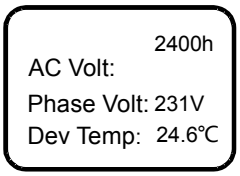



*Figure 4-14 AC Volt and Dev Temp*

The first line of this information screen is the bottom line of the screen which displays energy-saving state, rectifier module output power and the next boost charging time, the two screens is a continuous multi-line screen, press ▲ and ▼ to scroll line by line.

1. Single: AC voltage detected by the rectifier.

2. Dev Temp: Temperature detected by the controller. If the temperature sensor is not connected or is faulty, the system will prompt '---'. Meanwhile, alarm information screen will display.

## 4.4 Querying Rectifier Status

**Note**

If the controller has not detected rectifiers, you cannot query the rectifier information.

The rectifier information includes the rectifier serial No., voltage, current, current limit, AC input voltage, mains situation, rectifier power limit and temperature power limit.

At the **STATUS** screen (see Figure 4-7), press ▲ or ▼ to select the **Rectifiers** sub-menu, as shown in Figure 4-15. Press the **ENT** key to confirm.

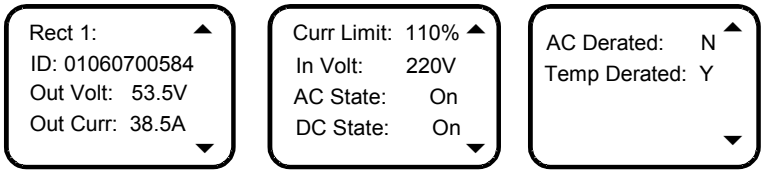



*Figure 4-15 Rectifier information screen*

The information of every rectifier is displayed in three screens. Press ► to scroll to the next screen, or ◄ to return to the last.

At most thirty pieces of rectifier information can be displayed. When selecting one rectifier, the green indicator of the corresponding rectifier will blink. If the rectifier communication is interrupted, the information will be displayed in high light.

## 4.5 Querying Solar Module Information

**Note**

If the controller cannot detect the solar module, you cannot query the solar module information.

The solar module information includes the rectifier serial No., each solar module output voltage, output current, current limit, input voltage, input current, output power, DC status.

In the **STATUS** screen shown in Figure 4-7, press ▲ or ▼ to select the sub-menu **Solar Convt**, press the **Enter** key to enter the information screen of the solar module, as shown in Figure 4-16.

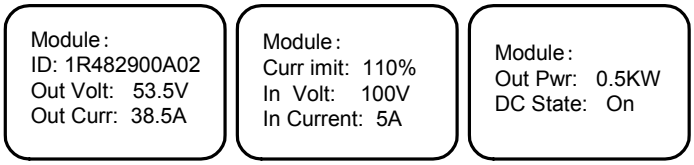



*Figure 4-16 The information screen of the solar module*

All of the information of each solar module is divided into three screens to display. Press ▲ or ▼ key to change the line, you can cycle between the three information screens. Press ► or ◄ key to query the information of other solar modules.

The controller displays up to 10 pieces of rectifier module information. When selecting one certain solar module, the power indicator (green) flashes. If the rectifier module communications interrupt, the information will be highlighted.

## 4.6 Querying DG Information

In the STATUS screen shown in Figure 4-7, press ▲ or ▼ to select the sub-menu **DG status**, Press the **Enter** button to enter DG information screen, as shown in Figure 4-17.

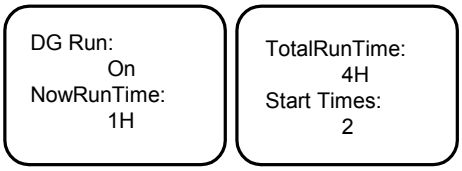



*Figure 4-17 DG information screen*

All of the information is divided into two screens to display. Press ▲ or ▼ to change the line, you can cycle between the two information screens.

## 4.7 Querying Battery Record

In the **STATUS** screen shown in Figure 4-9, press ▲ or ▼ to select the sub-menu **battery record**, Press the **Enter** button to enter the battery record information screen, as shown in Figure 4-18.

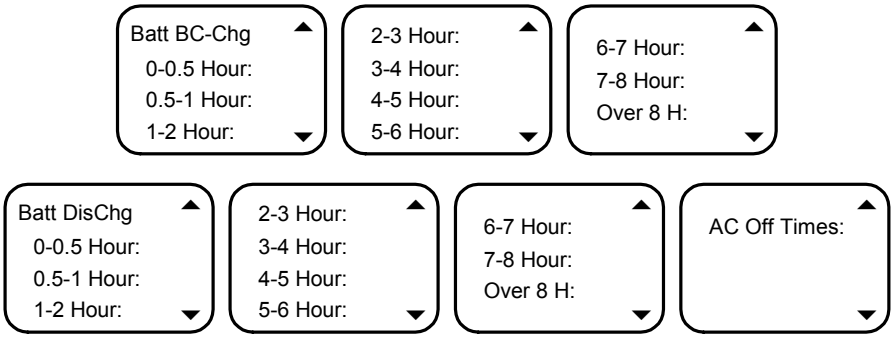



*Figure 4-18 Battery record information screen*

Battery record information includes the number of BC, the number of battery discharge, AC power failure frequency, which contains the number of BC, battery discharge frequency is the statistics in accordance with 0-0.5 hours, 0.5-1 hour, 1-2 hours, 2-3 hours, 3-4 hours, 4-5 hours; 5-6 hours; 6-7 hours; 7-8 hours, 8 hours. The displayed contents on Figure 4-18 are just examples. Press ▲ or ▼ to change the line, you can cycle to switch between screens of information.

## 4.8 Querying Statistical Information

In the running information screen shown in Figure 4-8, press ▲ or ▼ to select the sub-menu **statistic**, Press the **ENT** key to enter the statistical information screen, as shown in Figure 4-19.

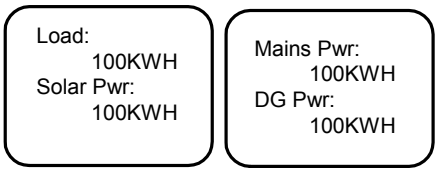



*Figure 4-19 Statistical information*

All of the information is divided into two screens to display. Press ▲ or ▼ to change the line, you can cycle between the two information screens.

## 4.9 Querying Alarms

You can query historical alarms and active alarms through the LCD of the controller.

### 4.9.1 Querying Active Alarm

When a new alarm is raised, and there is no operation on controller keypad within two minutes, the LCD of the controller will prompt the active alarm automatically. Querying the detailed information of all the active alarms in the following steps:

In the **STATUS** screen Shown in Figure 4-8, press ▲ or ▼ to select the sub-menu 'active alarm', Press the **ENT** key to confirm.

1. If there is no active alarm, you cannot enter the alarm prompt. If there is active alarm, once entering into the active alarm information screens, the alarm disappears, displays 'the current system: no alarm.'

2. When the system has active alarms, the screen is shown in Figure 4-20.

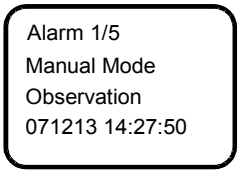



*Figure 4-20 Active alarm screen*

The preceding screen includes alarm serial No., alarm name, alarm level and time. The alarm rising time determines the sequence it is displayed, with the latest alarm displayed first. Use ▲ or ▼ to view all active alarms.

While querying rectifier alarms, press ► to display the ID number of the rectifier, the green indicator of the corresponding rectifier will blink.

In the case of battery test alarm or maintenance time alarm, press ► to display the prompt information, then press the **ENT** key to confirm that the alarm is cleared.

The controller alarms are described in Table 4-4.

*Table 4-5 Controller alarms*

| Serial No. | Alarm type | Alarm name | Alarm level | Alarm description |
|---|---|---|---|---|
| 1 | DG | DG low oil | Observation | DG low oil |
| 2 | | DG input fault | Observation | - |
| 3 | | DG start fault | Observation | - |

| Serial No. | Alarm type | Alarm name | Alarm level | Alarm description |
|---|---|---|---|---|
| 4 | System | DoorOpen Alarm | No alarm | - |
| 5 | | SPD Alarm | Critical | Including DC-SPD Alarm and AC-SPD Alarm |
| 6 | | IR Alarm | Observation | - |
| 7 | | Water Alarm | Observation | - |
| 8 | DC | Load Fuse Alarm | Major | - |
| 9 | | Batt Fuse Alarm | Major | - |
| 10 | | LVD1Ctrl Fail | Major | - |
| 11 | | Batt Ctrl Fail | Major | - |
| 12 | Controller | Controller fails | Observation | Controller fails |
| 13 | | Manual Mode | Observation | Enter manual mode |
| 14 | Battery | Boost Charge | No alarm | The battery is boost charging |
| 15 | | Batt Test | No alarm | The battery is testing |
| 16 | | Batt Discharge | Observation | Battery is discharging |
| 17 | | Curr Imbalance | Observation | - |
| 18 | | DC output voltage abnormal | Observation | For hybrid subrack, the DC bus voltage is abnormal |
| 19 | | ShortTest Fail | Observation | Press ► to prompt whether clear this alarm or not |
| 20 | | Batt Test Fail | Observation | |
| 21 | | LVD | Major | Non-priority load disconnection |
| 22 | | Batt protection | Major | Priority load disconnection |
| 23 | System | Mains Failure | Critical | - |
| 24 | Rectifier | Rect Overload | Observation | Press ► to query the faulty rectifier ID |
| 25 | | Rect Lost | Major | Press ► to prompt whether confirm this alarm or not. If yes, it indicates the rectifier is lost, you can clear this alarm manually |
| 26 | System | System Maintain | No alarm | Press ► to prompt whether clear this alarm or not |
| 27 | Rectifier | Multi-module alarm | Major | - |
| 28 | | Module communication interrupted | Critical | Press ► to query the ID of the faulty rectifier |
| 29 | | AC mails of the module fails | Critical | |
| 30 | | Module over-temperature | Critical | |
| 31 | | Module failure | Major | |
| 32 | | Module protection | Observation | |
| 33 | | Module fan failure | Critical | |
| 34 | | Module power limiting | Observation | |
| 35 | | Unbalanced module current sharing | Observation | |
| 36 | | Module over-voltage | Critical | |
| 37 | System | DC under-voltage | Major | - |
| 38 | | DC voltage low | Major | - |
| 39 | | DC voltage high | Major | - |
| 40 | | DC over-voltage | Major | - |
| 41 | Battery | Battery under-voltage | No alarm | - |
| 42 | | Battery voltage low | No alarm | - |
| 43 | | Battery voltage high | No alarm | - |
| 44 | | Charging over-current | observation | - |
| 45 | System | Temperature low | observation | - |
| 46 | | Temperature high | Critical | - |
| 47 | | Temperature too high | Critical | - |
| 48 | AC | AC phase loss | Observation | - |
| 49 | | AC under-voltage | Observation | - |
| 50 | | AC over-voltage | Observation | - |

| Serial No. | Alarm type | Alarm name | Alarm level | Alarm description |
|---|---|---|---|---|
| 51 | System | Energy saving | Observation | The subrack is be in saving energy status |
| 52 | | Energy saving failure | Critical | - |
| 53 | | Fan failure | Critical | - |
| 54 | | Heater failure | Observation | - |
| 55 | | Unbalanced battery | Observation | - |
| 56 | Solar Module | Mppt Lost | Major | Press ► to query the faulty solar module's ID |
| 57 | | Module communication interrupted | Critical | |
| 58 | | Module over-temperature | Critical | |
| 59 | | Module failure | Major | |
| 60 | | Module protection | Observation | |
| 61 | | Module fan failure | Critical | |
| 62 | | Module power limiting | Observation | |
| 63 | | Unbalanced module current sharing | No alarm | Press ► to query the faulty solar module's ID |
| 64 | | Module over-voltage | Observation | |
| 65 | Photovoltaic board | Photovoltaic board fault | Critical | - |
| 66 | Fan | Fan over-voltage break | Observation | - |

### 4.9.2 Querying History Alarm

1. At the **STATUS** screen (see Figure 4-4), press ▲ or ▼ to select **History Alarm** menu. Press the **ENT** key to confirm.

1) If there is no history alarm, the system cannot enter the lower level menu.

2) If there is history alarm, the screen is shown in Figure 4-21.

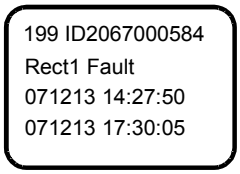



*Figure 4-21 History alarm screen*

If the alarm is a rectifier related alarm, the first line in Figure 4-9 will display the latter 10 number of the rectifier ID.

The history alarms of the controller are stored in cyclic order. Up to 200 alarms will be recorded. Above that, the earliest alarm will be cleared automatically.

2. Use ▲ or ▼ to view other history alarms.

3. At any **History Alarm** screen, press the **ESC** key repeatedly to return to the first system information screen.

## 4.10 Maintenance

1. At the battery basic parameter setting screen, change the battery management mode from Auto to Manual. Press the **ENT** key to confirm. For the detailed procedures, see Basic parameters i*n 4.11.2 Battery Settings*.

2. At the **MAINMENU** screen, press ▲ or ▼ to select the **Maintenance** menu. Press the **ENT** key and the system will prompt you to enter the password.

3. Input the password and press the **ENT** key to enter the **Maintenance** page, as shown in Figure 4-22.

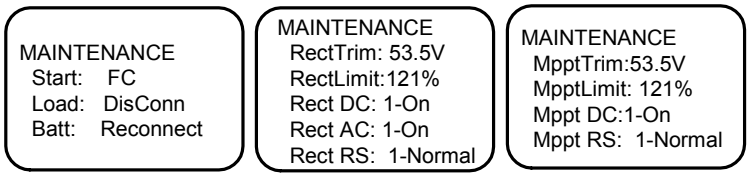



*Figure 4-22 Maintenance screen*

4. Press ◄ or ► to select the maintenance, press the **ENT** key to confirm, the screen pops up with corresponding prompt. If the maintenance is permitted, it will prompt the user to press the **ENT** key to confirm, the maintenance is enabled. Press the **ESC** key to abandon operations. If it does not meet the maintenance, the controller will prompt that the maintenance is disabled. The following describes the control content respectively.

1) Start: including BC, floating and testing. After selecting this item, press ◄ or ► to display three options in cycle. When it is in the case of AC power failure alarm or low voltage busbar, the system does not perform BC and battery test command. When the module communication is interrupted, the battery cannot be tested. After the battery test, the management mode will return to the 'automatic' state automatically.

2) Battery: battery power-on and power-off. If there is battery branch alarm, the system does not perform on/off operation.

3) Load: including the load Reconnect and Disconnect.

4) RectTrim: Range: 42V ~ 58V. If the value of this parameter cannot exceed the over-voltage alarm point, otherwise, the parameter will be invalid.

5) RectLimit: Range: 10% ~ 121%.

6) Rect N: The maintenance operations over a single rectifier include: DC ON/OFF, AC ON/OFF and Reset.

7) MpptTrim: Range: 42V ~ 58V, If the value of this parameter is lower than the power supply module setting voltage, otherwise, the parameter will be invalid.

8) MpptLimit: Range: 10% ~ 121%.

The Operation method:

Use ▲ or ▼ to select the rectifier parameter and MPPT module, and ◄ or ► to change the serial No.. Then press the **ENT** key to confirm. The bottom line of the screen displays the ID. Use ▲ or ▼ to move the cursor to the maintenance operation area (that is DC On in Figure 4-15), use ◄ or ► to select the value and press the **ENT** key to confirm.

If the rectifier voltage is too high, you can select Reset to restore the output voltage of that rectifier to normal.

If overvoltage protection occurs in any module, the reset command will reset the module once. If over-voltage fault disappears at this time, the rectifier module will work normally. If the fault persists, the module over-voltage protection will occur again. The RectTrim, RectLimit and single module control command can be implemented only when the system is in floating state.

5. Press the **ESC** key to return to the **MAINMENU** screen and change the battery management mode from Manual to Auto. And then press the **ESC** key to return to the system information page.

## 4.11 Setting System Parameters

The system parameters are divided into ten kinds: alarm, battery, AC, DC, rectifier, MPPT, Climate, System, Communication and DG parameters. In the actual using, you need to set the parameters according to the actual situation of the battery pairs and battery capacity. Without any special needs, you need to accept the defaults for parameters.

### 4.11.1 Alarm Settings

At the **Settings** screen, press ▲ or ▼ to select **Alarm Settings** menu. Then press the **ENT** key to enter the **Alarm Settings** screen, as shown in Figure 4-23.

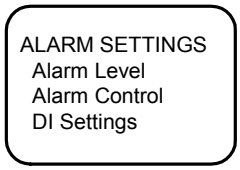



*Figure 4-23 Alarm setting screen*

There are three sub-menus, including **Alarm Level**, **Alarm Control** and **DI Settings.**

**Setting alarm level**

At the **Alarm Settings** screen, press ▲ or ▼ to select **Alarm Level** menu. Then press the **ENT** key to enter the **Alarm Level** screen, as shown in Figure 4-24.

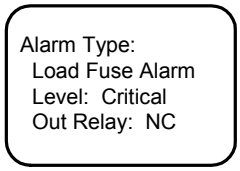



*Figure 4-24 Alarm Level screen*

Press ▲ or ▼ to move the cursor to the option you need to change, press the **ENT** key to confirm, press ◄ or ► to select the corresponding content, press the **ENT** key to confirm.

The controller alarms are classified into four types: critical alarm, major alarm, observation and no alarm.

Critical alarm, major alarm: These two types of alarms have strong impacts on the system performance. Whenever these alarms are generated, you are supposed to handle them immediately. The controller lights the Major indicator (red), together with sound alarm.

Observation: When this type of alarm is raised, the system maintains normal output for a while. If the alarm occurs during watch time, it should be handled immediately. If the alarm occurs during non- watch- time, handle it during watch time. The controller only lights alarm indicator (yellow).

No alarm: There is no visible or audible indication after this type of the alarms happen.

See Table 4-4 for the controller alarms and factory setting.

**Setting alarm control**

At the **Alarm Settings** screen, press ▲ or ▼ to select **Alarm Control** menu. Then press the **ENT** key to enter the **Alarm Control** screen, as shown in Figure 4-25.

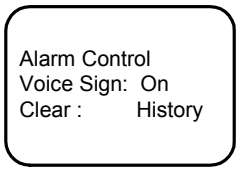



*Figure 4-25 Alarm Control screen*

Voice Sign option: open/ off/ 3min/ 10min/ 1h/ 4h. You can set according to you requirement.

'Clear: His Alarm' option: His Alarm, Rect Lost, TestFail, ShortTest, Maintain, ESaveFail, Batt Record. Press the ENT key to clear the saved alarm information in the controller.

**DI settings**

At the **Alarm Settings** screen, press ▲ or ▼ to select **DI Settings** menu. Then press the **ENT** key to enter the **DI Settings** screen, as shown in Figure 4-26.

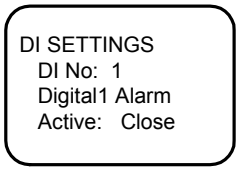



*Figure 4-26 DI Settings screen*

Press ▲ or ▼ to select the needed option and press the **ENT** key to confirm. Press ◄ or ► to select the parameter value and press the **ENT** key to confirm. Press ▲ or ▼ to modify the number and letter of DI name on the third line after pressing the **ENT** key to confirm, press ◄ or ► to move the cursor left or right and input '#' to end. Finally, press the **ENT** key to confirm.

The value description of the DI parameter is listed in Table 4-5.

*Table 4-6 DI parameter setting range and default value*

| Parameter | Range | Default value | Value description |
|---|---|---|---|
| DI No. | 1 ~ 4 | 1 | The four corresponding connecting terminals, queued up in the order that the hardware switches are put |
| DI Name | Figures or letters, 10 at most | Digital1 Alarm | When there are DI alarms, this parameter shows the alarm name you have actually defined |
| Alarm Mode | Open, closed | closed | Closed: closed alarm; open: open alarm |

In this screen, press ▲ or ▼ to change the number, press ◄ or ► to move the cursor, press the **ENT** key to confirm after the change. For the setting range of the parameters and the ex-factory values, see Table 4-5.

### 4.11.2 Battery Settings

At the **Settings** screen, press ▲ or ▼ to select **Batt. Settings** menu. Then press the **ENT** key to enter the **BAT Settings** screen, as shown in Figure 4-27.

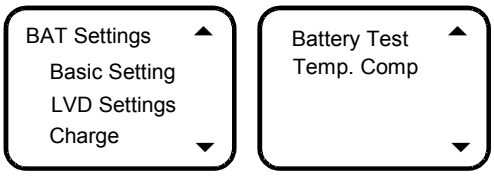



*Figure 4-27 BAT Settings screen*

The BAT Settings screen is a multi-line screen, press ▲ or ▼ to scroll line by line.

The battery parameters are divided into five kinds: basic, LVD, charging management, battery test and temperature coefficient parameters.

**Basic parameters**

1. At the **BAT Settings** screen, press ▲ or ▼ to select **Basic Setting** menu. Then press the **ENT** key to enter the battery basic parameter setting page, as shown in Figure 4-28.

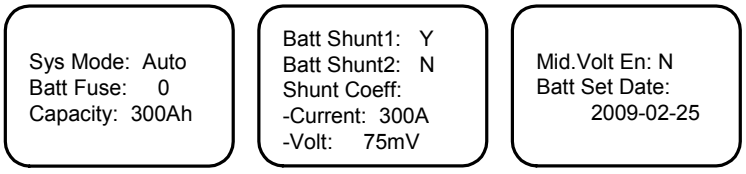



*Figure 4-28 Battery basic parameter setting screen*

The battery basic parameter setting screen is a multi-line screen, press ▲ or ▼ to scroll line by line.

2. Press ▲ or ▼ to select the parameter and press the **ENT** key to confirm. Press ◄ or ► to select the parameter value and press the **ENT** key to confirm. The controller will save the setting value automatically. For the range of the battery basic parameter setting and the default values, see Table 4-6.

*Table 4-7 Range of the battery basic parameter setting and the default values*

| Parameter | Range | Default | Value description |
|---|---|---|---|
| Sys Mode | Auto, Manual | Auto | In the Auto mode, you can manage the system through the controller. In the Manual mode, you can manage the system manually. Under this mode, the controller still calculates battery BC time protection automatically .Upon the system DC under-voltage alarm, system can automatically switch to the Auto mode |
| Bat. Fuse | 0 ~ 4 | 2 | Set according to the actual number battery fuse by the users |
| Bat. capacity | 50Ah ~ 9999Ah | 600Ah | It is the total battery capacity connected to the shunt. Set according to the actual battery configuration by the users |

| Parameter | Range | Default | Value description |
|---|---|---|---|
| Bat. Shunt1 | Y, N | N | Only when the system type is **SET**, the shunt parameter can be set |
| Bat. Shunt2 | Y, N | N | |
| Shunt Coeff Current | 1A ~ 2000A | 300A | Only when the system type is **SET**, the shunt parameter can be set |
| Shunt Coeff Volt | 1mV ~ 500mV | 75mV | |
| Mid Volt Enable | Y, N | N | The controller does not directly manage the battery, this parameter cannot be changed |
| Battery installation date | Setting according to the actual situation | 2009-01-01 | Setting according to the actual situation |

**LVD parameters**

At the **BAT Settings** screen, press ▲ or ▼ to select LVD Setting menu. Then press the **ENT** key to enter **LVD settings** screen, as shown in Figure 4-29.

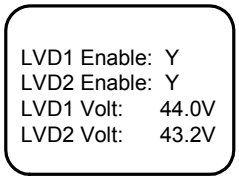



*Figure 4-29 LVD settings screen*

Press ▲ or ▼ to select the parameter and the **ENT** key confirm, and ◄ or ► to select the parameter value and the **ENT** key to confirm. The controller will save the setting value automatically.

**Charge management parameters**

At the BAT Settings screen, press ▲ or ▼ to select **Charge** menu. Then press **ENT** to enter charge management settings screen, as shown in Figure 4-30.

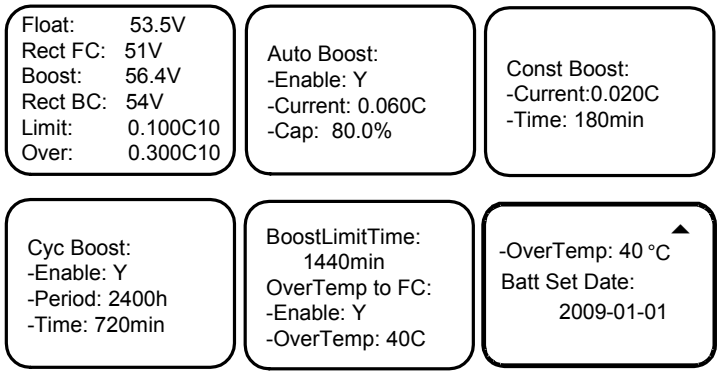



*Figure 4-30 Charge management settings screen*

The charging management setting screen is a multi-line screen. Press ▲ or ▼ to view the items line by line.

Press ▲ or ▼ to select the parameter and press the **ENT** key to confirm, and ◄ or ► to select the parameter value. Then press the **ENT** key to confirm. The controller will save the setting value automatically.

The value descriptions of the charging management parameter are listed in Table 4-7.

*Table 4-8 Charging management parameter value description*

| Parameter | Range | Factory setting | Value description |
|---|---|---|---|
| Float | 42V ~ 58V | 54.0V | Under FC, the output voltage of solar modules |
| Rect FC | | 51.5V | Under FC, the output voltage of rectifiers |
| Boost | | 56.6V | Under BC, the output voltage of solar module, must bigger than FC voltage |
| Rect BC | | 56.4V | Under BC, the output voltage of rectifiers, must be bigger than FC voltage |
| Limit (current limit point) | $0.1C_{10}$ ~ $0.25C_{10}$ | $0.1C_{10}$ | The max. charging current value. C10 is the battery nominal capacity, generally it is set as 10% to 20% capacity of a single group of battery |

| Parameter | Range | Factory setting | Value description |
|---|---|---|---|
| Over (over current point) | $0.3C_{10}$ ~ $1.0C_{10}$ | $0.3C_{10}$ | If the charging current is greater than 'over-current point', the controller will generate the battery charging over-current alarm |
| Auto Boost Enable | Y, N | Y | Y: Use this function. N: Not use this function |
| Auto Boost Current | $0.050C_{10}$ ~ $0.080C_{10}$ | $0.06C_{10}$ | If you use automatic BC function, when the battery capacity drops to 'switch to BC capacity' setting value or when the charge current to 'switch to BC current' setting value, the controller controls rectifier to switch to BC, the battery charging voltage is 'BC voltage' setting value |
| Auto Boost Cap | 10% ~ 99% | 80% | |
| Const Boost Current | $0.002C_{10}$ ~ $0.02C_{10}$ | $0.01C_{10}$ | When the system is in BC state, if the charging current is smaller than 'steady flow BC current' setting, after a period of time set by 'steady flow BC time', the system automatically switches to floating state |
| Const Boost Time | 30min ~ 1440min | 180min | |
| Cyc Boost Enable | Y, N | Y | Y: Use this function. N: Not use this function |
| Cyc Boost Period | 48h ~ 8760h | 2400h | The 'regular BC cycle' refers to the interval between two regular BC. The battery charging voltage is 'BC voltage' setting value, charging time is 'regular BC time' setting value |
| Cyc Boost Time | 30min ~ 2880min | 720min | |
| BC protection time | 60min ~ 880min | 1080min | In the BC process, when the BC time reaches 'BC protection time' setting value, the controller controls rectifier to switch to float charging to ensure the security of the system |
| BC over-temperature -En | Y, N | N | Yes: Use this function. N: Not use this function |
| BC over-temperature –En temp. | 20°C ~ 60°C | 40°C | In the BC process, when the battery temperature reaches 'BC over-temperature protection – protection temperature' setting value, the controller controls rectifier to switch to float charging to ensure the security of the system |

The BC/FC switchover diagram is shown in Figure 4-31.

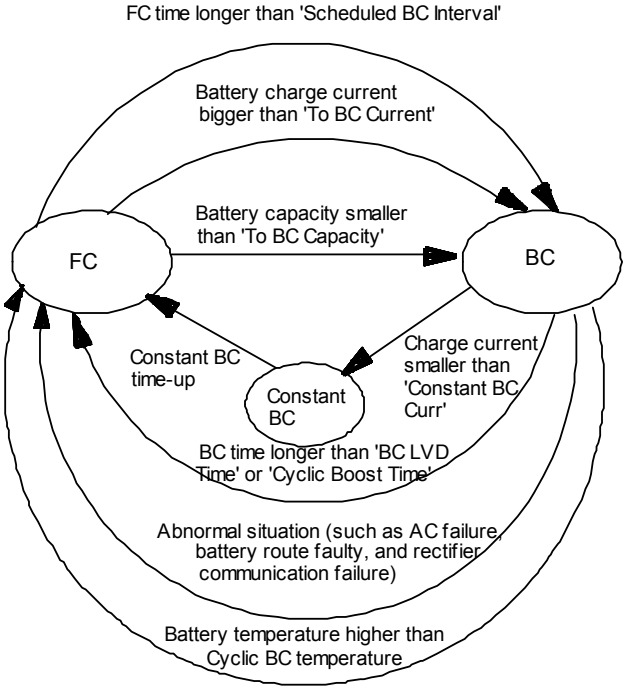



*Figure 4-31 BC/FC switchover diagram*

**Battery test parameters**

At the **BAT Settings** screen, press ▲ or ▼ to select **Battery Test** menu. Then press the **ENT** key to enter battery test settings screen, as shown in Figure 4-32.

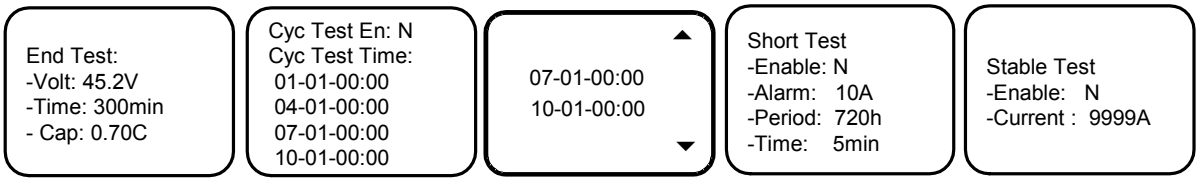



*Figure 4-32 Battery test parameters screen*

The battery test parameter setting screen is a multi-line screen, press ▲ or ▼ to scroll line by line.

Press ▲ or ▼ to select the parameter and press the **ENT** key to confirm, and ◄ or ► to select the parameter value and the **ENT** key to confirm. The controller will save the setting value automatically.

The controller can do battery test, and record 10 sets of test data (accessible only through the host). After the battery test is started, the controller will control the rectifier output voltage, make it lower than the battery voltage, and the battery discharge will begin. The controller will stop the test if the battery voltage reaches the Battery Test Voltage, or the discharge time reaches Battery Test Time, or the battery capacity reaches Test End Cap. Afterwards, it will restore the rectifier output voltage to the normal FC voltage, begin the battery charge and switch the system to battery auto-management.

Meanwhile the test start time/voltage and end time/voltage and battery remaining capacity will be recorded. The records can be queried through the host. During the battery test, if abnormalities occur, the controller will stop the battery test automatically.

The value description of the battery test parameters is listed in Table 4-8.

*Table 4-9 Battery test parameters description*

| Parameter | Range | Default value | Value description |
|---|---|---|---|
| End Test Volt | 43.1V ~ 57.9V | 48.2V | When the battery voltage reaches 'End test Volt' setting value or the discharging time reaches 'End test Time' setting value, or battery capacity to 'End test Cap.' setting value, the controller will terminate the battery test, switching to floating |
| End Test Time | 5min ~ 1440min | 300min | |
| End Test Cap | $0.01C_{10}$ ~ $0.95C_{10}$ | $0.7C_{10}$ | |
| Cyc Test En | Y, N | N | Yes: Use this function. No: Not use this function |
| Cyc Test Time | Month, day, time | 01-01-00:00 | In the case of using timing test function, when the system reaches the 'Cyc Test Time' setting value, it will carry out battery test automatically |
| | | 04-01-00:00 | |
| | | 07-01-00:00 | |
| | | 10-01-00:00 | |
| Short Test Enable | Y, N | N | Y: Use this function. N: Not use this function |
| Short Test Alarm | 1A ~ 100A | 10A | The fast test is for two groups of the battery discharging test comparation. It is also a good method with reference value to test whether the battery is good or not when single group of battery does discharge for a long time. If the battery continuous non-discharging time exceeds 'fast test cycle' setting value, the controller starts fast test, the running time is the 'fast test time' setting value. For the system with two groups of the batteries, at the end of the test, if the battery discharging current difference between the two groups of the batteries is greater than the battery 'fast test alarm point' setting value, the fast test fault alarm will occur |
| Short Test Period | 24h ~ 8760h | 720h | |
| Short Test Time | 1min ~ 60min | 5min | |
| Stable Test Enable | Y, N | N | The stable current test means the battery testing in a constant discharge current. The condition to enter the stable current test is that the active load current is greater than the setting current value of the stable current test. This type of battery test is suitable for larger loads and loads with relatively stable current. It is not recommended in the case of small loads. The current value is set through the 'stable test current'. In the case of allowing the stable current test , if the battery meets the test conditions, carry out the stable current testing |
| Stable Test Current | 0 ~ 9999A | 9999A | |

The schematic diagram of the battery test function is shown Figure 4-33.

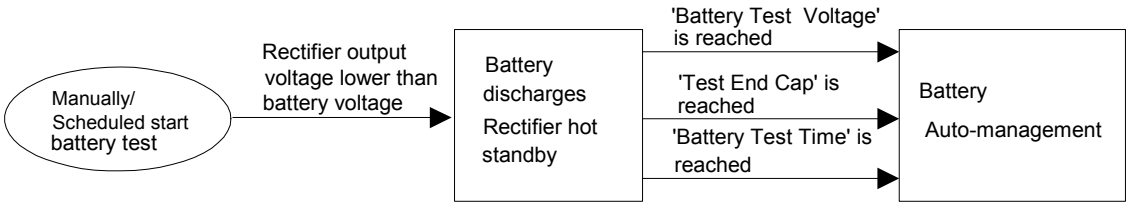



*Figure 4-33 Schematic diagram of the test function*

**Temperature coefficient**

At the **BAT Settings** screen, press ▲ or ▼ to select **Temp. Comp**. Then press the **ENT** key to enter the **Temp. Comp** settings screen, as shown in Figure 4-34.

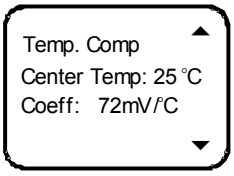



*Figure 4-34 Temp. Comp settings screen*

Press ▲ or ▼ to select the parameter and press the **ENT** key to confirm, and ◄ or ► to select the parameter value. Then press the **ENT** key to confirm. The controller will save the set value automatically.

The value description of the temperature compensation coefficients is listed in Table 4-9.

*Table 4-10 Temperature compensation coefficient description*

| Parameter | Range | Default | Value description |
|---|---|---|---|
| Center Temp | 10°C ~ 40°C | 25°C | Float voltage drop value = (battery temperature measured value – 'center temp comp' setting value) × temp comp coefficient.<br>When a rectifier communication interruption is detected, or alarms such as DC over-/under-voltage or battery disconnection, the controller does not do temperature compensation to the floating voltage of the battery |
| Coeff | 0 ~ 500mV/°C | 72mV/°C(48Vsystem)<br>36mV/°C(24Vsystem) | |

## 4.11.3 AC Settings

At the Settings screen, press ▲ or ▼ to select **AC Settings**. Then press the **ENT** key to enter **AC Settings** screen, as shown in Figure 4-35.

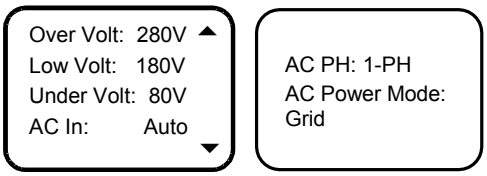



*Figure 4-35 AC Settings screen*

Press ▲ or ▼ to select the parameter and ◄ or ► to select the parameter value. Then press the **ENT** key to confirm. The value description of the AC parameters is listed in Table 4-10.

*Table 4-11 AC setting parameter description*

| Parameter | Range | Default | Value description |
|---|---|---|---|
| Over Volt | 50V ~ 300V | 280V | The controller will raise an alarm when the AC input voltage is higher than the Over Volt |
| Low Volt | 50V ~ 300V | 180V | The controller will raise an alarm when the AC input voltage is lower than the Low Volt. The value of the Low Volt must lower than that of the Over Volt |
| Under Volt | 50V ~ 300V | 80V | Set according to the actual requirement |
| AC In | Y, N | N | Decide according to the AC input mode of the AC sampling board, for the system without AC sampling board , you can only choose 'N' |

| Parameter | Range | Default | Value description |
|---|---|---|---|
| AC PH | 1-PH, 3-PH | 1-PH | Set according to the actual configuration of the power system. For the system with AC sampling board, you can only choose '1-PH' or '3-PH' |
| AC Power Mode | Grid, DG, Grid + DG, No | Grid | - |

### 4.11.4 DC Settings

At the Settings screen, press ▲ or ▼ to select **DC Settings** menu. Then press the **ENT** key to enter **DC Settings** screen, as shown in Figure 4-36.

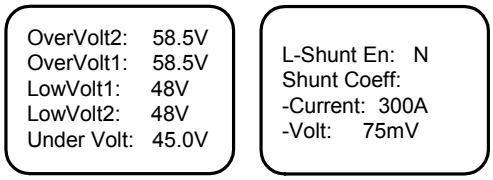



*Figure 4-36 DC Settings screen*

Press ▲ or ▼ to select the parameter and ◄ or ► to select the parameter value. Then press the **ENT** key to confirm.

The value description of the DC setting parameters is listed in Table 4-11.

*Table 4-12 DC setting parameter description*

| Parameter | Range | Default value | Value description |
|---|---|---|---|
| Over Volt | 40V ~ 60V | 58.5V | The DC Over Voltage alarm will be raised when the system DC output voltage is higher than the value of Over Volt |
| Low Volt | | 48.0V | The DC Low Volt alarm will be raised when the system DC voltage is lower than the value of Low Volt, it should be smaller the than over voltage alarm value |
| Low Volt alarm | | 48.0V | When the system DC voltage is lower than the setting value, the system will send out DC low voltage alarm, it should be smaller the than low voltage alarm value |
| L-Shunt | Y, N | N | Setting according to the actual requirement |
| Shunt Coeff Current | 1A ~ 5000A | 300 | In a system with load shunt, it is settable when the shunt option is 'SET' |
| Shunt Coeff Volt | 1mV ~ 500mV | 25 | |

### 4.11.5 Rectifier Settings

At the Settings screen, press ▲ or ▼ to select **Rect Settings** menu. Then press the **ENT** key to confirm to enter **Rect Settings** screen, as shown in Figure 4-37.

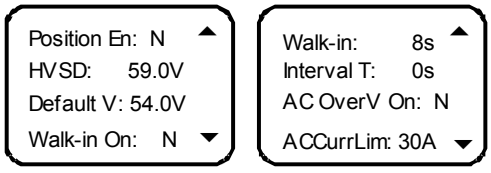



*Figure 4-37 Rect Settings screen*

The Rect settings screen is a multi-line screen, press ▲ or ▼ to scroll line by line.

Press ▲ or ▼ to select the parameter and press the **ENT** key to confirm, and ◄ or ► to select the parameter value. Then press the **ENT** key to confirm. The controller will save the set value automatically.

The value description of the rectifier parameters is listed in Table 4-12.

*Table 4-13 Rectifier parameter description*

| Parameter | Range | Default value | Value description |
|---|---|---|---|
| Position En | Y, N | N | - |
| HVSD | 56V ~ 59V | 59V | The rectifier over-voltage alarm will be raised when the rectifier output voltage is higher than the HVSD voltage |

| Parameter | Range | Default value | Value description |
|---|---|---|---|
| Default V | 48V ~ 58V | 54.0V | The rectifier will output the default output voltage when the communication is interrupted. The setting value must be lower than the HVSD voltage |
| Walk-in On | Y, N | N | The output soft start function means the rectifier voltage will rise from 0V to the Default Volt after the Walk-in time |
| Walk-in | 8s ~ 128s | 8s | |
| Interval T | 0 ~ 10s | 0s | The controller can set the system rectifier DCDC startup time interval to make the rectifier DCDC startup one by one, 0s means that DCDC startup of all rectifiers at the same time |
| AC OverV On | Y, N | N | The controller can set the rectifier to OverVolt Enable, meanwhile, the rectifier can start forcibly. The monitoring unit will set automatically the rectifier with least address to have this function. If the rectifier always exceeds the normal voltage for 60s, the function will be canceled automatically |
| ACCurrLim | 1A ~ 50A | 30A | - |

### 4.11.6 Solar Convt Setting

At the **Settings** screen, press ▲ or ▼ to select **Solar Convt**. Then press the **ENT** key to confirm to enter solar module parameter setting screen, as shown in Figure 4-38.

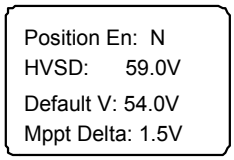



*Figure 4-38 Solar module parameter setting screen*

Press ▲ or ▼ to select the parameter and press the **ENT** key to confirm, and ◄ or ► to select the parameter value. Then press the **ENT** key to confirm. The controller will save the set value automatically.

For solar module parameter setting, see Table 4-13.

*Table 4-14 Solar module parameter setting*

| Parameter | Range | Default value | Value description |
|---|---|---|---|
| Position En | Y, N | N | - |
| HVSD | 56V ~ 59V | 59V | When the output voltage of the module is greater than the setting value, the over-voltage alarm will be generated |
| Default V | 48V ~ 58V | 54.0V | When the rectifier communication is interrupted, the rectifier will output the 'Default V' setting value. The setting value must be less than 'HVSD' setting value |
| Mppt Delta | 0.2V ~ 3V | 1.5V | When the voltage of the busbar is less than the value ('setting value – Mppt Delta'), the system will enter the Mppt status to make the most use of the solar energy. The setting value should be less than the FC voltage point difference between the solar module and the rectifier |

**Note**

1. The system reliably and the battery life will be reduced if the setting value of the 'Mppt Delta' is smaller. Therefore, you should take cautions in setting the 'Mppt Delta'.

2. It is not recommended that the setting value of 'Mppt Delta' should be less than the value which is equal to the FC voltage difference between the rectifier and the solar module + 0.2V.

### 4.11.7 Climate Settings

At the Settings screen, press ▲ or ▼ to select **Climate** menu, and press the **ENT** key to enter **Climate** screen, as shown in Figure 4-39.

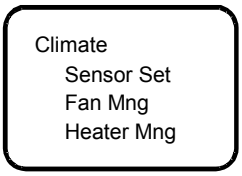



*Figure 4-39 Climate screen*

Climate contains three sub-menus, including **Sensor Set**, **Fan Mng** and **Heater Mng**.

**Sensor settings**

At the Climate screen, press ▲ or ▼ to select **Sensor Set** menu, and press the **ENT** key to enter Sensor Set screen, as shown in Figure 4-40.

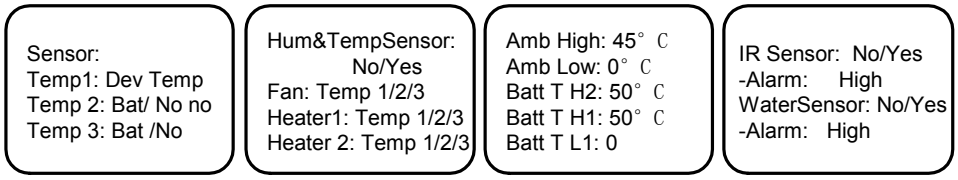



*Figure 4-40 Sensor screen*

The **Sensor** screen is a multi-line screen, press ▲ or ▼ to scroll line by line.

Press ▲ or ▼ to select the parameter and press the **ENT** key to confirm, and ◄ or ► to select the parameter value. Then press the **ENT** key to confirm. The controller will save the set value automatically.

The value description of the sensor parameter is listed in Table 4-14.

*Table 4-15 Sensor parameter setting description*

| Parameter | Range | Default value | Value description |
|---|---|---|---|
| Temp1 | Battery chamber, equipment chamber, none | No | Relate to system internal configuration and connection. It is prohibited to change this parameter |
| Temp2 | Battery chamber, equipment chamber, none | No | Relate to system internal configuration and connection. It is prohibited to change this parameter |
| Temp3 | Battery cabinet, none | No | Relate to system internal configuration and connection. It is prohibited to change this parameter |
| Hum & TempSensor | Y, N | No | Relate to system internal configuration and connection. It is prohibited to change this parameter |
| Fan | Temp1, temp2, temp 3 | Temp1 | Temperature point related to fan control, relate to system internal configuration and connection. It is prohibited to change this parameter |
| Heater 1 | Temp1, temp2, temp 3 | Temp1 | Temperature point related to heater 1 control |
| Heater 2 | Temp1, temp2, temp 3 | Temp2 | temperature point related to heater 2 control |
| Amb High (equipment high temperature) | -40°C ~ 100°C | 58°C | No less than Amb Low. Amb High alarm will be generated when the equipment temperature is higher than this value |
| Amb Low (equipment low temperature) | -40°C ~ 100°C | -10°C | No higher than Amb High. Amb Low alarm will be generated when the equipment temperature is lower than this value |
| Batt T H2 (battery overtemperature) | 10°C ~ 100°C | 50°C | Not less than the battery high temperature value |
| Batt T H1 (battery high temperature) | 10°C ~ 100°C | 50°C | Not less than the battery low temperature value and greater than the value of the battery over-temperature |
| Batt T L1 (battery low temperature) | -40°C ~ 100°C | 0°C | No bigger than the equipment high temperature value |
| IR Sensor (infrared sensor) | Y, N | N | Relate to system internal configuration and connection. It is prohibited to change this parameter |

| Parameter | Range | Default value | Value description |
|---|---|---|---|
| IR Sensor – alarm | High, low | High | Choose IR Sensor – alarm level |
| WaterSensor | Y, N | N | Relate to system internal configuration and connection. It is prohibited to change this parameter |
| WaterSensor – alarm | High, low | Low | Choose WaterSensor – alarm level |

**Fan settings**

At the Climate screen, press ▲ or ▼ to select **Fan Mng** menu, and press the **ENT** key to enter fan settings screen, as shown in Figure 4-41.

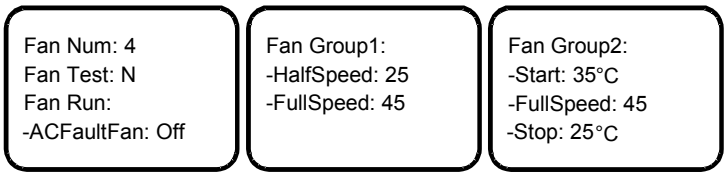



*Figure 4-41 Fan settings screen*

The fan settings screen is a multi-line screen, press ▲ or ▼ to scroll line by line.

Press ▲ or ▼ to select the parameter and press the **ENT** key to confirm, and ◄ or ► to select the parameter value. Then press the **ENT** key to confirm. The controller will save the set value automatically.

The value description of the fan parameters is listed in Table 4-15.

*Table 4-16 Fan parameter setting description*

| Parameter | Range | Default value | Value description |
|---|---|---|---|
| Fan Num (fan number) | None, 1, 2, 3, 4 | None | Fan number. Relate to system internal configuration and connection. It is prohibited to change this parameter |
| Fan Test | Y, N | N | If yes, the fan will start self test. After test, it returns to 'N' |
| Fan Run - -ACFaultFan (fan operation – upon power failure) | On, off | Off | Whether the fan is running upon the AC failure is relate to system internal configuration and connection. It is prohibited to change this parameter |
| Fan Group1 - -HalfSpeed | 20ºC ~ full speed temperature -5ºC | 25ºC | Temperature of the internal fan at half speed (no less than half speed). It is recommended to keep factory setting |
| Fan Group1 - FullSpeed | Half-speed temperature +5ºC ~ 80ºC | 45ºC | Temperature of the internal fan at full speed. It is recommended to keep factory setting |
| Fan Group2 - Start | Stop temperature +5ºC ~ full speed temperature -5ºC | 35ºC | Temperature when the external fan starts. It is recommended to keep factory setting |
| Fan Group2 - FullSpeed | Startup temperature +5ºC ~ 55ºC | 45ºC | Temperature of the external fan at full speed. It is recommended to keep factory setting |
| Fan Group2 - Stop | 15ºC ~ startup temperature -5ºC | 25ºC | Temperature when the external fan stops. It is recommended to keep factory setting |

**Heater settings**

At the Climate screen, press ▲ or ▼ to select **Heater Mng** menu, and press the **ENT** key to enter heater settings page, as shown in Figure 4-42.

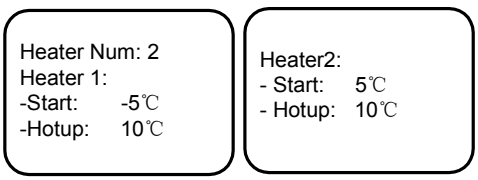



*Figure 4-42 Heater settings screen*

The heater settings screen is a multi-line screen, press ▲ or ▼ to scroll line by line.

Press ▲ or ▼ to select the parameter and press the **ENT** key to confirm, and ◄ or ► to select the parameter value. Then press ENT to confirm. The controller will save the set value automatically.

*Table 4-17 Heater parameter setting description*

| Parameter | Range | Default value | Value description |
|---|---|---|---|
| Heater Num (heater number) | None, 1, 2 | None | Numbers of heater |
| Heater1 - Start | -40°C ~ 10°C | -5°C | Heater1start temperature |
| Heater1 – HotUp (heater 1 heating range) | 10ºC ~ 15ºC | 10ºC | The ending temperature and start temperature difference of Heater1 |
| Heater2 - Start | -40°C ~ 10°C | 5°C | Heater 2 start temperature |
| Heater2 – HotUp (heater 1 heating range) | 10°C ~ 15°C | 10ºC | The ending temperature and start temperature difference of Heater 2 |

## 4.11.8 Setting DG Parameter

At the Settings screen, press ▲ or ▼ to select DG parameter. Then press the **ENT** key to confirm to enter the DG parameter setting screen, as shown in Figure 4-43.

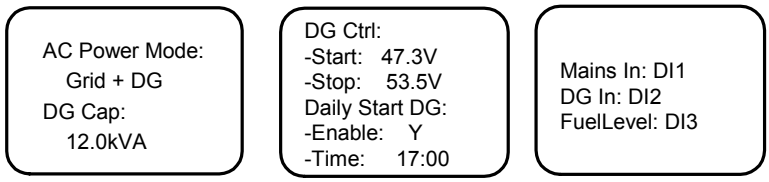



*Figure 4-43 DG parameter setting screen*

The DG parameter setting screen is a multi-line screen, press ▲ or ▼ to scroll line by line.

Press ▲ or ▼ to select the parameter and press the **ENT** key to confirm, and ◄ or ► to select the parameter value. Then press the **ENT** key to confirm. The controller will save the set value automatically.

See table 4-17 for DG parameter setting.

*Table 4-18 DG parameter setting*

| Parameter | Range | Default value | Value description |
|---|---|---|---|
| AC Power Mode | None, Grid, DG, Grid + DG | Mains + DG | Set according to the actual AC power mode of the system |
| DG Cap | 5kVA ~ 100kVA | 12kVA | Set according to the actual capacity of DG |
| DG Ctrol-Start | 40V ~ 60V | 47.3 | Set according to the actual AC power supply need |
| DG Ctrol-Stop | 440V ~ 60V | 53.5V | set according to the actual AC power supply need |
| Daily Start DG | Enable: Y/N | Y | Set according to actual needs of users, as for the 'Y', the setting time is effective |
| | Time: 00:00 ~ 24:00 | 17:00 | Set in accordance with the 24-hour time, be daily effective |
| Mains In | N, DI1, DI2, DI3,DI4 | DI1 | Mains running sate is dry contact input, the default is 'normally closed' effective, the state can be set by software |
| DG In | N, DI1, DI2, DI3,DI4 | DI2 | DG running sate is dry contact input, the default is 'normally open' effective, the state can be set by software |
| FuelLevel | N, DI1, DI2, DI3,DI4 | DI3 | DG low oil level is dry contact input the default is 'normally closed' effective, the state can be set by software |
| DG Fault | N, DI1, DI2, DI3,DI4 | DI4 | DG over – temperature fault alarm is dry contact input the default is 'normally closed' effective, the state can be set by software |
| DG Relay | N, 1, 2, 3, 4, 5, 6 | 1 | DG startup output is dry contact input the default is 'normally closed' effective, the state can be set by software |

### 4.11.9 System Settings

At the Settings screen, press ▲ or ▼ to select **Sys Settings** menu, and press the **ENT** key to confirm to enter settings screen, as shown in Figure 4-44.

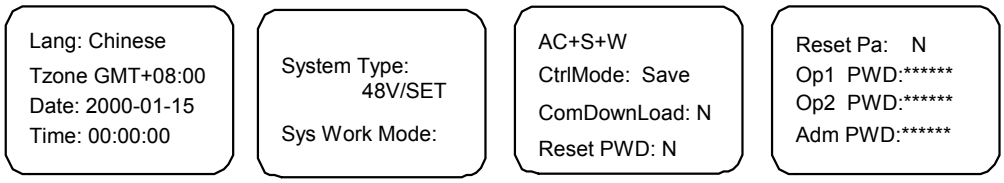



*Figure 4-44 System parameter setting screen*

The system parameter setting screen is a multi-line screen, press ▲ or ▼ to scroll line by line.

If the 'Rest Para' is set to 'Y', press the **ENT** key and prompt a screen shown in Figure 4-45. Upon engineer or administrator level password, you can reset parameters. If the current password level is inadequate, the controller will prompt you to enter senior level password.

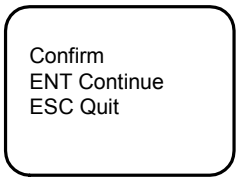



*Figure 4-45 Password confirmation screen*

Press the **ESC** key to cancel the resetting, or the **ENT** key to confirm, all the parameters will resume the default value. The default parameters are not applicable for hybrid power system, for the default parameters will bring serious abnormity to the hybrid power system. It is recommended to power off or reset to perform system resetting when the controller cannot work normally. And all the parameters should be changed to the factory values in the manual immediately!

Press ▲ or ▼ to select the parameter and press the **ENT** key to confirm, and ◄ or ► to select the parameter value. Then press the **ENT** key to confirm. The controller will save the set value automatically.

*Table 4-19 System setting parameter description*

| Parameter | Range | Default value | Password level | Value description |
|---|---|---|---|---|
| Lang | Chinese, English | Chinese | User | Set according to your need |
| Tzone | - | - | User | Set according to actual instance |
| Date | 2000 ~ 2099 | - | User | Set the time according to the current actual time, regardless of whether it is a leap year or not |
| Time | - | - | User | 24h circadian, set according to actual time |
| System Type | 48V/100<br>48V/300<br>48V/500<br>48V/1000<br>48V/SET | 48V/SET | Engineer | Must be set to '48V/SET' |
| Sys Work Mode | AC + Rect<br>Switch. S.C<br>AC + S+ W<br>S + W | AC + S + W | Administrator | This parameter must be set to ' AC + S + W' |
| CtrlMode | Save, Stably | Save | Administrator | If 'Sys Work Mode' is set to 'AC + S + W', this option is valid.<br>Save: make the most use of solar energy. It is applicable to the case that the FC voltage points difference between the PV module and the rectifier is great (such as 3V, default value);<br>Stably: It is priority to ensure that the system output voltage is stabilified in a small range. It is applicable to the case that the FC voltage point difference between the PV module and the rectifier is small (such as 0.5V) |

| Parameter | Range | Default value | Password level | Value description |
|---|---|---|---|---|
| ComDownLoad | Y, N | N | Administrator | Whether downloading software from the serial port and updating the software of the controller |
| Reset PWD | Y, N | N | Administrator | Whether resetting the password to the default |
| Reset Pa | Y, N | N | Engineer | Whether resetting the parameters to the default |
| Op1 PWD | - | 1 | User | The password can be 6 digits long at most. If it is shorter than 6 digits, end it with #. Use ▲ or ▼ to change the number, and ◄ or ► to move the cursor left or right. Press ENT to confirm. You should input the same number twice to complete the setting |
| Op2 PWD | - | - | Engineer | |
| Adm PWD | - | - | Administrator | |

### 4.11.10 Communication Settings

At the Settings screen, press ▲ or ▼ to select **Comm Settings** menu, and press the **ENT** key to enter communication settings screen, as shown in Figure 4-46.

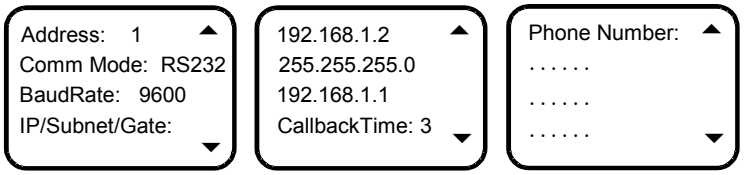



*Figure 4-46 Communication Settings screen*

When the Comm Mode is 'MODEM', the **CallbackTime** and **Phone Number** should be set. Use ◄ or ► to change the **Phone Number** or press ▲ or ▼ to move the cursor left or right. And then press the **ENT** key to confirm. The value description of the communication parameters is listed in Table 4-19.

*Table 4-20 Communication parameter setting description*

| Parameter | Range | Default | Value description |
|---|---|---|---|
| Address | 1 ~ 254 | 1 | The addresses of power systems that are at the same monitored office should be different |
| Comm Mode | Modem | RS232 | The system only supports RS232 mode communication |
| BaudRate | 1200bps ~ 9600bps | 9600bps | Make sure the baud rates of both the sending and receiving parties are the same |
| IP/Subnet/Gate | - | - | Set according to actual instance |
| CallbackTime | - | - | |
| Phone Number | - | - | |

## 4.12 Setting Energy Saving

The Energy Saving is a sub-menu of the **MAINMENU**. At the **MAINMENU**, press ▲ or ▼ to select **Energy Saving**, then press the **ENT** key to confirm. After you input the correct engineer level or administrator level password, the screen shown in Figure 4-47 is displayed.

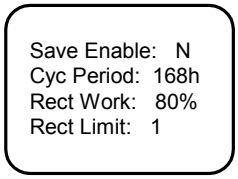



*Figure 4-47 Energy saving screen*

If you want the system operating under energy saving mode, set 'Save Enable' to 'Y', otherwise, set it to 'N'. Set 'Cyc Period' according to actual instance.

1. Operating theory

Under energy saving mode, the controller will switch off some rectifiers, the power-on rectifiers will be charged with all loads. Each power-on rectifier works on the best efficiency to improve utilization ratio of the rectifier and save energy consumption. After certain time (that is 'Cyc Period' in Figure 4-47), the power-off rectifiers will work, meanwhile the power-on rectifiers will stop work. Two states circulate, so as to make sure that the working hours of the rectifiers in the system approach. If the battery current and load current change, the controller will switch off some power-on rectifiers or switch on some power-off rectifiers. In any case, the system guarantees at least one rectifier (detailed number is based on 'Rect Limit') to work.

2. Prerequisite

If the battery is configured and load current without instantly shocks, the system will operate under energy saving mode, that is, 'Save Enable' is set to 'Y'. If it is Solar + electricity, the system can operate under energy saving mode.

If it is the opto-electronic hybrid system, it will not run on energy-saving mode.

3. Advantage

- Working on the best efficiency to save energy.
- Balancing working hours of the rectifiers to prolong the lifetime of the rectifier.
- In shutdown state, preventing rectifiers from damaged about AC inrush to reduce lightning fault.

4. Abnormal situation treatment

- Switch off all the rectifiers when busbar voltage fails (DC over- voltage or low - voltage).
- Switch on all the rectifiers when a rectifier alarm (Rect Not Respond) is generated.
- Switch on all the rectifiers when an AC alarm (Mains Failure) is generated.
- Switch on all the rectifiers automatically when the system has no controller or the communication is interrupted between the rectifier and controller.
- Delay implementation when the rectifier receives shutdown command, immediately execute when the rectifier receives startup order.

The value description of the energy saving parameters is listed in Table 4-20.

*Table 4-21 Energy saving parameters description*

| Parameter | Range | Default value | Value description |
|---|---|---|---|
| Save Enable | Y, N | N | It can be set to 'Y' when the battery is configured and load current without instantly shocks |
| Cyc Period* | 1h ~ 8760h | 48h | Time of rectifier under power-on state and power-off state, it can be set according to actual requirement |
| Rect Work | 30% ~ 90% | 80% | Output capacity percentage. More rectifiers will startup to work through the controller when larger than this setting percentage |
| Rect Limit | 1 ~ 30 | 1 | Minimum number of the rectifier |
| Note*: Cyc Period, Rect Work and Rect Limit are available when 'Save Enable' is set to 'Y' | | | |

## 4.13 Fast Settings

The Fast Settings is a sub-menu of the **MAINMENU**. At the **MAINMENU** screen, press ▲ or ▼ to select **Fast Settings**, then press the **ENT** key to confirm. After you input the correct password, the screen shown in Figure 4-48 is displayed.

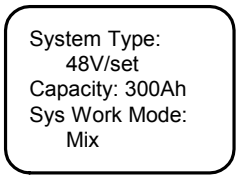



*Figure 4-48 Fast Settings screen*

At the **Fast Settings** screen, you can set the **system type**, **Sys Work Mode** and **Sys Work Mode**, as listed in Table 4-21.

*Table 4-22 Fast settings list*

| Parameter | Range | Default value | Value description |
|---|---|---|---|
| System Type | 48V/100<br>48V/300<br>48V/500<br>48V/1000<br>48V/SET | PS48300-3B/2900 : 48V/SET | When the controller is delivery from the factory together with the power system, the type of the controller of system has been set according to the actual situation, you need not change. When replacing a new controller, you need to set the monitor units in the new power supply system according to the actual type setting.<br>After changing the type of system, the monitor unit will restart automatically, and all other parameters within the monitor unit will become the default value of the corresponding system type. You need to change parameters setting according to the requirements of the system battery and other equipment |
| Capacity | 50Ah ~ 9999Ah | PS48300-3B/2900 : 200Ah | The total battery capacity connected to the shunt. Set according to the user actual battery configuration |
| Sys Work Mode | AC + Rect<br>Switch.S.C<br>AC + S + W<br>S + W | AC + S + W | Set the parameter according to the system configuration status |

# Chapter 5 Maintenance

This chapter introduces the routine maintenance, alarm and fault handling, and part replacement of the solar power supply system.

**Note**

1. The maintenance of the solar power supply system must be conducted in compliance with relevant safety rules.

2. Only the trained personnel with adequate knowledge about the solar power supply system shall work on the internal parts of the system.

## 5.1 Routine Maintenance

Inspect the solar power supply system periodically and shoot the trouble in time. The routine maintenance items are given in Table 5-1.

*Table 5-1 Routine maintenance items*

| Maintenance item | Frequency | Inspecting method | Guide |
|---|---|---|---|
| The voltage output is normal or not | Once half a year | Multimeter | Measure the voltage between the load MCB and the DC output positive busbar. Check that the voltage is normal |
| The fan running is normal or not | Once half a year | Visual inspection | See *3.3 Alarm Check And System Operation Status Check* for the testing methods of the fan. If the fans run abnormally, refer to *5.3.2 Replacing Fans* to maintain or replace the fan |
| Indicators of each module are normal or not | Once half a year | Visual inspection | See *5.2.1 Handling Alarms Of Controller* and *5.2.2 Handling Faults Of Rectifier* |
| Cabinet paint, galvanization layer are free of peeling and scratches | Once half a year | Visual inspection | If there are scratches or peeling, paint them immediately |

## 5.2 Alarm And Fault Handling

### 5.2.1 Handling Alarms Of Controller

The controller alarms are classified into four types: critical alarm, major alarm, observation and no alarm.

Critical alarm, major alarm: These two types of alarms have strong impacts on the solar power supply system performance. Whenever these alarms are generated, you are supposed to handle them immediately. The alarm indicators will be on and audible indication will be given.

Observation: When this type of alarm is raised, the solar power supply system maintains normal output for a while. If the alarm occurs during watch time, it should be handled immediately. If the alarm occurs during non-watch-time, handle it during watch time. The alarm indicators will be on when observation alarm occurs.

No alarm: Alarms set as ‘no alarm’ by the users, will generate no visible or audible indication and the system works normally.

The handling methods of normal alarms about solar power supply system are given in Table 5-2.

*Table 5-2 Handling methods of normal alarms*

| No. | Alarm | Handling method |
|---|---|---|
| 1 | AC power failure | If the power failure lasts for a short time, the DC power supply will be provided by the battery. If the power failure is of unclear reason or it lasts too long, then it needs to start the DG for generating electricity. It is recommended to switch to the DG to supply power to the solar power system at least 5min after it starts, to reduce the potential impact to the solar power supply system during the transitional process of the starting of the DG |

| No. | Alarm | Handling method |
|---|---|---|
| 2 | AC Over Voltage Alarm | Check if the AC Over Voltage Limit is too low. If yes, change it.<br>A mild over-voltage does not affect the system operation. However, the rectifier will stop operation if the mains voltage is higher than 290V. Therefore, if the mains grid is often in over-voltage state, contact the mains grid maintenance personnel to improve it |
| 3 | AC Low Voltage Alarm | Check if the AC Under Voltage Limit is too high. If yes, change it.<br>The rectifiers will derate the output power when the mains voltage is lower than 176V, and stop operation when the mains voltage is lower than 85V. Therefore, if the mains grid is often in under-voltage state, contact the mains grid maintenance personnel to improve it |
| 4 | AC SPD Fault | Check the AC SPD status. If the AC SPD is damaged, replace it. For the replacement procedures, see *5.3.5 Replacing AC SPD* |
| 5 | DC SPD Fault | Check the DC SPD status. If the DC SPD is damaged, replace it. For the replacement procedures, see *5.3.6 Replacing DC SPDs* |
| 6 | DC Over Volt Alarm | 1. Check the DC output voltage and the DC Over Voltage Limits of the controller. If the DC Over Voltage Limits are inappropriate, change them.<br>2. Find out the rectifier that caused the DC Over Volt Alarm. Ensure that the batteries can operate normally. Switch off the AC input MCBs of all rectifiers, and close the AC input MCBs one by one. When closing the AC input MCB of a certain rectifier, the DC Over Volt Alarm reoccurs to the system, the rectifier is in overvoltage, replace it |
| 7 | DC Under Volt Alarm | 1. Check the DC output voltage and the DC Under Voltage Limits of the controller. If the DC Under Voltage Limits are inappropriate, change them.<br>2. Check if the AC power is faulty. Upon AC power failure, disconnect certain loads to prolong the operating time of the whole solar power supply system.<br>3. Check if any rectifier is out of work, that is, there is no output current, if there is any, replace the faulty rectifier.<br>4. Check the total current of the loads. If it exceeds the total output current of the rectifiers during float charge, you need to cut off some loads or add some rectifiers, to make that the total current of the rectifiers exceeds 120% of the total current of the loads with at least one backup rectifier |
| 8 | Load Fuse Alarm | Check if the corresponding load MCB is open (check the position of the MCB handle). If yes, locate and remove the fault. If not, the alarm loop is faulty; please contact company. |
| 9 | Battery Fuse Alarm | Check if the corresponding battery fuse is open (check the fuse voltage). If yes, locate and remove the fault. If not, the alarm loop is faulty; please contact company |
| 10 | Rectifier fault | The red LED on the rectifier panel is on. Cut off the input of the rectifier, and restart it after a period of time. If the alarm persists, please replace the rectifier |
| 11 | Pri Load DisConnect | 1. Check if the rectifier output current and total current of the solar input can sustain the loads, or the battery voltage is lower than the Pri Load DisConnect of the solar power supply system.<br>2. Check if the primary loads are disconnected from the system manually |
| 12 | Sla Load DisConnect | 1. Check if the rectifier output current and total current of the solar input can sustain the loads, or the battery voltage is lower than the Sla Load DisConnect of the solar power supply system.<br>2. Check if the secondary loads are disconnected from the system manually |
| 13 | Rect Protect | Check if the mains is outside the range of 85V ~ 290V (between the AC under-voltage point and over-voltage point). Therefore, if the mains grid is often in over/under-voltage state, contact the mains grid maintenance personnel to improve it |
| 14 | Solar Module Protect | Check if the PV input is outside the range of (Vo + 2) ~ 152V (between the under-voltage point and over-voltage point). Therefore, if the PV system is often in over/under-voltage state, contact the maintenance personnel to improve it |
| 15 | Rect Fan Fails | Check whether the rectifier fan is still working. If the fan stands still, check whether the fan is blocked or not. If yes, clean it. However, if the fan still does not move, replace it (see *5.2.2 Handling Faults Of Rectifier*) |
| 16 | Rect Comm Failure | Check if the communication cable is connected properly between rectifier and controller. If yes, restart the rectifier. If the alarm persists, replace the rectifier |
| 17 | Batt Over Temp | Check if there is battery internal fault. If yes, replace the fault battery.<br>Check if the battery ambient temperature is too high. If yes, reduce the ambient temperature |
| 18 | Fan Fault | Check if the system fan is faulty. For the fan check method and replacement procedures, see *5.3.2 Replacing Fans* |

## 5.2.2 Handling Faults Of Rectifier

**Fault diagnosis of rectifier**

The usual symptoms of rectifier faults include: power indicator (green) off, protection indicator (yellow) on or blinking, fault indicator (red) on or blinking.

The indicators are shown in Figure 5-1. The handling methods of rectifier faults are provided in Table 5-3.

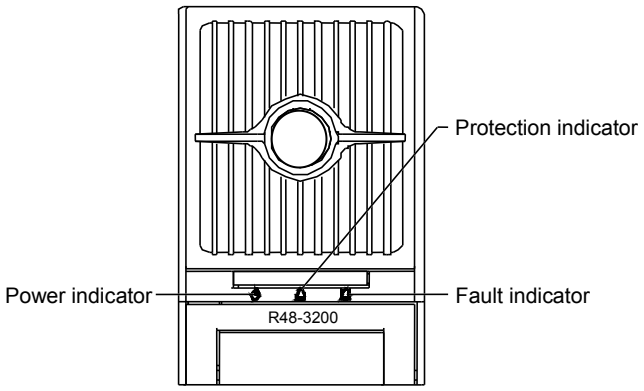



*Figure 5-1 Rectifier indicators*

*Table 5-3 Handling methods of rectifier faults*

| Abnormal symptom | Relevant monitoring alarm | Causes | | Handling method |
|---|---|---|---|---|
| The power indicator (green) is off | No alarm | No input/output voltage | | Make sure that there is input/output voltage |
| | | The auxiliary power source of the rectifier is out of work | | Exchange the positions of abnormal rectifier and normal rectifier, if the abnormal rectifier cannot work normally, replace it |
| The power indicator (green) is blinking | No alarm | The background monitor makes operations to the rectifier | | - |
| The protection indicator (yellow) is on | Rect over temp | Over temp protection occurs in the rectifier, the main causes are: | Fan blocked | Remove the object that blocks the fan |
| | | | Ventilation path blocked at the inlet or vent | Remove the object at the inlet or vent |
| | | | Ambient temperature too high or the inlet too close to a heat source | Decrease the ambient temperature or remove the heat source |
| | Rectifier protection | Current sharing imbalance | | Check that the rectifier communication is normal, if not, check that the communication cable is properly connected, if it is properly connected and the communication is still abnormal, replace the faulty rectifier |
| | | PFC output OverVolt/LowVolt protection | | Exchange the positions of abnormal rectifier and normal rectifier, if the abnormal rectifier cannot work normally, replace it |
| | | AC input overvoltage | | Ensure that the AC input voltage is within normal range |
| The protection indicator (yellow) is blinking | Rectifier communication interrupted | Rectifier communication interrupted | | Check that the communication cable is properly connected |
| The fault indicator (red) is on | Rectifier fault | Rectifier overvoltage | | Reset the rectifier. If the overvoltage protection is triggered again, replace the rectifier |
| | Rectifier fault | Two or more rectifiers of the same ID exist in one system | | Contact company for maintenance |

| Abnormal symptom | Relevant monitoring alarm | Causes | Handling method |
|---|---|---|---|
| The fault indicator (red) is on | System current imbalance | Current sharing imbalance strongly (> ±5%) | Check that the rectifier communication is normal, if not, check that the communication cable is properly connected, if it is properly connected and the communication is still abnormal, replace the faulty rectifier |
| The fault indicator (red) is blinking | Rectifier fan fault | Fan fault | Replace the fan |

**Replacing rectifier fan**

If the rectifier fan is faulty, it should be replaced. Use the following procedures to replace the fan:

1. Use a cross head screwdriver to remove the three fixing screws and pull out the front panel, as shown in Figure 5-2.

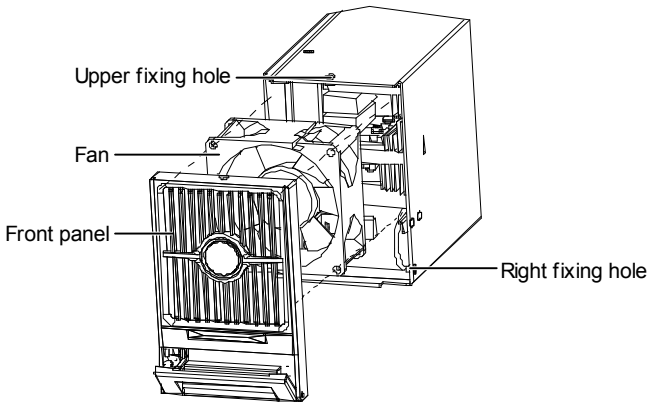



*Figure 5-2 Replacing rectifier fan*

2. Unplug the power cable of the fan and remove the fan.

3. Plug in the new fan.

4. Install the new fan, with fan blowing-direction inward.

5. Replace the front panel.

**Replacing rectifier**

Except replacing the fan, it is not recommended to do any other repair on the rectifier, just send it back to company for repair. In case of rectifier fault, replace the rectifier using the following procedures.

1. Check the new rectifier for damage.

2. Press the handle of the faulty rectifier to pop the handle out. Pull out the rectifier from the rack by grabbing its handle.

Be careful with the rectifier just pulled out from the system, as it could be very hot due to long-term operation. Do not let it slip away and get damaged.

3. Hold the rectifier handle, push the new rectifier into the slot and make sure the connection is good.

After a brief delay, the rectifier run indicator will turn on and the fan will start running.

4. Check that the rectifier works normally.

You should make sure that:

1) The controller recognizes the rectifier.

2) The rectifier shares current with other rectifiers.

3) When this rectifier is pulled out, there is a corresponding alarm and the controller displays the alarm.

If the rectifier passes all the above tests, the replacement is a success.

5. Push the handle back into the front panel to lock the rectifier.

## 5.2.3 Handling Faults Of Solar Module

**Fault diagnosis of solar module**

The symptoms of usual solar module faults include: power indicator (green) off, protection indicator (yellow) on or blinking, fault indicator (red) on or blinking.

The handling methods of solar module faults are provided in Table 5-4.

*Table 5-4 Handling methods of solar module faults*

| Abnormal symptom | Causes | | Handling method |
|---|---|---|---|
| The power indicator (green) is off | No input voltage | | Make sure that there is input voltage |
| | The input polarity is reverse-connected or the output fuse is blown | | Replace the fuse with a new one of the same capacity, or reconnect the input power cable correctly |
| The protection indicator (yellow) is off | The DC input voltage is out of the normal range | | Ensure that the DC input voltage is within the normal range |
| | Over temp protection occurs in the solar module, the main causes are: | 1. Fan blocked | 1. Remove the object that blocks the fan |
| | | 2. Ventilation path blocked at the inlet or vent | 2. Remove the object at the inlet or vent |
| | | 3. Ambient temperature too high or the inlet too close to a heat source | 3. Remove the heat source, decrease the ambient temperature |
| The protection indicator (yellow) is blinking | Solar module communication interrupted | | Check that the communication cable is properly connected |
| The fault indicator (red) is on | Solar module output overvoltage | | Reset the solar module. If the overvoltage protection is triggered again, replace the solar module |
| | Address repeated | | Replace the solar module |
| The fault indicator (red) is blinking | Fan fault | | Replace the fan with a new one |

**Replacing solar module**

It is not recommended to do any repair on the solar module, just send it back to company for repair. In case of solar module fault, replace it using the following procedures.

1. Press the handle of the faulty solar module gently and unscrew it out from the front panel, and the positioning pin retracts into the solar module.

2. Pull out the solar module.

3. Ensure that the new solar module is free of damage. Hold the handle of the new solar module, push it into the cabinet slowly and make sure that the input and output sockets are well connected. Push it until it is stopped by the positioning pin.

4. Screw down the handle nuts, and the positioning pin retracts into the solar module.

5. After a brief delay, the solar module will start working, the power indicator (green) will turn on and the fan will start running.

## 5.2.4 Handling Faults Of Controller

**Fault diagnosis of controller**

The symptoms of controller faults are: the LCD has no display or wrong display. In case of controller faults, diagnose the fault causes according to the following procedures:

1. Unscrew the fixing screws of the cover of the M521S monitoring board, and remove the cover, as shown in Figure 5-3.

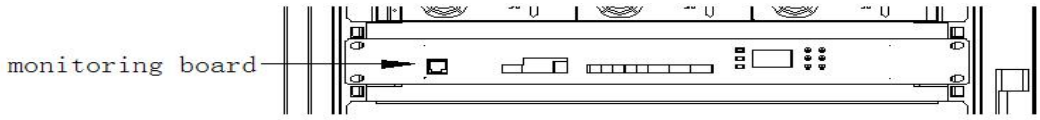



*Figure 5-3 Remove the cover*

2. Diagnose the fault causes according to the indicators on the M521S monitoring board, as provided in Table 5-5.

*Table 5-5 Faults causes and handling methods of controller*

| Fault symptom | Causes | Handling methods |
|---|---|---|
| The watchdog indicator (LED1) and power indicator (LED2) are off | The auxiliary power source does not supply power to the M521S monitoring board | Check that the J27 port on the M521S monitoring board is correctly connected. If the port is correctly connected and the voltage in normal (close to the busbar voltage of the power system), the monitoring board of the controller is broken, replace the M521S monitoring board |
| The power indicator (LED2) is on, and the watchdog indicator (LED1) is on or off | The controller program is not operating | Replace the M521S monitoring board |
| The watchdog indicator (LED1) blinks, and the LCD displays wrong content | The signal cable is wrongly connected or the PCB board fails | Check that the signal cable is correctly connected. If not, reconnect the signal cable. If the signal cable is correctly connected, the PCB board fails, replace it |
| The watchdog indicator (LED1) blinks, and the LCD has no display | The PCB board fails or the LCD fails | Replace the LCD according to *Replacing LCD* in next section, check that the LCD displays normally, if not, the M521S monitoring board fails, replace the M521S monitoring board |
| The power indicator (LED2) is on, the watchdog indicator (LED1) is on or off, and the LCD displays ‘Bootloader is Running’ | The program enters firmware upgrade interface | Wait about 5min, the controller will switch back to the main program automatically. If it fails to switch after 5min, the application program fails to program, or the application program is damaged. At this point, you need to program the applicable program again. If it still fails, the CPU is damaged |

The ports of the M521S monitoring board are shown in Figure 5-4.

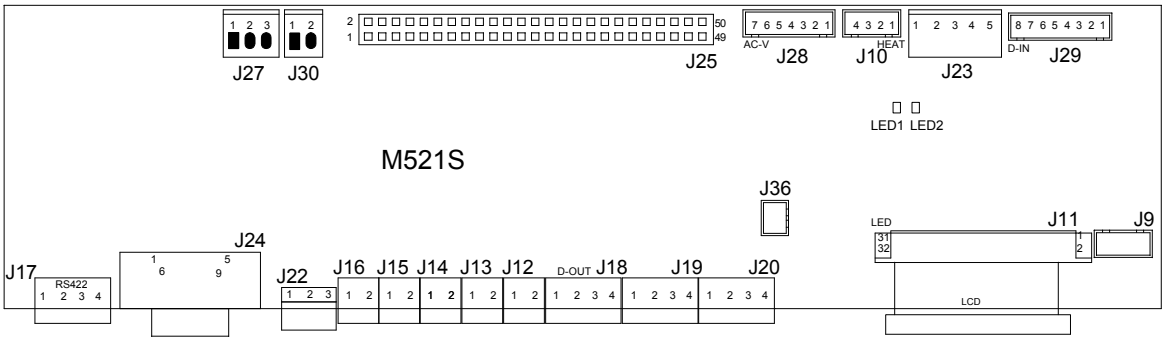



*Figure 5-4 Indicators and ports of the M521S monitoring board*

**Replacing M521S monitoring board**

**Note**

The maintenance of the controller must be conducted carefully. Unplugging the connecting cable may cause power failure accident. During the replacement, strictly follow the sequence to plug in and plug out the connecting cables.

The replacing procedures of the M521S monitoring board are as follows:

1. Open all MCBs and fuses of the system.

2. Remove the fixing screws of the cover of the M521S monitoring board, and the M521S monitoring board is revealed.

3. Loosen all connecting cables on the M521S monitoring board.

4. Remove the fixing screws of the M521S monitoring board and remove the M521S monitoring board.

5. Take out the new M521S monitoring board, use the fixing screws to fix it, connect the cables and fix the cover.

6. Check that the cable connection above is correct, and power on the system. If the watchdog indicator (LED1) blinks, and the power indicator (LED2) is on, the M521S monitoring board is in normal operation.

7. Set the parameters of the controller according to *4.11 Setting System Parameters*.

**Replacing LCD**

The replacing procedures of the LCD are as follows:

1. Remove the fixing screws of the cover of the M521S monitoring board, and the M521S monitoring board is revealed. (Note: the screwdriver is not allowed to contact the bared metal of the signal cable port to avoid short circuit.)

2. Unplug the signal cable and the power plug on J27 and J30 ports one by one. (Note: the unplugged power plug and signal cable should be kept insulated with the components of the power system or the replaced M521S monitoring board to avoid short circuit.)

3. Unplug the flat cable from LCD port (J11).

4. Replace the LCD and restore the connection between the LCD port and the LCD. At this point, note not to cause short circuit between the LCD port and the power system or M521S monitoring board.

5. Insert the power plug into the J30 port.

6. Connect the signal cable to the J27 port, switch on the power of the controller, and the replacement of the LCD is completed.

# 5.3 Replacing Parts

## 5.3.1 Replacing Door Status Sensor

There is a door status sensor (see Figure 5-9) installed in the cabinet for monitoring the close and open status of the cabinet door. When the cabinet door is open, the system generates an alarm; when the cabinet door is closed, the alarm is cleared.

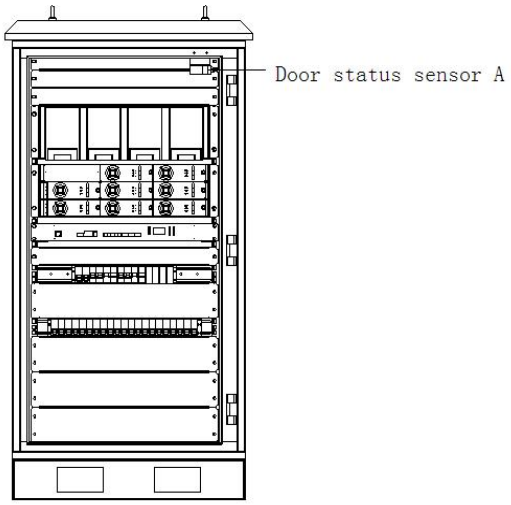



*Figure 5-5 Position of the door status sensor*

The door status sensor requires no particular maintenance; just replace it when it is damaged. If the door is closed, while the door status sensor alarm occurs, the sensor must have been damaged and needs replacement.

The position of the sensor is shown in Figure 5-9. The replacement procedures are simple: Remove the sensor top cover and the two fixing screws of the sensor, and replace the sensor with a new one. Note to reconnect the signal cables of the new sensor to the screws.

# Appendix 1 Spare Part List

*Table 1 Spare part list*

| Component | Description | Number |
|---|---|---|
| Controller | Finished board-M2433U1-M2433U11 monitoring control board-ROHS | 1 |
| Rectifier | Power module-HA415BZ-48V/55A single output rectifier (R48-3200)-{R5} | 4 |
| | Power module-HC415Z-R48-3200e-48V/50A rectifier-without package-{R5} | 4 |
| Solar module | Functional module-S1415Z-48V-3000W-solar converter-3X1U-S48-3000 | 1 |
| Battery fuse | Fuse-NT00 fuse link -500VAC-400A-/-IEC-EU+CN-ROHS | 4 |
| DC SPD | SPD-200Vdc-20kA-40kA-0.5kV-90 × 18 × 65mm-CE | 4 |
| | SPD-180Vdc-20kA-40kA-0.5kV-90 × 18 × 65mm-CE | 4 |
| AC SPD | SPD-Power SPD-VH40TA385M-K-385Vac-20kA-40kA-3-phase 3 + 1 SPD- 95 × 72 × 68mm -guide rail mounted-TUV-CE-ROHS | 1 |
| Fan | Φ120 × Φ120 × Φ38 | 2 |

# Appendix 2 Rectifier Introduction

This chapter introduces the rectifier (R48-3200) on its appearance and structure, functions and features, and technical parameters.

## 1. Appearance And Structure

**Front panel**

The rectifier has three indicators on its front panel, as shown in Figure 1.

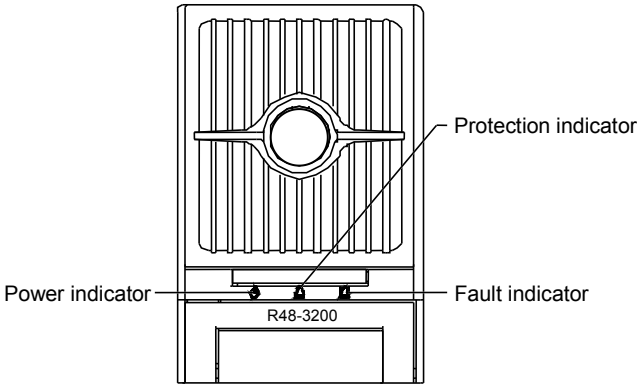



*Figure 1 Front panel of the rectifier*

The functions of the indicators are given in Table 2.

*Table 2 Functions of indicators*

| Indicators | Color | Normal state | Fault state | Fault reason |
|---|---|---|---|---|
| Power indicator | Green | On | Off | There is no input and output power supply |
| | | | Blinking | The background makes operation to the rectifier |
| Protection indicator | Yellow | Off | On | AC input over/under voltage, rectifier PFC output over/under voltage, over-temperature, uneven load sharing of the rectifier |
| | | | Blinking | The rectifier communication is interrupted |
| Fault indicator | Red | Off | On | Output over-voltage occurs, rectifier output fuse is blown, conflict of rectifier address occurs |
| | | | Blinking | The rectifier fan is faulty |

**Rear Panel**

The rectifier has an AC input socket and a DC output socket on its rear panel, as shown in Figure 2.

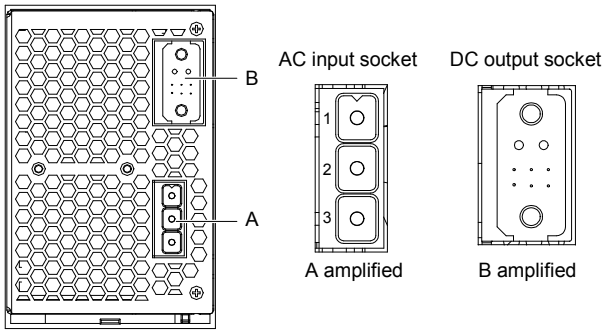



*Figure 2 Rear panel of the rectifier*

The rectifier is hot-pluggable, with convenient installation and maintenance.

The specific functions of the rectifier pins are given in Table 3 and Table 4.

*Table 3 Pin functions of AC input socket*

| Pin | Signal |
|---|---|
| 1 | PE |
| 2 | Phase line |
| 3 | Neutral line |

*Table 4 Pin functions of DC output socket*

| Pin | Signal | | Pin | Signal |
|---|---|---|---|---|
| 1 | Negative pole of DC output | | 6 | Negative signal of communication |
| 2 | Positive pole of the pre-charging | | 7 | NC |
| 3 | Negative pole of the pre-charging | | 8 | Communication signal ground |
| 4 | NC | | 9 | Positive signal of communication |
| 5 | NC | | 10 | Positive pole of DC output |

# 2. Functions And Features

**Hot plugging**

The rectifier adopts hot plugging technology. In a live power supply system, plugging in or out the rectifier will not generate sparks, or damage the terminals. It takes less than one minute to replace the rectifier. The surge current is less than or equal to the value of 1.5 times as large as the rated input steady-state peak current.

When the rectifier is inserted into the system, the system output voltage will not be disturbed.

**Active load-sharing**

The rectifier uses advanced digital active load-sharing technology, and the imbalance degree of the load-sharing is less than 3%.

**Input power limiting**

The rectifier adopts advanced power limiting method, with its output power changing with the input voltage and output voltage. When the input voltage is 176Vac ~ 290Vac (the return difference is less than 3V), the rectifier outputs the maximal power (3200W); when the input voltage is 85Vac ~ 176Vac, the rectifier works normally, but it will enter the power limiting mode. The relationship between its output power and input voltage is shown in Figure 3.

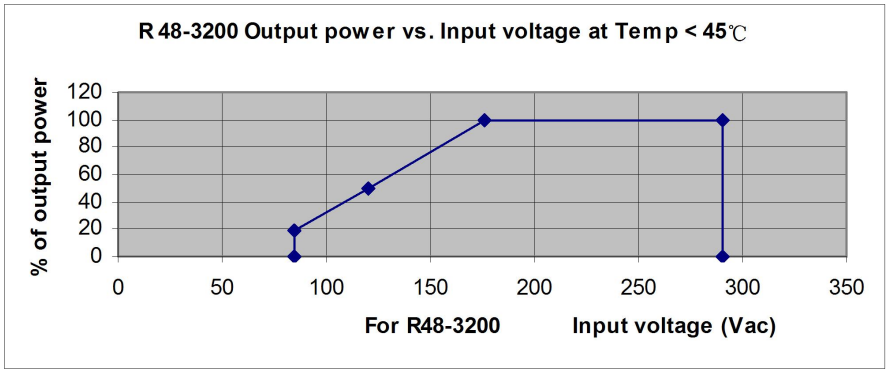



*Figure 3 Relationship between output power and input voltage of the rectifier (the temperature is less than 45°C)*

Note: as shown in Figure 3, when the input voltage drops to 176Vac, the output power of the rectifier begins to derate from 100% of the rated capacity; when the input voltage drops to 85Vac, the output power of the module derates to 20% of the rated capacity.

**Output characteristics**

The schematic diagram of the relationship between the output voltage and output current is shown in Figure 4.

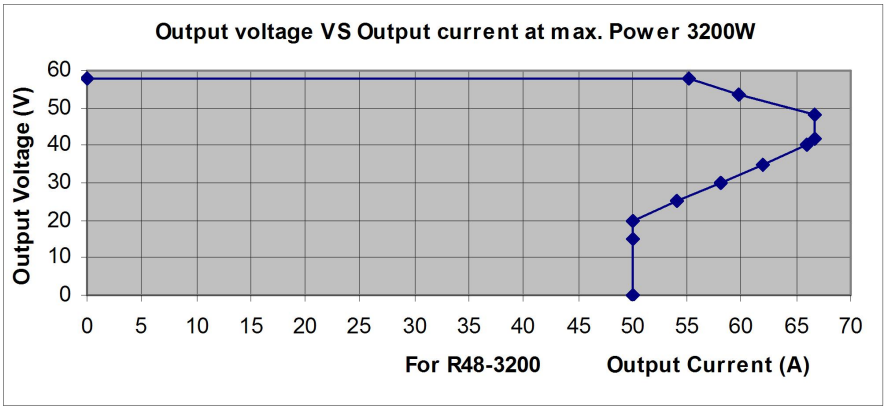



*Figure 4 Schematic diagram of the relationship between output voltage and output current with the rectifier outputting 3200W*

With the rated input voltage, the allowable rectifier output power is 3250W ± 50W. When the output power exceeds 3250W ± 50W, the rectifier uses constant power control.

- When the output voltage is 58V, the maximal output current is not less than 55A.
- When the output voltage is 48V ~ 42V, the maximal output current is not less than 66.7A.
- When the output voltage is 42V ~ 20V, the output current linearly drops from 66.7A to 50A.
- When the output voltage is less than 20V, the output current is not less than 50A.

**Temperature limiting power**

The rectifier can start up under the ambient temperature of -40°C.

- Below the ambient temperature of 45°C, the rectifier outputs 3200W with full power.
- Above the ambient temperature of 45°C, the rectifier must derate with subsection linearity limiting power.
- Under the ambient temperature of 55°C, the allowable rectifier output power is larger than or equal to 2900W.
- Under the ambient temperature of 65°C, the allowable rectifier output power is larger than or equal to 2320W.
- Under the ambient temperature of 70°C, the allowable rectifier output power is larger than or equal to 1450W.
- Under the ambient temperature of 75°C, the allowable rectifier output power is larger than or equal to 0W.

When the input voltage is larger than 176Vac, the schematic diagram of the relationship between the output power and ambient temperature of the rectifier is shown in Figure 5.

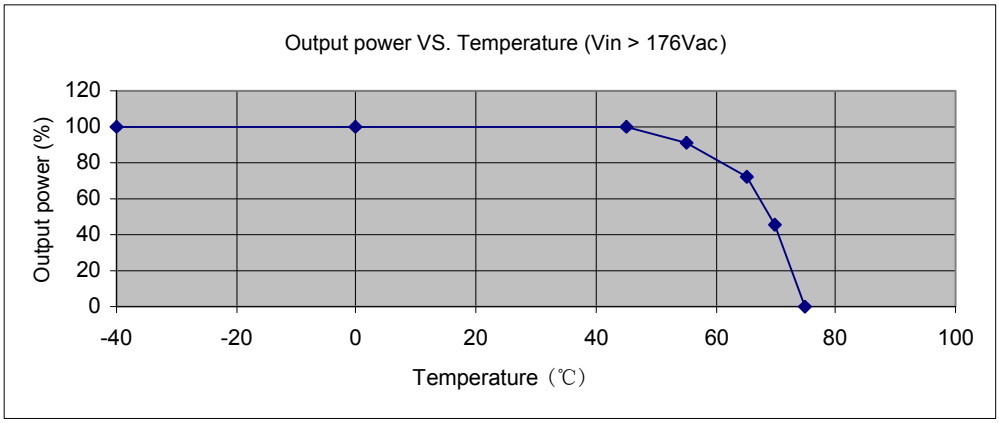



*Figure 5 Schematic diagram of the relationship between the output power and ambient temperature of the rectifier*

**Output current limit adjustment**

The rectifier provides output current limiting function. Through the external controller, the current limit of the rectifier can be adjusted between 0 and 60A.

When the output voltage is between 42V and 58.5V, the adjustment accuracy of the current limit is not larger than ±1.5A. When the output voltage is below 42V, the adjustment accuracy of the current limit is not larger than ±3A.

**Output voltage regulation**

Through the external controller, the output voltage of the rectifier can be adjusted between 42V and 58.5V, and the adjustment accuracy is ±0.1V.

**Fan control**

When the rectifier input voltage is within the normal range, the fan speed will increase with the rise of the rectifier internal temperature. When the internal temperature is higher than 40°C, the fan will run at full speed. When the AC input is too high or too low, the fan will stop running.

**Input over/under voltage protection**

When the input voltage is lower than 85Vac or higher than 290Vac, the yellow indicator will be on, and the rectifier will stop working. When a protection event occurs, the rectifier will report it to the controller, which will handle the alarm.

**Output overvoltage protection**

The rectifier has the output over-voltage protection function, including hardware over-voltage protection and software over-voltage protection. The hardware over-voltage protection point is within the range of 58.5V ~ 60V. After the hardware over-voltage protection occurs, the rectifier can only be manually started. The software protection point can be set by the controller. The setting range is from 56V to 59V, which must be at least 0.5V higher than the output voltage. The factory default setting is 59V.

The software overvoltage protection mode can be selected by the controller.

1. First overvoltage lockout mode

When the rectifier encounters software overvoltage, the rectifier will shut down and stay off. It can only be manually recovered.

2. Second overvoltage lockout mode

After the rectifier software protection occurs, the rectifier will restart within 5s after shutdown. If a second overvoltage occurs within the set time (5 minutes by default, it can be set by the controller), the rectifier will shut down and stay off. It can only be manually started up. If the rectifier output current is less than 5A, the rectifier will not shut down.

Manual startup: you can restore the rectifier either by the controller or by releasing the rectifier from the power system.

**Over-temperature protection**

When the internal temperature exceeds 85°C owing to the reasons that the rectifier air inlet is blocked, the ambient temperature is too high or the fan is faulty, the output power of the rectifier drops to 50% of the rated value. When the internal temperature of the rectifier reaches 90°C, the yellow indicator on the panel will be on, and the rectifier will stop working.

When an over-temperature protection occurs, the rectifier reports the alarm signal to the controller for the corresponding handling. When the internal temperature of the rectifier restore to normal value (the return difference is larger than 10°C), the rectifier will resume working automatically, and the over-temperature alarm will disappear.

**PFC over/under voltage**

When the voltage of the internal bus exceeds the protection points of the over/under voltage, the rectifier will stop working, and the protection indicator (yellow) will be on.

**Communication failure protection**

When a communication failure occurs to the rectifier, the protection indicator (yellow) on the panel blinks. The fault information will be reported to the controller. To protect the battery, the rectifier output voltage becomes 53.5V (default value, which can be set by the controller) after the communication failure occurs. When the communication recovers, the rectifier will resume normal operation automatically.

**Fan failure protection**

When a fan fails, the rectifier will generate a fan failure alarm, the fault indicator (red) on the panel will blink, and the rectifier stops output. After the failure is removed, the rectifier can resume normal operation automatically.

**Imbalanced output current**

When several rectifiers are used in parallel in the power supply system, the rectifier with big errors in current sharing can be identified automatically, and the protection indicator (yellow) on its panel will be on.

When the failure event occurs, the rectifier will report the alarm signal to the controller for corresponding handling.

**Monitoring function**

An advanced digital signal processor is embedded inside the rectifier. It monitors and controls the operation of the rectifier, and makes real-time communication with the controller through CAN bus. Table 5 lists the order and information exchanged between the rectifier and the controller.

*Table 5 Exchanged information between rectifier and controller*

| | |
|---|---|
| Order and signal received by the rectifier | Switch on/off, current step on/off, reset of overvoltage shutdown, current limiting adjustment, voltage adjustment |
| Information reported by the rectifier to the controller | Input voltage, output voltage, output current, setting value of current limit point, temperature, set point of over-voltage, on/off state, failure alarm (such as overvoltage shutdown, fan failure), protection information (such as input voltage protection, internal bus voltage protection, high temperature protection), derating of high temperature, input derating, input power failure, output uneven output load-sharing, address, coding, date, software version, hardware version |

# 3. Technical Parameters

*Table 6 Technical parameters of the rectifier*

| Parameter type | Parameter name | Value |
|---|---|---|
| Ambient conditions | Operating Temperature | -5°C ~ 40°C |
| | Relative humidity | ≤ 90%RH |
| | Altitude | ≤ 2000m (limit power above 2000m) |
| | Cooling mode | Forced air cooling |
| AC input | Input voltage standard | Single-phase, three-line |
| | Input voltage range | 85Vac ~ 290Vac |
| | Rated input voltage | 200Vac ~ 240Vac |
| | Maximum static voltage in non-working condition | 320Vac |
| | Input current | < 21A@3200W/176Vac |
| | Inrush current upon startup | < 30A |
| | Inrush current | < 150% of the rated steady-state input peak current |
| | Allowable input grid frequency | 45Hz ~ 65Hz |
| | Rated input grid frequency | 50Hz/60Hz |
| DC output | DC output voltage range | 42V ~ 58.5V |
| | Output DC current | 0 ~ 60A |
| | Total regulation | ≤ ±0.5% |
| | Load regulation | ≤ ±0.5% |
| | Voltage regulation | ≤ ±0.1% |
| | Red range of startup | ≤ ±1% |
| THD and power factors | THD parameter | ≤ 5% @50% ~ 100% of rated output power |
| | Parameters of power factors | ≥ 0.90 @25% ~ 50% of rated output power |
| | | ≥ 0.98 @50% ~ 100% of rated output power |
| | | ≥ 0.99 @100% of rated output power |
| Noise index | Peak-peak noise | < 200mV, 0 ~ 100MHz, normal output voltage<br>Reference standard: YD/T7314.4.3.4 |
| | Phone sophomorically weighted noise | < 2mV, the rectifier works independently,300Hz ~ 3400Hz<br>Reference standard: YD/T731-2002 4.4.3.1 |
| | | < 1mV, the rectifier works in the power supply system, 300Hz ~ 3400Hz |
| | Wide frequency noise | ≤ 50mV, 3.4kHz ~ 150kHz Reference standard: YD/T731_2002 4.4.3.2 |
| | Discrete noise | ≤ 5mV, 3.4kHz ~ 150kHz Reference standard: YD/T731 4.4.3.3 |
| | | ≤ 3mV, 150kHz ~ 200kHz Reference standard: YD/T731 4.4.3.3 |
| Noise index | Discrete noise | ≤ 2mV, 200kHz ~ 500kHz Reference standard: YD/T731 4.4.3.3 |
| | | ≤ 1mV, 500kHz ~ 30000kHz Reference standard: YD/T731 4.4.3.3 |
| EMC index | Surge | 800V/2Ω Reference standard: EN61000-4-5 |
| | EFT | 4kV/2kV Reference standard：EN 61000-4-4 |
| | ESD | 8kV/15kV Reference standard：EN 61000-4-2 |

| Parameter type | Parameter name | Value |
|---|---|---|
| EMC index | Immunity to continuous conducted interference | 3V 0.15MHz ~ 80MHz, 89dBuA 0.01MHz ~ 0.27MHz<br>Reference standard: EN 61000-4-6 |
| | Immunity to radiated electric fields | 10V 80Hz ~ 2GHz, 10kHz ~ 10GHz Reference standard: EN 61000-4-3 |
| | Immunity to power frequency magnetic field | 30A/m Reference standard: EN 61000-4-8 |
| | Conduction current emission | 0.27MHz ~ 30MHz Reference standard: GR-1089-CORE |
| Protection characteristics | Over-current protection | Input/output over current protection (using the fuse). Short circuit protection |
| | Over/under voltage protection | Input under voltage protection point: 80Vac ± 3Vac, return difference > 15Vac |
| | | Input overvoltage protection point: 295Vac ± 5Vac, return difference > 10Vac |
| | | PFC overvoltage protection point: 425Vac ± 5Vac，return difference ≥ 10Vac |
| | | Output overvoltage hardware protection point: 58.5Vdc ~ 60Vdc |
| | | Output overvoltage software protection point: 56Vdc ~ 59Vdc (it can be configured through the controller) |
| Others | Efficiency | Up to 91% |
| | Current sharing | The current sharing error of the rectifier is smaller than ±1.5A in the same power supply system (maximum: 1200A) with 10% ~ 100% rated load |
| | Temperature coefficient (1/°C) | ≤ ±0.01% |
| | Dynamic response (the rated input and output voltage) | When the load current is changing among 50% ~ 25% ~ 50% in saltus step and 50% ~ 75% ~ 50% in phase step, the recovery time of the load effect is: ≤ 200μs, the overshoot is: ≤ 5%; When the load current is changing among 10% ~ 90% ~ 10% in phase step (Telcordia GR-947), tr/tf is 50μs, the upper/lower overshoot of the rectifier is: ≤ 5%, the time that the output voltage of the rectifier exceeds ±1% error belt is: ≤ 4ms |
| | Start-up time (select the startup mode through the controller) | Normal soft startup: the time delay from AC power-up to rectifier output is less than 5s |
| | | Gradual onset of output: With 90% of rated load, the rise time of rectifier output voltage is more than 8s. With 100% of rated load, the maximum rise time is 10s.<br>This function can be enabled or not through the controller, the start-up time can also be set through the controller (according to Telcordia GR-947-CORE, R3-19) |
| | Hold up time | 10ms (It is allowed for the output to drop from 54V to 42V in the test process) |
| | Noise | ≤ 50dB (A) (at place of 1.0m) |
| | Surge protection | Satisfy the class of IEEE C62 41-1991 B3, 6kV/3kA (1.2/50μs impulse voltage and 8/20μs impulse current) |
| | Insulation strength | (Remove the potentiometers and filter capacitors before the test)<br>AC input terminal to enclosure: 2121Vdc.<br>AC input terminal to DC output terminal: 4242Vdc.<br>DC output terminal to enclosure: 707Vdc.<br>DC output terminal to earth: 1500Vdc.<br>For all the four tests above, there should be no breakdown within 1min, with steady state leakage current no bigger than 1mA |
| | Insulation resistant | Apply a test voltage of 500Vdc. The insulation resistances between DC circuit and earth, AC circuit and earth, and AC and DC circuits are all not less than 20MΩ |
| Mechanical parameters | Size | 85.3 (2U width) × 287 (depth, excluding LOGO) × 132.3 (3U height) |
| | Weight | ≤ 3.5kg |

# Appendix 3 Solar Module Introduction

This chapter introduces the solar module (S48-3000) on its appearance and structure, functions and features, and technical parameters.

## 1. Appearance And Structure

**Front panel**

The solar module has three indicators on its front panel, as shown in Figure 6.

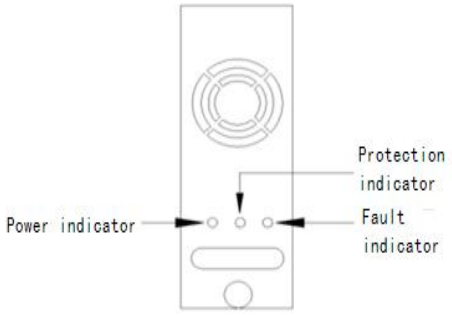



*Figure 6 Front panel of the solar module*

The functions of the indicators are given in Table 7.

*Table 7 Functions of indicators*

| Indicators | Color | Normal state | Fault state | Fault reason |
|---|---|---|---|---|
| Power indicator | Green | On | Off | No input power supply or solar module failure |
| | | | Blinking | The background makes operation to the solar module |
| Protection indicator | Yellow | Off | On | Over-temperature, input over-voltage, input under voltage, current limiting of the solar module |
| | | | Blinking | Solar module CAN bus communication is interrupted |
| Fault indicator | Red | Off | On | Output over-voltage, repeated address, solar module failure |
| | | | Blinking | Fan failure of the solar module |

**Rear panel**

The solar module provides a DC input socket and a DC output socket on its rear panel, as shown in Figure 7.

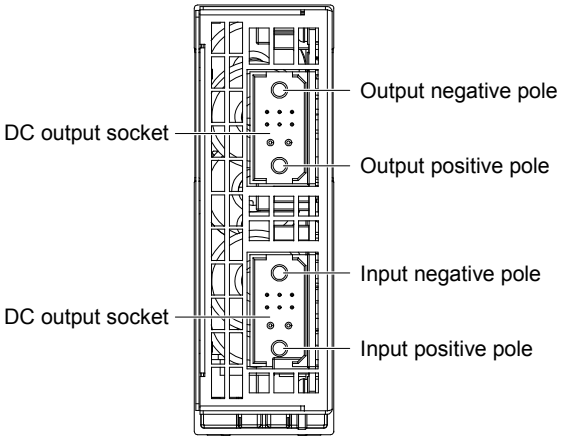



*Figure 7 Rear panel of the solar module*

The solar module is hot-pluggable, with convenient installation and maintenance.

The side cover of the solar module is affixed with a label, which provides the pin definitions of the input socket and output socket, and some certifications. Table 8 and Table 9 list the detailed functions of the pins.

*Table 8 Pin functions of DC input socket*

| Pin | Signal |
|---|---|
| 1 | Positive pole of DC input |
| 2, 3 | PE |
| 10 | Negative pole of DC input |

*Table 9 Pin functions of DC output socket*

| Pin | Signal |
|---|---|
| 1 | Positive pole of DC output |
| 10 | Negative pole of DC output |

# 2. Functions And Features

**Maximum power point tracking**

The solar module can track the maximum power point of photovoltaic batteries, and the maximum power point tracking accuracy is more than 99.5%.

**Hot plugging**

The solar module adopts hot plugging technology. In a live power supply system, plugging in or plugging out the solar module will not generate sparks, or damage the terminals. It takes less than one minute to replace the solar module.

When the solar module is inserted into the system, the system output voltage will not be disturbed.

**Output characteristics**

Table 10 lists the relationship between the output voltage and output current, and the schematic diagram is shown in Figure 9.

*Table 10 Output characteristics*

| Output power | Output current | Output voltage |
|---|---|---|
| 3000W | 51.7A | 58Vdc |
| 3000W | 61A | 49.2Vdc |

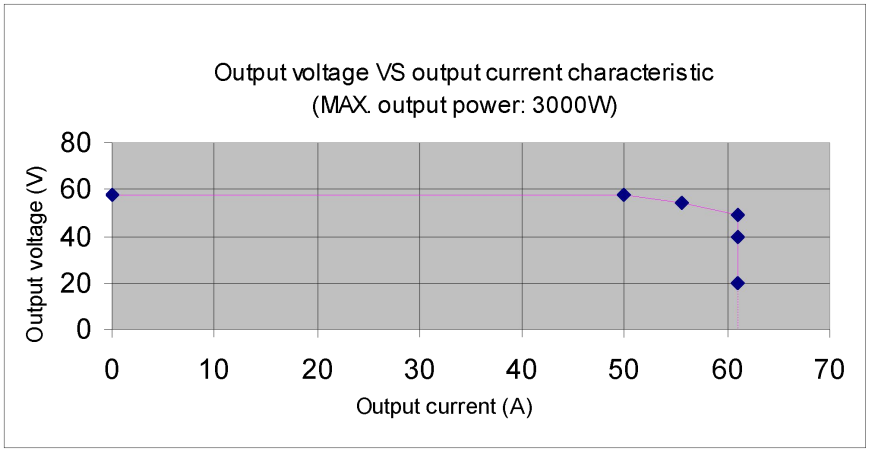



*Figure 8 Schematic diagram of the relationship between output voltage VS. output current (the solar module outputs 3000W)*

The solar module has the following output characteristics:

- When the output voltage is between 49.2V and 58V, the maximum output power is 3000W.
- When the output voltage is lower than 49.2V, the output current maintains at 61A.
- When the output voltage is lower than 20V, the module turns off.
- When the output voltage is 58V, the maximum output current can reach 51.7A.
- When the load exceeds 3000W, the solar module output power will be limited to 3000W.

**Temperature limiting power**

- Under the ambient temperature of -20°C ~ 55°C, the solar module can output full power.
- Under the ambient temperature of 65°C, the maximal output power of the solar module is 2400W.
- Under the ambient temperature of 75°C, the solar module has no output.
- Under the ambient temperature of -40°C, the solar module can start up.

When the input voltage is larger than the output voltage, the schematic diagram of the relationship between the output power and ambient temperature of the solar module is shown in Figure 10.

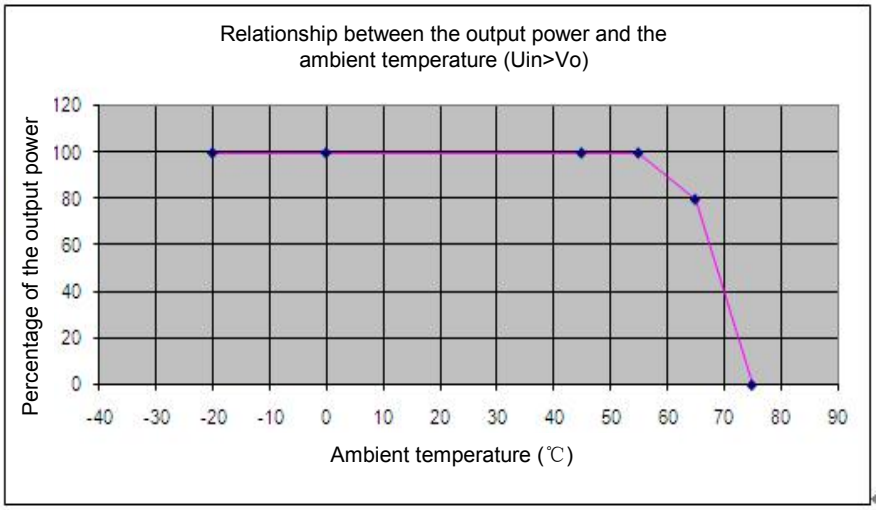



*Figure 9 Relationship between output power and ambient temperature of the solar module*

**Output current limit adjustment**

The solar module provides output current limit function. Through the external controller, the current limit of the solar module can be adjusted between 5A and 61A.

When the output voltage is between 42V and 58V, the adjustment accuracy of the current limit is ±1.5A.

**Output voltage regulation**

Through the external controller, the output voltage of the solar module can be adjusted between 42V and 58V, and the adjustment accuracy is ±0.1V.

**Fan control**

When the input voltage of the solar module is within the normal range, the fan speed will increase with the rise of the internal temperature of the solar module. In the event of input/output overvoltage protection, the controller will send shutdown command, and the fan will fail and stop running.

**Input overvoltage protection**

When the input voltage is larger than 152Vdc, the protection indicator (yellow) will be on, and the solar module will stop working. When a protection event occurs, the solar module will report it to the controller, which will handle the alarm.

**Output overvoltage protection**

The solar module has output over-voltage protection function, including Hardware over-voltage protection and software over-voltage protection. The hardware over-voltage protection point is 59.5. After the hardware over-voltage protection occurs, the solar module can only be manually started. The software over-voltage protection point can be set by the controller. The setting range is from 56V to 59V, which must be at least 0.5V higher than the output voltage. The factory default setting is 59V.

The software over-voltage protection mode is fourth over-voltage lockout mode.

After the software protection occurs, the solar module will restart within 5s after shutdown. If four times of over-voltage occur within the set time (5 minutes by default, it can be set by the controller), the solar module will shut down and stay off. It can only be manually started up.

Manual startup: you can restore the solar module either by the controller or by releasing the solar module from the power system.

**Over-temperature protection**

When the internal temperature exceeds the over temperature protection point owing to the reasons that the air inlet of the solar module is blocked, or the ambient temperature is too high, the protection indicator (yellow) on the panel will be on, and the solar module will stop working.

When an over temperature protection occurs, the solar module reports the alarm signal to the controller for corresponding handling. When the internal temperature of the solar module restore to normal value (the return difference is larger than 5°C), the solar module will resume working automatically, and the over temperature alarm will disappear.

**Communication failure protection**

When a communication failure occurs to the solar module, the protection indicator (yellow) on the panel blinks. The fault information will be reported to the controller. To protect the battery, the output voltage of the solar module becomes 54V (default value, which can be set by the controller) after the communication failure occurs. When the communication recovers, the solar module will resume normal operation automatically.

**Fan failure protection**

When a fan fails, the solar module will generate a fan failure alarm, the fault indicator (red) on the panel will blink, and the solar module stops output. After the failure is removed, the solar module can resume normal operation automatically.

# 3. Technical Parameters

*Table 11 Technical parameters*

| Parameter type | Parameter name | Value |
|---|---|---|
| Ambient conditions | Operating temperature | -20°C ~ +55°C |
| | Relative humidity | ≤ 95%RH |
| | Altitude | ≤ 2000m (limit power above 2000m), max.: 3000m |
| | Cooling mode | Forced air cooling |
| DC input | Input voltage standard | Solar energy PV input, rated 68Vdc, maximal 150Vdc |
| | Input voltage range | 58Vdc ~ 150Vdc |
| | the maximum static voltage in non-working condition | 165Vdc |
| DC output | DC output voltage range | 42V ~ 58V |
| | Output DC current | 0 ~ 61A |
| | Load regulation | ≤ ±0.5% |
| | Total regulation | ≤ ±0.6% |
| | Source regulation | ≤ ±0.1% |
| EMC index | CE/RE | Class A/Class B |
| Others | Efficiency | Maximal 98.2% |
| Mechanical parameters | Size | 41.4 (1U width) × 287 (depth, excluding LOGO) × 132.3 (3U height) |
| | Weight | ≤ 3kg |

Note: please refer to *S48-3000 Solar Converter Module User Manual* for other specific parameters.

# Appendix 4 Parameter Setting Of The Controller

This chapter gives the description of the controller parameter setting. The detailed information of the parameter setting and operating method are given in *Chapter 4 Use Of The Controller.*

*Table 12 Parameter setting of the controller*

| Item | | Parameter | Range | Factory setting | Value description |
|---|---|---|---|---|---|
| Alarm | | DI No. | 1 ~ 4 | 1 | The 4 corresponding connecting terminals, queued up in the order that the hardware switches are put |
| | | DI Name | - | Digital Alarm | Figures or letters, 10 at most |
| | | Alarm Mode | Off, On | Off | |
| Battery | Basic | Sys Mode | Auto, Manual | Auto | Manage the system through the controller or manually |
| | | Bat. Fuse | 0 ~ 4 | 2 | Set it according to the actual battery configuration |
| | | Capacity | 20Ah ~ 5000Ah | 200Ah | The battery nominal capacity. You should set this parameter according to the actual battery configuration |
| | | Bat. Shunt1 | Y, N | Y | You can set shunt parameters when system type is 'SET' |
| | | Bat. Shunt2 | | N | |
| | | Shunt Coeff -Current | 1A ~ 5000A | 300A | |
| | | Shunt Coeff -Volt | 1mV ~ 500mV | 75mV | |
| | LVD | LVD1 Enable | Y, N | Y | Y: to enable LVD1/ LVD2 function;<br>N: to disable the LVD1/ LVD2 function |
| | | LVD2 Enable | | Y | |
| | | LVD1 Volt | 40V ~ 60V | 46.6V | Select battery voltage as standard, when the controller detects that the battery voltage is lower than the preset LVD1 Volt, the load will be disconnected, and so does the battery when the battery voltage is lower than the preset LVD2 Volt |
| | | LVD2 Volt | | 45.6V | |
| | Charge management | Float | 42V ~ 58V | 54.0V | Battery float charge voltage of the solar module |
| | | Rect FC | | 51.5V | Battery float charge voltage of the rectifier |
| | | Boost | | 56.4V | Battery boost charge voltage of the solar module, and the 'Boost' must be higher than the 'Float' |
| | | Rect BC | | 56.0V | Battery boost charge voltage of the rectifier, and the 'Boost' must be higher than the 'Float' |
| | | Limit | $0.1C_{10}$ ~ $0.25C_{10}$ | $0.1C_{10}$ | Maximum battery charging current |
| | | Over | $0.3C_{10}$ ~ $1.0C_{10}$ | $0.300C_{10}$ | Battery charge over-current alarm point |
| | | Auto Boost -Enable | Y, N | Y | Select Y to enable this function;<br>Select N to disable this function |
| | | Auto Boost -Current | $0.050C_{10}$ ~ $0.080C_{10}$ | $0.06C_{10}$ | The controller will control the system enter the BC state when the battery capacity decreases to the value of 'To Boost Cap', or when the charge current reaches the 'To Boost Current'. The charge voltage will be the Boost state |
| | | Auto Boost -Cap | 10% ~ 99% | 80% | |
| | | Const Boost -Current | $0.002C_{10}$ ~ $0.02C_{10}$ | $0.02C_{10}$ | The system in the BC state will enter the FC state when the charge current decreases to the 'Const Boost Current' and after the 'Const Boost Time'. The battery charge voltage then will be the Float state |
| | | Const Boost -Time | 30min ~ 1440min | 180min | |

| Item | | Parameter | Range | Factory setting | Value description |
|---|---|---|---|---|---|
| Battery | Charge management | Cyc Boost -Enable | Y, N | Y | Select Y to enable this function;<br>Select N to disable this function |
| | | Cyc Boost -Period | 48h ~ 8760h | 2400h | The 'Cyc Boost Period' means the interval between the two cyclic boost charges. The battery charging voltage is the preset 'Boost', and the time is the preset 'Cyc Boost Time' |
| | | Cyc Boost -Time | 30min ~ 2880min | 720min | |
| | | BoostLimitTime | 60min ~ 2880min | 1440min | To ensure the system safety, the controller will forcefully control the system to enter the FC state from the BC state, if the boost charge time reaches the 'BoostLimitTime' |
| | Battery test | End Test Volt | 43.1V ~ 57.9V | 48.2V | The controller will stop the test if the battery voltage reaches the 'End Test Volt', or the discharge time reaches the 'End Test Time', or the battery capacity reaches the 'End Test Cap' |
| | | End Test Time | 5min ~ 1440min | 300min | |
| | | End Test Cap | $0.01C_{10}$ ~ $0.95C_{10}$ | $0.7C_{10}$ | |
| | | Cyc Test En | Y, N | N | Whether using the cyclic test function |
| | | Cyc Test Time 1 | Month, day, time | 01-01-00:00 | When the parameter 'Cyc Test En' is set to 'Y', the controller will test the battery automatically according to the 'Cyc Test Time' |
| | | Cyc Test Time 2 | | 04-01-00:00 | |
| | | Cyc Test Time 3 | | 07-01-00:00 | |
| | | Cyc Test Time 4 | | 10-01-00:00 | |
| | | Short Test -Enable | Y, N | N | Whether using short test function |
| | | Short Test -Alarm | 1A ~ 100A | 10A | If the battery is not discharged within the 'Short Test Period', the controller will start a short test, whose operation time is set by the parameter 'Short Test Time'. By the end of the test, if the difference in the discharge currents of batteries is bigger than the 'Short Test Alarm', the battery charge abnormal alarm will be generated |
| | | Short Test -Period | 24h ~ 8760h | 720h | |
| | | Short Test -Time | 1min ~ 60min | 5min | |
| | | Stable Test -Enable | Y, N | N | Whether using the stable test function |
| | | Stable Test -Current | 0 ~ 9999A | 9999A | Battery discharging current upon stable test |
| | Temperature coefficient | Center Temp | 10°C ~ 40°C | 25°C | FC voltage derated value = (Batt Temp – 'Center Temp') * Temp Coeff.<br>Upon alarms such as rectifier communication interruption, DC over/under voltage or battery fuse alarm, the controller will not do temperature compensation to the battery FC voltage |
| | | Coeff | 0 ~ 500mV/°C | 72mV/°C | |
| AC | | Over Volt | 50V ~ 300V | 280V | AC over-voltage alarm point |
| | | Low Volt | 50V ~ 300V | 180V | AC low-voltage alarm point, must be lower than AC over-voltage alarm point |
| | | Under Volt | 50V ~ 300V | 80V | Set it according to the actual requirement |
| | | AC In | Y, N | N | Set it according to the AC input mode of AC sampling board. Choose 'N' if the AC sampling board is not configured |
| | | AC PH | 1-PH, 3-PH | 3-PH | Set it according to the actual configuration |
| | | AC Power Mode | Grid, DG, Grid + DG, N | Grid | Se it according to the actual AC power mode |
| DC | | Over Volt | 40V ~ 60V | 58.5V | DC over-voltage alarm point |
| | | Low Volt 1 | | 48.0V | DC low-voltage alarm point, must be lower than DC over-voltage alarm point |
| | | Low Volt 2 | | 48.0V | DC under-voltage alarm point, must be lower than DC low-voltage alarm point |
| | | L-Shunt | Y, N | N | Set it according to the actual instance |
| | | Shunt Coeff Current | 1A ~ 5000A | 200A | They can be reset when the shunt options are 'SET' in the system with load shunt |
| | | Shunt Coeff Volt | 1mV ~ 500mV | 25mV | |

| Item | Parameter | Range | Factory setting | Value description |
|---|---|---|---|---|
| Rectifier | Position En | Y, N | Y | Y: The controller will prompt you to set rectifier position before the rectifier and controller are powered on.<br>N: You do not need to set the rectifier position |
| | R-Posi | 1 ~ 30 | - | R-Posi: represented in two figures, the first figure represents the rectifier number; the next figure represents position number. Press the **ENT** key to select the rectifier, press ◄ or ► to change position number. When the controller communicates with the rectifier, the green indicator on the corresponding rectifier will blink |
| | HVSD | 56V ~ 59V | 59V | Rectifier over-voltage alarm point |
| | Default V | 48V ~ 58V | 54V | Default output voltage when communication is interrupted. Must be lower than the 'HVSD' voltage |
| | Walk-in On | Y, N | N | The output soft start function means the rectifier voltage will rise from 0V to the 'Default V' after the 'Walk-in T' |
| | Walk-in T | 8s ~ 128s | 8s | |
| | Interval T | 0 ~ 10s | 0s | The controller can set the DC-DC interval start of the modules.<br>DC-DC start time = module address * interval time |
| | AC OverV On | Y, N | N | The controller can set the rectifier to 'Over Volt En', meanwhile, the rectifier can start forcibly. The controller will automatically set the rectifier with least address to have this function. If the rectifier always exceeds the normal voltage for 60s, the function will be canceled automatically |
| | ACCurrLim | 1A ~ 50A | 30A | The controller limits the input current of the rectifier within the AC current limiting range |
| Solar Convt | Position En | Y, N | N | Y: The controller will prompt you to set solar converter position before the solar converter and controller are powered on.<br>N: You do not need to set the position |
| | R-Posi | 1 ~ 10 | - | R-Posi: represented in two figures, the first figure represents the rectifier number, the next figure represents position number. Press the **ENT** key to select the rectifier, press ◄ or ► to change position number. When the controller communicates with the solar converter, the green indicator on the corresponding solar converter will blink |
| | HVSD | 56V ~ 59V | 59V | Solar converter over-voltage alarm point |
| | Default V | 48V ~ 58V | 54V | Default output voltage when communication is interrupted. Must be lower than the 'HVSD' voltage |
| | MpptDelta | 0.2V ~ 3V | 1.5V | When the busbar voltage is under the solar converter set output volt, the Solar Converter must work in MPPT mode |
| System | Lang | Chinese, English | Chinese | Set it according to your need |
| | Tzone | - | - | Set it according to the actual instance |
| | Date | 2000 ~ 2099 | - | Set the time according to the current actual time, regardless of whether it is a leap year or not |

| Item | Parameter | Range | Factory setting | Value description |
|---|---|---|---|---|
| System | System Type | 48V/100<br>48V/300<br>48V/500<br>48V/1000<br>48V/SET | 48V/SET | The system type of the controller has been set according to the actual instance before the controller is delivered with power supply system. You do not need to change the value except that the controller needs to be replaced with a new one.<br>After changing the type, the controller will restart and the other parameters will resume the default. You need to reset and change some parameters according to the battery and equipment configured with the system |
| | Sys Work Mode | AC+Rect, Switch.S.C, AC + S + W, S + W | AC + S + W | Select it according to the actual system work mode |
| | CtrlMode | Save, Stably | Save | When the 'Sys Work Mode' is set to 'AC + S + W', this option will appear |
| | ComDownLoad | Y, N | N | Whether accessing the serial port upgrade program |
| | Reset PWD | Y, N | N | Whether resetting the password to the default |
| | Reset Para | Default, N | N | Whether resetting the parameter to the default |
| | Op1 PWD | - | - | The password can be 6 digits long at most. If it is shorter than 6 digits, end it with space key |
| | Op2 PWD | - | - | |
| | Adm PWD | - | - | |
| Communication | Address | 1 ~ 254 | 1 | The addresses of power systems that are at the same monitored office should be different |
| | Comm Mode | MODEM | RS232 | |
| | BaudRate | 1200bps ~ 9600bps | 9600bps | Make sure that the baud rates of both the sending and receiving parties are the same |
| | IP/Subnet/Gate | - | - | Set it according to the actual instance |
| | CallbackTime | - | - | |
| | Phone Number | - | - | |
| Energy saving[1] | Save Enable | Y, N | N | It can be set to 'Y' when the battery is configured and load current without instantly shocks |
| | Cyc Period | 1h ~ 8760h | 168h | Time of rectifier in power-on state and power-off state, it can be set according to the actual requirement |
| | Rect Work | 30% ~ 90% | 80% | Output capacity percentage. More rectifiers will start to work when larger than this setting percentage |
| | Rect Limit | 1 ~ 30 | 1 | Minimum number of the rectifier in energy saving state |
| Fast settings | Capacity | 20Ah ~ 5000Ah | 200Ah | The capacity of the battery strings connected with the shunt. You should set this parameter according to the actual battery configuration |
| | Sys Work Mode | AC + Rect, Switch.S.C, AC + S+ W, S + W | AC + Rect | - |

| Item | Parameter | Range | Factory setting | Value description |
|---|---|---|---|---|
| Fast settings | System Type | 48V/100<br>48V/300<br>48V/500<br>48V/1000<br>48V/SET | 48V/SET | The system type of the controller has been set according to the actual instance before the controller is delivered with power supply system. You do not need to change the value except that the controller needs to be replaced with a new one.<br>After changing the type, the controller will restart and the other parameters will resume the default. You need to reset and change some parameters according to the battery and equipment configured with the system |
| Climate settings | Temp1 | BattTemp, DevTemp, N | BattTemp | Set them according to the actual sensor |
| | Temp2 | BattTemp, DevTemp, N | DevTemp | |
| | Temp3 | Bat2Temp, N | N | |
| | Hum&TempSensor | Y, N | N | |
| | Fan | Temp1, Temp2, Temp3 | Temp2 | The fan does the control according to the selected (measure object) temperature |
| | Heater1 | Temp1, Temp2, Temp3 | Temp1 | The heater1 does the control according to the selected (measure object) temperature |
| | Heater2 | Temp1, Temp2, Temp3 | Temp2 | The heater2 does the control according to the selected (measure object) temperature |
| | Amb High | -10°C ~ +100°C | 58°C | Define the temperature point |
| | Amb Low | -40°C ~ +58°C | -10°C | |
| | Batt T H2 | 50°C ~ 100°C | 55°C | |
| | Batt T H1 | 10°C ~ 50°C | 55°C | |
| | Batt T L1 | -40°C ~ +10°C | 0°C | |
| | IR Sensor | Y, N | N | Set the infrared sensor configuration |
| | IR Sensor -Alarm | High, Low | High | Set the infrared sensor alarm level |
| | WaterSensor | Y, N | N | Set the water sensor configuration |
| | WaterSensor -Alarm | High, Low | Low | Set the water sensor alarm level |
| | Fan Num | 0 ~ 4 | 4 | The fan number controlled |
| | Fan Test | Y, N | N | Select 'Y' to start the fan test, then estimate the fan status, abnormity will generate an alarm; the setting value will automatically return to 'N' after the test is finished |
| | Fan Run-ACFaultFan | On, Off | Off | Check that the fan is off in power-off state |
| | Fan Group1 - HalfSpeed | 20°C ~ 30°C | 25°C | When the temperature is lower than the preset value, the fan will run at half speed, but its speed will be increased along with the increasing temperature when the temperature is higher than the preset value |
| | Fan Group1 - FullSpeed | 30°C ~ 80°C | 45°C | When the temperature reaches the preset value, the fan will run at full speed |
| | Fan Group2 - Start | 30°C ~ 40°C | 35°C | When the temperature reaches the preset value, the fan will start |
| | Fan Group2 -FullSpeed | 40°C ~ 55°C | 45°C | When the temperature reaches the preset value, the fan will run at full speed |
| | Fan Group2 - Stop | 15°C ~ 30°C | 25°C | When the temperature reaches the preset value, the fan will stop |
| | Heater Num | 0 ~ 2 | 2 | - |

| Item | Parameter | Range | Factory setting | Value description |
|---|---|---|---|---|
| Climate settings | Heater1-Start | -40°C ~ +10°C | 5°C | When the temperature is lower than the preset value, the heater will start |
| | Heater1-HotUp | 10°C ~ 15°C | 10°C | The difference between heater stop temperature and start temperature |
| | Heater2-Start | -40°C ~ +10°C | -5°C | When the temperature is lower than the preset value, the heater will start |
| | Heater2-HotUp | 10°C ~ 15°C | 10°C | The difference between heater stop temperature and start temperature |
| DG settings[2] | DG Cap | 5kVA ~ 100kVA | 12.5kVA | Set it according to DG actual capacity |
| | DG Ctrl-Start | 40V ~ 60V | 47.3V | Se it according to the actual requirement |
| | DG Ctrl-Stop | 40V ~ 60V | 53.5V | Se it according to the actual requirement |
| | Mains In | N, DI1, DI2, DI3, DI4 | DI1 | Input the dry contact in mains state, you can set the state through 'Active' at the *DI settings* screen in *4.11.1 Alarm Settings*. For example, this parameter is set to DI1, and the DI 'Active' of DI1 is set to 'Close', then the mains will be in normal/power-off state upon DI1 input close/open |
| | DG In | N, DI1, DI2, DI3, DI4 | DI2 | Input the dry contact in DG state, you can set the state through 'Active' at the *DI settings* screen in *4.11.1 Alarm Settings*. For example, this parameter is set to DI2, and the DI 'Active' of DI2 is set to 'Close', then DG will be in startup/stop state upon DI2 input close/open |
| | FuelLevel | N, DI1, DI2, DI3, DI4 | N | Input the alarm dry contact in fuel level state, you can set the state through 'Active' at the *DI settings* screen in *4.11.1 Alarm Settings* |
| | DGFault | N, DI1, DI2, DI3, DI4 | N | Input the alarm dry contact in DG over-temperature state, you can set the state through 'Active' at the *DI settings* screen in *4.11.1 Alarm Settings* |
| | DG Relay | N, 1, 2, 3, 4, 5, 6 | N | Output the dry contact signal in DG start/stop state, the default state is 'Close', you can set the hardware state |
| | Daily Start DG-Enable | Y, N | N | Set it according to the actual requirements. Y: the setting time is valid |
| | Time | 00:00 ~ 23:59 | 17:00 | Set it according to 24 hours mode, everyday is valid |
| Wind Settings[3] | Wind shunt | Y, N | Y | If 'Bat. Shunt2' is set to 'N', this parameter will appear |
| | shunt -Current | 1A ~ 5000A | 150A | |
| | shunt -Volt | 1mV ~ 500mV | 25mV | |
| | Ctrl Relay | NO, 1~6 | No | The wind is controlled by the relay |
| | OverVoltProt-Cut | 48V ~ 60V | 57V | |
| | OverVoltProt-resume | 48V ~ 60V | 54.5V | |

Note:

1: Cyc Period, Rect Work and Rect Limit are available when 'Save Enable' is set to 'Y'.

2: When the parameter 'AC Power Mode' is set to 'DG' or 'Grid + DG', DG can be valid.

3: If 'Wind shunt' is set to 'N', the wind will be invalid

# Appendix 5 Menu Structure Of The Controller

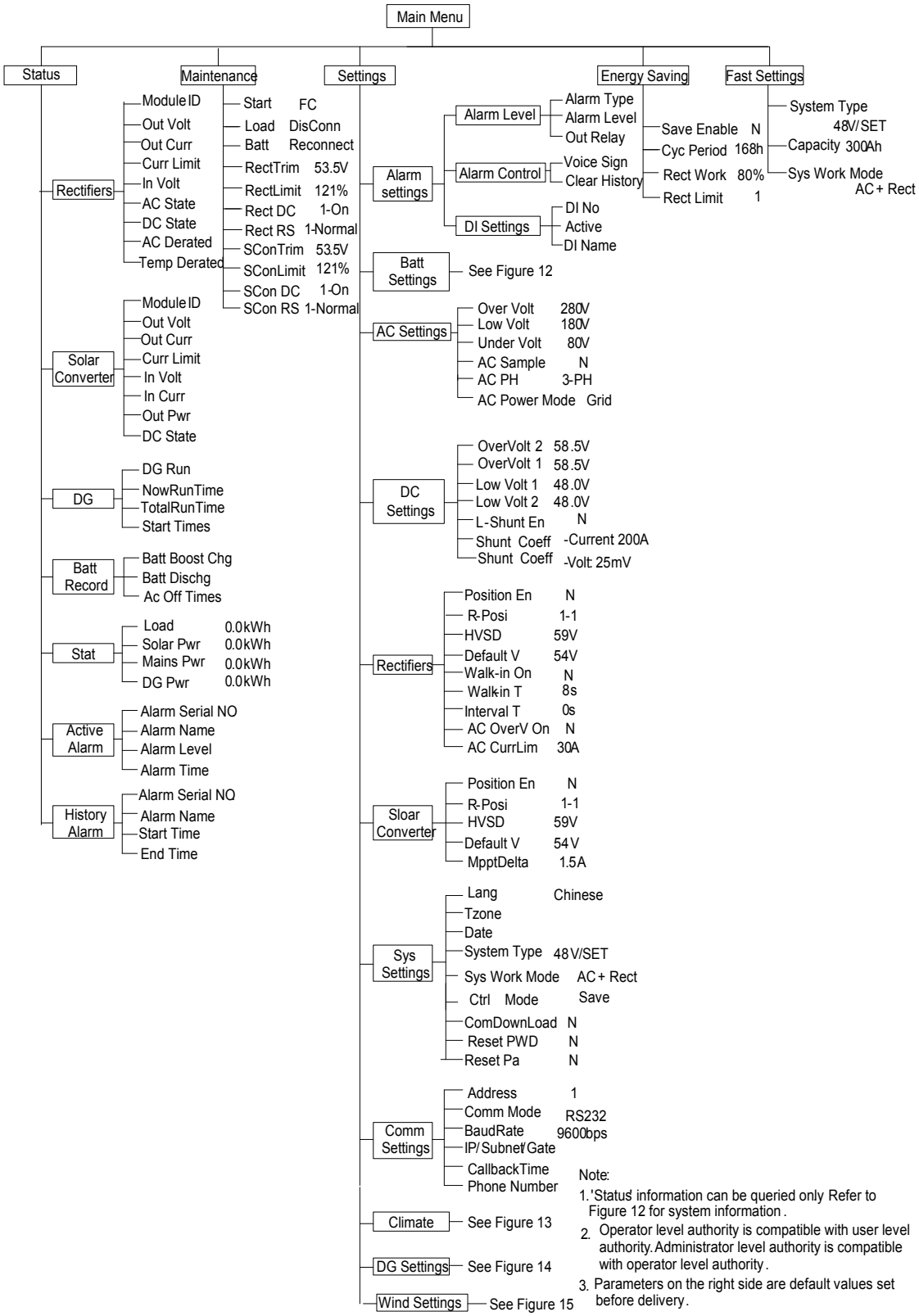
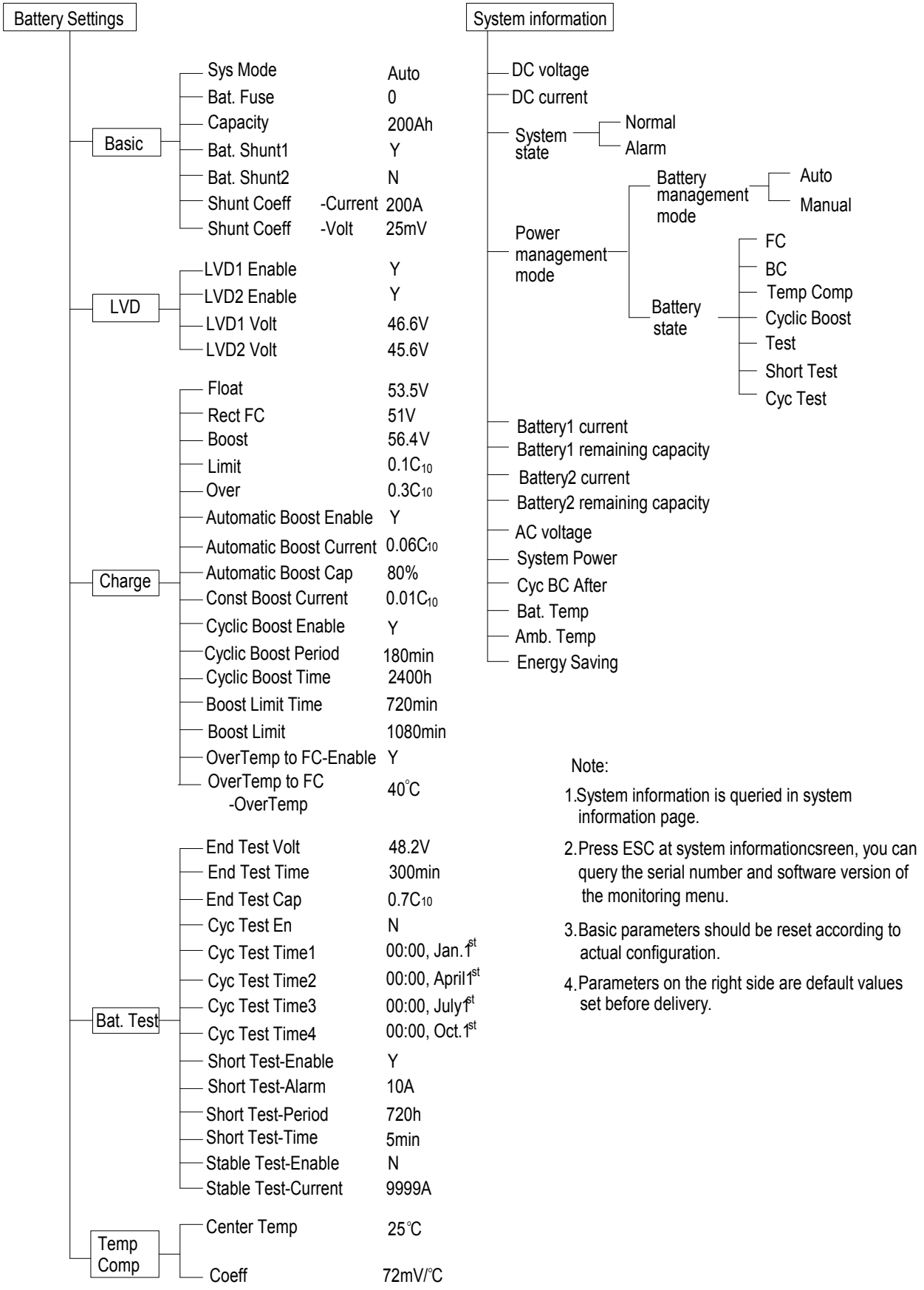



*Figure 10 Menu structure of the controller*




Note:

1. System information is queried in system information page.
2. Press ESC at system informationcsreen, you can query the serial number and software version of the monitoring menu.
3. Basic parameters should be reset according to actual configuration.
4. Parameters on the right side are default values set before delivery.

*Figure 11 Menu structure of the battery parameter*

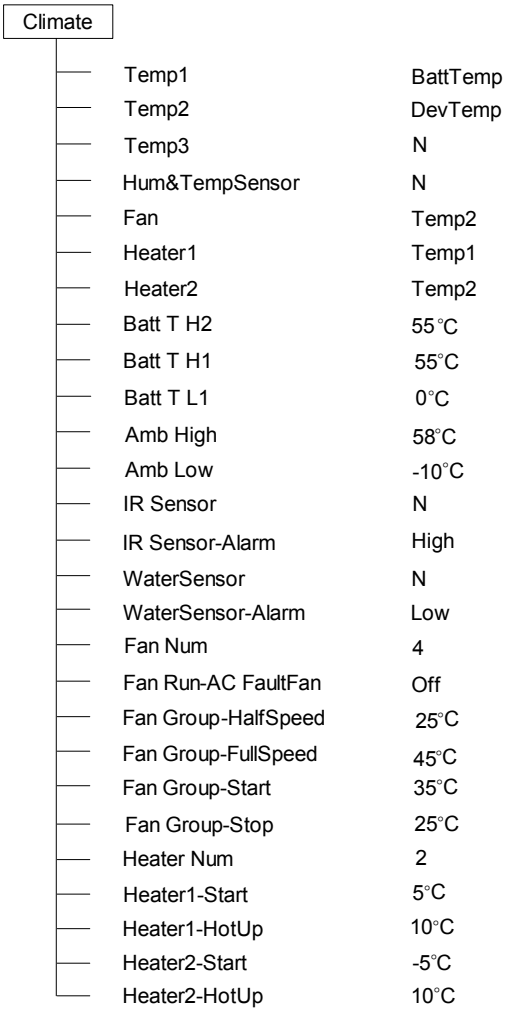



*Figure 12 Menu structure of the temperature control parameter*

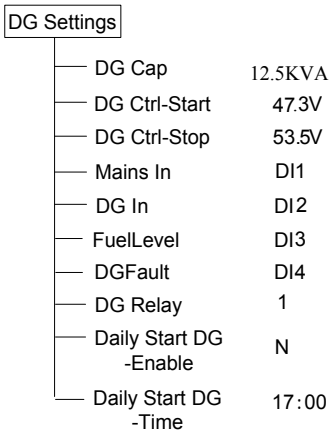



*Figure 13 Menu structure of the DG parameter*

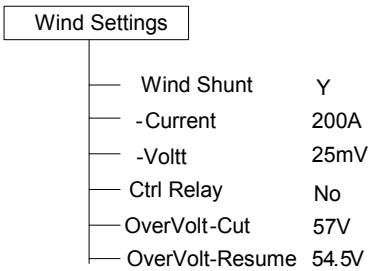



*Figure 14 Menu structure of the Wind parameter*