M45D65B

User manual

Rev:01

Date:2019-10-18

Purpose

This document describes the DC power system in terms of product overview, components, installation, commissioning, and maintenance.

The figures provided in this document are for reference only.

Intended Audience

This document is intended for:

- Sales engineer
- Technical support engineer
- Maintenance engineer

Safety regulations

Please read the instructions and notes carefully in order to reduce unexpected occurrences. The items in the product and product manual "caution, attention, warning, danger" do not represent all safety matters that are to be observed, they are only a supplement to the various operational safety considerations.

Therefore, the personnel responsible for the installation and operation of this product must be properly trained to handle the operation of the equipment according to the correct operating method and all kinds of safety precautions.

During the operation of the company's products and equipment, we must comply with the safety standards of relevant industries and strictly observe the relevant equipment and special safety instructions provided by the company.

Symbol Conventions

The symbols that may be found in this document are defined as follows.

 **High Voltage**	The AC Input cable is high-voltage, and the operation must ensure that the AC input is cut off. During the operation the switch which is not to be used must be added a temporary prohibition sign.
 **DANGER**	Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.
 **CAUTION**	Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.
 **NOTICE**	Indicates a potentially hazardous situation which, if not avoided, could result in equipment damage, data loss, performance deterioration, or unanticipated results. NOTICE is used to address practices not related to personal injury.
 **NOTE**	Calls attention to important information, best practices

Change History

Issue 01[2019-10-18] This issue is the first official release.

Content

Charpter 1 Preface

1.1 General Safety Precautions

- Ensure that the product is used in environments that meet its design specifications to avoid damaging components and voiding the warranty.
- Ensure that only trained and qualified personnel install, operate, and maintain equipment.
- Comply with local laws and regulations. The safety instructions in this document are only supplements to local laws and regulations.
- Do not operate the device or cables during thunderstorms.
- Remove metal objects such as watches, bracelets, and rings when using the product.
- Use insulated tools on the product.
- Follow specified procedures during installation and maintenance.
- Measure contact point voltage with an electric meter before touching a conductor surface or terminal. Ensure that the contact point has no voltage or it is within the specified range.
- Note that the load may power off during maintenance or fault location if the power system is not
- Connected to a battery or if battery capacity is insufficient.
- Store cables for at least 24 hours at room temperature before laying out them if they were previously stored at sub-0ºC.
- Routinely check installed equipment and perform maintenance according to the user manual; replace faulty components quickly to ensure that the device works properly.

1.2 Electrical Safety

Grounding Requirements

- When installing a device, install the ground cable first. When removing a device, remove the ground cable last.
- Before operating a device, ensure that the device is properly grounded.

Operation requirement

 DANGER	The supply voltage of the power supply system is the dangerous voltage. Direct contact or indirect contact with these parts through wet objects can bring fatal danger. Irregular and incorrect operation may cause accidents such as fire or electric shock

- AC power equipment installation, must abide to the relevant industry safety standards. The personnel who install equipment must have high voltage and alternating current job qualification.
- Before the equipment is electrically connected, the front protection switch must be disconnected from the device.
- Before connecting the AC, it is necessary to ensure that the electrical connection of the equipment has been completed.
- Before connecting load (electrical equipment) to cable or battery cable, must confirm the polarity of the cable and terminal, to prevent the reverse.
- Remove metal objects such as watches, bracelets, and rings when using the product.
- If found water in the cabinet or damp, please shut off the power immediately. When operating in a humid environment, water should be strictly prevented from entering the equipment.

- In the installation process, switches and buttons that cannot be used in operation must have a have attached a prohibition sign.

ESD Requirements

- To prevent electrostatic-sensitive components from being damaged by the static on human bodies, wear a well-grounded ESD wrist strap or gloves when touching circuit boards. And the other end of the anti-static wrist band should be well grounding.
- When holding a board, hold its edge without components. Do not touch chips.
- Removed boards must be packaged with ESD packaging materials before storage and transportation.

- **Liquid Prevention Requirements**

- Place this product far away from areas with liquid. Do not place the product under positions prone to leakage, such as air conditioner vents, ventilation vents, and feeder windows of the equipment room. Prevent liquid from entering the inside of the device to avoid short circuits, and ensure that there is no condensation inside the equipment room or device.
- If detecting any liquid inside the device, immediately disconnect the power supply and contact the administrator.

1.3 Battery Safety

 **DANGER**	Before installing, operating, and maintaining batteries, read the instructions provided by the battery vendor. For more safety precautions, see the instructions provided by the battery vendor.

- Incorrect handling of batteries causes hazards. When operating batteries, avoid battery short circuits and electrolyte overflow or leakage.
- Electrolyte overflow may damage the device. It will corrode metal parts and circuit boards, and ultimately damage the device and cause short circuits of circuit boards.

When installing and maintaining batteries, pay attention to the following points:

- Use special insulation tools.
- Take care to protect your eyes when operating batteries.
- Wear rubber gloves and a protective coat in case of electrolyte overflow.
- When handling a battery, ensure that its electrodes are upward. Leaning or reversing the battery is prohibited.
- Switch off the power supply during installation and maintenance.
- Secure battery cables to a torque specified in battery documentation. Loose connections will result in excessive voltage drop or cause batteries to burn out when the current is large.
- Short circuits will generate high transient currents and release a great deal of energy, which may cause personal injury. If conditions permit, disconnect the batteries in use before performing any other operations.
- Do not use unsealed lead-acid batteries.
- Place and secure lead-acid batteries horizontally to prevent device inflammation or corrosion due to flammable gas emitted from batteries. Lead-acid batteries in use emit flammable gas. Therefore, store the batteries in a place with good ventilation, and take measures against fire.
- High temperatures may result in battery distortion, damage, and electrolyte overflow. When the battery temperature is higher than 60°C, check the battery for electrolyte overflow. If the electrolyte overflows,

absorb and counteract the electrolyte immediately. When moving or handling a battery whose electrolyte leaks, exercise caution because the leaking electrolyte may hurt human bodies. When you find electrolyte leaks, use sodium bicarbonate (NaHCO3) or sodium carbonate (Na2CO3) to counteract and absorb the leaking electrolyte.

- After you connect batteries, ensure that the battery fuse is disconnected or the circuit breaker is OFF before powering on the power system. This prevents battery over discharge, which damages batteries.

1.4 Mechanical Safety

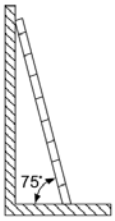
Hoisting Devices

- Only trained and qualified personnel are allowed to perform hoisting operations.
- Before hoisting objects, ensure that hoisting tools are firmly fixed onto a weight-bearing object or wall.
- Ensure that the angle formed by two cables is less than 90 degrees.

Using a Ladder

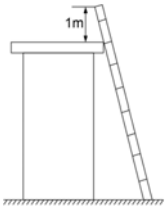
- Use only ladders that are in good condition. Find out and do not exceed the maximum weight capacity.
- The recommended angle for a ladder against another object is 75 degrees. Measure the gradient with a right angle or your arms, as shown in Figure 1-1. Ensure that the wider end of the frame is at the bottom, the base cannot slide, and that the ladder is securely positioned.

Figure 1-1 correct angle for ladders



When climbing a ladder:

- Ensure that your body's center of gravity does not shift outside the legs of the ladder.
- To minimize the risk of falling, steady your balance on the ladder before performing any operation.
- Do not climb higher than the fourth rung from the top.
- To climb onto a roof, ensure that the ladder top is at least one meter higher than the roofline, as shown in Figure 1-2.



Moving Heavy Objects

- Be cautious to prevent injury when moving heavy objects.
- Wear protective gloves when moving heavy objects.

Charpter 2 Product Introduction

2.1 Product Overview

M45D65B it is an embedded power supply system, which supplies power to communication equipment of -48Vdc series, and the maximum output current is 300A.The product appearance is shown in figure 2-1.

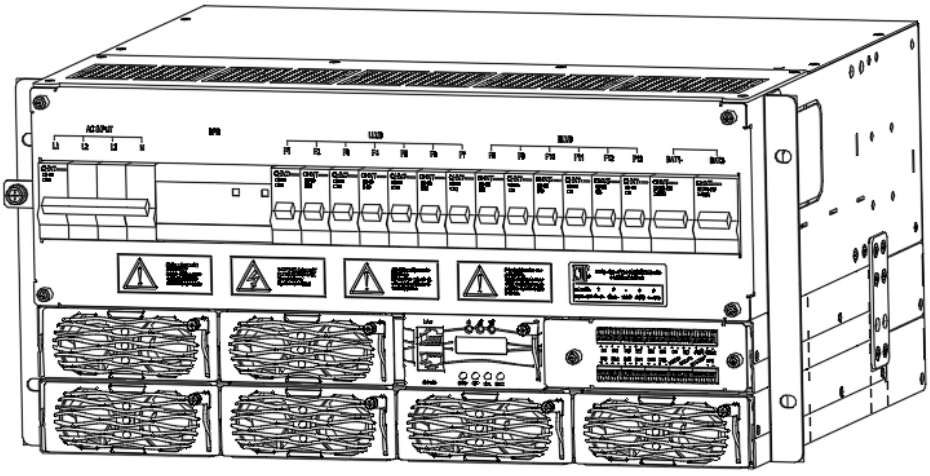


Figure2-1 product appearance diagram

2.2 System feature

- Wide range of AC input voltage to 85Vac ~ 300Vac (Phase voltage)
- Complete battery management functions
- Network design, provide all the LAN interface, RS485 interface
- Support the LCD interface display, keystrokes
- Hot plug support rectifier module
- Rectifier module power due to the value of 0.99

2.3 Working Principles

Figure 2-2 shows the conceptual diagram. AC power enters rectifiers through the AC power distribution unit (PDU). The rectifiers convert the AC power input into -48Vdc power output, which is directed by the DC PDU to DC loads along different routes.

When the AC power is normal, rectifiers power DC loads and charge batteries. When the AC power is absent, rectifiers stop working and batteries start to power loads. After the AC power resumes, rectifiers power DC loads and charge batteries again. The monitoring unit monitors the running state of each component of the power supply system in real time, and carries out the corresponding intelligent control. When detecting a fault, the monitoring module generates an alarm. At the same time, the monitoring unit controls and regulates the temperature control unit according to the temperature monitored by the sensor, so that the temperature in the cabinet is kept within the range required.

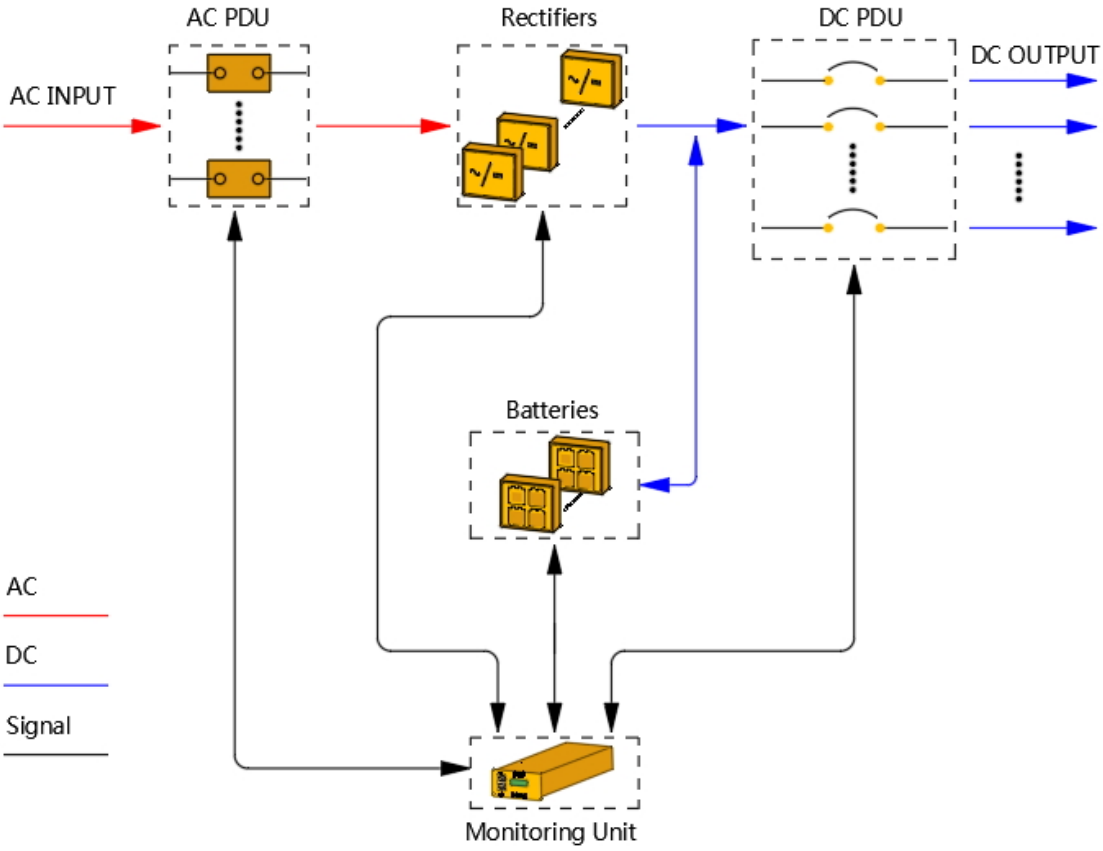


Figure2-2 Conceptual Diagram

2.4 Configurations

Table 2-1 lists power system configurations.

Table 2-1 configurations

Item	Configurations
Subrack	3U AC/DC distribution space 1U The monitor+ rectifier unit space 1U Rectifier installation space
The power distribution unit	AC power distribution：AC input MCB DC power distribution：battery low voltage disconnection (BLVD) route, load low voltage disconnection (LLVD) route and battery route
Monitor unit	MC2600
Rectifier module	A Maximum of six MR483000HG1 or MR483000HG2
AC SPD	Class C
DC SPD	Class D

2.5 Components

2.5.1 Interior structure

Product internal structure as follows Figure2-3.

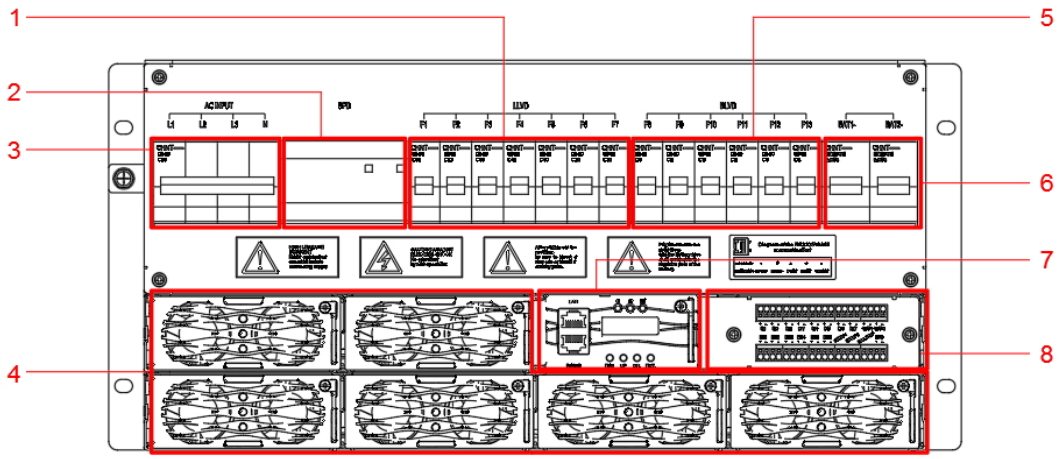


Figure2-3 M45D65B

(1) LLVD MCB	(2) AC SPD	(3) AC input MCB
(4) Rectifier unit	(5) BLVD MCB	(6) Battery MCB
(7) Monitor unit	(8) User interface board	

NOTE

Before delivery, the RTN+ bus is short-circuited with the subrack PE by default.

2.5.2 The power distribution unit

AC/DC power distribution unit is shown in Figure 2-4. Distribution specifications are shown in table 2-2.

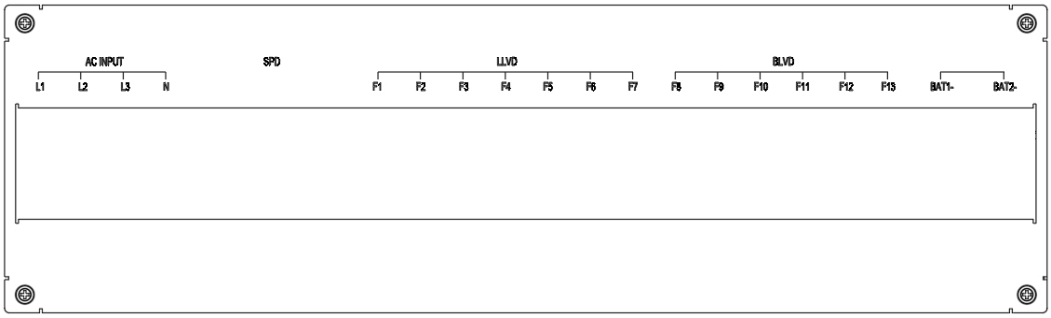


Figure2-4 AC/DC power distribution unit

Table 2-2 power distribution specifications

Item	Configurations
Input system	380Vac three -phase, five-wire
AC power distribution	Input MCB：3-pole 63A
DC power distribution	BLVD MCB：two 1-pole 6A, two 1-pole 10A, two 1-pole 16A LLVD MCB：two 1-pole 32A, two 1-pole 40A, three 1-pole 63A
Battery route	two 1-pole 125A MCB

2.5.3 Rectifier module

The rectifier panel is as follows Figure2-5.

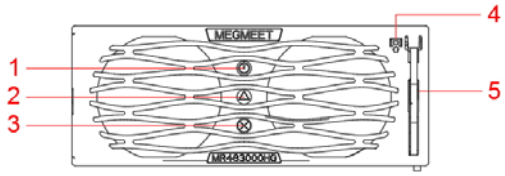


Figure2-5 Rectifier panel

(1) Power indicator (2) Alarm indicator (3) Fault indicator

(4) Locking latch (5) Handle

There are three indicator on the panel, which are used to reflect the operation status of the rectifier , see tab.2-3 for details.

Table 2-3 rectifier indicator description

Indicator	Color	Status	Reasons for abnormal status
Power indicator	Green	Normally on	The rectifier has an AC power input.
		Off	Main supply fault(no AC input or OVP, UVP of AC input), non-output
Alarm indicator	Yellow	Normally on	Temperature alarm(OTP when the ambient temperature > 65℃)
			The rectifier is hibernating. (indicator lighting, no alarm)
			The rectifier is current-limiting
		Flickering	Communication failure
Fault indicator	Red	Normally on	Non-output caused by module inner reason such as OVP, fan fault, OTP
		Normally off	The rectifier is running properly.

2.5.4 Monitoring module

The appearance of MC2000 monitor module is shown in figure 2-6.

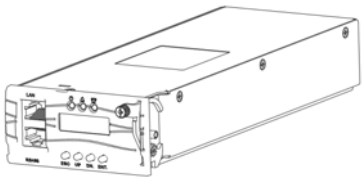


Figure2-6 appearance of monitor module

The front panel of the MC2000 monitor module is shown in figure 2-7.

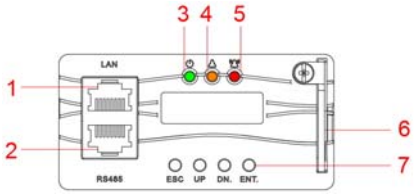


Figure2-7 front panel of the monitor module

(1) LAN port (2) RS485 port (3) Run indicator

(4) Minor alarm indicator (5) Major alarm indicator (6) Handle

(7) Buttons

Describes the buttons on the monitor panel is shown in table 2-4.

Table 2-4 Monitor button description

Button	Name	Description	
ESC	Return	Returns to the previous menu without saving the settings.	Press the ESC and ENT button at the same time within a short period of time can reset and restart the monitor.
ENT.	Confirm	• Enters the main menu from the standby screen. • Enters a submenu from the main menu. • Saves the menu settings.	
UP	Up	Turns to the previous menu or sets parameter values. When setting parameter values, you can hold down this button to quickly adjust values.	When the parameter value is set by multiple string types, press up or down button to change each value. After setting the value, press the confirm button to move the cursor back automatically
DN.	Down	Turns to the next menu or sets parameter values. When setting parameter values, you can hold down this button to quickly adjust values.	

Describes the indicator on the monitor panel is shown in table 2-5.

Table 2-5 Indicator description

Type	Color	State	Instructions
Run indicator	Green	Normally on	Monitor is running properly
		Flickering	Monitor is running properly ,but is not communicating
		Off	Monitoring isfault or has no DC input
Minor alarm indicator	Yellow	Normally on	The monitor generates a minor alarm.
		Off	The monitor does not generate any minor alarms.
Major alarm indicator	Red	Normally on	A major alarm is generated
		Off	No major alarm is generated

The monitor provides two communication ports (Reserve the RJ45 interface) The functional description is shown in the table 2-6.

Figure2-8 RS485 Communication interface pin:

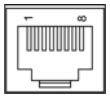


Table 2-6 RS485 Communication interface description table

Pin number	1	2	3	4	5	6	7	8
The signal name	RS485+	-	RS485-	-	-	-	-	-

2.5.5 user interface board

The user interface board front panel as shown in figure 2-9：

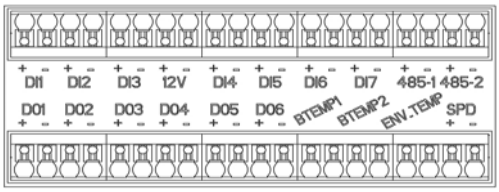


Figure2-9 User interface board front pane

User interface board contains 7 sets of DI and 6 sets of DO, respectively with DI1~DI7 7 sets of input, expressed in DO1 ~ DO6 6 sets of output。

Factory defaults in DI settings screen are shown in table 2-7：

Table 2-7 Factory defaults in DI settings screen

Digital No.	Digital name	DI Normal	Description
DI1	Climate Alarm	Open	Digital input 1 Alarm ,Default settings: Climate Alarm
DI2	Door Alarm	Open	Digital input 2 Alarm ,Default settings: Door Alarm
DI3	Digital3 Alarm	Open	Digital input 3 Alarm, User programmable.
DI4	Digital4 Alarm	Open	Digital input 4 Alarm, User programmable.
DI5	Digital5 Alarm	Open	Digital input 5 Alarm, User programmable.
DI6	Digital6 Alarm	Open	Digital input 6 Alarm, User programmable.
DI7	Digital7 Alarm	Open	Digital input 7 Alarm, User programmable.

Factory defaults in DO settings screen are shown in table 2-8:

Table 2-8 Factory defaults in DO settings screen

Digital No.	Digital name	Alarm mode	Description
DO1	Relay output 1	Closed	User programmable
DO2	Relay output 2	Closed	User programmable
DO3	Relay output 3	Closed	User programmable
DO4	Relay output 4	Closed	User programmable
DO5	Relay output 5	Closed	User programmable
DO6	Relay output 6	Closed	User programmable

Wiring methods:

1, with wire stripping pliers remove the dry contacts alarm signal lines insulation, wire core exposed length shall not be less than10 mm;

2, use slot type screwdriver to press the terminal button at the top of the card spring to insert the cable terminal connection at the button of the mouth, loosen the button to complete the connection;

3, with handle gently pull cables, to ensure that the cable does not fall off.

2.6 Technical Specifications

2.6.1 Environmental Specifications

Table 2-9 Environmental Specifications

Item	Specifications
Operating temperature	-40℃ ~ + 75℃ (+55 ~ + 75 ℃ derating work properly)
Transportation temperature	-40℃ ~ + 70℃
Storage temperature	-40℃ ~ + 70℃

Operating humidity	5%RH～95%RH
Storage humidity	5%RH～95%RH
Altitude	0～4000m（Under the environment of 3000 m ~ 4000 m high temperature derating, every 200 m, working temperature by 1 ℃）

2.6.2 Electrical Specifications

Table 2-10 Electrical Specifications

Item		Specifications
AC input	Input system	TT/TN,Phase voltage 220Vac
	Input frequency	50Hz（47Hz～63Hz）;The rated frequency：50Hz/60Hz
	The power factor	≥ 0.99@(rate input voltage,full load)
DC output	Output voltage range	-43Vdc～-58Vdc
	Output rated voltage	-53.5Vdc
	Maximum power output	18KW（The system satisfies N+1 backup, and the long-term working output current does not exceed 250A）
	Voltage regulation accuracy	≤ ±1%(the output voltage is stable in the range of 53.5Vdc± 0.1Vdc at half-load)
	Peak to peak value noise voltage	≤ 200mV(rated input voltage and load range)
	The telephone weigh the noise voltage	≤ 2mV（300Hz～3400Hz，The input voltage≤ 260Vac）
	Average current imbalance	≤ ±5%（176Vac～290Vac，50%～100%Load）
AC input protection	AC input overvoltage protection point	310±10Vac
	AC input overvoltage recovery point	290Vac～300Vac
	AC input under voltage protection point	80±5Vac
	AC input under voltage recovery point	80Vac～90Vac
DC output protection	DC output overvoltage protection point	60±2V (lock)
Rectifier module	Efficiency	The highest point≥ 96%； ≥ 95%（220Vac，30%～100%load）
	The output power	3000W（Input voltage range：176Vac～300Vac） 1250W（Input voltage range：85Vac～176Vac Linear derating）
	Overvoltage protection	The module locks up when the voltage is over voltage； The external voltage is above 60±2Vdc and lasts above 500ms,The module is locked.
EMC specifications	Conducted interference	AC port EN 55022 class A
		DC port EN 55022 class A
	Radiated interference	EN 55022 class A
	Harmonic current	IEC 61000-3-12
	Voltage flicker and wave	IEC 61000-3-3
	Electrostatic discharge resistance（ESD）	IEC 61000-4-2 Shell port contact discharge 6kV, air discharge 8kV, signal port contact discharge 2kV
	Electrical fast pulse group disturbance rejection（EFT）	IEC 61000-4-4 AC/DC power port 2kV

	Radiation immunity (RS)	IEC 61000-4-3 10V/m Magnetic field intensity
	Conduction immunity (CS)	IEC 61000-4-6 The power port meets the requirement of 10V and the signal port meets the requirement of 3V
	Surge immunity (SURGE)	IEC 61000-4-5 AC/DC power port differential mode 2kV, total mode 4kV , 8/20μs
	Voltage dip and break Off during short circuit (DIP)	Meet IEC 61000-4-11 standard requirements
Other	SPD	AC SPD protection: Class C ;DC SPD protection: Class D
	Safety design	Meet the standard IEC/EN60950-1/GB 4943
	Insulation resistance	Remove the monitoring module and rectifier module, lightning protection module, DC part, AC part and the chassis of the insulation resistance between > 10mΩ (test voltage 500 Vdc)
	Dielectric strength	Apply 3000Vac (or 4242Vdc) to AC input and DC output;The AC part is applied to the enclosure with 1500Vac (or 2121Vdc);Apply 500Vac (or 707Vdc) between DC output and housing.No breakdown of flight arc and leakage current is less than 10mA.

2.6.3 Mechanics Specifications

Item		Specifications
Mechanical	Power system (H×W×D)	220.3mm×482.0mm×350.6mm
	weight	≤ 20kg (Rectifier modules are not included)
	Protection grade	IP20
	installation	Support 19 inch rack mounting
	In and out mode	Into the line above, out the line above
	Maintenance mode	In front of the maintenance
	The cooling way	Forced air cooling

Charpter 3 System Installation

This chapter describes the installation requirements, installation, cable connection and installation.

3.1 Installation Requirements

3.1.1 Construction Personnel Requirements

Only trained and qualified construction personnel are allowed to perform the installation.

NOTICE

Our company will not be liable for the damage to devices or injury to humans caused by failure to following instructions in this document.

Before installation, pay attention to the following items:

- The customer's technical engineers must be trained and be familiar with the proper installation and operational methods.
- The number of installation personnel varies based on the project progress and the installation environment. Typically, two to four persons are required.

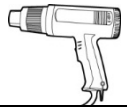
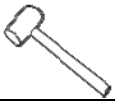
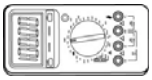
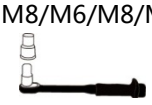
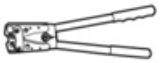
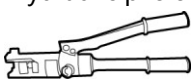
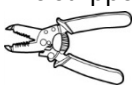
3.1.2 Tools Requirements

NOTICE

Use tools with insulated handles!

Introduction of tools and instrumentation (including, but not limited to, use of the following table tools) required before installation operations are performed.

Table 3-1 Tools and meters

Tools and Meters				
Pallet truck 	Ladder 	Hammer drill and drill bit 	Utility knife 	Heat gun 
Rubber mallet 	Insulated adjustable wrench 	Multimeter 	Flat-head screwdriver 	Phillips screwdriver 
Ruler 	Insulated torque wrench M5 M8/M6/M8/M12 	Cable tie 	Wire nippers 	Insulation gloves 
Polyvinyl chloride (PVC) insulation tape 	Combination wrench 	Heat shrink tubing 	Crimping pliers 	Insulation protective shoes 
Hydraulic pliers 	Diagonal pliers 	Wire stripper 	Measuring tape 	Marker 

3.1.3 Requirements for Cable Routing

- Cables should be more than 20 mm away from heat sources to prevent insulation layer damage (melting) functional degradation (aging or breakage).
- The bending radius of cables should be at least five times the diameter of the cables.
- Cables of the same type should be bound together. Cables of different types should be a minimum of 30 mm from each other to avoid tangling.
- Cables that are bound together should be close to each other, tidy, and undamaged.
- Ground cables must not be bound to or tangled with signal cables. There should be an appropriate distance between them to minimize interruptions.
- AC power cables, DC power cables, signal cables, and communications cables must be bound separately.
- Power cables must be routed straight. No joints or welding should be performed on power cables.
- Use a longer cable if necessary.

3.2 Installing Subrack

3.2.1 Planned installation space

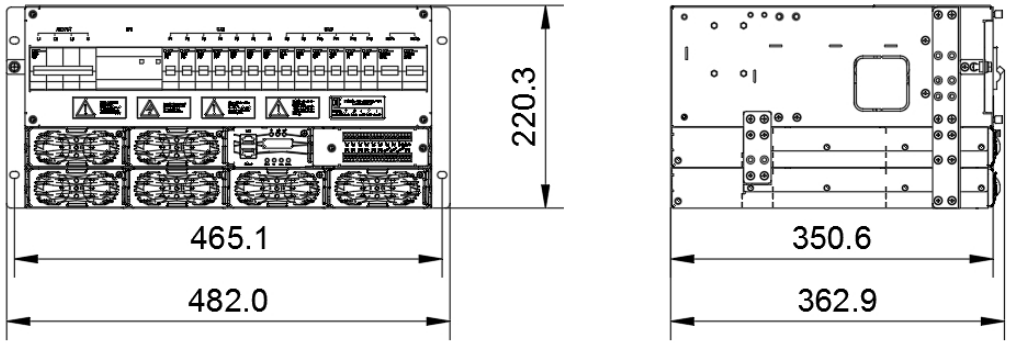


Figure3-1 Installation space requirements

3.2.2 Unpacking and Acceptance

- Step 1. Check if the packing boxes are intact.
  If the packing case is seriously damaged or wet, please find out the reason and give us feedback.
- Step 2. Open the box.
- Step 3. Check the number of parts on the packing list.
  If the quantity is different from that on the packing list, please confirm the reason and give us feedback.

3.2.3 Installing Subrack

Install the subrack to the 19-inch rack, as shown in figure 3-2.

- Step 1.remove the plug from the package.
- Step 2.Push the plug into the 19-inch rack.
- Step 3.install the fixed screw (if the mounting hole of the plug frame ear does not correspond to the position of the floating nut of the frame, it needs to be adjusted according to the actual installation).

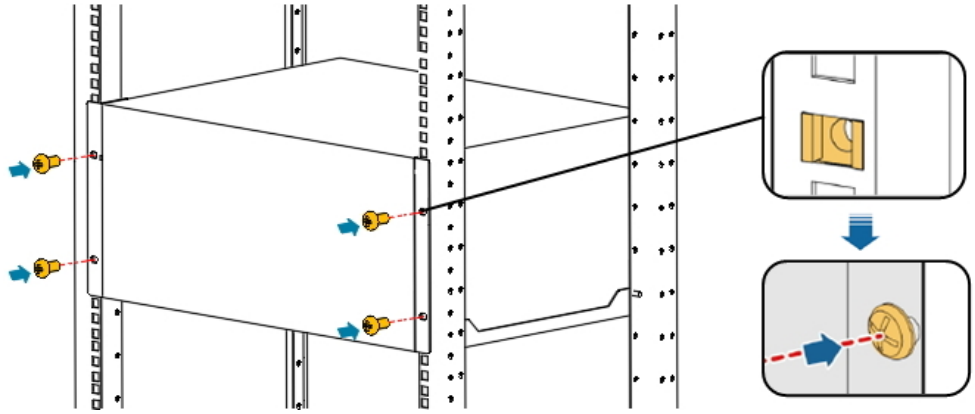


Figure3-2 Installing subrack

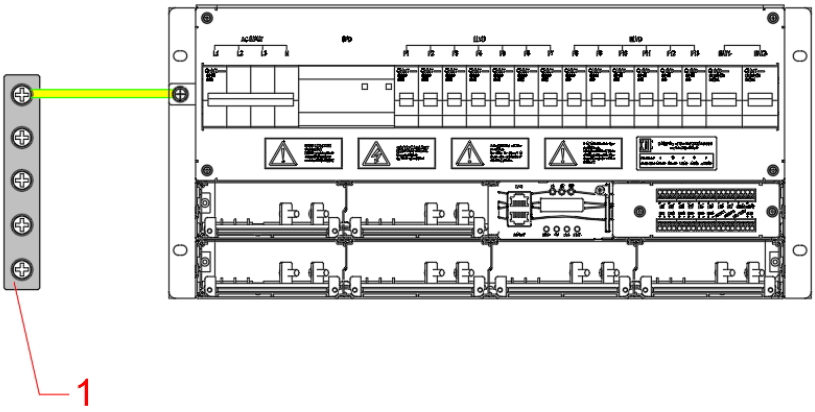
3.3 Install the module and cable

3.3.1 Install the ground cable

CAUTION

Ensure that the ground cable is installed securely. If devices are not properly grounded, damage to devices or human injuries may occur.

- Step 1. Connect one end of the protective ground wire to the M6 screw on the PE row in the insert box.
- Step 2. Connect the other end of the protection ground wire to the ground set screw on the cabinet/rack, as shown in figure 3-3. The sequence number 1 is the ground set.



(1) Grounding Busbar

Figure3-3 Install protective grounding

3.3.2 Install the rectifier module

NOTICE

1 . Do not put your hand into the slot of the rectifier module to avoid electric shock;

2 . Non-professional maintenance staff can not hot plug .

- Step 1, Take out the rectifier from the package.
- Step 2, Hold the rectifier handle on the front panel and put the rectifier onto the slot
- Step 3,Push the rectifier module slowly to the front panel of the module and flush with the power distribution panel
- Step 4,Tighten the fixing screws on the front panel of the rectifier to lock the rectifier automatically to the power distribution sub-rack.

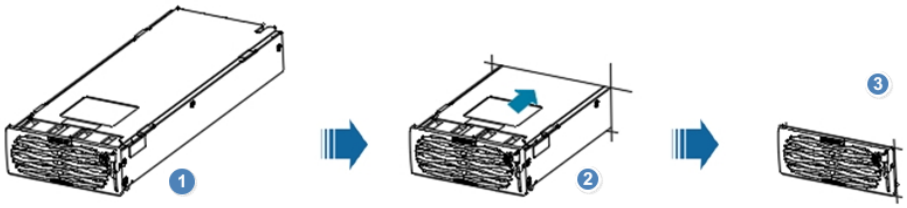
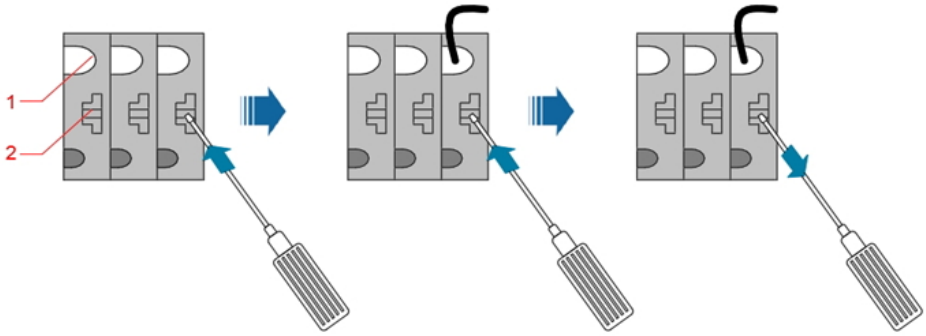


Figure3-8 Installing a rectifier

3.3.3 Installation of dry contact signal line (optional)

- Step 1: use one word screwdriver to push the contact piece corresponding to the dry contact point to make the metal shrapnel of the dry contact point to spring up;
- Step 2: install the signal line into the corresponding dry contact interface;
- Step 3. Retrieve the screwdriver and make sure the dry contact signal line is connected tightly.

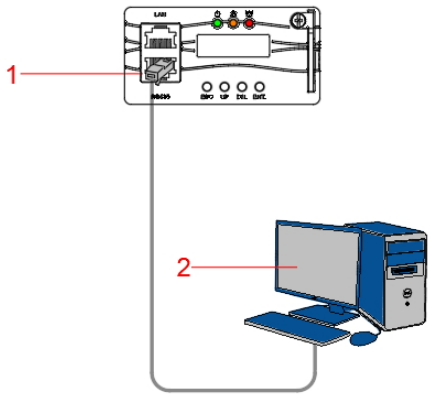


(1) Wire hole (2) Contact button

Figure3-9 Dry contact signal line installation process

3.3.4 Install communication cables

- Step 1. Connect one end of the cable to the RS485 port of the monitoring module.
- Step 2: connect the other end of the cable to the upper computer network port, as shown in figure3-10.



(1) MC2600 RS485 interface (2) upper computer

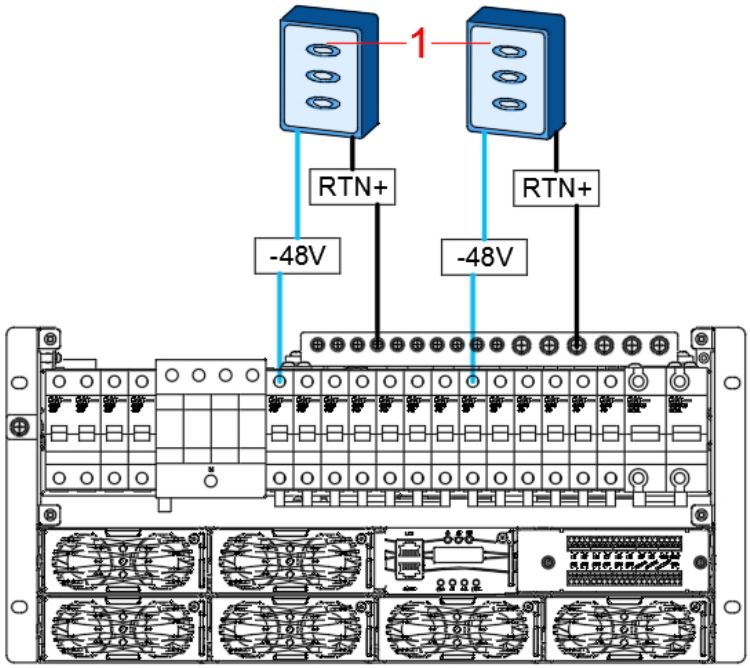
Figure3-10 Communication cable connection diagram

3.3.5 Install DC output cable

- Step 1: place the DC output cable. Insert the DC output cable through the hole on the right side of the subrack or remove the front cover wiring ①。
- Step 2. Fastening the DC output cathode cable to the DC output of the corresponding specification to MCB according to the actual load capacity.
- Step 3. Fastening DC output anode cable to the screw of RTN+ bus specifications.

NOTICE

①The front cover should be removed according to the need of connection before the installation of the system. When the top cover is removed, enough space should be reserved on the upper part of the plug frame for convenient construction。



(1) DC load

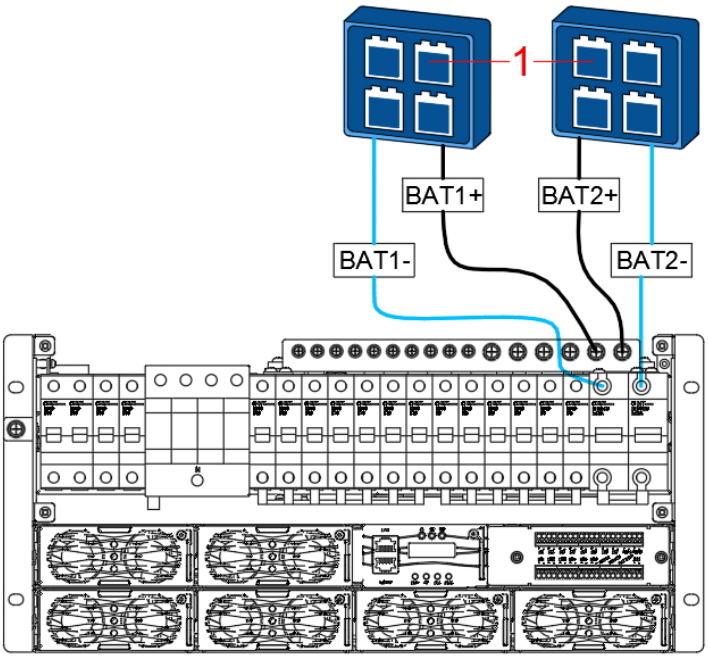
Figure3-11 DC output cable wiring diagram

3.3.6 Install the battery cable

DANGER

1. No smoking or sparking near the battery.
2. Turn off the battery breaker before installing the battery.
3. Comply with battery manufacturer's regulations and warnings. Use tools with insulated handles, otherwise the battery may burn out and personal injury may occur.
4. Wear goggles, rubber gloves and protective clothing during battery operation.
5. Remove conductive items such as watches, bracelets and rings. If battery fluid enters the eye, flush with cold water for more than 15 minutes and seek medical attention immediately.
6. If battery acid touches skin or clothing, wash immediately with soap and water.
7. Do not use metal to contact two or more battery terminals at the same time. Otherwise, a transient short circuit can produce a spark or explosion.
8. Do not short circuit or reverse connect positive or negative battery terminals during battery installation.
9. When the current is too high, loose connections can lead to excessive voltage drops or battery burning.
10. Make sure the battery comes from the same manufacturer and the same model, and has close voltages. Old batteries cannot be used together.

- Step 1: place the battery cable. Insert the battery cable through the hole on the right side of the subrack or remove the front cover wiring.
- Step 2. Fastening the battery cathode cable to the battery empty.
- Step 3. Fastening the battery anode cable to the RTN+ bus.



(1) The battery pack

Figure3-12 battery wiring diagram

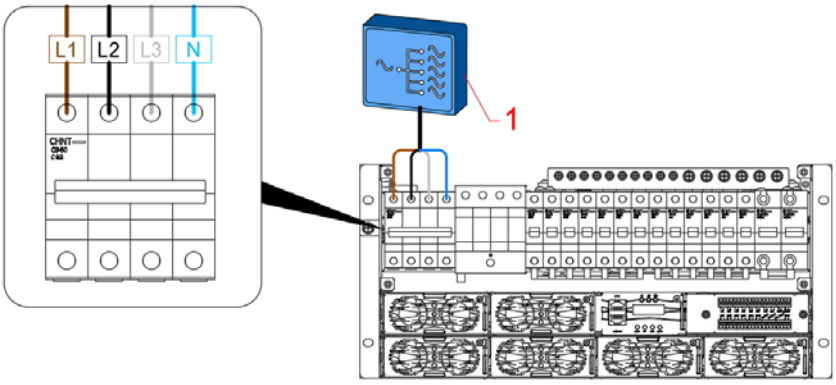
3.3.7 Install AC input cable

DANGER

1、Make sure the front AC input is left open to an OFF state, and place a prominent "do not operate" sign.

2、Put all MCB OFF before installing the cable.

- Step 1: put the 220/380Vac three-phase four-wire AC input cable through the wire hole on the right side of the plug or remove the front cover wiring.
- Step 2: Fastening the AC input line to the corresponding AC input open and terminal, as shown in figure 3-13.



(1) AC distribution box/cabinet

Figure3-13 AC input cable wiring diagram

3.4 Inspection installation

3.4.1 Check hardware installation

- Check that all screws are properly fastened (especially those used for electrical connections) and that the flat washer and spring washer are properly installed.
- Check that the rectifier module is fully inserted into each slot and locked correctly.

3.4.2 Check electrical connection

- Check that all MCB are OFF.
- Check that the flat washer and spring washer are securely installed on all the terminals, and that all OT terminals are complete and correctly connected.
- Check whether the battery is properly installed and whether the battery cable is properly connected.
- Check that the input and output power cables and ground cables are properly connected.

3.4.3 Check the cable installation

- Check the cable installation
- Check that all cables are lined up neatly and tightly connected to their nearest cables, without twisting or overly bending.
- Check cable label is correct, firm and consistent.

Charpter 4 System Test

NOTICE

- The downgrading of the test steps may result in power failure or alarm and the warning center needs to be notified before and after the operation.
- The test personnel must undergo corresponding technical training. Please refer to the test instructions.
- The adjustment process is do not cut off power. Please stand on the dry insulation during operation. Do not wear metal objects such as watches and necklaces. Tools should be insulated.
- Before any "closing operation" in power equipment adjustment, it is necessary to check whether the status of relevant units or components meets the requirements.
- In the process of operation, if no other person is allowed to operate, the prohibited mark should be hung on the distribution equipment: "no closing, someone is operating".
- In the process of adjustment and testing, the side should be adjusted while observing. If abnormal phenomena are found, the machine should be shut down immediately. After identifying the cause, continue.

4.1 AC power on commissioning

- Step 1: measure the MCB input voltage of AC input, which should be between 85Vac and 300Vac.
- Step 2: set the AC input MCB to ON, measure the output voltage of the AC input to open, which should be between 85Vac and 300Vac.
- Step 3. Check the running indicator light (green) of the rectifier module, which should be in a constant light state.
- Step 4: measure the voltage between the -48v bus and RTN+ bus, which should be between -42Vdc and -58Vdc.

4.2 Set system parameters

NOTE

- Login again if there is no button operation within 10 minutes, and LCD backlight within 8 minutes.
- The default user name is “admin”, the default password is 1-user level, and 2-engineer (please consult the manufacturer if you need to obtain higher authorities).
  After the monitoring unit is powered on, the LCD display language selection interface，through “UP” or “DN.” select Chinese or English， press “ENT” enter the default system information interface after the key.
- In parameter Settings screen click "UP" or "DN. Select" Settings, press the "ENT" button to enter setup screen, as shown in 4-1.

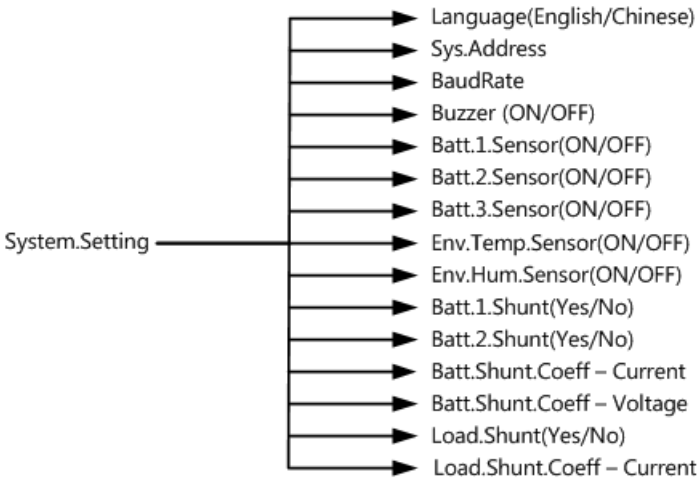


Figure4-1 system parameter setting

NOTE

1. battery parameters

Set battery capacity：

- If the battery branch 1 and battery branch 2 are connected to a battery pack with the same capacity, the "nominal capacity" is set to the sum of the two battery packs.
- If the battery branch 1 or branch 2 is connected in parallel to two battery packs of the same capacity, the "nominal capacity" is set to the sum of the two battery packs.

When the battery is lithium battery, the following Settings should be made:

- The setting of the average charging pressure value is the same as the floating charging pressure value, and the voltage value should be set according to the recommended value of lithium battery.
- Set the temperature compensation to "no" in the "temperature compensation" interface.

2. Set sensor parameters (optional): The user interface board is used for access. See 2.5.5.

3. Set the system date and time ：From the main interface of the monitoring module, press ESC button to enter the setting, and complete the setting through the monitoring button.

4.3 Set energy saving parameters

Click on the parameter setting screen “UP” or “DN.”，move the arrow to the "energy saving parameter" setting item，press “ENT” to the password setting interface. Enter the correct password and enter the energy saving parameter setting screen, as shown in figure 4-2.

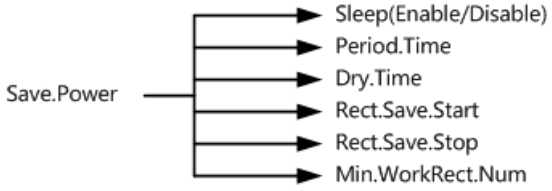


Figure4-2 Energy saving parameter setting screen

Energy saving parameters are advanced，you need to enter a high-level password to set it. If you want the system to run in energy efficient mode, the parameter of "energy saving permit" is set as "yes", otherwise it is set as "no".

4.4 Power on the battery for debugging

NOTICE

- After the battery parameters of the monitoring module are set correctly, the battery can be closed MCB; otherwise, the battery may be damaged.

- Step 1: set the AC input MCB to OFF.
- Step 2: set the battery MCB to OFF.
- Step 3:set the AC input MCB to ON
- Step 4: set all MCB to the required state in the actual field.
- Step 5: observe for 10 minutes. The monitoring module has no other alarm information except door contact alarm. The current and voltage parameters of the battery and load are normal.

4.5 Other dispose

- Put the removed panel or cover board back in place.
- The external paint of subrack should be kept intact. If any paint is removed, the paint part should be repainted immediately to prevent corrosion.
- Clean up the site and exit the site.

Charpter 5 System Maintenance

5.1 Routine maintenance

Table5-1 Routine maintenance checklist

Maintenance item	Maintenance content			
	Check the item	Check the method	Repair condition	Processing method
electrical	Whether the voltage output is normal	multimeter	The battery branch or load branch voltage exceeds the set	Please refer to 5.2 Alarm troubleshooting
The fault inspection	Whether the indicator light is normal	eyeballing	Failure warning	
appearance	Power system coating no peeling, no scratch	eyeballing	The power system looks damaged or deformed	Repaint and repair the housing
Grounding detection	Whether the power supply is connected to the grounding bar of the machine room	eyeballing、screwdriver, wrench and other tools	Check the power connection point and the grounding bus of the machine room The cable connection is not	Retighten the grounding point or replace the grounding cable

5.2 The alarm fault handling

5.2.1. AC power failure

Possible causes：

1. The AC input power cable is faulty.
2. The AC input circuit breaker is OFF.
3. The mains grid is faulty.

Measures：

1. Check whether the AC input cable is loose. If yes, secure the AC input cable.
2. Check whether the AC input circuit breaker is OFF. If yes, handle the back-end circuit failure and then switch on the circuit breaker.
3. Check whether the AC input voltage is lower than 50 Vac. If yes, handle the mains grid fault.

5.2.2. AC overvoltage

Possible Causes:

1. The AC overvoltage alarm threshold is not set properly on the monitoring module.
2. The power grid is faulty.

Measures：

1. Check whether the AC overvoltage alarm threshold is properly set. If no, adjust it to a proper value.
2. Check whether the AC input voltage exceeds the AC overvoltage alarm threshold (280 Vac by default). If yes, handle the AC input fault.

5.2.3. AC undervoltage

Possible Causes:

1. The AC undervoltage alarm threshold is not set properly on the monitoring module.
2. The power grid is faulty.

Measures：

3. Check whether the AC undervoltage alarm threshold is properly set. If no, adjust it to a proper value.
4. Check whether the AC input voltage is below the AC undervoltage alarm threshold (180Vac by default). If yes, handle the AC input fault.

5.2.4. DC overvoltage

Possible Causes:

1. The DC overvoltage alarm threshold is not set properly on the monitoring module.
2. The power system voltage is set too high in manual mode.
3. Rectifiers are faulty.

Measures：

1. Check whether the DC overvoltage alarm threshold (58Vdc by default) is properly set. If no, adjust it to a proper value.
2. Check whether the system voltage is set too high in manual mode. If yes, confirm the reason and adjust the voltage to normal after the operation.
3. Remove the rectifiers one by one and check whether the alarm is cleared. If the alarm still exists, reinstall the rectifier. If the alarm is cleared, replace the rectifier.

5.2.5. DC undervoltage

Possible Causes:

1. AC power failure occurs.
2. The DC under voltage alarm threshold is not set properly on the monitoring module.
3. The system configuration is not proper.
4. The power system voltage is set too low in manual mode.
5. Rectifiers are faulty.

Measures：

1. Check whether an AC power failure occurs. If yes, resume the AC power supply.
2. Check whether the DC under voltage alarm threshold (45Vdc by default) is properly set. If no, adjust it to a proper value.
3. Check whether the load current is greater than the current power system capacity. If yes, expand the power system capacity or reduce the load power.
4. Check whether the system voltage is set too low in manual mode. If yes, confirm the reason and adjust the voltage to a proper value after the operation.
5. Check whether the power system capacity is insufficient for the loads due to rectifier failures. If yes, replace the faulty rectifier.

5.2.6. The battery overcharged

Possible Causes:

1. The rectifier communication is interrupted
2. Poor contact of the monitoring module.
3. The monitoring module is faulty.

Measures：

1. Check whether an alarm is generated for rectifier communication interruption. If yes, remove the rectifier and reinstall it to check whether the alarm is cleared. If the alarm still exists, replace the rectifier.

2. Remove the monitoring module and reinstall it to check whether the alarm is cleared. If the alarm still exists, replace the monitoring module.

5.2.7. LLVD Disconnected

Possible Causes：

1. AC power failure occurs.
2. Loads are manually disconnected.
3. The load disconnection voltage is set too high on the monitoring module.
4. Rectifiers are faulty.
5. The system configuration is not proper.

Measures：

1. Check whether an AC power failure occurs. If yes, resume the AC power supply.
2. Check whether loads are manually disconnected. If yes, confirm the reason of the manual disconnection, and reconnect the loads after the operation.
3. Check whether the load disconnection voltage (44Vdc by default) is set too high on the monitoring module. If yes, adjust it to a proper value.
4. Check whether the power system capacity is insufficient for the loads due to rectifier failures. If yes, replace the faulty rectifier.
5. Check whether the load current is greater than the current power system capacity. If yes, expand the power system capacity or reduce the load power.

5.2.8. BLVD Disconnected

Possible Causes：

1. AC power failure occurs.
2. Batteries are manually disconnected.
3. The battery disconnection voltage is set too high on the monitoring module.
4. Rectifiers are faulty.
5. The system configuration is not proper.

Measures：

1. Check whether an AC power failure occurs. If yes, resume the AC power supply.
2. Check whether batteries are manually disconnected. If yes, confirm the reason of the manual disconnection, and reconnect the batteries after the operation.
3. Check whether the battery disconnection voltage (43.2Vdc by default) is set too high on the monitoring module. If yes, adjust it to a proper value.
4. Check whether the power system capacity is insufficient for the loads due to rectifier failures. If yes, replace the faulty rectifier.
5. Check whether the load current is greater than the current power system capacity. If yes, expand the power system capacity or reduce the load power.

5.2.9. Batt Loop Trip

Possible Causes：

1. The battery circuit breaker trips or battery fuse detection cable is disconnected.
2. The battery circuit breaker trips or battery fuse is blown.
3. The contactor is faulty.

Measures：

1. Check whether the battery circuit breaker trips or battery fuse detection cable is disconnected .If yes, reconnect the cable.
2. Check whether the battery circuit breaker trips or battery fuse is blown. If yes, rectify the battery loop fault and then switch on the circuit breaker or replace the fuse.
3. Manually switch on or switch off the battery contactor and check the battery current changes accordingly. If no, replace the contactor.

5.2.10. High Amb. Temp.

NOTE

This alarm is generated only for the power system that has ambient temperature sensors installed.

Possible Causes：

1. The ambient over temperature alarm threshold is not set properly on the monitoring module.
2. The temperature control system is faulty in the cabinet where the ambient temperature sensor is located.
3. The ambient temperature sensor is faulty.

Measures：

1. Check whether the ambient temperature alarm threshold (55°C by default) is properly set
2. on the monitoring module. If no, adjust it based on site requirements.
3. Check whether the temperature control system in the cabinet is faulty. If yes, rectify the fault. The alarm is cleared when the cabinet temperature falls within the allowed range.
4. Check whether the ambient temperature sensor is faulty. If yes, replace the ambient temperature sensor.

5.2.11. Low Amb. Temp.

NOTE

This alarm is generated only for the power system that has ambient temperature sensors installed.

Possible Causes：

1. The ambient under temperature alarm threshold is not set properly on the monitoring module.
2. The temperature control system is faulty in the cabinet where the ambient temperature sensor is located.
3. The ambient temperature sensor is faulty.

Measures：

1. Check whether the ambient under temperature alarm threshold (-20°C by default) is properly set on the monitoring module. If no, adjust it based on site requirements.
2. Check whether the temperature control system in the cabinet is faulty. If yes, rectify the fault. The alarm is cleared when the cabinet temperature falls within the allowed range.
3. Check Check whether the ambient temperature sensor is faulty. If yes, replace the ambient temperature sensor.

5.2.12. High Amb. Humi.

NOTE

This alarm is generated only for the power system that has humidity sensors installed.

Possible Causes：

1. The ambient over humidity alarm threshold is not set properly on the monitoring module.
2. The humidity is too high in the cabinet where the humidity sensor is located.
3. The humidity sensor is faulty.

Measures：

1. Check whether the ambient over humidity alarm threshold (95% RH by default) is properly set on the monitoring module. If no, adjust it based on site requirements.

2. Check whether water intrudes into the cabinet. If yes, wipe the water with dry cotton or other tools and rectify the fault.
3. Check whether the humidity sensor is faulty. If yes, replace the humidity sensor.

5.2.13. Low Amb. Humi.

NOTE

This alarm is generated only for the power system that has humidity sensors installed.

Possible Causes：

1. The ambient under humidity alarm threshold is not properly set on the monitoring module.
4. The humidity is too low in the cabinet where the humidity sensor is located.
5. The humidity sensor is faulty.

Measures：

1. Check whether the ambient under humidity alarm threshold (5% RH by default) is properly set on the monitoring module. If no, adjust it based on site requirements.
2. Check whether the cabinet humidity is too low. If yes, adjust the cabinet humidity. The alarm is cleared when the humidity falls within the allowed range.
3. Check whether the humidity sensor is faulty. If yes, replace the humidity sensor.

5.2.14. Batt. High Temp.

NOTE

This alarm is generated only for the power system that has battery temperature sensor installed.

Possible Causes：

1. The battery over temperature alarm threshold is not set properly on the monitoring module。
2. The battery temperature controlling system is faulty。
3. The battery temperature sensor is faulty。

Measures：

1. Check whether the battery over temperature alarm threshold (50°C by default) is properly set. If no, adjust it to a proper value.
2. Check whether the battery temperature controlling system is faulty. If yes, rectify the fault. The alarm is cleared when the battery temperature falls within the allowed range.
3. Check whether the battery temperature sensor is faulty. If yes, replace the temperature sensor.

5.2.15. Batt. Low Temp

NOTE

This alarm is generated only for the power system that has battery temperature sensor installed.

Possible Causes：

1. The battery under temperature alarm threshold is not set properly on the monitoring module。
2. The battery temperature controlling system is faulty。
3. The battery temperature sensor is faulty。

Measures：

1. Check whether the battery under temperature alarm threshold (-10°C by default) is properly set. If no, adjust it to a proper value.
2. Check whether the battery temperature controlling system is faulty. If yes, rectify the fault. The alarm is cleared when the battery temperature falls within the allowed range.
3. Check whether the battery temperature sensor is faulty. If yes, replace the temperature sensor.

5.2.16. Door Alarm

NOTE

This alarm is generated only for the power system that has door status sensor installed.

Possible Causes：

1. The cabinet doors are open.
2. The door status sensor is faulty.

Measures：

1. Close cabinet doors.
2. Check whether the door status sensor is faulty. If yes, replace the door status sensor.

5.2.17. Water Alarm

NOTE

This alarm is generated only for the power system that has water sensors installed.

Possible Causes：

1. Water intrudes into the cabinet.
2. The water sensor is faulty.

Measures：

1. Check whether water intrudes into the cabinet. If yes, wipe the water with dry cotton or other tools and rectify the fault.
2. Check whether the water sensor is faulty. If yes, replace the water sensor.

5.2.18. Smoke Alarm

NOTE

This alarm is generated only for the power system that has smoke sensors installed.

Possible Causes：

1. There is smoke inside the cabinet.
2. The smoke sensor is faulty.

Measures：

1. Check whether there is smoke inside the cabinet. If yes, disconnect the power supply from the cabinet, handle the fault, and then resume system operation and clear the alarm on the monitoring module.
2. Check whether the smoke sensor is faulty. If yes, replace the smoke sensor.

5.2.19. Rect Fault

Possible Causes：

1. The rectifier is in poor contact.
2. The rectifier is faulty.

Measures：

1. Check the Fault indicator on the rectifier panel. If it is steady red, remove the rectifier ,and then reinstall it after the indicator turns off.
2. If the alarm still exists, replace the rectifier.

5.2.20. Rect Protection

Possible Causes：

1. The rectifier input voltage is too high.
2. The rectifier input voltage is too low.
3. The ambient temperature is too high.
4. The rectifier is abnormal.

Measures：

1. Check whether the AC input voltage exceeds the upper threshold of the rectifier working voltage. If yes, rectify the power supply fault and then resume the power supply.
2. Check whether the AC input voltage is below the lower threshold of the rectifier working voltage. If yes, rectify the power supply fault and then resume the power supply.
3. Check whether the ambient temperature is higher than the normal operating temperature of the rectifier. If yes, check and rectify the temperature unit fault.
4. Remove the rectifier that generates the alarm and reinstall it after the indicator turns off. If the alarm still exists, replace the rectifier.

5.2.21. Rect Comm Fault

Possible Causes：

1. The rectifier is removed.
2. The rectifier is in poor contact.
3. The rectifier is faulty

Measures：

1. Check whether the rectifier is removed. If yes, reinstall it.
2. If the rectifier is in position, remove the rectifier and reinstall it
3. If the alarm still exists, replace the rectifier.

5.2.22. AC SPD Alarm

Possible Causes：

1. The AC SPD is faulty.
2. The AC SPD detection cable is disconnected.

Measures：

1. Check whether the AC SPD indication window turns red. If yes, replace the SPD.
2. Check whether the AC SPD detection cable is disconnected. If yes, reconnect the cable.

5.2.23. DC SPD Alarm

Possible Causes：

1. The DC SPD is faulty.
2. The DC SPD detection cable is disconnected.

Measures：

1. Check whether the DC SPD indication window turns red. If yes, replace the SPD.
2. Check whether the DC SPD detection cable is disconnected. If yes, reconnect the cable.

5.3 Identifying Component Faults

5.3.1. Identifying Circuit Breaker Faults

The following lists main circuit breaker faults：

- The circuit breaker cannot be switched to ON/OFF after the short circuit fault for its end circuit is rectified.

- When the circuit breaker is switched to ON and its input voltage is normal, the voltage between the two ends of the circuit breaker exceeds 1 V.
- The input voltage is normal, but the resistance between both ends of the circuit breaker is less than1kΩ when the circuit breaker is OFF.

5.3.2. Identifying AC SPD Faults

- Check the color of the AC SPD indication window. Green indicates that the AC SPD is normal. Red indicates the AC SPD is faulty.

5.3.3. Identifying DC SPD Faults

- Check the color of the DC SPD indication window. Green indicates that the DC SPD is normal. Red indicates the DC SPD is faulty.

5.3.4. Identifying Rectifier Faults.

A rectifier is damaged if any of the following conditions is not met：

- When the rectifier does not communicate with the monitoring module and the AC input voltage is around 220Vac, the green indicator on the rectifier is steady on, the yellow indicator is blinking, the red indicator is off, and the rectifier output is normal.
- The monitoring module can perform equalized charging, float charging, and current limiting control for the rectifier when the communication cable to the rectifier is correct.

5.3.5. Identifying Monitoring Module Faults

The following are the main symptoms of monitoring module faults：

- The DC output is normal while the green indicator on the monitoring module is off.
- The monitoring module breaks down or cannot be started. Its LCD has abnormal display or buttons cannot be operated.
- With the alarm reporting enabled, the monitoring module does not report alarms when the power system is faulty.
- The monitoring module reports an alarm while the power system does not experience the fault.
- The monitoring module fails to communicate with the connected lower-level devices while the communications cables are correctly connected.
- Communication between the monitoring module and all rectifiers fails while both the rectifiers and the communications cables are normal.
- The monitoring module cannot monitor AC or DC power distribution when communications cables are intact and AC and DC power distribution is normal.
- Parameters cannot be set or running information cannot be viewed on the monitoring module.

Charpter 6 Acronym

AC	alternating current
BLVD	battery low voltage disconnection
DC	direct current
EMI	electromagnetic interference
EMS	electromagnetic susceptibility
ESD	electrostatic discharge
HTTPS	hypertext transfer protocol secure
IEC	International electrotechnical commission
LCD	liquid crystal display
LLVD	load low voltage disconnection
MTBF	mean time between failures
MC	monitoring controller
MCB	miniature circuit breaker
SPD	surge protection device