PS24600-2A/2200 Power Supply System

User Manual

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Emerson Network Power provides customers with technical support. Users may contact the nearest Emerson local sales office or service center.

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Safety Precautions

To reduce the chance of accident, please read the safety precautions very carefully before operation. The "Caution, Notice, Warning, Danger" in this book 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 be strictly trained and master the correct operations and all the safety points before actual operation.

When operating Emerson products, the safety rules in the industry, the general safety points and special safety instructions specified in this book must be strictly observed.

Electrical Safety

I. Hazardous voltage

Danger

Some components of the power system carry hazardous voltage in operation. Direct contact or indirect contact through moist objects with these components will result in fatal injury.

Safety rules in the industry must be observed when installing the power system. The installation personnel must be licensed to operate 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 finding the water or moisture on the cabinet, turn off the power immediately. In moist environment, precautions must be taken to keep moisture out of the power 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 fire and 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.

II. Tools

Warning

In high voltage and AC operation, special tools must be used. No common or self-carried tools should be used.

III. 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.

IV. ESD

Notice

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

V. Short circuit

Danger

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

Check carefully 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.

Insulated tools must be used.

In live operation, keep the arm muscle tense, so that when tool connection is loosened, the free movement of the human body and tool is reduced to a minimum.

Battery

Danger

Before any operation on battery, read carefully the safety precautions for battery transportation and the correct battery connection method.

Non-standard operation on the battery will cause danger. In operation, precautions should be taken to prevent battery short circuit and overflow of electrolyte. The overflow of electrolyte will erode the metal objects and PCBs, thus causing equipment damage and short circuit of PCBs.

Before any operation on battery, pay attention to the following points:

Remove the watch, bracelet, bangle, ring, and other metal objects on the wrist.

Use special insulated tools.

Use eye protection device, and take preventive measures.

Wear rubber gloves and apron to guard against electrolyte overflow.

In battery transportation, the electrode of the battery should always be kept facing upward. Never put the battery upside down or slanted.

LLVD And BLVD

The power supply system has battery low voltage disconnection (BLVD) function and load low voltage disconnection (LLVD) function. LLVD means when the mains fail and batteries supply power, the monitoring module cuts the non-priority load off when the battery voltage drops down to below 22.5V. In this way, the battery remaining capacity can sustain the priority load longer. The LLVD voltage is settable. Refer to *4.7.2 Battery Selection* for setting method.

BLVD means when the mains fail and batteries supply power, the monitoring module cuts the load off when the battery voltage drops down to below 21.6V to prevent over-discharge. The BLVD voltage is settable. Refer to *4.7.2 Battery Selection* for setting method.

The factory setting is enabling LLVD and BLVD, which means that if power outage lasts for a long time or the power supply system fails, there might be LLVD and BLVD. Users should classify the loads and connect the non-priority loads to LLVD routes, and connect the priority loads to BLVD routes. For vital loads, users can disable BLVD of these loads to insure reliability of the power supply.

The method of disabling BLVD is:

1. Hardware disabling: unplug the signal cable in J427 port of M500S monitoring module. Tag the BLVD-disabled label. The position of M500S monitoring module and the port description are given in *2.4.2 Connecting Signal Cables*.

2. Software disabling: set “BLVD Enable” item of the monitoring module to “N”. Refer to *4.7.2 Battery Selection* for setting method.

Notice

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

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

The advantage of hardware disabling BLVD is preventing unwanted power failure due to misoperation or power supply system failure, and ensuring the continuity of vital loads’ power supply.

Others

I. Sharp object

Warning

When moving equipment by hand, protective gloves should be worn to avoid injury by sharp object.

II. Cable connection

Notice

Please verify the compliance of the cable and cable label with the actual installation prior to cable connection.

III. Binding the signal lines

Notice

The signal lines should be bound separately from heavy current and high voltage lines, with binding interval of at least 150mm.

Note

Notice

To preserve the environment, the busbar of the power supply system may use tinning technique or passivation technique. The busbar may become dark due to long-term operation, which does not influence the performance or use of the system.

Contents

Chapter 1 Overview

This chapter introduces model description, composition and configuration, and features.

The “system” in this manual refers to the PS24600-2A/2200 (NetSure 700 C82) (abbreviated as “PS24600-2A/2200”) power supply system.

1.1 Model Description

Take PS24600-2A/2200 (NetSure 700 C82) power supply system as an example, the model description is given in the following figures.

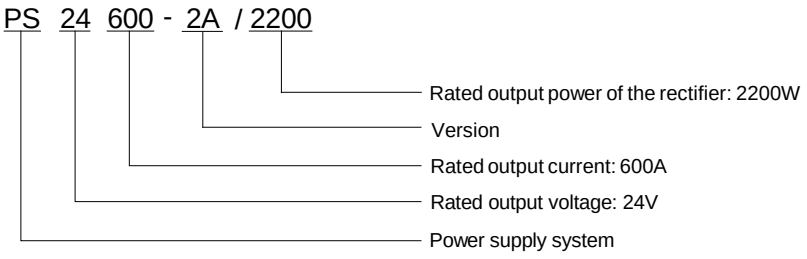


Figure 1-1 Model description (1)

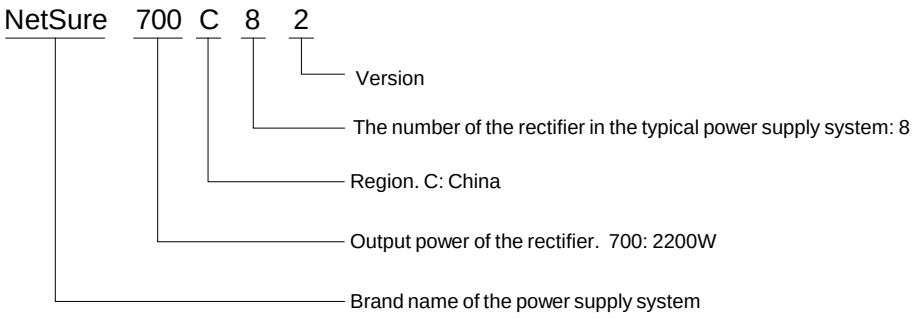


Figure 1-2 Model description (2)

1.2 Composition And Configuration

System composition

The system consists of DC distribution units, AC distribution units, rectifiers and monitoring module. The AC distribution unit is in the underpart and the DC distribution unit is in the upper part. The rectifier model is R24-2200, and the monitoring module model is M500S. The internal structure of the system is shown in Figure 1-3.

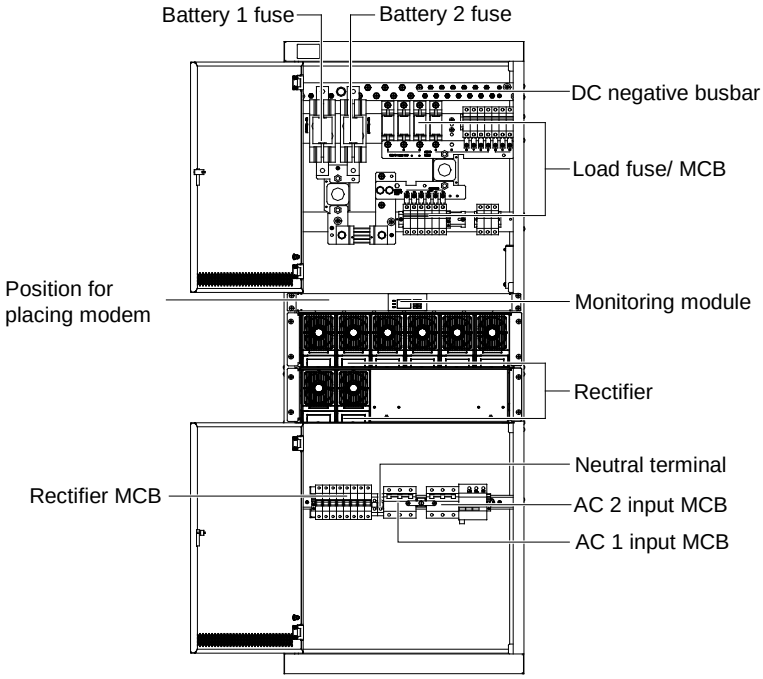


Figure 1-3 PS24600-2A/2200 structure

System configuration

The power supply system configuration is in Table 1-1.

Table 1-1 Power supply system configuration

Item	Configuration
Rectifier	Standard configuration: 8 pieces Optional configuration: 2 ~ 8 pieces
Monitoring module	One piece
AC input	2 × 63A/ 3P MCB
DC output	Battery fuse: 2 × 500A NT3
	BLVD routes: 2 × 63A/ 1P, 2 × 32A/ 1P, 2 × 10A/ 1P MCB LLVD routes: 4 × 100A NT00 fuse, 6 × 63A/ 1P, 4 × 32A/ 1P MCB
Optional parts	Modem and temperature sensor

1.3 Features

- The rectifier uses the active Power Factor Compensation (PFC) technology, raising the power factor to 0.99
- The power supply system has wide AC input voltage range: 80V ~ 290V
- The rectifier uses soft switching technology, raising the efficiency to 88.0%
- The rectifier has ultra-low radiation. With advanced EMC design, the rectifier meets international standards such as CE and NEBS. Both the conducted and radiated interference reach Class B
- The rectifier safety design complies with UL, CE and NEBS standards

- The rectifier is of High power density
- The rectifier is hot pluggable. It takes less than 1min to replace a rectifier
- The rectifier has two optional over-voltage protection methods: hardware protection and software protection. The latter one also has two optional modes: lock-out at the first over-voltage and lock-out at the second over-voltage
- The monitoring module has perfect battery management. The management functions include the LLVD (optional), BLVD, temperature compensation, auto voltage regulation, stepless current limiting, battery capacity calculation and on-line battery test, etc
- The monitoring module can save up to 200 pieces of historical alarm records, and 10 sets of battery test data records
- The power supply system is of network design. Providing multiple communication ports (such as RS232, modem and dry contacts), which enables flexible networking and remote monitoring
- The power supply system has perfect lightning protection at both AC side and DC side
- The power supply system has complete fault protection and fault alarm functions

Chapter 2 Installation Instruction

This chapter introduces installation and cable connection. Before installation, please read through safety regulations, and then follow this instruction to carry out the installation step by step.

2.1 Safety Regulations

Certain components in this power system carry hazardous voltage and current. Always follow the instructions below:

1. Only the adequately trained personnel with satisfactory knowledge of the power system can carry out the installation. The most recent revision of these safety rules and local safety rules in force shall be adhered to during the installation.

2. All external circuits that are below 24V and connected to the power system must comply with the requirements of SELV as defined in IEC 60950.

3. Make sure that the power (mains and battery) to the system is cut off before any operations can be carried out within the system cabinet.

4. The power cabinets shall be kept locked and placed in a locked room. The key keeper should be the one responsible for the power system.

5. The wiring of the power distribution cables should be arranged carefully so that the cables are kept away from the maintenance personnel.

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 Emerson Network Power Co., Ltd.

To inspect the equipment, you should:

1. Open the packing case in which the packing list is put.

2. Take out the packing list.

3. Check against the packing label, including customer name, customer address, machine No., total amount, case No., contract No.

Unpacking and inspection: After opening the packing case, check the goods one by one according to the goods list on the packing label. The checking should include:

1. The number of the packing cases and the serial number marked on them.

2. The correctness of the equipment packing according to the packing list.

3. The number and model of the accessories according to the accessory list.

4. The completeness of the equipment set according to the system configuration.

5. The condition of the goods through visual inspection. For example, check the cabinet for any damage and condensation. Shake the rectifier module gently to see if any component or connection has loosened during transportation.

Cables

The cable design should meet relevant industry standards.

It is recommended to use the RVVZ cables as AC cables. The cable should reach at least +70°C temperature durability. With cable length shorter than 30 meters, the cross-sectional area (CSA) calculation should be based on the current density of 2.5A/mm^2. The suggested CSA value is not less than 25mm^2.

The CSA of DC cable depends on the current flowing through the cable and the allowable voltage drop. Select the battery cable CSA according to Table 2-1. Select the DC load cable CSA according to Table 2-2.

Table 2-1 Battery cable CSA selection

Battery fuse rated current	Max. battery current	Min. cable CSA	Max. cable length (allowable voltage drop: 0.5V)
500A	300A	150mm^2	14m
Note: 1. The specs are applicable at ambient temperature of 25°C. If the temperature is higher or lower than this, the CSA of the cable should be increased. 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			

Table 2-2 DC load cable selection

Load route 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)
100A	50A	25mm^2	14m	50mm^2	25m
63A	32A	16mm^2	7m	25mm^2	11m
32A	16A	16mm^2	14m	25mm^2	22m
10A	5A	6mm^2	17m	25mm^2	71m
Note: The specs are applicable at ambient temperature of 25°C. If the temperature is higher or lower than this, the CSA of the cable should be increased					

The MCB/fuse capacity should be strictly limited so that it can function properly upon load over-current. The recommended MCB/fuse capacity is 1.5 ~ 2 times larger than the load peak capacity.

The CSA of the system earth cable should be the same with that of the largest power distribution cable and not less than 35mm^2.

The recommended CSA of AC input cables are shown in Table 2-3.

Table 2-3 AC input cable selection

Connector	Specs		Remarks
	Capacity	Connector specs	
AC input MCB	2 × 63A/3P	H cable terminals, 3pcs (cable CSA ≤ 25mm^2)	The live line of AC power supply
Grounding busbar	One M10 bolt	Cable CSA ≤ 35mm^2	Connected to the grounding bar of the room
Input neutral terminal	Two neutral line terminals	Cable CSA ≤ 25mm^2	Neutral line of AC power
Output neutral busbar	3 × M6 bolts in the busbar		The neutral terminal of the AC output power serving other equipment

2.3 Mechanical Installation

2.3.1 Fixing The Power Cabinet

The power cabinet must be installed directly onto the cement floor. Follow the steps below to install it:

1. Mark the specific installation position of the cabinet

Determine the installation position of the power cabinet in the equipment room according to Figure 2-1.

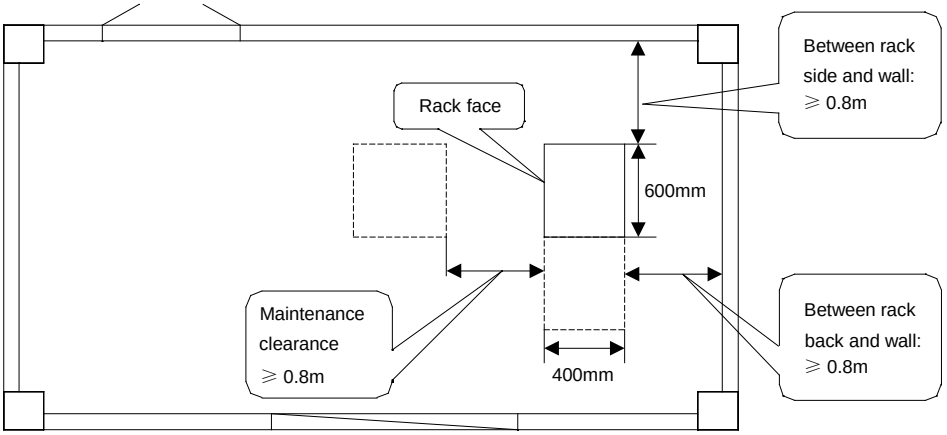


Figure 2-1 Equipment room layout

2. Drill holes

By referring to Figure 2-2, determine the exact central points of the installation holes on the floor, and mark them with a pencil or oil pen. Use the electric drill (aiguille: &14) to dig holes (depth: 70mm) at the marked points. Clean the drilled hole of dust. Put the expansion bolt into the hole and knock it with a hammer till it is totally in.

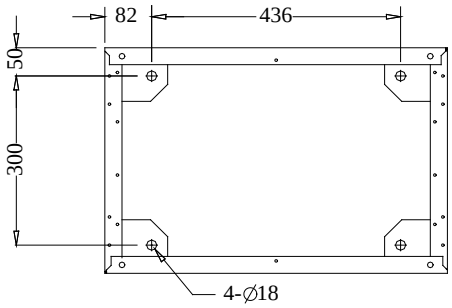


Figure 2-2 Installation size of the cabinet base (unit: mm)

3. Fix the cabinet

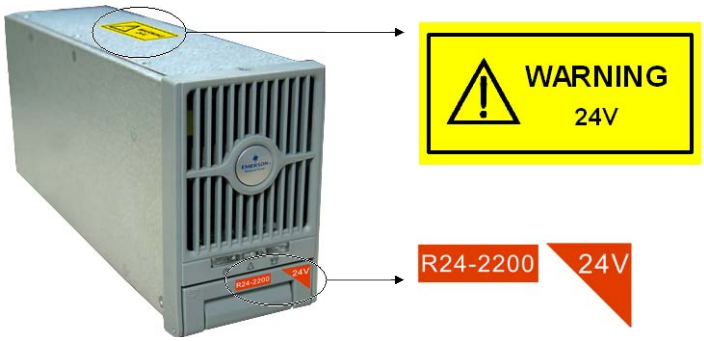
Move the cabinet to the installation position. Align the installation holes on ht cabinet with those dug on the floor. Screw the expansion bolt down into the expansion pipe in the floor.

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

2.3.2 Installing Rectifiers

Warning

24V rectifiers (R24-2200) are forbidden to be used together with 48V rectifiers (R48-2900) in one power supply system. Take notice of the mis-mating prevention label before inserting the rectifiers.



The rectifier is shown in Figure 2-3.

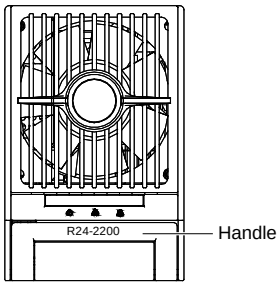


Figure 2-3 Rectifiers

Note

1. In the non-full-configuration, insert the rectifiers into the slots from up to down and left to right.
2. When installing the rectifier, hold the handle and push the rectifier to the slot gently, otherwise the slot may be damaged.

The procedures of installing R24-2200 rectifiers are as follows:

1. Press the handle of the rectifier, and the positioning pin will retract into the rectifier.

2. Put the rectifier onto the guide rail. See Figure 2-4 for installation positions. Push the rectifier completely into the cabinet. Push the handle into the front panel to pop out the positioning pin and lock the rectifier to the cabinet. The mounted rectifiers are shown in the following figure.

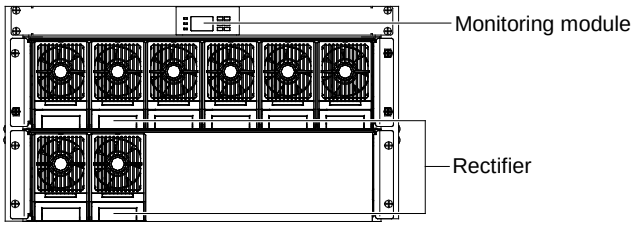


Figure 2-4 Mounted rectifiers

2.4 Electrical Installation

2.4.1 Connecting Power Cables

Danger

1. Switch off all MCBs and pull out all fuses before the electrical connection.
2. Only the qualified personnel can do the mains cable connection.

Connecting AC cables

Feed the cables into the cabinet from the top. Connect the AC cables to the AC input MCBs and neutral terminals, as shown in Figure 2-5.

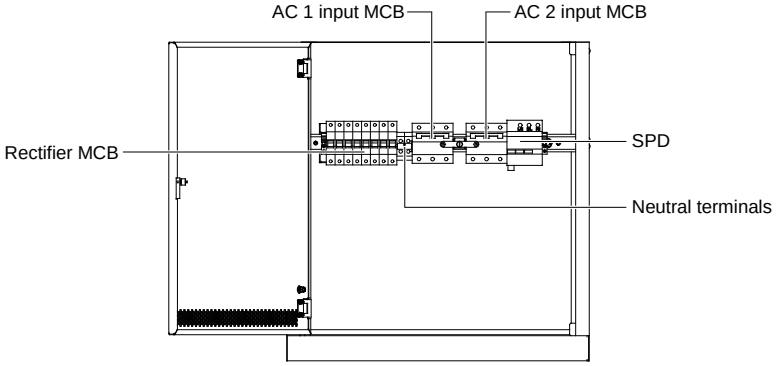


Figure 2-5 AC connection terminals

Connecting load cables

Connect the positive load cable to the upper terminal of load MCB or load fuse. Connect the negative load cable to the DC negative busbar, as shown in Figure 2-6.

Connecting battery cables

Note

1. The batteries may have dangerous current. Before connecting the battery cables, the corresponding battery input MCBs or the battery cell connector must be disconnected to avoid live state of the power system after installation.
2. Be careful not to reversely connect the battery. Otherwise, both the battery and the power system will be damaged!
3. It is suggested to connect the positive battery cables to the two battery fuses instead of one battery fuse.

1. Connect one end of the positive battery cable to the upper terminal of battery 1 fuse or battery 2 fuse. Connect one end of the negative battery cable to the DC negative bus bar.

2. Connect copper lugs to the other end of the battery cables. Bind the connecting parts with insulating tape, and put them beside the battery. Connect the cables to the battery when the DC distribution unit is to be tested.

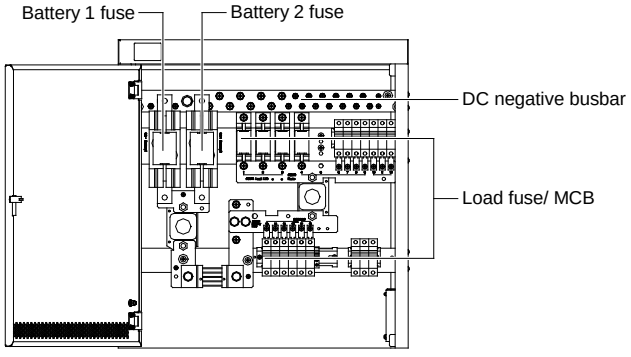


Figure 2-6 DC connection terminals

2.4.2 Connecting Signal Cables

All the signal cables are connected to M500S monitoring module. The position of the M500S monitoring module is shown in Figure 2-4.

The interfaces of M500S are shown in Figure 2-7. The functions of the interfaces J401 ~ J430 are shown in Table 2-4.

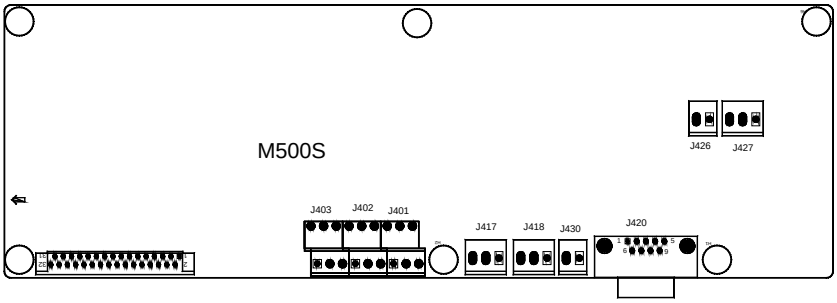


Figure 2-7 M500S interface

Table 2-4 Port functions

Port	Function
J401 ~ J403	Six dry contact outputs
J417	Battery temperature sensor interface
J418	Ambient temperature sensor interface
J420	RS232 interface. It can be connected to the modem or laptop
J426	LLVD. Switching on this port gets the LLVD contactor controlled by the monitoring module. Refer to *4.7.2 Battery Selection* for the method of controlling BLVD contactor
J427	BLVD. Switching on this port gets the BLVD contactor controlled by the monitoring module. Refer to *4.7.2 Battery Selection* for the method of controlling BLVD contactor
J430	Providing modem with the 12V power

Connecting temperature sensor cable

The temperature sensor (cable) is an optional accessory.

Operating voltage: 5V

Measurement range: -5°C ~ 100°C

Measurement precision: 6 2°C

Installation procedures:

1. Connect the 3-core plug of the temperature sensor cable to the J417 or J418 socket on M500S.

2. Put the temperature probe in the battery room where best represents the ambient temperature of the battery. Do not connect it to other heat-generating equipment.

Installing modem

Modem is an optional accessory, suitable for those who have purchased the modem remote monitoring system.

The following is an introduction to the specific modem installation position and connection, taking e-TEK TD-5648DC modem for example.

1. Fastening the modem

The position for placing modem is shown in Figure 2-8.

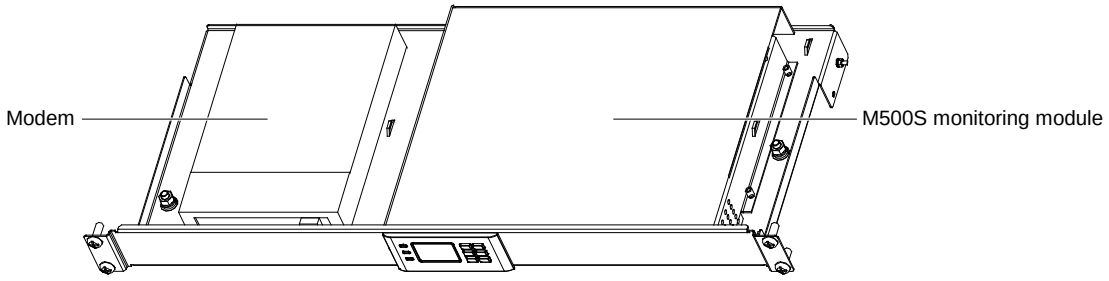


Figure 2-8 Position for placing modem

2. Connecting modem with M500S

Connect the modem with M500S monitoring module through the interfaces on board M500S. The input and output interfaces of TD-5648DC modem are shown in Figure 2-9.

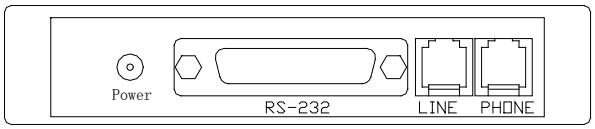


Figure 2-9 Input & output interfaces of TD-5648DC modem

1) Connect a telephone line to the “LINE” interface on the modem.

2) Connect the “POWER” (12V power supply interface) of the modem to the J420 terminal on board M500S.

3) Connect the “RS-232” (DB25 female) communication port of the modem to the J430 terminal (DB9 male) on board M500S through the communication cable.

3. Modem configuration:

In modem mode, "Y" should be selected for the communication parameter "MODEM" of the monitoring module. If modem has the Automatic Answer indicator (AA), the indicator will turn on when modem and monitoring module are powered on. In the modem mode, the monitoring module will initialize modem upon power-on, reset or upon communication interruptions that last more than one hour.

Connecting dry contacts

M500S monitoring module provides 3 pairs of dry contacts, which are J401 ~ J403 dry contacts shown in Figure 2-7.

Peel one end of the signal cable and insert it into the J401 ~ J403 sockets. Fasten the connection by tightening the screw on the terminal.

The functions of J401 ~ J403 dry contacts are given in Table 2-5.

Table 2-5 Dry contact functions

Interface	Function		Interface	Function
J401_1	Mains failure		J402_2	LLVD
J401_2	DC over/ under voltage		J403_1	BLVD
J402_1	Rectifier failure		J403_2	Reserved
Note: the above functions are default settings. Users can change them through the monitoring module				

Chapter 3 Installation Testing

This chapter introduces procedures of installation testing. The corresponding safety rules shall be adhered to in the test.

3.1 Installation Check And Startup

Before the test, inform the chief manufacturer representative. Only the trained electrical engineer can maintain and operate this equipment. In operation, the installation personnel are not allowed to wear conductive objects such as watches, bracelets, bangles and rings.

During operation, parts of this equipment carry hazardous voltage. Misoperation can result in severe or fatal injuries and property damage. Before the test, check the equipment to ensure the proper earthing. Installation check must be done before testing. Then the batteries can be charged for the first time.

Make sure that the AC input MCBs, rectifier MCBs and load MCBs are switched off. Make sure that all the devices are properly installed.

Installation check

	OK	Comments
Check all the fuse and cables. Are their models correct?	☐	
Check the bus bar connections, input and output cable connection, and connection between the power system and the system grounding	☐	
Check if the number and connections of the batteries are correct. Check the polarity of the battery string with a voltmeter	☐	
Make sure all the communication cables and alarm cables are connected to M500S. Check that the temperature sensor, if any, has been installed	☐	

Startup preparations

	OK	Comments
Make sure that all the MCB are switched off and all the fuses are removed	☐	
Measure the AC input voltage. Make sure the input voltage is within the allowable range	☐	Umin=___V
Check that the battery string circuit is not closed	☐	
Connect the disconnected batteries to the battery string circuit	☐	
Measure with a voltmeter across the connection points of each battery and make sure that the polarity is right. For a lead-acid battery with 24 cells, the voltmeter should read 2.0 ~ 2.1V/cell or 24 ~ 25V V/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 distribution bus bars, or between the positive & negative battery poles (Note: Pull out all modules before the check and restore them after the check)	☐	

Startup

	OK	Comments
Switch on the system AC input MCB. Switch on one rectifier MCB. The green LED on the rectifier will be on and the fan will start running after a certain delay. The monitoring module will show that the power supply voltage is 26.8V	☐	
Check the system voltage and busbar polarity with a voltmeter. The voltage difference between the measured value and displayed value should be less than ！0.3V	☐	
Start and stop each rectifier of the system by switching on and switching off the rectifier MCBs. Check their output voltages	☐	

3.2 Basic Settings

When the system is put into service for the first time, the parameters of monitoring module must be set based on the actual system configuration, such as battery number, capacity, user's charge current limit and other functional requirements. Only after that can the monitoring module display system operation information and control the output.

Enter the main menu → Settings (password: 1) → Battery Settings → Batt. Selection submenu. Set the "Mode" parameter to "Manual". Return to the Settings menu to set the parameters in relative submenus. For detailed monitoring module parameter setting method, see *4.7 Setting System Parameters*.

	OK	Comments
The system model has been set correctly in factory before delivery, check that the setting agrees with the actual system (24V/75A/500/NONE)	☐	
The battery string number set at the monitoring module should be the same as the number actually connected. (By default: 2)	☐	
Set the battery capacity according to the total capacity of the battery connected to the system. Default: 300Ah	☐	
Configure the temperature coefficient according to the battery manufacturer's requirement. Setting range: 0-500mV/°C. By default: 36mV/°C. (if no temperature sensor is installed, do not set this parameter)	☐	
Set the charge current limit according to your needs. Setting range: 0.1 ~ 0.25C_{10}. (By default: 0.1C_{10})	☐	
Set the monitoring module according to the voltage suggested by the battery supplier. Floating Charge (FC) voltage range: 21.6V ~ Boost Charge (BC) voltage. Default: 26.8V. BC voltage range: FC voltage ~ 29.0. By default: 28.0V. For batteries that do not need BC, set the BC voltage to FC voltage plus 0.1V	☐	
Measure the battery voltage with a multimeter and record it. Enter Main menu → Maintenance (password: 1) → RectTrim submenu. Set the output voltage of the rectifier to the value of the battery voltage. Insert the battery fuse. Set the output voltage of the rectifier to 26.8V Enter the Batt. Selection submenu. Set the "Mode" parameter to "Auto"	☐	

3.3 Alarm Check And System Operation Status Check

Alarm check

Check that all functional units can trigger alarms that can be displayed on the monitoring module.

	OK	Comments
Pull out one rectifier. The "Rect N Com Failure" alarm should be triggered. Insert the rectifier in. The alarm should disappear. Repeat the same procedures on other rectifiers	☐	
Remove battery fuse 1. The "Batt1 Failure" alarm should be triggered. Put on the fuse. The alarm should be cleared. Repeat the same on battery fuse 2	☐	
Switch off a load MCB connected to a load route. The alarm "Load Fuse N Failure" should be triggered. Switch on the MCB, and the alarm should be cleared. Repeat the same on the other load MCBs	☐	
Remove all the battery input fuses. Keep only one rectifier in operation. Through the monitoring module, adjust the rectifier FC voltage to make it lower than the alarm point. The alarm "DC Voltage Low" should be triggered	☐	
Keep the rectifiers in operation. Set through the monitoring module the battery management parameter to "Manual". Enter the maintenance menu at the monitoring module. Select "Disconnect" and confirm it. The battery protection contactor should be open, and the "BLVD" alarm should be displayed at the monitoring module	☐	
Pull out the varistor of the AC SPD. The "SPD fault" alarm should be triggered. Insert the varistor, the alarm should be cleared	☐	
Note: when the preceding alarms are generated, the monitoring module will give alarms after approximately 3s. Refer to *4.5 Querying Alarms And Setting Alarm Plans* for methods of querying alarms		

System operation status check

There should be no alarms during normal system operation. The system operation status check can be conducted through the monitoring module.

For the parameter query method, refer to *4.3 Querying System Status* and *4.4 Querying Rectifier Status*.

	OK	Comments
The system model is 24V/75A/500/NONE	☐	
The monitoring module should display the correct AC voltage	☐	
The monitoring module should be able to display the DC voltage. The difference between the displayed voltage and that measured at the bus bar with should be less than 1%	☐	
The monitoring module should display the battery current. The difference between the displayed and measured battery current should be less than 1%	☐	

	OK	Comments
Check the number of the rectifier through the monitoring module. The number should be consistent with the actual number	☐	
Check the voltage, current, current limiting point of rectifiers through the monitoring module. They should agree with the actual parameters	☐	
For the system configured with temperature sensor, the monitoring module should be able to display the battery ambient temperature. Hold the probe of the temperature sensor with hand and watch the monitoring module, which should diplay the change of temperature	☐	

3.4 Final Steps

	OK	Comments
Make sure that materials irrelevant to the equipment have been all removed	☐	
Fill in the installation report and hand it over to the user	☐	
Fill in the parameter table at the cabinet door	☐	

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

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

Chapter 4 Use Of Monitoring Module

This chapter introduces the front panel and functional keys briefly, and expounds screen contents, access method, system controlling, information querying and parameter setting.

After the monitoring module is powered on, the language selection screen will pop up, and the monitoring module is initialized. The default language is Chinese. After the initialization, the first system information page will appear.

4.1 Front Panel

There are backlit LCD display, functional keypad, indicators and positioning pin on the front panel of M500S monitoring module, as shown in the following figure:

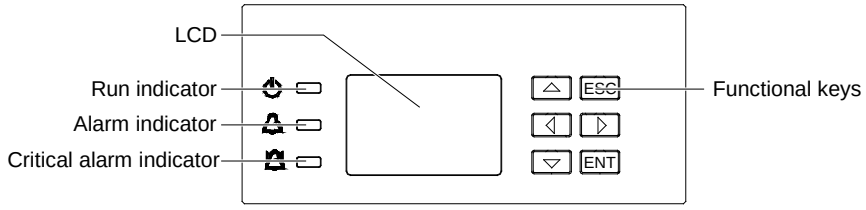


Figure 4-1 Front panel of M500S monitoring module

Description of the indicators on the front panel is in the following table:

Table 4-1 Monitoring module indicator description

Indicator	Normal state	Fault state	Fault cause
Run (green)	On	Off	No operation power supply
Alarm (yellow)	Off	On	There are observation alarms
Critical alarm (red)	Off	On	There are major or critical alarms

M500S monitoring module uses a 128 × 64 LCD, a keypad with 6 keys. The interface language is Chinese/English optional.

Table 4-2 Description of monitoring module keypad

Key	Function
ESC	Return to the upper level menu
ENT	Enter the main menu or confirm the menu operation
"▲" and "▼"	Shift among parallel menus. For a character string, these 2 keys can be used to shift among different options
"◀" and "▶"	Change values at a value setting interface. For a character string, these 2 keys can move the cursor left or right

4.2 Power On Order

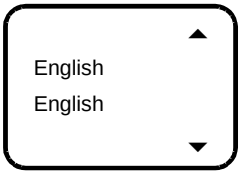
After the system is powered on for the first time, you should set the system type according to the actual configuration. The monitoring module will restart after the system type is changed. In that case, you should re-configure those parameters whose default values are inconsistent with the actual situation. Only after that can the monitoring module operate normally.

After configuring the system parameters, you can carry out various operations directly without resetting the parameter values. As for those important parameters related to battery management, such as BLVD, you should be fully aware of their influence upon the system before you change their values.

Note

For the exact meanings of the abbreviations used in LCD displayer, see *Appendix 7 Glossary.*

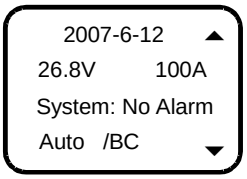
1. The LCD will prompt you to select a language once the monitoring module is powered on.



You can use ◄, ►, ▲ or ▼ to select the language you want, and press ENT to confirm.

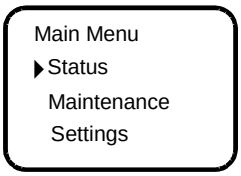
2. The monitoring module will prompt you to wait, and start initialization.

3. The first system information page appears



The system information is shown in many pages. You can repeatedly press ▼ to view other system information pages in a cycle.

4. At any system information page, press ENT to enter the 'MAIN MENU' page, which contains 3 sub-menus: 'Status', 'Maintenance' and 'Settings'.



You can press ▲ or ▼ repeatedly to select a sub-menu, and press ENT to enter the sub-menu. Press ESC to return to the menu of higher level.

1) Status

Including rectifier information, active alarm information and alarm history information.

2) Maintenance

The maintenance operation can be conducted only when the battery management mode is set to 'Manual'. The maintenance includes battery FC, BC and test, load power off/on, battery power off/on and rectifier voltage trimming, current limit, switch control and resetting.

3) Settings

Including the setting of alarm parameter, battery parameter, AC/DC parameter, rectifier parameter and system parameter.

4.3 Querying System Status

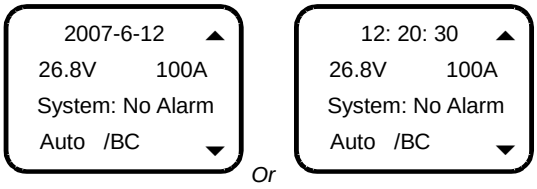
4.3.1 First Page Of System Information

1. At the main menu page, press ESC to return to the first system information page.

2. If no operation is conducted on the monitoring module keypad for 8 minutes, the LCD will return to the first system information page and shut down the back light to protect the screen. Pressing any key will turn on the back light.

The first system information page contains the major system operation information, including date/time, busbar voltage, total load current, system operation state (normal or alarm), battery management mode (AUTO or MANUAL) and battery state.

Among which, the battery state include FC, temperature compensation, BC, Cyclic Boost, test, short test and scheduled test. The current time are displayed in two pages shifting at the interval of 2s. One page shows year, month and date, the other shows hour, minute and second. The year is displayed with 4 digits; other time units are in 2 digits.



Note

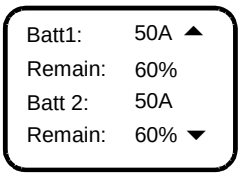
1. At this page, you may use ◄ and ► to adjust the LCD contrast (7-level).

2. If there has been no keypad operation for 8 minutes, the monitoring module will return to the first system information page. The time of that return will be recorded automatically, and can be queried through the host.

4.3.2 Other System Information Pages

The system information is shown in many pages. The default page of the monitoring module after the system power on is the system information first page. You can press ▲ or ▼ to scroll up or down to view more operation information, as shown in the following page:

Battery information page



1. Battery 1, battery 2

They represent respectively the current of the battery that battery shunt 1 and shunt 2 is connected to. If the 'Shunt Coeff' of a certain battery group is set to 'No', this situation will be reflected at the battery information page by 'Not connected', and no actual capacity will be displayed.

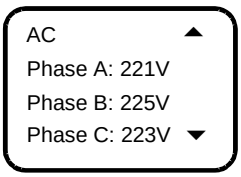
2. Actual battery capacity

The monitoring module can approximately calculate the remaining battery capacity in real time. Through configuration at the host, the remaining battery capacity can be displayed in the mode of percentage, remaining Ah or remaining time. The default is the percentage.

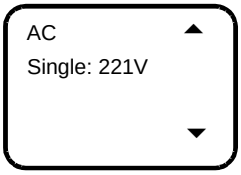
During the normal BC/FC management, the monitoring module regards the rated capacity as the capacity that each battery group can reach. When the battery discharges, the monitoring module will calculate the battery remaining capacity according to the discharge current, discharge time and the preset 'battery discharge curve'. When the battery is being charged, the monitoring module will calculate the real-time battery capacity according to the detected charge current, charge time and preset 'battery charge efficiency'. If the calculated battery remaining capacity is higher than the rated capacity, the monitoring module will automatically change the calculated battery remaining capacity to the rated capacity.

AC information page

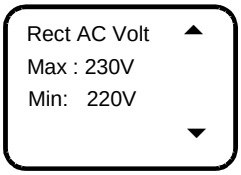
1. If the power system is a 3-phase input system with manual-switchover between 2 AC inputs, the voltage of the three phases will be displayed.



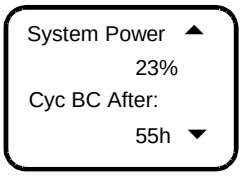
2. If the power system is a 1-phase input system with manual-switchover between 2 AC inputs, the single-phase voltage will be displayed.

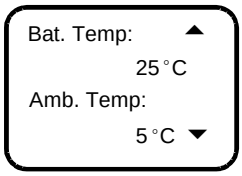


3. If there is no AC sampling board in the power system, the LCD will display the max and min AC input voltages of all rectifiers.



BC prompt and temperature information page





If the monitoring module bans BC and no temperature sensor is configured, this page will not be displayed.

The first line of the information page displays the BC prompts, which will be different with different systems, including:

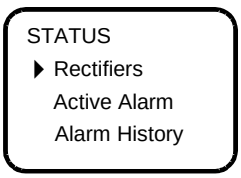
1. Prompt the time of next Cyclic Boost according to the battery state
2. If BC is going on, the 'Charging' will be prompted
3. If BC is disabled, this row will be empty

The 2nd and 3rd rows of the page are the temperature information detected by the temperature sensor. The display will vary with different parameter settings (see *4.7 Setting System Parameters* for parameter setting). If the temperature sensor is not connected or is faulty, system will prompt invalid. Meanwhile, the 4th row will display 'Check Temp Sensor'.

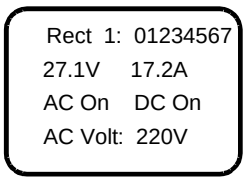
4.4 Querying Rectifier Status

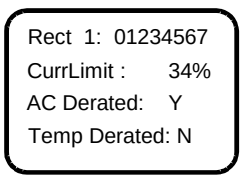
The rectifier information includes the rectifier serial No., voltage, current, current limit, mains situation, rectifier power limit and temperature power limit.

1. At any page of the system information, press ENT to enter the main menu.
2. Use ▲ or ▼ keys to select the 'Status' sub-menu in the main menu, and press ENT to confirm.



3. Use ▲ or ▼ to select the 'Rect Info' submenu, as shown in the above figure. Press ENT to confirm.





The information of every rectifier is displayed in two pages. The information in the first page includes: rectifier serial No., output voltage and current, AC/DC on/off state and AC input voltage. The information in the second page includes: rectifier serial No., current limit, the states of 'AC Derated' and 'Temp Derated'. Press ► to scroll to the next page, or ◄ to return to the last.

4. Press ▼ or ▲ to query other rectifier's information.

At most 48 pieces of rectifier's information can be displayed. If the rectifier does not exist, there will be no information. If the rectifier communication is interrupted, the information will be displayed in high light.

5. At any rectifier information page, press ESC repeatedly and you can return to the higher-level menus.

4.5 Querying Alarms And Setting Alarm Plans

The monitoring module can locate and record the system fault according to the collected data, as well as raise audible/visual alarms and output through dry contact according to the preset alarm level. Meanwhile, it reports the alarms to the host.

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

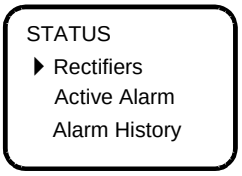
4.5.1 Querying Active Alarm

When a new alarm is raised, and there is no operation on monitoring module keypad within 2 minutes, the LCD of the monitoring module will prompt automatically the active alarm.

If there are multiple alarms in the current system, you can query alarms through the following steps:

1. At any system information page, press ENT to enter the main menu

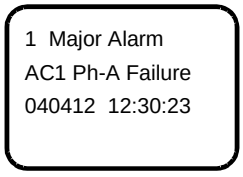
2. Use ▲ or ▼ to select the 'Status' submenu in the main menu and press ENT to confirm



3. Press ▲ or ▼ to select the 'Active Alarm', as shown in the above figure, and press ENT to confirm.

1) If there is no active alarm, 'Active Alarm: None' will be displayed

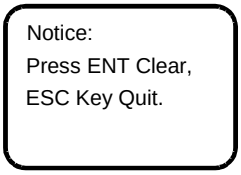
2) If there is any alarm, the display will be like the following:



The information in the active alarm information pages includes: alarm serial No., alarm level, alarm name and time (year, month, day, hour, minute and second). The alarm raising 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 ►, and the rectifier ID will be displayed, and the Run indicator of the corresponding rectifier will blink.

In the case of battery test alarm or maintenance time alarm, press ► to display the prompt information.



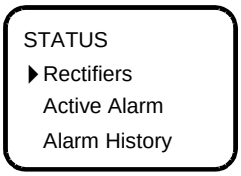
In the prompt page, press ENT to confirm the alarm.

4. At any active alarm information page, press ESC repeatedly and you can return to the higher-level menus.

4.5.2 Querying Alarm History

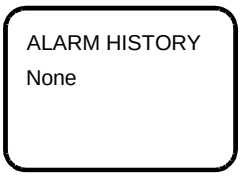
1. At any system information page, press ENT to enter the main menu

2. Press ▲ or ▼ to select the 'Status' submenu, and press ENT to confirm.

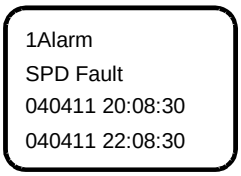


3. Use ▲ or ▼ to select the 'Alarm History', as shown in the above figure and press ENT to confirm.

If there is no historical alarm, the prompt will be 'Alarm History: None'.



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



At the monitoring module, the displayed historical alarm information includes: alarm serial No., alarm name and alarm start/end time (year, month, day, hour, minute, second).

If it is a rectifier that raised the alarm, the ID of that rectifier will be displayed.

4. At any Alarm History information page, press ESC repeatedly to return to the higher-level menus.

4.5.3 Alarm Type Table

The alarm type table of the system is as follows.

Table 4-3 Alarm type table

Serial No.	Alarm	Description	Default alarm level	Default related relay	Related parameter configuration
1	Load Fuse Alarm	Load failure caused by overload, short circuit, manual disconnect, and alarm circuit failure	Critical	6	
2	LVD1	Load low voltage disconnects	Critical	5	LLVD enabled
3	LVD2	Battery low voltage disconnects	Critical	4	BLVD enabled
4	Batt Curr High	Charging current of battery higher than the setting of "Over" (Charging over current limit)	Observation	None	
5	Batt Fuse Alarm	Batt Failure caused by overload, short circuit, manual disconnect, and alarm circuit failure	Critical	None	
6	Non Float Status	Including auto boost charge, cyclic boost charge, constant current test, and short test	NoAlarm	7	
7	Batt Discharge	Battery is discharging	NoAlarm	None	

Serial No.	Alarm	Description	Default alarm level	Default related relay	Related parameter configuration
8	Curr Discrepancy	If the DC Power System has shunts, the addition of measured load current and Battery current differs rectifier output current noticeably	NoAlarm	None	
9	Short Test Fail	Short Test Fault, In short test, difference in discharging current of two batteries is bigger than setting value	Observation	None	
10	Batt Test Fail	Battery discharging time shorter than expected	Observation	None	
11	Volt Discrepancy	Actual output voltage is different from both the measured DC bus voltage and different from the voltaged reported by the rectifier to monitoring module. The error is bigger than 1V	Observation	None	
12	DC Volt Low#2	DC output voltage very low	Critical	2	DC output under-voltage alarm point
13	DC Volt Low#1	DC output voltage low	Critical	2	DC output under-voltage alarm point
14	DC Volt High#1	DC output voltage high	Critical	2	DC output over-voltage alarm point
15	DC Volt High#2	DC output voltage very high	Critical	2	DC output over-voltage alarm point
16	Mains Failure	All the AC input voltages from the rectifier are less than 80V	Major	1	
17	AC Voltage Low2#	AC input voltage less than “AC Low#2”. The default for AC Voltage Low#2 is 80Vac	Observation	None	AC input under-voltage alarm point
18	AC Voltage Low1#	AC input voltage lower than the setting of “AC Low#1”. The default for AC Voltage Low#1 is 180Vac	Observation	None	AC input under-voltage alarm point
19	AC Voltage High	AC input voltage higher than the setting of “AC High”. The default for AC Voltage High is 280Vac	Observation	None	AC input over-voltage alarm point
20	Maintain Alarm	Time to maintain system	Observation	None	
21	Self-detect Err	Hardware Self-detect Error	No Alarm	None	
22	Manual Mode	Battery management is in manual control mode	No Alarm	None	
23	High Load	When system reaches settable level of total capacity. The default is 75%			
24	Power Major	System contains Major or Critical alarm (red LED)	Critical	None	
25	Power Minor	System contains Observation alarm (yellow LED)	Critical	None	
26	Rectifier Lost	The controller has detected a reduction in the number of running rectifiers	Observation	None	
27	Multi-Rect Alarm	More than two rectifiers alarm	Critical	None	
28	Load share Alarm	The output current of one rectifier is higher than the certain value and higher than the average value for all rectifiers	Critical	None	
29	Rect Not Respond	Rectifier does not communicate with M500S	Major	3	
30	Rect AC Fail	AC input voltage of this rectifier lower than 80V	Major	3	
31	Rect HVSD	This rectifier output voltage was higher than the rectfier HVSD setting and has shut down	Major	3	
32	Rect Failure	Serious load sharing alarm (the output current of the rectifier is lower than 1A and the average load is greater than 6A). Or rectifier’s ID repetition	Critical	3	
33	Rect Protect	AC over voltage or Rectifier PFC failure or current unbalance or Over-temperature or AC Low voltage or AC phase loss or position pin failure or Inner communication fault	Observation	3	
34	Rect Fan Fails	Rectifier fan fails	Major	3	
35	Rect Derated	Rectifier AC input voltage is low and the rectifier internal temperature is high and high load	Observation	3	
36	Temp Alarm	Temperature higher or Lower than the setting of Temp,inluding Ambient temp and battery Temp	Observation	None	

Serial No.	Alarm	Description	Default alarm level	Default related relay	Related parameter configuration
37	Batt Over Temp	Battery temperature higher than the setting of "High Temp", inluding temperature sensor fault	Major	None	Over-temperature alarm point
38	Digital 1 ~ Digital 6	Alarm name can be defined by user. Whether the alarm is triggered at high voltage level or low voltage level can be configured	No alarm	8	
39	Digital7 /LVD1 Alarm	Alarm name can be defined by user. Whether the alarm is triggered at high voltage level or low voltage level can be configured	No alarm	None	
40	Digital8 /LVD2 Alarm	Alarm name can be defined by user. Whether the alarm is triggered at high voltage level or low voltage level can be configured	No alarm	None	

4.5.4 Changing Audible/Visual Alarm And Alarm Call Back Plan

There are different audible/visual alarms and call back modes for alarms of different levels. For the products in China market, the alarming mode for major alarms and critical alarms are the same.

Table 4-4 Different alarms and call back modes for different alarm levels

Alarm level	Red indicator	Yellow indicator	Alarm horn	Call back	Remark
Critical	ON		ON	Y	Callback No. can be set
Major	ON		ON	Y	Callback No. can be set
Observation		ON	OFF	N	
No alarm	OFF	OFF	OFF	N	

Therefore, changing the alarm level of different alarms may change their audible/visual alarm mode and call back plan too.

Pressing any key on the monitoring module can silence the alarm sound. The sound will disappear and alarm indicator will be off when all alarms are cleared.

You can configure how long an alarm sound will last, or choose to make no alarm sound. For details, see *4.7.11 Alarms Settings.*

4.5.5 Changing Alarm Types Of Dry Contacts

As one of the alarm type parameter, 'Related Relay' refers to the serial No. of the dry contract corresponding to the alarm type, whose value is either 1 ~ 8 or 'None'. 'None' means there is no corresponding dry contact. For details, see *4.7.11 Alarms Settings*.

4.6 Maintenance

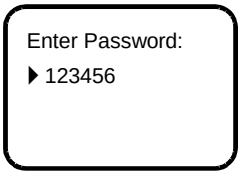
🕮 **Note**

1. This operation can be conducted only when the battery management is set to 'Manual'.
2. Be careful! BLVD operations may result in power interruption.

1. At any information page, press ENT to enter the main menu.
2. Press ▼ to select the 'Maintenance' menu.

You cannot enter the system Maintenance menu if the 'Battery Management' is set to 'Auto'.

3. Press ENT and input the correct operation password. Press ENT again to enter the 'Maintenance' menu.



To input the password, use ▲ or ▼ to modify numbers, and use ◄ or ► to move the cursor. After the input, press ENT to confirm.

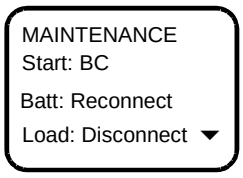
If the password is incorrect, system will prompt ‘password incorrect’. If the password is less than 6 digits, end it with a #.

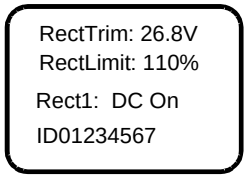
Note

You can choose to enter the ‘Maintenance’ menu by using either the user, operator or administrator password, for in this menu, all users have the same authority.

4. Press ▲ or ▼ to scroll to the operation page you need.

There are two pages:





5. Press ◄ and ► to select the needed action.

‘Start’: The options include ‘FC’, ’BC’ and ’Test’. If the system is not configured with any battery, the control would be invalid. If there is AC power off alarm, or the busbar voltage is too low, the BC and battery test control will not be executed by the system. No battery test control can be conducted when the rectifier communication is interrupted. Finally, after the battery test, the battery management mode will be changed from ’Manual’ to ‘Auto’ automatically.

‘Battery’: The options include ‘Reconnect’ and ‘Disconnect’. If there is no battery, or there is a battery alarm, the battery operations will be invalid.

’Load’: The options include ‘Reconnect’ and ’Disconnect’.

The following maintenance over the rectifier can be conducted only when the power system is in the FC state.

‘RectTrim’: Range: 22.2V ~ 28.4V. It can be used to improve the current sharing among rectifiers. Note that the value of this parameter cannot exceed the over-voltage alarm point, or the parameter will be invalid.

‘RectLimit’: Range: 5% ~ 106.7%.

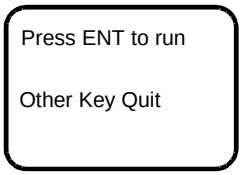
The maintenance operations over a single rectifier include: ‘DC ON/OFF’, ‘AC ON/OFF’ and ‘Reset’. The operation method is:

1) Use ▲ or ▼ to select the rectifier parameter, and ◄ or ► to change the rectifier serial No. Then press ENT to confirm. The bottom line of the page displays the rectifier ID.

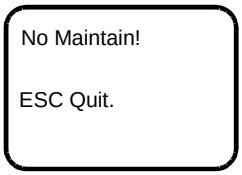
2) Use ▲ or ▼ to move the cursor to the maintenance operation area, and ◄ or ► to select the value.

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

6. There will be prompts as the confirmation of control commands. If the maintenance operation is valid, system will prompt you press ENT to confirm and execute the operation, or ESC to abort the operation. Otherwise, system will prompt you the operation is invalid, and press ESC to quit.



or



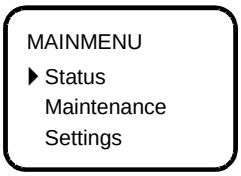
Press ESC to return to the menu of higher level.

4.7 Setting System Parameters

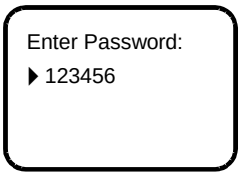
Battery parameters are very important, for they are related to the life of battery. Before delivery, the battery parameters have been initialized. Without any special needs, you only need to reset the battery group number and battery capacity, and accept the defaults for other parameters.

4.7.1 Parameter Setting Method

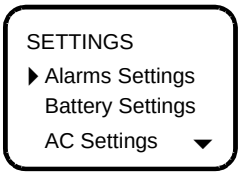
1. At any system information page, press ENT to enter the main menu.

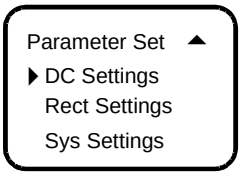


2. Use ▲ or ▼ to select the submenu ‘Settings’ and press ENT to confirm. System will then prompt you to input the password.



3. Press ◄ or ► to select the number of password digits. Enter the password digit by digit using ▲ or ▼. Press ENT to confirm and enter the parameter setting submenu.





Users with different password levels have different authorities. See the following table:

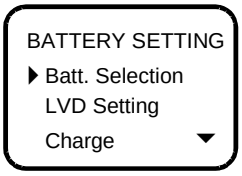
Table 4-5 Different password levels and relevant different authorities

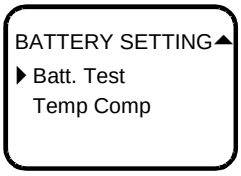
Level	Authority	Default password
User	Configuration of general parameters	1
Operator	User’s authority, plus resetting system, resetting password and modifying system type	2
Administrator	Operator’s authority, plus modifying password of all levels, controling alarm sound volume, browsing system parameters that can be set only through the host	640275

4. There are two pages of ‘Settings’. Shift page by using ▼ or ▲, and select the parameter by using ▼ or ▲. Press ENT to confirm.

As shown in the above figure, the monitoring module divides the parameters to be set into 6 kinds: alarms parameter, battery parameter, AC parameter, DC parameter, rectifier parameter and system parameter.

Among which, the battery parameters are divided into five kinds: basic, BLVD, charging management, battery test, temperature coefficient, and they are displayed in two pages, as shown below:

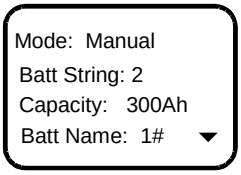




What follows is the description of the parameter functions and values by dividing them into 5 small categories and 5 big categories.

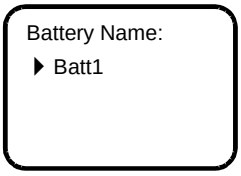
4.7.2 Battery Selection

1. The first page of the Battery Selection is shown below:



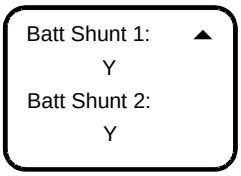
Use ▼ or ▲ to select the page and the parameter to be set, and ◄ or ► to select the proper value for the parameter. Press ENT to confirm.

After setting the 'Battery Type', the following prompt will appear, asking you to name a certain type of battery for the sake of identifying them:

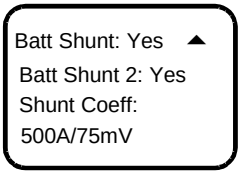


To name a rectifier, you can use ▲ or ▼ to change the number, and ◄ or ► to move the cursor left or right. Press ENT to confirm afterwards.

2. If setting parameter 'System Type' does not require setting the battery shunt coefficient, the second page of the basic battery settings is as follows:



3. If setting parameter 'System Type' requires setting the battery shunt coefficient, the second page of the basic battery settings is as follows:



4. The value description of the basic battery parameters is listed below:

Table 4-6 Basic battery parameters descriptions

Parameter	Range	Factory setting	Value description
Mgmt Mode (Management mode)	Auto, Manual	Auto	In normal situation, it should be in the 'Auto' mode, which enables the monitoring module manage the whole power system automatically, including: Automatic FC/BC switchover, LLVD and BLVC. In the manual mode, you can do operations like BC, FC, test and battery on/off, as well as enabling automatic battery BC time protection and capacity calculation. Upon the system DC under-voltage alarm, system can automatically switch to the 'Auto' mode, lest wrong manual operation should damage the system
Batt String (number of battery strings)	0 ~ 5	2	You should set this parameter according to the actual battery configuration. If 'Batt Shunt' is set as 'Y', there should be batteries actually configured
Rated AH (rated capacity)	50 ~ 5000Ah	300Ah	The total capacity of the battery strings connected to one battery shunt. You should set this parameter according to the actual battery configuration
BTT Name	1# ~ 11#	1#	
Battery Name	10 characters		Name different battery types to identify them
Batt Shunt1	Yes, No	Yes	Select 'Y' when a corresponding shunt is configured, otherwise, select 'N'. Battery management aims at only the batteries connected to the shunt
Batt Shunt2		No	
Shunt Coeff (shunt coefficient)	Dependent on system type		In the system type setting, if the parameter 'Shunt' is set to 'Y', this parameter will be displayed. Otherwise this parameter will take the default value, and is the same for both battery strings

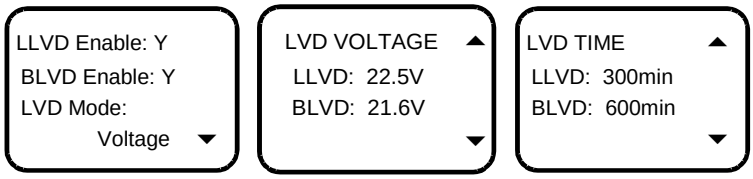
4.7.3 LVD Parameter Description

1. Function description

LLVD means the monitoring module opens the LLVD contactor, so that the non-priority load will be powered off. In this way, the battery remaining capacity can sustain the priority load longer.

BLVD means the monitoring module opens the BLVD contactor. In this way, the battery will stop powering the load, preventing over-discharge.

2. There are three related pages, as shown below:



Use ▼ or ▲ to select one page or one of the parameters, and ◄ or ► to select the parameter value. Press ENT to confirm and save.

Note

Generally you do not need to set the LVD parameters' value. The defaults will do.

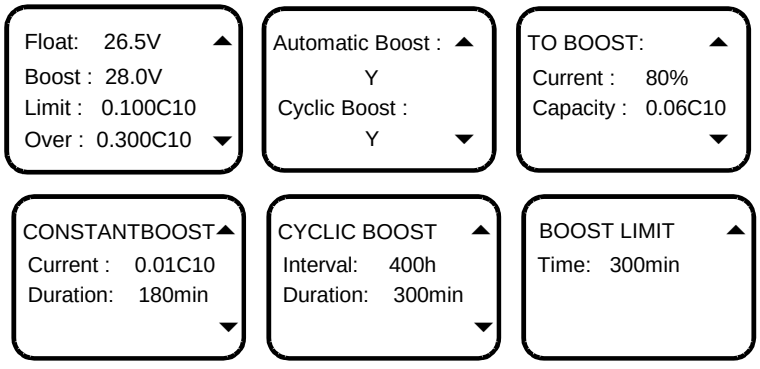
3. The value description of the LVD parameters is listed below.

Table 4-7 LVD parameters description

Parameter	Range	Factory setting	Value description
LLVD Enable	Y, N	Y	Select 'Y' to enable LLVD function
BLVD Enable		Y	Select 'N' to disable the BLVD function
LLVD Mode	Time, voltage	Voltage	Select 'Voltage', when the monitoring module detects that the battery voltage is lower than the prestet 'LLVD Volt', the load will be disconnected, and so is the battery when the battery voltage is lower than the preset 'BLVD Volt'. Select 'Time', when the discharge time reaches the preset 'LLVD Time', the monitoring module will disconnect the load; when the discharge time reaches the preset 'BLVD Time', it will disconnect the battery
LLVD Volt	20V ~ 30V	22.5V	
BLVD Volt		21.6V	
LLVD Time	3 ~ 1,000 min	300min	
BLVD Time		600min	

4.7.4 Charging Management Parameters

1. There are 6 related pages, as shown below:



Use ▼ or ▲ to select one page or one of the parameters, and ◄ or ► to select the parameter value. Press ENT to confirm and save.

Note

Generally you do not need to set the management value. The defaults will do.

2. The charging management parameter value description is listed below:

Table 4-8 Charging management parameter value description

Parameter	Range	Factory setting	Value description	
Float	21V ~ 29V	26.8V	In the FC state, all rectifiers output voltage according to the set 'Float'	The 'Boost' must be higher than the 'Float'
Boost		28.0V	In the BC state, all rectifiers output voltage according to the set 'Boost'	
Limit (current limit)	0.1 ~ 0.25C_{10}	0.1C_{10}	When the monitoring module detects that the battery charging current is higher than the 'Limit', it will control the current of the rectifiers, through which it can limit the battery charging current. C_{10} is the battery rated capacity, generally set to 10 ~ 20% of the rated capacity of one battery string	
Over (over current point)	0.3C_{10} ~ 1.0C_{10}	0.300C_{10}	When the monitoring module detects that the battery charging current is higher than the 'Over', it will raise the battery charge over-current alarm	
Automatic Boost	Yes, No	Y	Select 'Y', and BC will be conducted when conditions allow	
Cyclic Boost			Select 'Y', and the monitoring module will control the system to enter the Cyclic Boost when the FC time reaches the 'Cyclic Boost Interval'. The battery charging voltage is the preset 'Boost', and the time is the preset 'Cyclic Boost Time'	
Cyclic Boost Interval	48 ~ 8760h	2400h		
Cyclic Boost Time	30 ~ 2880min	720min		
To Boost Current	0.050 ~ 0.080C_{10}	0.06C_{10}	The monitoring module will control the system enter the BC state when the battery capacity decreases to the value of 'To Boost Capacity', or when the charge current reaches the 'To Boost Current'. The charge voltage will be the 'Boost'	
To Boost Capacity	10% ~ 99%	80%		
Constant BC Current	0.002 ~ 0.02 C_{10}	0.01C_{10}	The system in the BC state will enter the FC state when the charge current decreases to the 'Constant BC Curr' and after the 'Duration'. The battery charge voltage then will be the 'Float'	
Duration (of constant BC)	30 ~ 1440min	180min		
Boost Limit	60 ~ 2880min	1080min	To ensure safety, the monitoring module will forcefully control the system to enter the FC state if during the BC state, the BC time reaches the 'Boost Limit', or abnormalities occur (such as AC failure, battery route faulty, and rectifier communication failure)	

3. The BC/FC switchover diagram is shown below:

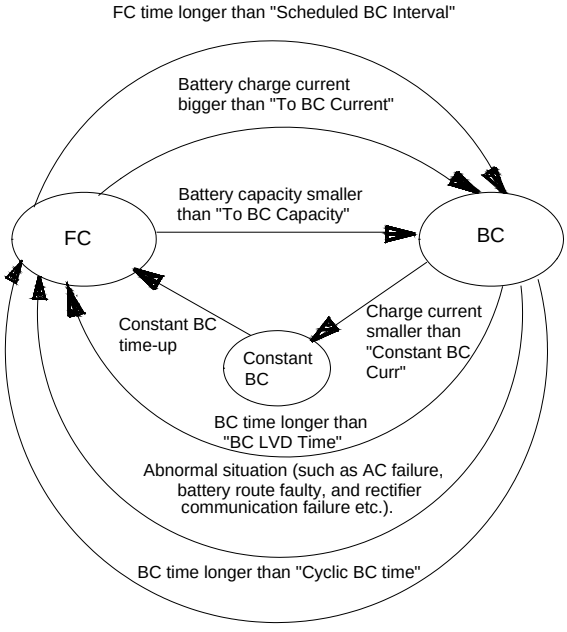
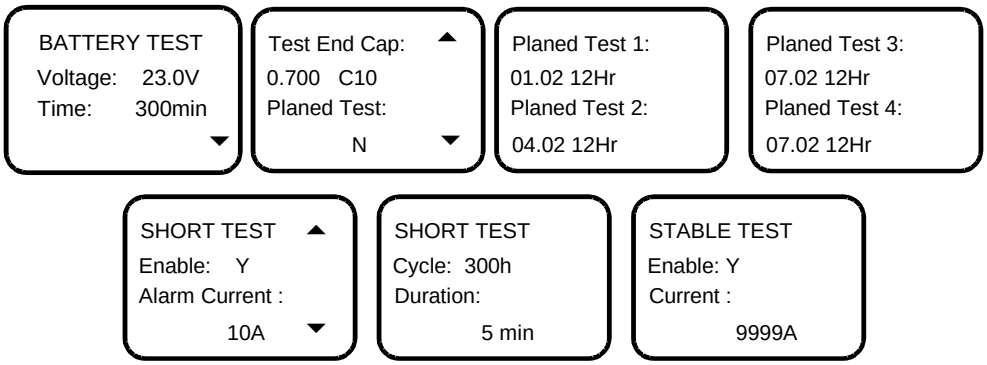


Figure 4-2 BC/FC switchover diagram

4.7.5 Battery Test Parameters

1. There are seven related pages, as shown below:



Use ▼ or ▲ to select one page or one of the parameters, and ◄ or ► to select the parameter value. Press ENT to confirm and save.

2. The value description of the parameters is listed below:

Table 4-9 Battery test parameters description

Parameter	Range	Factory setting	Value description
Battery test voltage	21.5V ~ 28.9V	22.6V	The monitoring module can do battery test, and record 10 sets of test data (accessible only through the host). The battery test has to be started manually, then monitoring module will control the rectifier output voltage, make it lower than the battery voltage, and the battery discharge will begin. Monitoring module 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 monitoring module will stop the battery test automatically
Battery test time	5 ~ 1440min	300min	
Test End Cap (capacity)	$0.01C_{10}$ ~ $0.95C_{10}$	$0.7C_{10}$	
Scheduled Test	Y, N	N	When the parameter 'Scheduled Test' is set to 'Y', the monitoring module will test the battery according to the 4 sets of test time. You can set at most 12 sets of test time through the host
Planned Test 1	Month, day, hour	00:00, Jan. 1st	
Planned Test 2		00:00, April 1st	
Planned Test 3		00:00, July 1st	
Planned Test 4		00:00, Oct. 1st	
Alarm Current	1A ~ 100A	10A	If the battery have not discharged within the 'ShortTest Cycle', the monitoring module will start a short test, whose operation time is set by the parameter 'ShortTest Duration'. By the end of the test, if the difference in the discharge currents of batteries is bigger than the 'Alarm Current', the battery discharge imbalance alarm will be raised. This alarm will automatically end after 5min of delay. Also you can end it by confirming it
ShortTest Cycle	24h ~ 8,760h	720h	
ShortTest Duration	1 ~ 60min	5min	
StableTest Enable	Y, N	N	The stable test is conducted with constant battery current, whose value is set through the parameter 'StableTest Current'. If the parameter 'StableTest' 'Enable' is set to 'Y', and the test will be started once the battery satisfies the test condition
StableTest Current	0 ~ 9999A	9999A	

3. The schematic diagram of the test function is shown below:

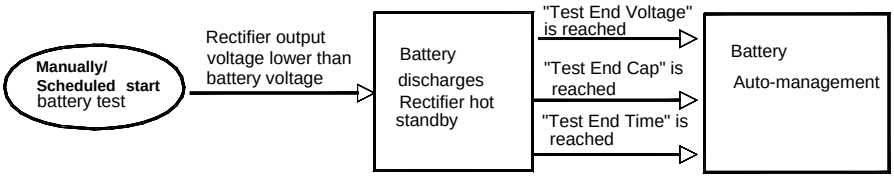
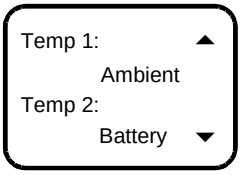


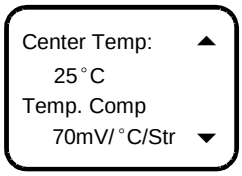
Figure 4-3 Schematic diagram of the test function

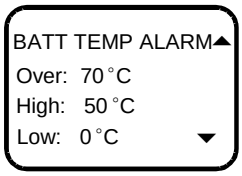
4.7.6 Temperature Compensation Coefficient Parameters

1. The first page of the setting interface is shown below:



2. If the ‘Temperature1’ or ‘Temperature2’ is set to ‘Battery Temp’, you need to set the following parameters:





Use ▼ or ▲ to select one page or one of the parameters, and ◄ or ► to select the parameter value. Press ENT to confirm and save.

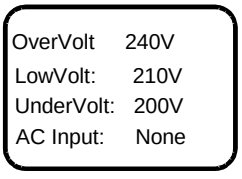
3. The value description of the parameters is listed below:

Table 4-10 Temperature compensation coefficient parameters description

Parameter		Range	Factory setting	Value description	
Temperature1		Ambient Temp, None, Battery Temp	None	The ‘Ambient Temp’ and ‘Battery Temp’ refer to the measurement of the ambient or battery temperature sensor at the local power system. ‘None’ means there is no measurement input. You should set this parameter according to the actual situation. The temperature measurement data will be displayed in the system operation information screen	
Temperature2					
When Temperature1 or Temperature 2 is set to ‘Battery Temp’	Center Temp	10°C ~ 40°C	25°C	Batteries are sensitive to temperature. To ensure battery’s capacity and life, its FC voltage should change together with the temperature: lower FC voltage for higher temperature, and vice versa. FC = BattTemp – Center Temp × Temp Comp Upon alarms such as ‘Rect Com Failure’, ‘DC Under-volt’ and ‘DC Voltage High’, the monitoring module will not do temperature compensation to the battery FC voltage. Set this parameter according to the actual battery technical parameters	
	Temp Comp	0 ~ 500mV/°C	36mV/°C		
	Over	10°C ~ 100°C	50°C	When the detected battery temperature is higher than the ‘Over’, the monitoring module will raise an alarm	The ‘High’ must not be higher than the ‘Over’
	High	10°C ~ 100°C	55°C	When the detected battery temperature is higher than the ‘High’, the monitoring module will raise an alarm	
	Low	-40°C ~ 10°C	0°C	The monitoring module will raise an alarm when the detected battery temperature is lower than the ‘Low’	

4.7.7 AC Settings

1. The configuration interface is shown below:



Use ▼ or ▲ to select one page or one of the parameters, and ◄ or ► to select the parameter value. Press ENT to confirm and save.

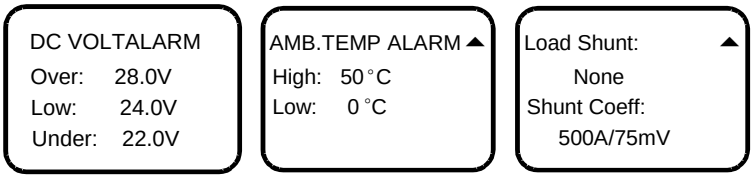
2. The value description of the parameters is listed below:

Table 4-11 AC Setting parameter description

Parameter	Range	Factory setting	Value description	
OverVolt	50V ~ 300V	275V	The monitoring module will raise an alarm when the AC input voltage is higher than the 'OverVolt '	The 'OverVolt' must be higher than the 'LowVolt'. To avoid alrm disorder, it is suggested to use the default values
LowVolt	50V ~ 300V	165V	The monitoring module will raise an alarm when the AC input voltage is lower than the 'LowVolt'	
UnderVolt	50V ~ 300V	77V	The monitoring module will raise an alarm when the AC input voltage is lower than the 'UnderVolt'	
AC Input	3-phase, Single Phase, None	None	Set this parameter according to the actual situation. In a system with an AC sampling board, you can only select 'Single Phase' or '3-phase'; in a system without an AC sampling board, you can select only 'None'	

4.7.8 DC Settings

1. There are three related pages, as shown below:



Use ▼ or ▲ to select one page or one of the parameters, and ◄ or ► to select the parameter value. Press ENT to confirm and save.

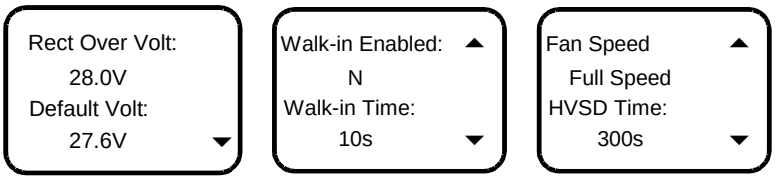
2. The value description of the parameters is listed below:

Table 4-12 DC setting parameter description

Parameter	Range	Factory setting	Value description	
Over (over-voltage)	20V ~ 30V	28.5V	The 'DC Over Voltage' alarm will be raised when the system DC output voltage is higher than the value of 'Over'	The values of these three parameters should be: Over > Low > Under
Low (low-voltage)		23.0V	The DC low voltage alarm will be raised when the system DC output voltage is lower than the value of 'Low'	
Under (under-voltage)		22.5V	The DC under voltage alarm will be raised when the system DC output voltage is lower than the value of 'Under'	
High (high temperature)	10°C ~ 100°C	40°C	The high temperature alarm will be raised when the detected ambient temperature is higher than the value of 'High'	The value of parameter 'High' must be higher than that of parameter 'Low'
Low (low temperature)	-40°C ~ 10°C	-5°C	The low temperature alarm will be raised when the detected ambient temperature is lower than the value of 'Low'	
Load shunt	Y, None	None	Set according to the system actual situation	
Shunt Coeff	Dependent on system type		In the system with a load shunt, this parameter can be set only when the parameter 'Shunt' (as a system type) is set to 'Set'	

4.7.9 Rectifier Settings

1. There are three related pages, as shown below:



Use ▼ or ▲ to select one page or one of the parameters, and ◄ or ► to select the parameter value. Press ENT to confirm and save.

2. The value description of the parameters is listed below:

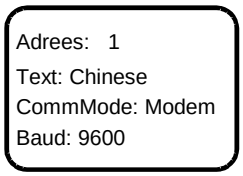
Table 4-13 DC rectifier parameter description

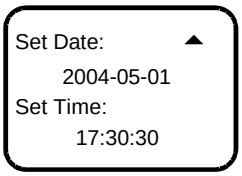
Parameter	Range	Factory setting	Value description	
Rect Over Volt	20V ~ 30V	29V	The rectifier over voltage alarm will be raised when the rectifier output voltage is higher than the 'Rect Over Volt'	The 'Default Volt' must be lower than the 'Rect Over Volt'
Default Volt	20V ~ 30V	26.8V		
Walkin Enabled	Y, N	N	The output soft start function means the rectifier voltage will rise from 0V to the 'Default Volt' after the 'Walkin Time'	
Walkin Time	8s ~ 128s	8s		
Fan Speed	Full Speed, Half Speed	Half speed	When set to 'Half Speed', the rectifier will regulate the fan speed according to the temperature. When set to 'Full Speed', the fan will operate at full speed	
HVSD Time	50s ~ 300s	300s	The rectifier will shut off automatically upon over-voltage, and restart after a certain delay to see whether it is still over-voltage then. That delay is set through the parameter 'HVSD Time'. If the rectifier's output voltage is normal within the delay, the rectifier is regarded normal; otherwise, the rectifier will be locked out and auto-restart function will be disabled	

4.7.10 System Settings

Users of different password levels have different authorities.

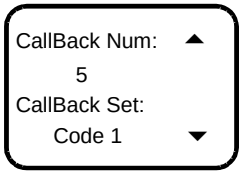
1. For the user level password ("1" by default), there are 2 related pages, as shown below:

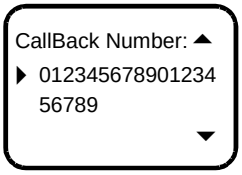




Use ▼ or ▲ to select one page or one of the parameters, and ◄ or ► to select the parameter value. Press ENT to confirm and save.

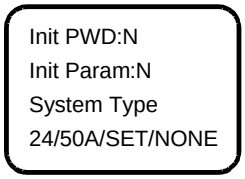
When the 'CommMode' is 'modem', the 'CallBack Number' and 'CallBack Num' (how many times should callback be made) should be set.



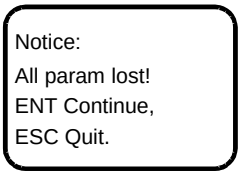


Use ▼ or ▲ to change the number, and ◄ or ► to move the cursor left or right. Press ENT to confirm.

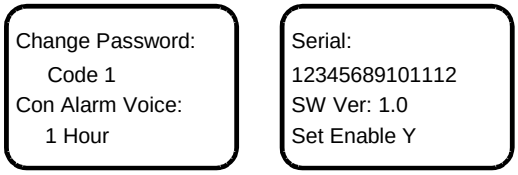
2. For the operator level password (by default: 2) or administrator level password (by default: 640275), you can see the following pages, besides the pages above, as shown below:



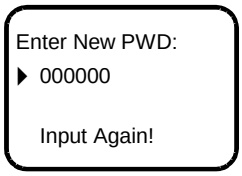
There will be a prompt when resetting the system:



3. For administrator level password (by default: 640275), you can see the following pages, besides all those above, as shown below:



You can change the value of the parameter 'Change Password' and press ENT to confirm.



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.

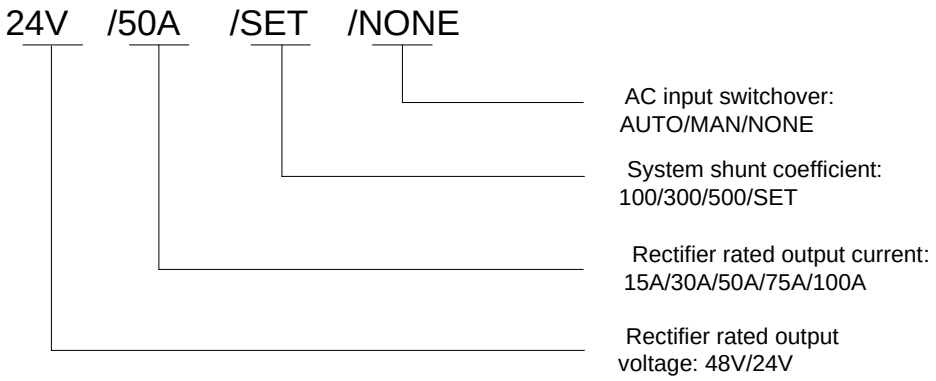
4. The value description of the parameters is listed below:

Table 4-14 System setting parameter description

Parameter		Range	Factory setting	Value description
Text		Chinese, English and Spanish	Chinese	Set according to your need
Address		1 ~ 254	1	The addresses of power systems that are at the same monitored office should be different
CommMode		Modem, RS-232	RS-232	'MODEM': Through modem and based on the Telecom protocol. 'RS-232': Through a transparent serial port and based on the Telecom protocol
BaudRate		1200bps, 2400bps, 4800bps, 9600bps	9600bps	Make sure the baud rates of both the sending and receiving parties are the same
When 'CommMode' is set to 'MODEM'	CallBack Num.	1 ~ 10	3	Set according to the actual need. In an extension system, sometimes you need to put a "," between the main number and extension number. When the callback number is less than 19 digits, end it with a #
	CallBack Number	19 digits at most		
Set Date		2,000 ~ 2,099		Set the time according to the current actual time, regardless of whether it is a leap year or not
Set Time		Hour, min, sec		
Operator level or above	Init PWD (Initialize password)	Y, N	N	Selecting 'Y' can reset the user level and administrator level passwords to the defaults
	Init Param (Initialize parameters)	Y, N	N	When the system parameters cannot be set normally, and the usual resetting methods do not work, you can set the 'Init Param' to 'Y', and all the system parameters will be restored to defaults. Alarms may be raised for the defaults may fail to meet the actual situation. Set the parameters according to the actual situation then
	System Type	24V/75A/500/NONE	This parameter has been set according to the actual situation upon delivery and needs not to be changed. However, when a new monitoring module is used, its 'System Type' should be set according to the actual situation. After this parameter is changed, the monitoring module will restart automatically, and other parameters of the monitoring module will be changed to the defaults of the corresponding system type. You should change some parameters according to the actual situation	

Parameter		Range	Factory setting	Value description
Administrator	Change Password	User, Operator, Admin	The password can be 6 digits long at most. If it is shorter than 6 digits, end it with a #	
	Con Alarm Voice	3min, 10min, 1h, 4h, constant	Contstant	The period that an alarm sound will last
	Serial	The production serial No. of the monitoring module. This parameter cannot be changed		
	SW Ver	The software version No. of the monitoring module. This parameter cannot be changed		
	Set Enable	Reflecting the jumper status of a hardware switch within the monitoring module. If this parameter is set to 'N', you are not allowed to use the jumper, nor change any parameter except the battery management mode. The maintenance over the monitoring module will not be affected		

5. The model description is shown below:

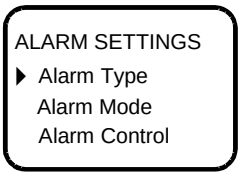


Note

Monitoring module M500S can monitor multiple power systems made by Emerson. If the system type is not set correctly, unpredictable faults may occur.

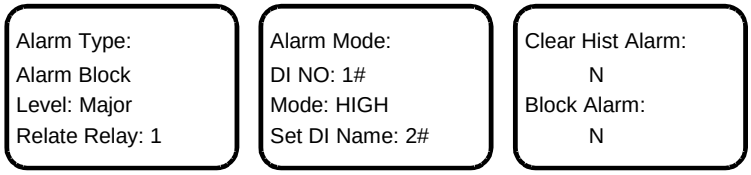
4.7.11 Alarm Settings

1. The first page of the setting interface is show below:



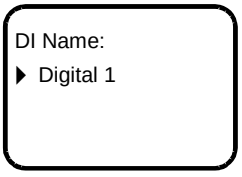
There are 3 submenus. Use ▼ or ▲ to select one, and use ENT to confirm.

2. The three submenus are shown below:



Use ▼ or ▲ to select one page or one of the parameters, and ◄ or ► to select the parameter value. Press ENT to confirm and save.

3. After setting the 'Set DI Name' and confirming it, the system will prompt you to name the DI:



Use ▼ or ▲ to change the number, and ◄ or ► to move the cursor left or right. Press ENT to confirm.

4. The value description of the parameter is listed below:

Table 4-15 Alarm setting parameter description

Parameter	Range	Factory setting	Value description	
Alarm Type	56 names of alarm events	Alarms of different types have different levels and different Relate Relays	Select those alarm events whose levels and relate relays should be reset	
Level	Critical, Major, Observation, None		There are different audible/visual alarm modes and callback modes for alarm events of different levels	
Relate Relay	Empty, No.1 ~ 8		'Empty': The corresponding dry contact will not output alarm information upon an alarm event 'No. 1 ~ 8': There will be a dry contact in the range of No.1 ~ 8 that outputs the alarm information upon an alarm event	
DI No.	No. 1 ~ 8	1	The 8 corresponding connecting terminals, queued up in the order that the hardware switches are put	Effective only to self-defined DI alarms
Alarm Mode	High, Low	Low	'High': alarm upon high level; 'Low': alarm upon low level. Set according to the actual situation	
Set DI Name	1# ~ 8#	1#	Serial No. of the connecting terminal for DI input	
DI Name	Figures or letters, 10 at most	SPD	When there are DI alarms, this parameter shows the alarm name you have actually defined. In the system with an AC sampling board, you can define by yourself the DIs of routes No.7 and No.8. In the system without an AC sampling board, you can define all DIs	
Clear His Alarm	Y, N	N	'Y': Delete historical alarms	
Block Alarm	Y, N	N	'Y': The active alarms will not be sent to the host	

Chapter 5 Alarm Handling

This chapter describes the handling of alarms, as well as the preventive maintenance of the system during system daily operation.

The maintenance personnel must have adequate knowledge about the power system.

Note

1. The maintenance must be conducted under the guidance of related safety regulations.
2. Only the trained personnel with adequate knowledge about the power system can maintain the inner part of the cabinet.

5.1 Handling Alarms

The monitoring module alarms are classified in 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, users 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 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: if alarms are set as 'no alarm' by the users, when these alarms occur, no visible or audible indication will be generated and the system works normally.

The handling methods of normal alarms are given in Table 5-1.

Table 5-1 System setting parameter description

No.	Alarm	Handling method
1	Mains Failure	If the failure does not last long, the battery will power the load. If the cause is unknown or the failure lasts too long, a diesel generator is needed. Before using the generator's power, it is suggested to run the generator 5 minutes to stabilize the power output
2	AC Voltage High	Check if the AC Over-voltage point is too low. Reset the value if too low A mild over-voltage does not affect the system operation. However, the rectifier will stop operation when the mains voltage is more than 295V. Therefore, if the power supply is constantly over-voltage, the mains power network should be improved
3	AC Voltage Low	Check if the AC Under- voltage point is too high. Reset the value if too high When the mains voltage is lower than 176V, the output power of the rectifiers will be derated. If the power supply is constantly under-voltage, the main power network should be improved
4	DC Volt High	1. Check the system DC output voltage and value of "Over" set through the monitoring module. If the setting value is improper, correct it. 2. Find out the rectifier that has caused the alarm. First of all, ensure that the batteries can operate normally. Then switch off the AC input of all rectifiers. Power on the rectifiers one by one. If the over-voltage protection is triggered when a certain rectifier is powered on, that rectifier is the faulty one. Replace the fault recitfier
5	DC Volt Low	1. Check the system DC output voltage and value of "Under" set through the monitoring module. If the set value is improper, correct it 2. If the alarm is caused by mains failure,check if certain loads can be disconnected to prolong the operation of the whole system 3. If the alarm is due to rectifier fault, find out the faulty rectifier and replace it 4. Compare the total load current with the rectifier current, and the former should not be bigger than the later at FC voltage, otherwise partial loads must be disconnected to ensure the safe operation of the whole system. Add several rectifiers to make the total rectifier current bigger than 120% of the total load current. In addition, there must be at least 1 rectifier for redundancy standby
6	Load Fuse Alarm/ Batt Fuse Alarm	Check if the MCB or fuse of the route is switched off.If the MCB is open, find out the fault and remove it. Or check the voltage at the alarm fuse. If the voltage is almost 0V, the fuse is normal Otherwise, the alarm loop is faulty. Please contact Emerson

No.	Alarm	Handling method
7	LVD2	1. Check if there is mains failure, or the battery voltage is lower than the “BLVD” value, or the battery discharge time is more than the “BLVD Time” 2. The battery is disconnected from the system manually
8	Rect Failure	The red LED on the rectifier will turn on 1. Reset the rectifier by powering it off and then on again 2. If the rectifier still causes this alarm, replace it
9	Rect Protect	Check if the mains is outside the range of 80V ~ 295V (between the AC under-voltage point and over-voltage point) If the power supply is constantly over/under-voltage, the mains power network should be improved
10	Rect Fan Fails	1. Check whether the rectifier fan is still working. 2. If the fan stands still, pull out the rectifier to check whether the fan is blocked or not. If yes, clean it and push the rectifier back. However, if the fan still does not move after the rectifier is powered on, replace it (see *Replacing rectifier fan* of *5.2 Handling Rectifier Fault*)
11	Rect Not Respond	Check if the communication between rectifier and monitoring module fails. If the communication is normal, reset the rectifier by pulling it out and pushing back in. If the alarm persists, replace the rectifier
12	Batt Over Temp	1. Check if there is battery internal fault. If yes, replace the fault battery 2. Check if the battery room temperature is too high. If yes, cool down the battery room

5.2 Handling Rectifier Fault

Handling indicator fault

The symptoms of usual rectifier faults include: green indicator (run indicator) off, yellow indicator (protection indicator) on, yellow indicator blink, red indicator (fault indicator) on and red indicator blink.

The indicators are shown in Figure 5-1 and the indicator descriptions are given in Table 5-2.

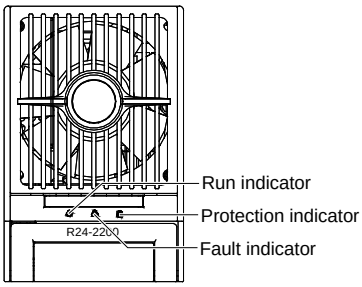


Figure 5-1 Rectifier indicator

Table 5-2 Indicator fault description

Symptom	Monitoring module alarms	Causes		Handling method
Run indicator off	No alarm	No input/output voltage		Make sure there is input/output voltage
		Assistant power source of the rectifier fails		Replace the recitifier
Run indicator blinks	No alarm	The monitoring module performs operations upon the rectifier		
Yellow indicator on	Rect Protect	AC input voltage abnormal		Make sure the AC input voltage is normal
		Over-temperature protection due to:	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
		Power factor compensation internal under voltage or over voltage		Replace the rectifier
Yellow indicator on	Load share Alarm	Current sharing imbalance		Check whether the rectifier communication is normal. If not, check whether the communication cable is in normal connection. If the communication is normal while the protection indicator is on, replace the rectifier

Symptom	Monitoring module alarms	Causes	Handling method
Yellow indicator blinks	Rect Not Respond	Rectifier communication interrupted	Check whether the communication cable is in normal connection
Red indictor on	Rect HVSD	Rectifier over-voltage	Reset the rectifier. If the protection is triggered again, replace the rectifier
	Rect Failure	Two or more recitifiers have the same ID number	Contact Emerson for maintenance
		Serious current sharing imbalance (> ± 3%)	Check whether the rectifier communication is normal. If not, check whether the communication cable is in normal connection. If the communication is normal while the protection indicator is on, replace the rectifier
Red indicator blinks	Rect Fan Fails	Fan fault	Replace the fan

Replacing rectifier fan

If the rectifier fan is faulty and does not work, it should be replaced. See the following procedures:

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

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

3. Install a new fan.

4. Plug the fan power cable.

5. Put the front panel back and fasten it with the three screws.

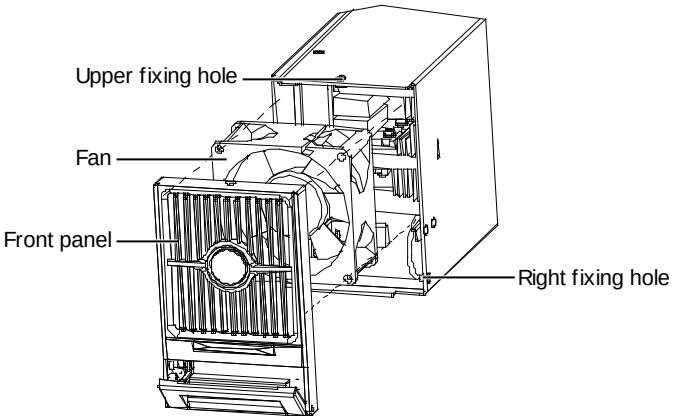


Figure 5-2 Disassembling the front panel

Replacing rectifier

Except replacing the fan, it is recommended not to repair any other parts of the rectifier. When faulty, the rectifier should be replaced, not repaired. See the following procedures to replace the rectifier.

1. Take a new rectifier and check it for any damage from transport.

2. Pull out the faulty 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. By holding the rectifier handle, push the new rectifier into the slot just vacated 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 whether the new rectifier works normally.

You should make sure that:

1) The monitoring module recognizes the new rectifier.

2) The new rectifier shares current with other rectifiers.

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

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

5. Push the handle back into the front panel to fix the rectifier with the positioning pin.

5.3 Handling Monitoring Module Fault

Fault estimation

The fault phenomena of the monitoring module are LCD failure or displayed contents incorrect. Users should take the following procedures to estimate fault causes:

1. Remove the three fixing screws of the cover plate, as shown in Figure 5-3.

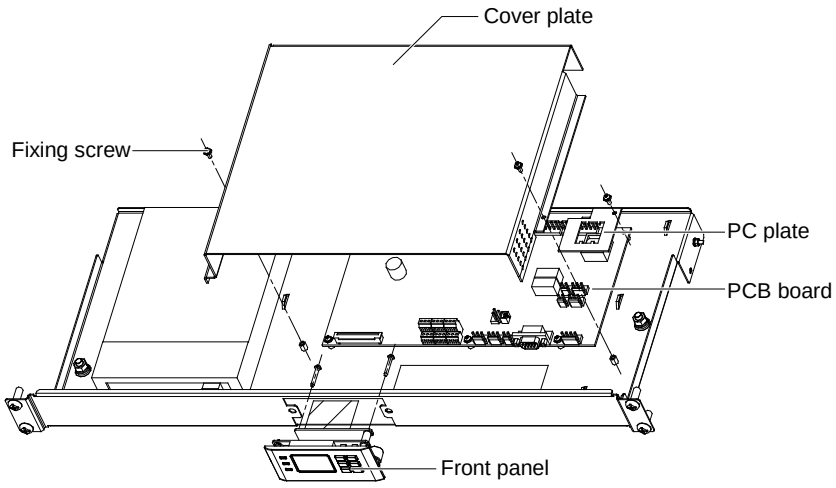


Figure 5-3 Removing cover plate

2. Estimate fault causes according to the indicator status of the PCB board, as listed in Table 5-3.

Table 5-3 monitoring module fault causes and handling methods

Phenomenon	Fault cause	Handling method
Watchdog indicator and communication indicator off	PCB board has no auxiliary power supply	Check if J421 teminal is connected reliably. If the connection is reliable and the terminal voltage is normal (approximately the busbar voltage of the system), the PCB board is faulty and needs replacement
Watchdog indicator and communication indicator on	Software not running	Replace the PCB board
Watchdog indicator and communication indicator flashing, LCD display incorrect	Signal cable incorrect connection or PCB board faulty	Check if the signal cable connection is correct and reliable. If not, reconnect it. If yes, the PCB board is faulty and needs replacement
Watchdog indicator and communication indicator flashing, LCD no display	PCB board faulty or LCD faulty	Replace the LCD according to the next section *Replacemen*. check if the LCD displays normally. If yes, the fault handling is over. If not, the PCB board is faulty and needs replacement

The indicators and terminals of the PCB board are shown in Figure 5-4.

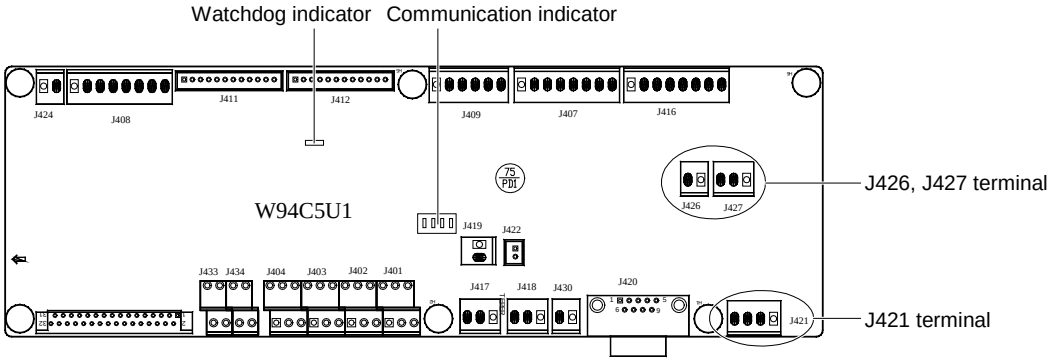


Figure 5-4 Indicators and terminals of the PCB board

Replacement

Note

Care should be taken when replacing components of the monitoring module. Unplugging terminals optionally may result in system shut down. Carry out the replacement sequentially according to the following procedures.

1. Replacement of the PCB board

The procedures of replacing PCB board are described as follows:

1) Unplug J426 and J427 terminals to prevent shutting down of the system.

2) Unplug the J421 power supply terminal to power off the PCB board.

3) Unplug other terminals and DI/DO cables.

4) Wrap the DI/DO cable terminals with insulating tape. Keep the unconnected terminals and cables should be insulated from components of the system and the PCB board to prevent short circuit.

5) Remove the fixing screws of the PCB board and replace the PCB board. Note that the screwdriver should be prevented from touching the bare parts of the signal cables to prevent short circuit.

6) Connect the signal cables in reverse sequence, that is, reconnect signal cables other than J421, J426, J427 terminal cables and DI/DO cables.

7) Check the cable connections. If the connections are correct, reconnect J421 terminal. If the watchdog indicator and communication indicator flash, the PCB board works normally.

8) Check the voltages of J426 and J427 terminals with a multimeter. Make sure that they output low voltage. Connect J426 and J427 terminals.

9) Set the parameters of the monitoring module according to *3.2 Basic Settings*.

2. Replacement of the LCD

The procedures of replacing LCD are described as follows:

1) Unplug J426, J427 and J421 terminals of the PCB board.

2) Unplug the J3 terminal tape cable connected to the LCD.

3) Replace the LCD. Restore the J3 terminal tape cable. Pay attention not to short the LCD with the system or the LCD with the PCB board.

4) Connect J421 terminal.

5) Check the voltages of J426 and J427 terminals with a multimeter. Make sure that they output low voltage.

6) Connect J426 and J427 terminals. The replacement is complete.

5.4 Replacing Signal Transfer Board

If the signal transfer board is damaged and needs replacement, follow the procedures below to carry out the replacement.

1. Remove the fixing screws of the protecting cover. Remove the protecting cover, as shown in Figure 5-5.

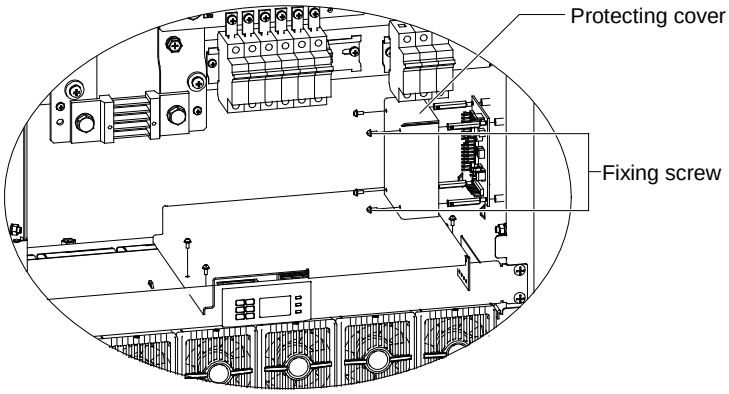


Figure 5-5 Removing the protecting cover

2. Disconnect the signal cables connecting to the signal transfer board.

3. Remove the fixing screws of the signal transfer board. Replace the signal transfer board, as shown in Figure 5-6.

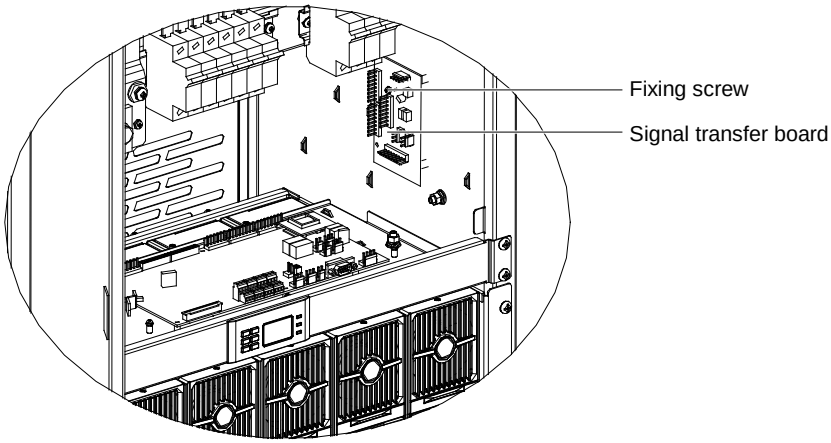


Figure 5-6 Removing the signal transfer board

4. Reconnect the signal cables to the signal transfer board. Replace the protecting cover.

Appendix 1 Technical Data

Table 1 Technical data

Parameter category	Parameter	Description
Environmental	Operating temperature	-5°C ~ 40°C
	Storage temperature	-40°C ~ 70°C
	Relative humidity	5%RH ~ 95%RH
	Altitude	≤ 2,000m (derating is necessary above 2,000m)
	Others	No conductive dust or erosive gases. No possibility of explosion
AC input	AC input system	3-phase 4-wire system or 3-phase 5-wire system
	Rated input phase voltage	220Vac
	Input voltage range	80Vac ~ 290Vac, derating from 176Vac
	Input AC voltage frequency	45Hz ~ 65Hz
	Max input current	≤ 45A (at 170V input)
	Power factor	≥ 0.99
DC output	Output DC voltage	21.6Vdc ~ 28.8Vdc
	Output DC current	Load current ≤ 400A, battery charge current ≤ 200A
	Voltage set-point accuracy	≤ 1%
	Efficiency	≥ 88%
	Noise (peak-peak)	≤ 200mV (0～20MHz)
	Weighted noise	≤ 2mV (300～3400Hz)
	Wide frequency noise	≤ 100mV (3.4kHz ~ 150kHz) ≤ 30mV (150kHz ~ 30MHz)
	Discrete noise	≤ 5mV (3.4kHz ~ 150kHz) ≤ 3mV (150kHz ~ 200kHz) ≤ 2mV (200kHz ~ 500kHz) ≤ 1mV (0.5MHz ~ 30MHz)
AC input alarm and protection	AC input over-voltage alarm point	Default: 275 ± 5Vac, cofigurable through monitoring module
	AC input over-voltage recovery point	Default: 265 ± 5Vac, 10Vac lower than the AC input over-voltage alarm point
	AC input under-voltage alarm point	Default: 165 ± 5Vac, configurable through monitoring module
	AC input under-voltage recovery point	Default: 175 ± 5Vac, 10Vac higher than the AC input under-voltage alarm point
	AC input over-voltage protection point	Default 295 ± 5Vac, configurable through monitoring module
	AC input over-voltage protection recovery point	10Vac lower than the AC input over-voltage protection point
	AC input under-voltage protection point	Default: 80 ± 5Vac, configurable through monitoring module
	AC input under-voltage protection recovery point	15Vac higher than the AC input under-voltage alarm point
DC output alarm and protection	DC output over-voltage alarm point	Default: 28.5 ± 0.2Vdc, configurable through monitoring module
	DC output over-voltage recovery point	Default: 28.0 ± 0.2Vdc, 0.5Vdc lower than the over-voltage alarm point
	DC output under-voltage alarm point	Default: 22.5 ± 0.2Vdc, configurable through monitoring module
	DC output under-voltage recovery point	Default: 23.0 ± 0.2Vdc, 0.5Vdc higher than the under-voltage alarm point
	LLVD	Default: 22.5 ± 0.2Vdc, configurable through monitoring module
	BLVD	Default: 21.6 ± 0.2Vdc, configurable through monitoring module
Rectifier	Current sharing	The rectifiers can work in parallel and share the current. The unbalance is better than ± 3% rated output current. Test current range: 10% ~ 100% rated current
	Derate by input (at 45°C)	The rectifier can output max. power of 2175W with input voltage of 176Vac ~ 290Vac. Rectifiers output 1173W power with input voltage of 120Vac Rectifiers output 544W power with input voltage of 85Vac

Parameter category	Parameter	Description
Rectifier	Over-voltage protection	The rectifier provides over-voltage hardware and software protection. The hardware protection point is 29.5V ~ 30.5V, and it requires manual resetting to restore operation. The software protection point is between 28 ~ 29.5V (0.5V above output voltage, 29V by default), and can be set through the monitoring module There are two software protection modes, which can be selected through the software at the host: 1. Lock out at the first over-voltage Once the output voltage reaches protection point, the rectifier will shut off and hold that state. it requires manual resetting to restore the operation 2. Lock out at the second over-voltage When the output voltage reaches the software protection point, the rectifier will shutdown, and restart automatically after 5 seconds. If the over-voltage happens again within a set time (default: 5min. Configurable through monitoring module), the rectifier will shut off and hold that state. It requires manual resetting to restore the operation Manual resetting: Resetting can be done manually through the monitoring module, or by removing the rectifier from system
	Output delay	Output voltage can rise slowly upon rectifier start up. The rise time is configurable
	Fan speed adjustable	Rectifier fan speed can be set to half or full speed
	Temperature derating	Temperature below 45°C, outputs full power: 2,175W Temperature above 45°C, there will be linear derating, that is: At 55°C, output power is 1,088W At 60°C, output power is 544W At 65°C, output power is 0W
EMC	Conducted emission	Class A EN55022
	Radiated emission	
	Immunity to EFT	Level 4 EN61000-4-4
	Immunity to ESD	Level 3 EN61000-4-2
	Immunity to Surges	Level 4 EN61000-4-5
	Immunity to radiation	Level 2 EN61000-4-3
	Immunity to conduction	Level 2 EN61000-4-6
Lightning protection features	At AC side	The AC input side can withstand five times of simulated lightning voltage of 5kV at 10/700μs, for the positive and negative polarities respectively. It can withstand five times of simulated lightning surge current of 20kA at 8/20μs, for the positive and negative polarities respectively. The test interval is not smaller than 1 minute. It can also withstand one event of simulated lightning surge current of 40kA at 8/20μs
	At DC side	The DC side can withstand one event of simulated lightning current of 10kA at 8/20μs
Others	Acoustic noise	≤ 55dB (A) (When the ambient temperature is lower than25℃)
	Insulation resistance	At temperature of 15°C ~ 35°C and relative humidity not bigger than 90%RH, apply a test voltage of 500Vdc. The insulation resistances between AC circuit and earth, DC circuit and earth, and AC and DC circuits are all not less than 10MΩ
	Insulation strength	(Remove the SPD, monitoring module and rectifiers from the system before the test.) AC circuit to earth: 50Hz, 2,500Vac DC circuit to earth: 50Hz, 1,000Vac Assistant circuit (not directly connected to the host circuit): 50Hz, 500Vac AC to DC circuits: 50Hz, 3,000Vac For all the three tests above, there should be no breakdown or flashover within 1min, with leakage current not bigger than 10mA
	MTBF	200,000hr

Parameter category	Parameter		Description
Mechanical	Dimensions (mm)	Cabinet	600 (W) × 400 (D) × 1600 (H)
		Rectifier	132.3 (H) ×85.3 (W) × 287 (D)
	Weight (kg)	Cabinet (excluding rectifiers)	≤ 98
		Rectifier	≤ 3.5

Appendix 2 Engineering Diagram

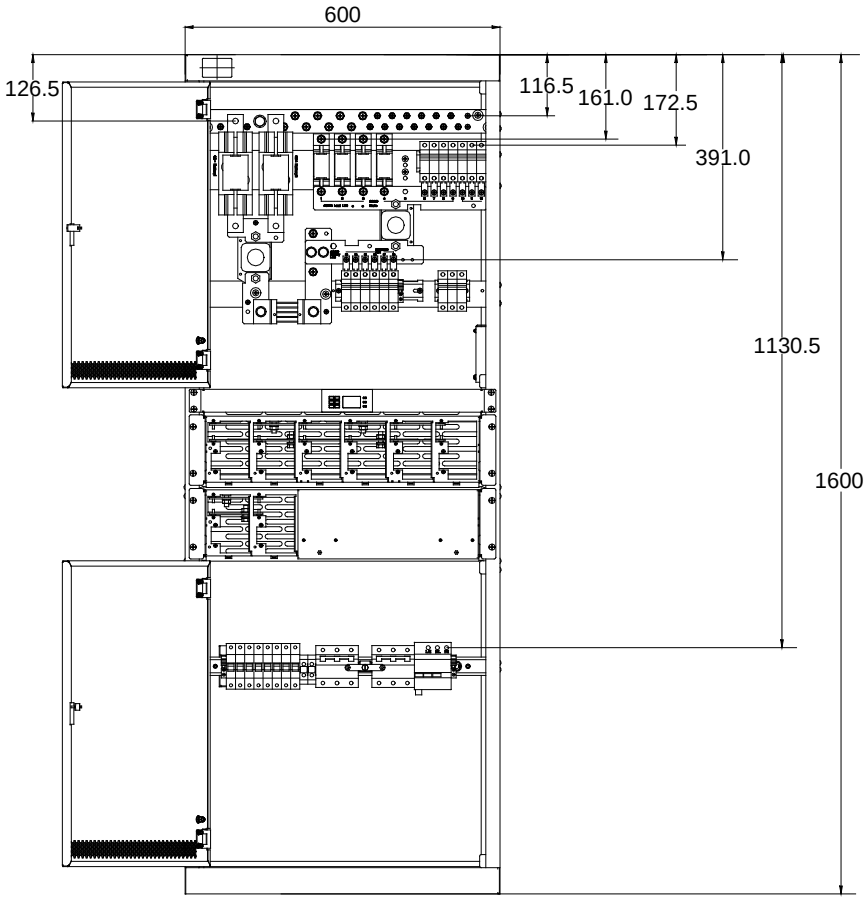


Figure 1 Engineering diagram (unit: mm)

Table 2 Input and output connector specs

Connector		Specs		Remarks
		Capacity	Connector specs	
AC Power distribution	AC input MCB	2 × 63A/3P	H cable terminals, 3pcs (cable CSA ≤ 35mm^2)	The live line of AC power supply
	Grounding busbar	One M10 bolt	Cable CSA ≤ 35mm^2	Connected to the grounding bar of the room
	Input neutral terminal	Two neutral line terminals	Cable CSA ≤ 25mm^2	Neutral line of AC power
	Output neutral busbar	3 × M6 bolts in the busbar		The neutral terminal of the AC output power serving other equipment
DC power distribution	DC negative busbar	2 × M10 (for battery connection), 4 × M8, 14 × M6		
	Battery fuse	2 × 500A NT3 Fuse bolt: 2 × M10 (for battery connection)		
	Load route	BLVD routes: 2 × 63A/ 1P, 2 × 32A/ 1P, 2 × 10A/ 1P MCB LLVD routes: 4 × 100A NT00 fuse, 6 × 63A/ 1P, 4 × 32A/ 1P MCB		

Appendix 3 Parameter Setting Of The Monitoring Module

This chapter gives the description of the monitoring- module parameter setting. The detailed information of parameter setting and operating method are given in *Chapter 4 Use Of Monitoring Module.* Refer to *4.7.11 Alarm Settings* for the alarm setting method.

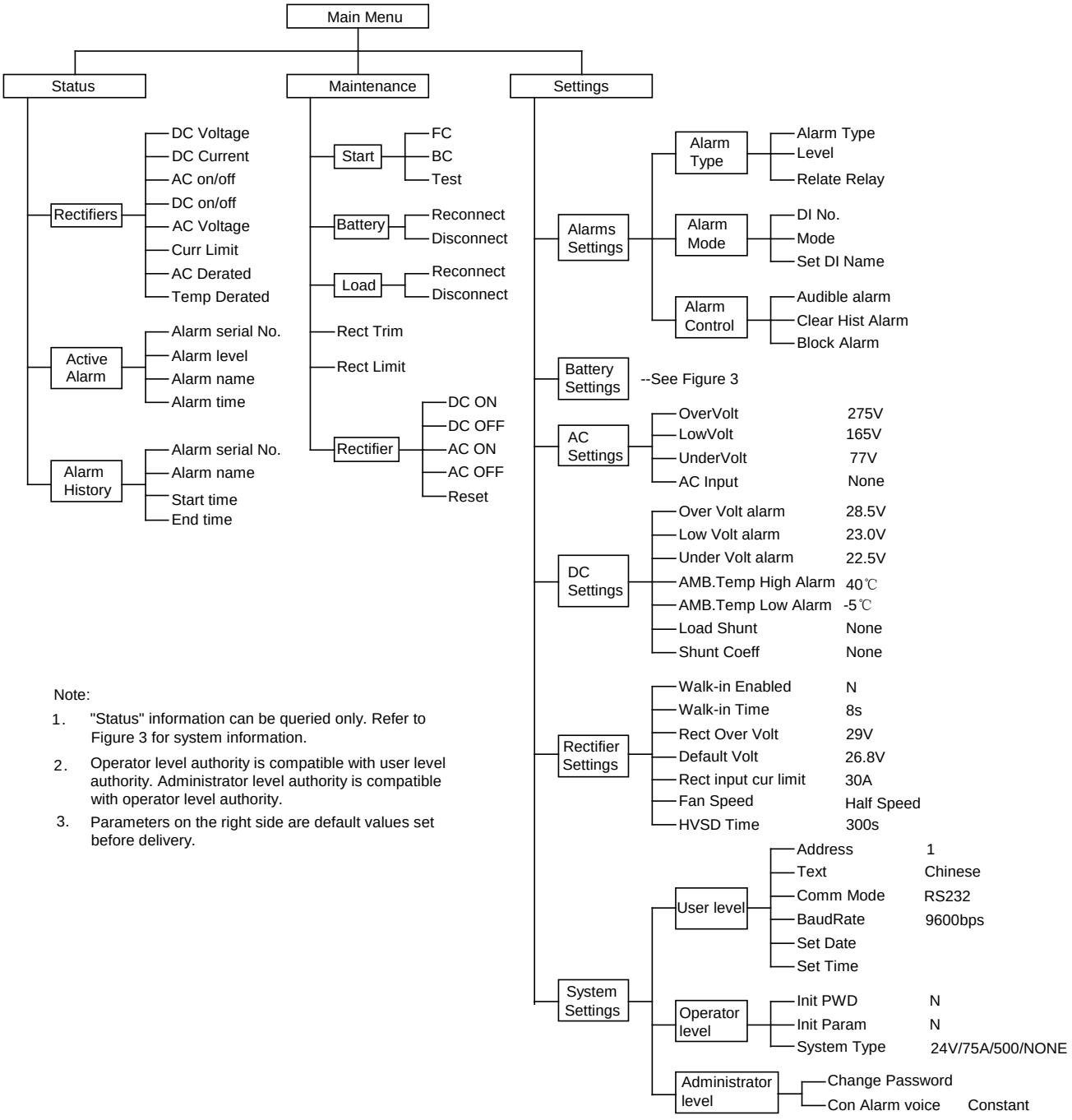
Table 3 Parameter setting of the monitoring module

Item	Parameter	Range	Factory settings	Value description
Basic battery parameter	Mgmt Mode (Management mode)	Auto, Manual	Auto	Choose 'Auto' management mode or 'Manual' management mode
	Batt String (number of battery strings)	0 ~ 5	2	Configure according to actual situation
	Rated AH (rated capacity)	50 ~ 5000Ah	300Ah	The total capacity of the battery strings connected to one battery shunt. You should set this parameter according to the actual battery configuration
	BTT Name	1# ~ 11#	1#	
	Battery Name	10 characters		Name different types of batteries for identification
	Batt Shunt1	Yes, No	Yes	Select 'Y' in this system. Battery management aims at only the batteries connected to the shunt
	Batt Shunt2		Yes	
LVD parameter	LLVD Enable	Y, N	Y	Select 'Y' to enable LLVD function Select 'Y' to disable the BLVD function
	BLVD Enable		Y	
	LLVD Mode	Time, voltage	Voltage	Disconnect load according to Time or Voltage
	LLVD Volt	20V ~ 30V	22.5V	When the monitoring module detects that the battery voltage is lower than the prestet 'LLVD Volt', the load will be disconnected, and so is the battery when the battery voltage is lower than the preset 'BLVD Volt'
	BLVD Volt		21.6V	
	LLVD Time	3 ~ 1,000 min	300min	When the discharge time reaches the preset 'LLVD Time', the monitoring module will disconnect the load; when the discharge time reaches the preset 'BLVD Time', it will disconnect the battery
	BLVD Time		600min	
Charging manage-ment	Float	20V ~ 30V	22.5V	Battery float charging voltage
	Boost		21.6V	Battery boost charging voltage, and the 'Boost' must be higher than the 'Float'
	Limit (current limit)	0.1 ~ 0.25C_{10}	0.1C_{10}	Maximum battery charging current
	Over (over current point)	0.3C_{10} ~ 1.0C_{10}	0.300C_{10}	Battery charge over-current alarm point
	Automatic Boost	Yes, No	Y	Y: enable the function N: disable the function
	Cyclic Boost			
	Cyclic Boost Interval	48 ~ 8760h	2400h	Interval between two cyclic boost chargings
	Cyclic Boost Time	30 ~ 2880min	720min	The time Cyclic Boost lasts
	To Boost Current	0.050 ~ 0.080C_{10}	0.06C_{10}	To boost charging current criterion
	To Boost Capacity	10% ~ 99%	80%	To boost charging capacity criterion
	Constant BC Current	0.002 ~ 0.02 C_{10}	0.01C_{10}	Beginning of constant BC current charging timing
	Duration (of constant BC)	30 ~ 1440min	180min	The duration that the constant BC current charging lasts
	Boost Limit	60 ~ 2880min	1080min	Maximum BC duration
Battery test parameter	Battery test voltage	21.5V ~ 28.9V	22.6V	Monitoring module 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
	Battery test time	5 ~ 1440min	300min	
	Test End Cap (capacity)	0.01C_{10} ~ 0.95C_{10}	0.7C_{10}	
	Scheduled Test	Y, N	N	Enable or disable Scheduled Test
	Planned Test 1	Month,day, hour	00:00, Jan. 1st	When the parameter Scheduled Test is set to Y, the monitoring module will test the battery according to the setting time automatically
	Planned Test 2		00:00, April 1st	
	Planned Test 3		00:00, July 1st	
	Planned Test 4		00:00, Oct. 1st	

Item	Parameter	Range	Factory settings	Value description
Battery test parameter	Alarm Current	1A ~ 100A	10A	If the battery have not discharged within the 'ShortTest Cycle', the monitoring module will start a short test, whose operation time is set by the parameter 'ShortTest Duration'. By the end of the test, if the difference in the discharge currents of batteries is bigger than the 'Alarm Current', the battery discharge imbalance alarm will be raised
	ShortTest Cycle	24h ~ 8,760h	720h	
	ShortTest Duration	1 ~ 60min	5min	
	StableTest Enable	Y, N	N	Enable or disable Stable Test
	StableTest Current	0 ~ 9999A	9999A	Constant battery discharging current in Stable Test
Tempe-rature compen-sation coefficient	Temperature1	Ambient Temp, None, Battery Temp	None	Measurement of the ambient temperature or battery temperature or no temperature measurement input
	Temperature2			
	Center Temp	10°C ~ 40°C	25°C	Temperature compensation center
	Temp Comp	0 ~ 500mV/°C	36mV/°C	Temperature compensation coefficient
	Over	10°C ~ 100°C	50°C	When the battery temperature is higher than the setting value, the monitoring module will raise an alarm. The High must not be higher than the Over
	High	10°C ~ 100°C	50°C	
	Low	-40°C ~ 10°C	0°C	When the battery temperature is lower than the setting value, the monitoring module will raise an alarm
AC Setting parameter	OverVolt	50V ~ 300V	275V	AC input Over voltage alarm point
	LowVolt	50V ~ 300V	165V	AC input low voltage alarm point must be lower than OverVolt
	UnderVolt	50V ~ 300V	77V	AC input under voltage alarm point must be lower than LowVolt
	AC Input	3-phase, Single Phase, None	None	Set this parameter according to the actual situation. The parameter cannot be changed
DC setting parameter	Over (over-voltage)	20V ~ 30V	28.5V	DC Over Voltage alarm point
	Low (low-voltage)		23.0V	DC Low Voltage alarm point, must be lower than DC Over Voltage alarm point
	Under (under-voltage)		22.5V	DC Under Voltage alarm point, must be lower than DC Low Voltage alarm point
	High (high temperature)	10°C ~ 100°C	40°C	High temperature alarm point
	Low (low temperature)	-40°C ~ 10°C	-5°C	Low temperature alarm point, must be lower than High temperature alarm point
	Load shunt	Y, None	None	Set according to the system actual situation. The parameter cannot be changed
	Shunt Coeff	--	--	The parameter is invalid in the system
Rectifier parameter	Rect Over Volt	20V ~ 30V	59V	Rectifier over voltage alarmpoint
	Default Volt	22.2V ~ 28.4V	26.8V	Default output voltage when communication interrupted. Must be lower than the 'Rect Over Volt'
	Walkin Enabled	Y, N	N	The output soft start function means the rectifier voltage will rise from 0V to the 'Default Volt' after the 'Walkin Time'
	Walkin Time	8s ~ 128s	8s	
	Rectifier input current limit	1A ~ 50A	30A	The monitoring module limits the rectifier input current within the limit value
	Fan Speed	Full Speed, Half Speed	Half speed	'Half Speed': the rectifier will regulate the fan speed according to the temperature. 'Full Speed': the fan will operate at full speed
	HVSD Time	50s ~ 300s	300s	Restart delay after HVSD
System setting parameter	Text	Chinese, English and Spanish	Chinese	Set according to customer need
	Address	1 ~ 254	1	The addresses of power systems that are at the same monitored office should be different
	CommMode	modem, RS-232	RS-232	The system supports RS-232 mode communication. 'MODEM': Through modem and based on the Telecom protocol
	BaudRate	1200bps, 2400bps, 4800bps, 9600bps	9600bps	Make sure the baud rates of both the sending and receiving parties are the same

Item	Parameter		Range	Factory settings	Value description
System setting parameter	Set Date		2,000 ~ 2,099		Set the time according to the current actual time, regardless of whether it is a leap year or not
	Set Time		Hour, min, sec		
	Oper-ator level or above	Init PWD (Initialize password)	Y, N	N	Whether resetting the user level and administrator level passwords to the defaults
		Init Param (Initialize parameter)	Y, N	N	Whether resetting the system parameters to defaults
		System Type	--	24V/75A/500/ NONE	The system type should be set according to the parameter card, and cannot be changed optionally
	Admi-nistrat or	Change Password	--	User level	The password can be 6 digits long at most. If it is shorte than 6 digits, end it with a #
		Con Alarm Voice	3min, 10min, 1h, 4h, constant	Contstant	The period that an alarm sound will last
DI Alarm setting	DI No.		No. 1 ~ 8	1	The 8 corresponding connecting terminals, queued up in the order that the hardware switches are put
	Alarm Mode		High, Low	Low	Alarm upon high level or upon low level
	Set DI Name		1# ~ 8#	1#	Serial No. of the connecting terminal for DI input
	DI Name		--	SPD	Figures or letters, 10 at most

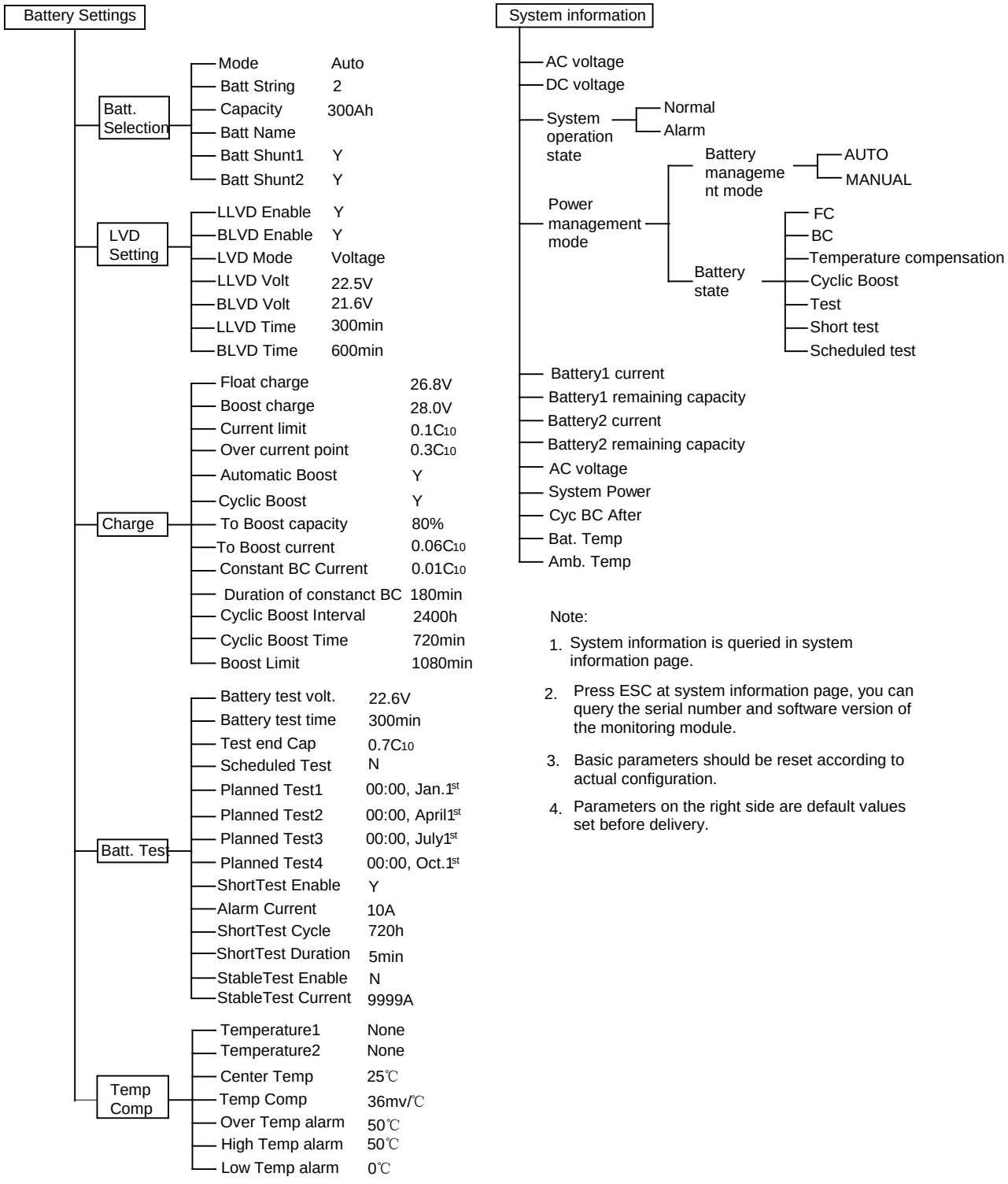
Appendix 4 Menu Structure Of The Monitoring Module



Note:

1. "Status" information can be queried only. Refer to Figure 3 for system information.
2. Operator level authority is compatible with user level authority. Administrator level authority is compatible with operator level authority.
3. Parameters on the right side are default values set before delivery.

Figure 2 Menu structure of the monitoring module (1)



Note:

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

Figure 3 Menu structure of the monitoring module (2)

Appendix 5 Schematic Diagram

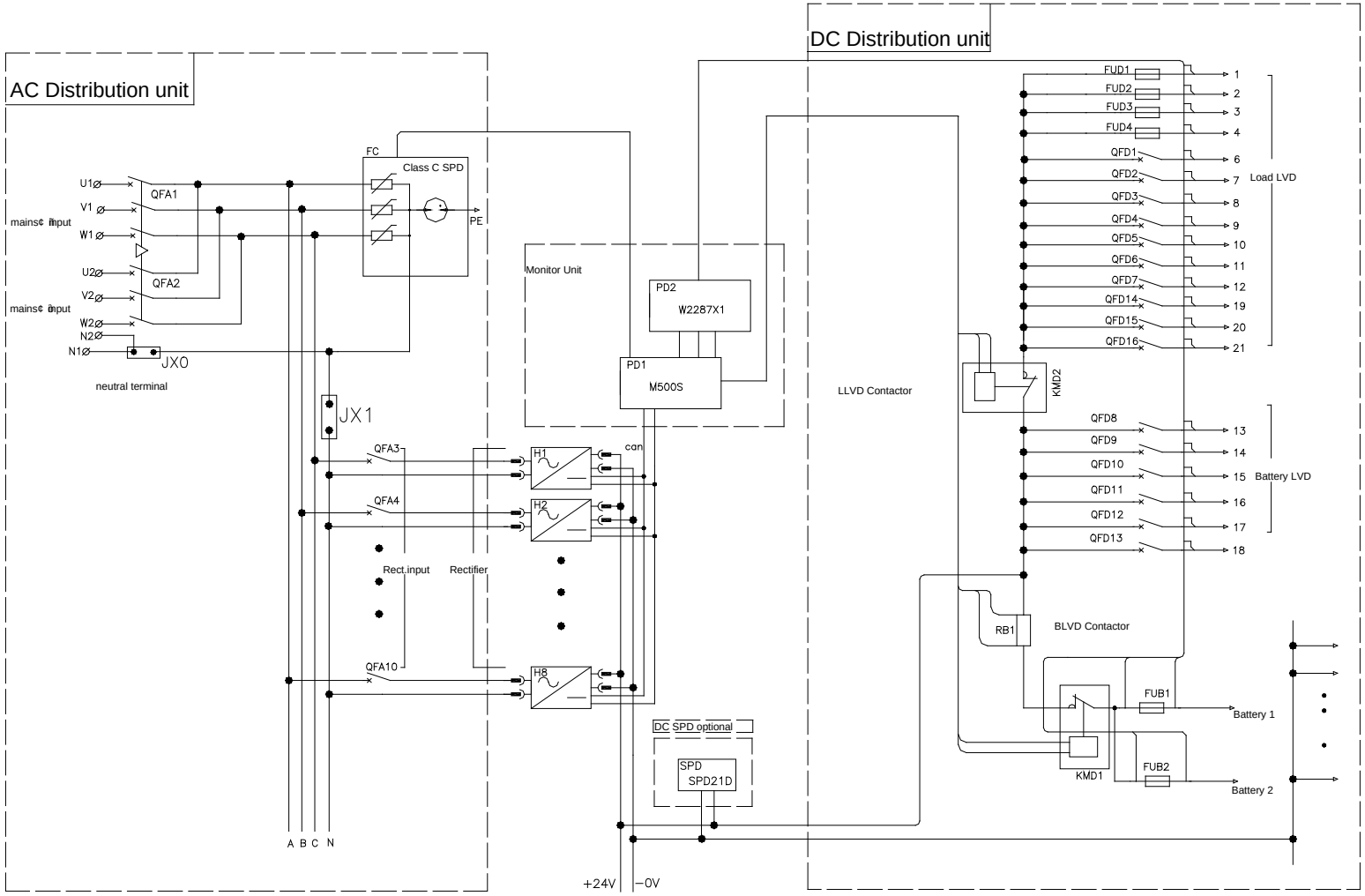


Figure 4 Schematic diagram

Appendix 6 Wiring Diagram

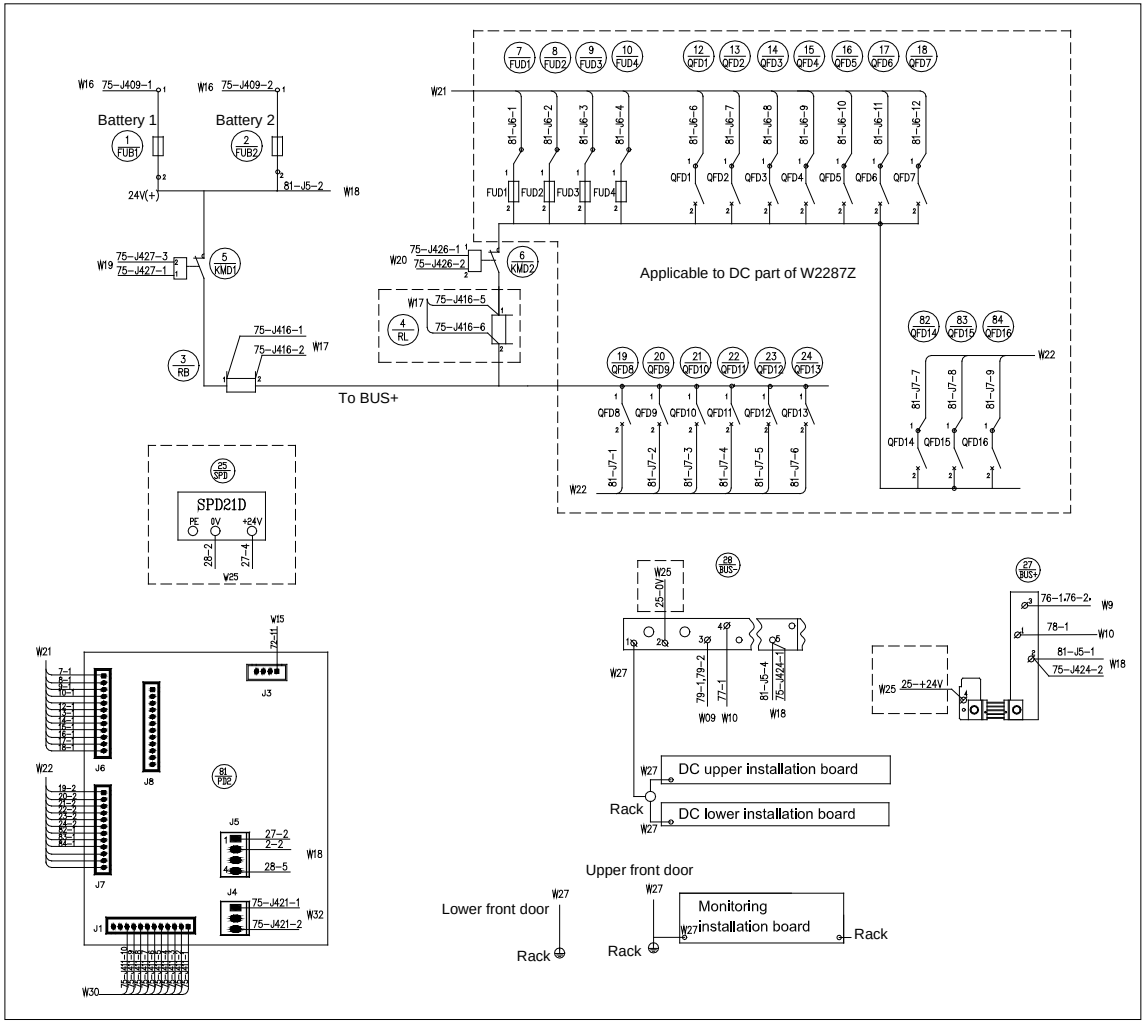
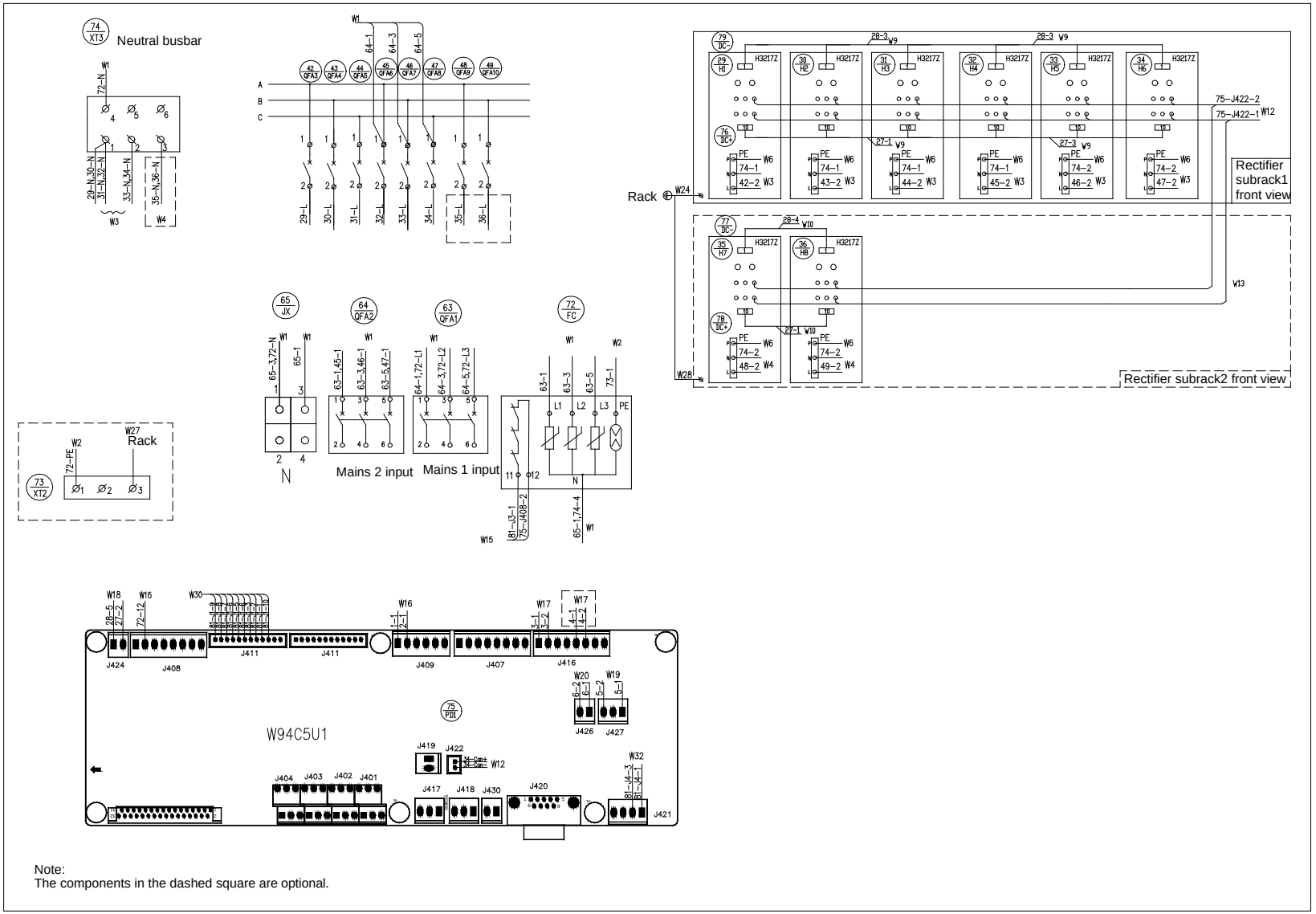


Figure 5 Wiring diagram (1)



Note:
The components in the dashed square are optional.

Figure 6 Wiring diagram (2)

Appendix 7 Glossary

Abbreviation	Full word
Amb.Temp	Ambient Temperature
Batt	Battery
BC	Boost Charging
BLVD	Battery Lower Voltage Disconnection
Cap	Capacity
CommMode	Communication Mode
CurrLimit	Current Limit
CycBC	Cyclic Boost Charging
Con Alarm Voice	Control Alarm Voice
Hist Alarm	Historical alarm
HVSD	High Voltage Shutdown
InitParam	Initialize Parameters
InitPWD	Initialize Password
LLVD	Load Low Voltage Disconnection
LVD	Low Voltage Disconnection
MCB	Miniature Circuit Breaker
Ph-A	Phase A
PWD	Password
Rect	Rectifier
Shunt coeff	Shunt Coefficient
SPD	Surge Protection Device
SW Version	Software Version
Sys	System
Temp	Temperature
Temp Comp	Temperature Compensation
Volt	Voltage