NetSure 731 A91 插框电源系统

用户手册

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NetSure 731 A91 Subrack Power System

User Manual

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维谛技术有限公司为客户提供全方位的技术支持，用户可与就近的维谛技术有限公司办事处或客户服务中心联系，也可直接与公司总部联系。

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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 Vertiv 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, rings.

When water or moisture is found on the Subrack, 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.

VI. Dangerous energy

Warning

More than 240VA system capacity, keep away from hazardous energy and avoid bridge connection.

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.

Battery installation requires reliable grounding. And battery is connected before accessing the battery protection device.

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.

Contents

Chapter 1 Overview

This chapter introduces model composition and configuration and features of NetSure 731 A91-S1, NetSure 731 A91-S2 and NerSure 731 A91-S3 (abbreviated as 'power system' hereinafter).

1.1 Composition and Configuration

Composition

The power system is composed of power distribution、rectifier modules and controller module.

Take NetSure731 A91-S1 for example, the internal structure is shown as Figure 1-1.

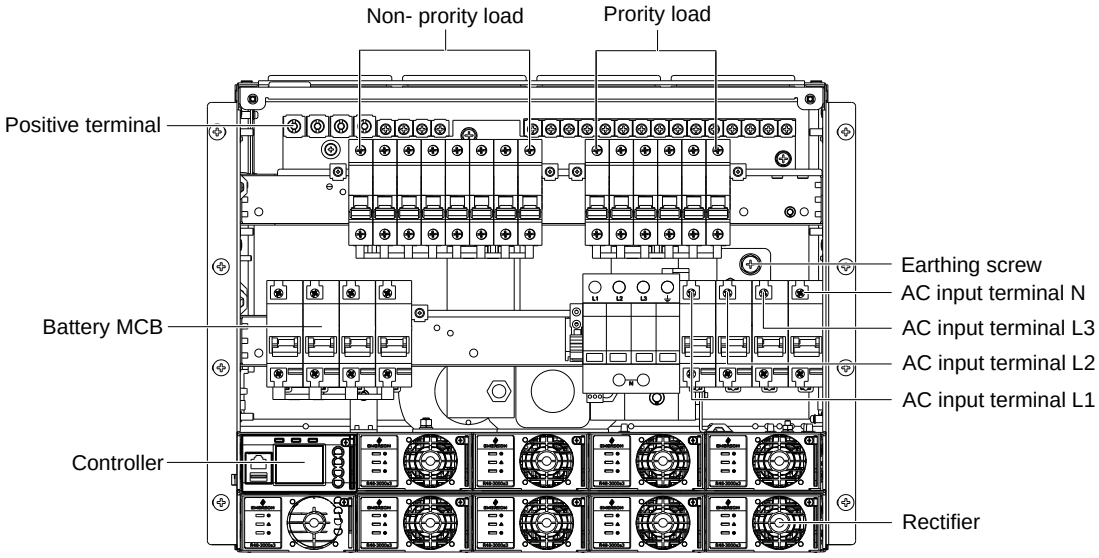


Figure 1-1 NetSure 731 A91- S1 system instruction

Configuration

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

Table 1-1 Configuration of power system

Item	NetSure 731 A91-S1	NetSure 731 A91-S2	NetSure 731 A91-S3
Controller	Mode: M830B	Mode: M530B	Mode: M830B
Rectifier	Model: R48-3500e3 Maximum configuration：9 pieces	Model： R48-3000e3/R48-3500e3 Maximum configuration：9 pieces Note: R48-3000e3 moudle and R48-3500e3 moudle are not mixed	Model： R48-3000e3 Maximum configuration：9 pieces
AC power distribution	3P＋N＋PE/380-415Vac	3P＋N＋PE/380-415Vac	3P＋N＋PE/380-415Vac
DC power distribution	PL: 63A/1P×2 MCB 32A/1P×2 MCB 16A/1P×2 MCB NPL: 63A/1P×3 MCB 32A/1P×3 MCB 16A/1P×2 MCB	PL: 63A/1P×2 MCB 32A/1P×2 MCB 16A/1P×2 MCB NPL: 63A/1P×3 MCB 32A/1P×3 MCB 16A/1P×2 MCB	PL: 63A/1P×2 MCB 32A/1P×2 MCB 16A/1P×2 MCB NPL: 63A/1P×3 MCB 32A/1P×3 MCB 16A/1P×2 MCB
AC output MCB	/	/	/
Battery MCB	4×125A/1P	4×125A/1P	4×125A/1P
AC SPD	1 piece	1 piece	1 piece
DC SPD	1 piece	1 piece	1 piece

Item	NetSure 731 A91-S1	NetSure 731 A91-S2	NetSure 731 A91-S3
Cover	Standard	Standard	Standard
BLVD controller control mode	Controller without power-losing mode	Controller without power-losing mode	Controller without power-losing mode

Main Features

- The rectifier uses the active Power Factor Compensation(PFC) technology and the power factor is up to 0.99.
- The power system has wide AC input voltage: 85Vac～300Vac.（Module single phase input voltage）。
- The rectifier uses soft switching technology, raising the efficiency above 95.3％.
- The rectifier has Ultra-low radiation. With advanced EMC design, the rectifier meets international standards such as CE、NEBS and YD/T983.Both the conducted and radiated interference reach Class B.（R48-3500e3 moudle reach Class B，R48-3000e3 moudle reach Class A）
- The rectifier safety design complies UL, CE and NEBS.
- The rectifier is of high power density.
- The rectifier is hot pluggable. It takes less than1 min to replace a rectifier.
- The rectifier has input over-voltage protection. The overvoltage protection point is set to 307.5V, which can be automatically restored.
- 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 controller module has perfect battery management. The management functions includes BLVD, temperature compensation, auto voltage regulation , stepless current limiting ,battery capacity calculation and on-line battery test, etc.
- History alarm records：M530B controller supports 200 history alarms and 5000 history data records, M830B controller supports 4000 history alarms and 60000 history data records.
- Battery test data: M530B controller can record up to 5 sets of battery test data. M830B controller can record up to 10 sets of battery test data.
- The power system is of network design. Providing multiple communication ports (such as RS232, RS485, USB, Ethernet and CAN), which enables flexible networking and remote monitoring.
- The power system has perfect lighting protection at both AC side and DC side.
- The power system has complete fault protection and fault alarm functions.

Chapter 2 Installation Instruction

2.1 Safety Regulation

Certain components in this power system carry hazardous voltage and current. Always following 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 48V and connected to the power system must comply with the requirements of SELV as defined in IEC 60950-1.

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 Vertiv Tech Co., Ltd.

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

Cables

The cable should be selected in accordance with 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 3.5A/mm2. The suggested CSA value is no less than the Table 2-1.

Table 2-1 AC cable CSA selection

AC MCB rated current	Max. AC input current	Min cable CSA	Max cable CSA
100A	64A	25mm2	50mm2

The CSA of DC cable depends on the current flowing through the cable and the allowable voltage drop. To select the battery cable CSA, see Table 2-2,select the DC load cable CSA according to the Table 2-3.

Table 2-2 Battery cable CSA selection

Battery MCB rated current	Max. battery current	Min cable CSA	Max cable length(volt drop: 0.35V with max. CSA)
125A	100A	35mm2	7m
Note: 1. The specs are applicable at ambient temperature of 25°C. 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 2-3 DC load cable CSA selection

Load route rated current	Max. output current	Min. cable CSA	Max cable length (volt drop: 0.35V with min. CSA)	Max. cable CSA	Max cable length (volt drop: 0.35V with max. CSA)
63A	63A	16mm2	5m	25mm2	8m
32A	32A	10mm2	6m	25mm2	15m
16A	16A	6mm2	8m	25mm2	31m
Note: The specs are applicable at ambient temperature of 25°C. If the temperature is higher than this, the CSA of the cable should be increased.					

To prevent the air switching capacity is too large, the load doesn't work when overload. Recommended the capacity of the air switching is up to 1.5~2 times of the load peak.

The CSA of the system grounding cables should be consistent with the largest power distribution cables. The CSA value is no less than 25mm2.

AC distribution、DC distribution interface definition see Table 2-4.

Table 2-4 AC distribution、DC distribution interface definition

Connector name		Connector specifications	Wiring instruction
AC power distribution	AC input MCB	H type terminal, max. cable CSA 50mm2	AC power line
	Grounding busbar	One M8 bolt, OT type wiring terminal, max. cable CSA 35mm2	Connected to the grounding bar of the building
DC power distribution	Battery output MCB	H type terminal, max. cable CSA 50mm2	Connected to the battery port
	Negative output MCB	H type terminal, max. cable CSA 25mm2	Connected to the users negative load port
	Positive busbar	Terminal subrack terminal：cable CSA ≤ 50mm2	Connected to the users positive load port

2.3 Mechanical Installation

📖 Note

1. The cabinet or rack that installed in the subrack must provide fireproof and electric protection casing, or install in cement or other difficult to burn, at the same time keep enough distance to other combustible material.

2. For the convenience of maintenance, users should maintain a clearance of 800mm at the front of the power system.

3. Subrack cannot be installed against the wall, it must leave enough space for heat dissipation.

Installed on the battery rack

Fix the subrack power system to the battery rack through the connectors with M6 bolts, as show in Figure 2-1.

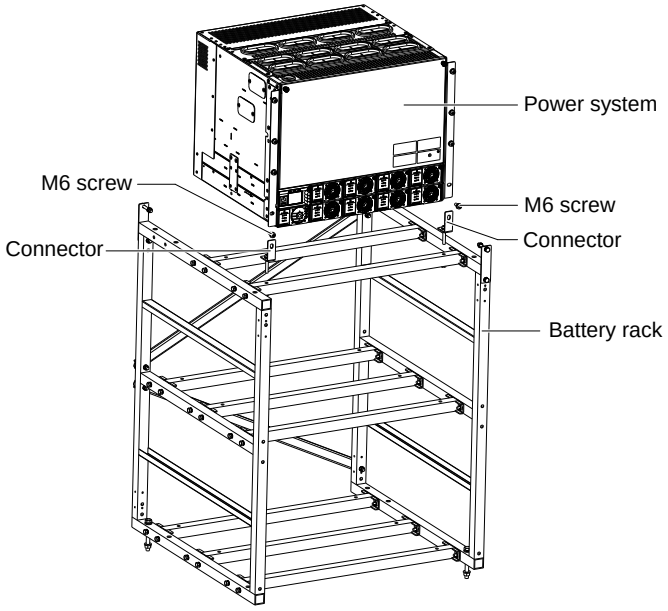


Figure 2-1 Cabinet and rack installation

Installed in cabinet

Insert the subrack power system to the matching cabinet, as shown in Figure 2-2.

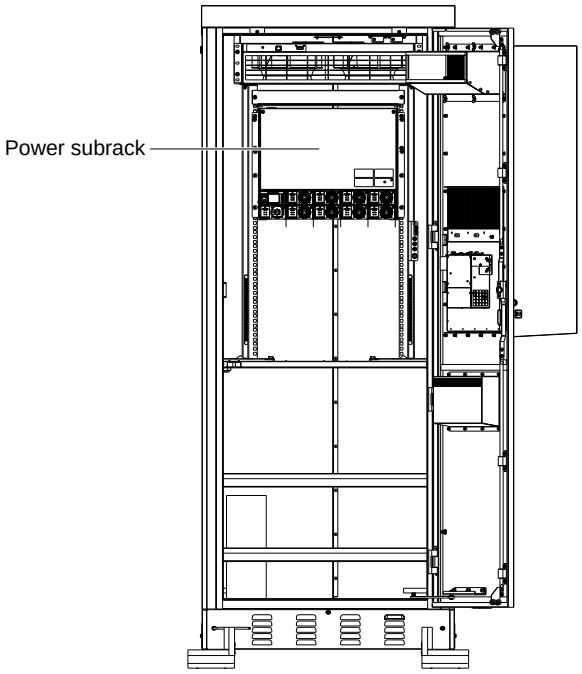


Figure 2-2 Installed in the cabinet system

The engineering graphics of the subrack power system as shown in Figure 2-3.

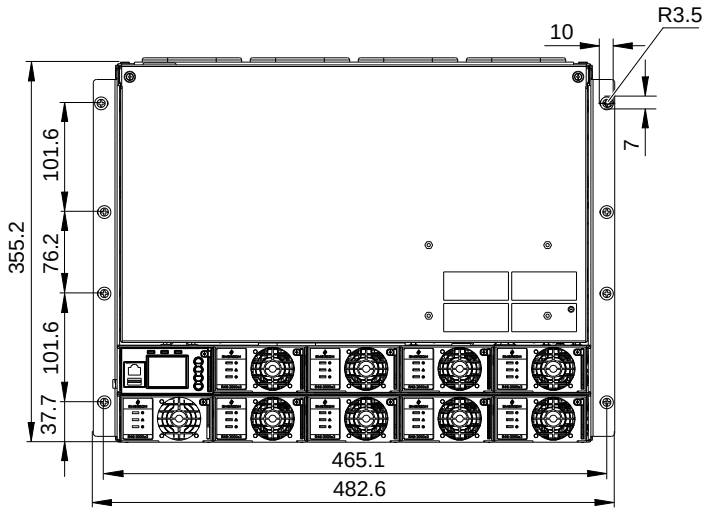


Figure 2-3 Installation size of 731 A91-S1/S2/S3（unit:：mm）

Note

1. Tighten the captive screw of the MFU Panel by the cross head screwdriver when there is no operation.
2. Also tighten the handle by the cross head screwdriver.
3. Please plug in the new modules or installing a new panel after removing the rectifier module.

2.4 Electrical Installation

2.4.1 Power System Cabling Method

Cabling from the top of the power system

The top cover is rubber ring top cover.

Rubber ring top cover for MFU unit cabling :

Use the electrician knife incise the "十" mark on the rubber unit. As shown in Figure 2-4. Cabling from the cable outlet area and then fixed to the cable--bunding plate and the top edge by using cable ties.

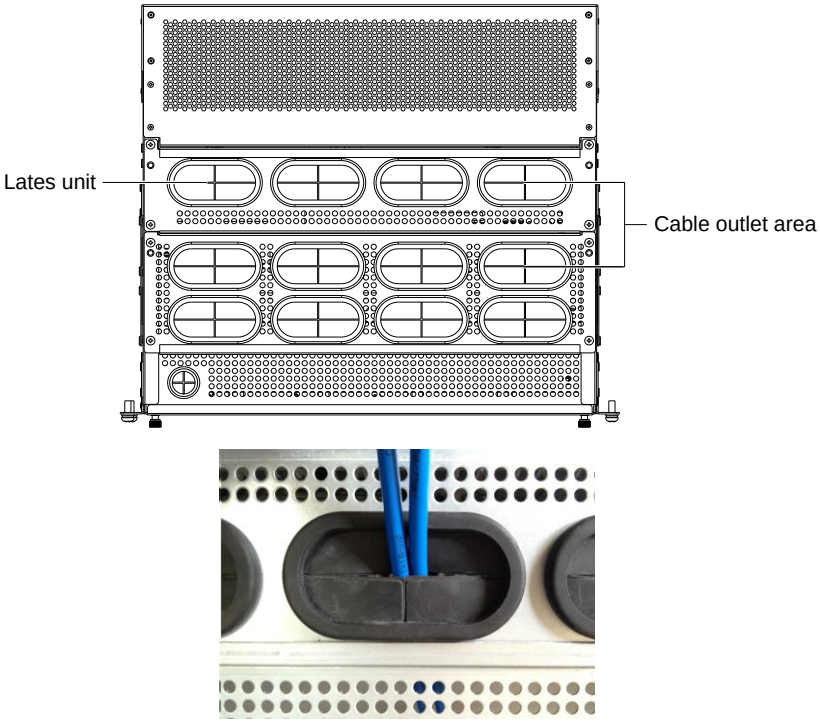


Figure 2-4 Cable entry illustration of the MFU unit

Cabling from the side of the power system

Use a cross head screwdriver to remove two screws which fix the cabling panel at side of cabling area, then the cable can be led out from the cabling area, as shown in Figure 2-5.

Warning

When the subrack is installed independently on the outside (not installed in the rack). Using system side outlet. The clearance of the outlet hole must be sealed after connecting the cable to prevent it from touching the live part of the frame.

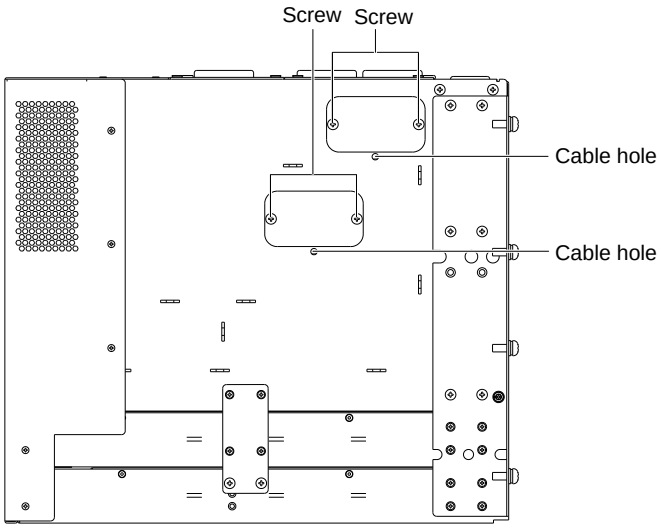


Figure 2-5 Side cabling

2.4.2 Connecting AC Input Cables

Danger

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

For NetSure 731 A91-S1 power system, the position of the connection terminals are shown in Figure 2-6.After connecting AC cables, fixing cables on top or side cable banding area by using cable ties.

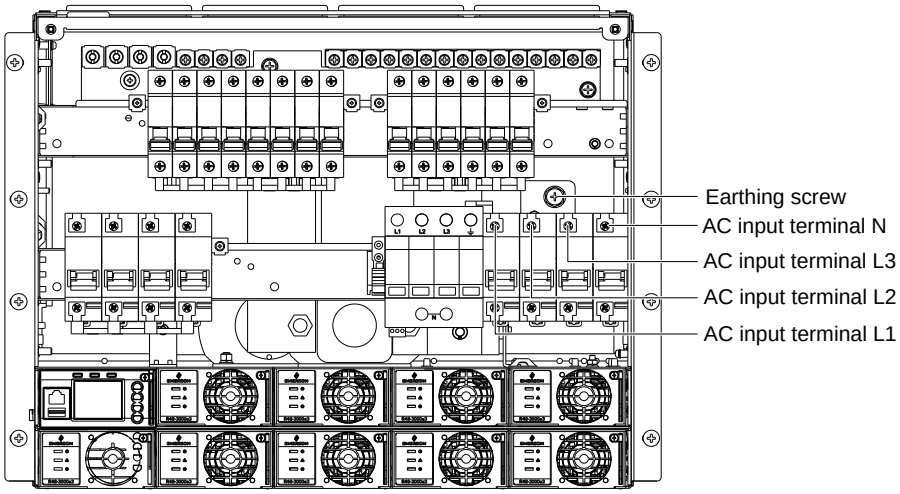


Figure 2-6 Illustration of NetSure 731 A91-S1 connection terminal

Note

1. Recommended tightening torque of user grounding screw is 11N*M.
2. In case system earthing cable lessen, please add another fixing point except for the earthing screw.

2.4.3 Connecting Load Cables

Connect the negative load cable to the upper terminal of load MCB and then connect the positive load cable to positive terminal. As shown in Figure 2-7.

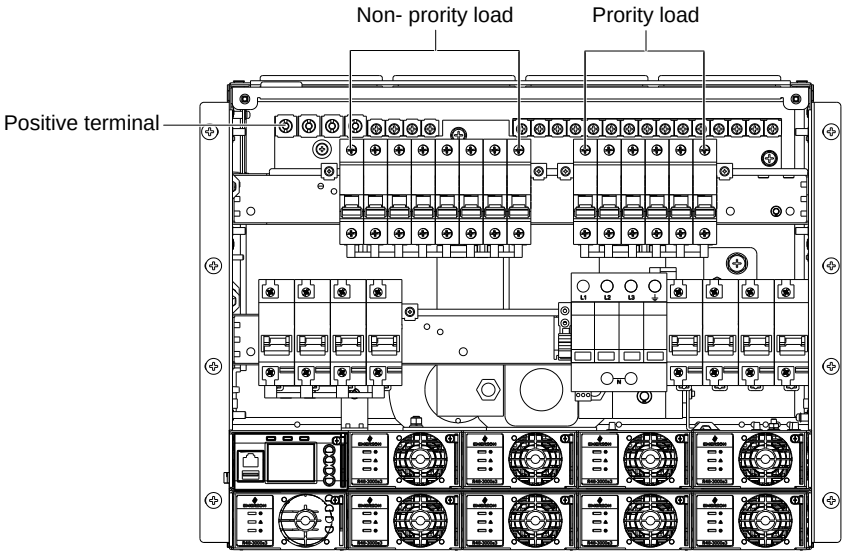


Figure 2-7 Illustration of the load cable connection terminal

2.4.4 Connecting Battery Cables

Note

1. The batteries may have dangerous current. Before connecting battery cables, make sure that the battery MCBs at the battery side are switched off.

2. If there are no battery MCBs at the battery side, users should disconnect any one of the connectors between battery cells to avoid live state of the system after installation.

3.Be careful not to reversely connect the battery. Otherwise, both the battery and the system will be damaged.

4.It's forbidden to disassemble battery cables in the up of the battery MCB when the battery input port is still connected.

1. Connect one end of the negative battery cable to the upper terminal of battery MCBs. Connect one end of the positive battery cable to the DC positive 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. As shown in Figure 2-8.

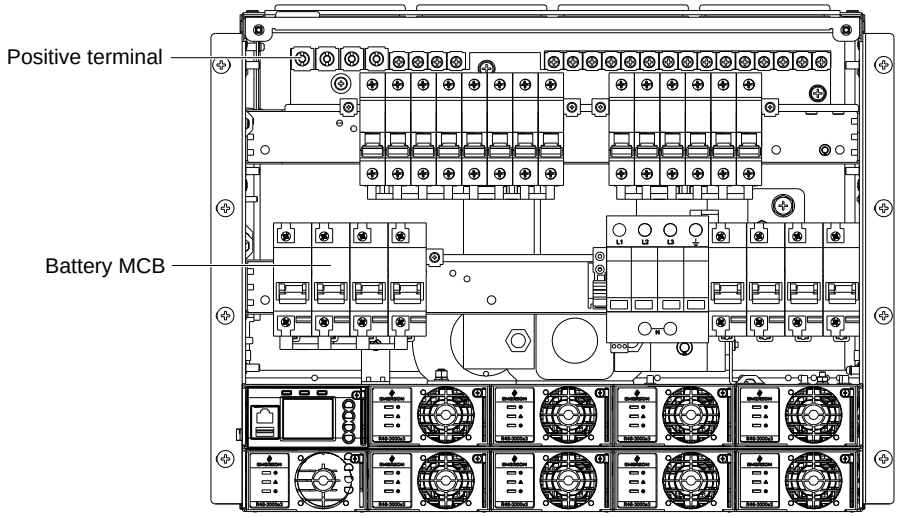


Figure 2-8 Illustration of the battery connection terminal

2.4.5 Connecting Signal Cables

Connecting NetSure 731 A91-S1/S3 Signal Cables

The standard configuration of the system is M830B controller. The MA4C5U31 user interface board is used for M830B. M830B controller and MA4C5U31 user interface board cable connection is show in the following:

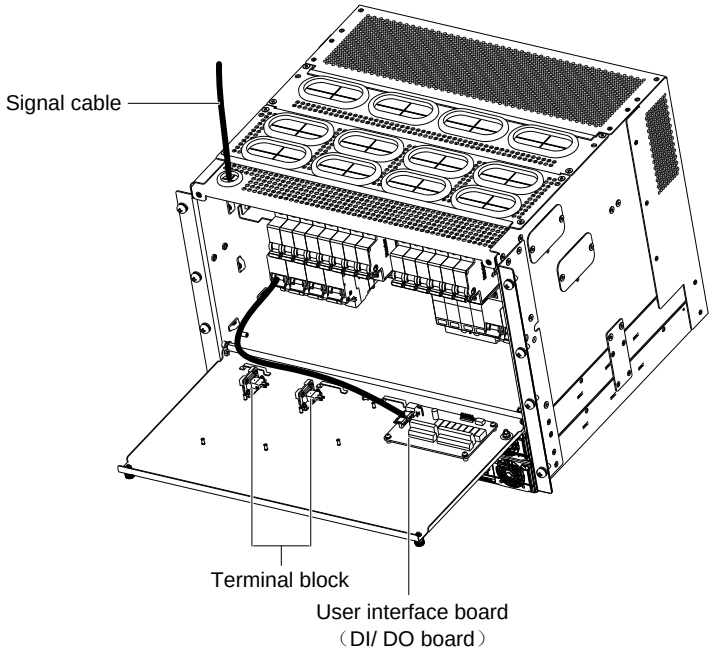


Figure 2-9 Netsure 731 A91-S1 user interface board illustration

MA4C5U31 User Interface Board can provide 8 DI and 8 DO. For alarm type and corresponding relay, users can set it by background software according to the actual situation.

Connecting Communication Signal Cable

The communication port of M830B controller is shown in Figure 2-10.

Figure 2-10 M830B controller communication port

Connecting NetSure 731 A91-S2 Signal Cables

The standard configuration of the system is M530B controller. Netsure 731 A91-S2 user interface board position as shown in Figure 2-11.

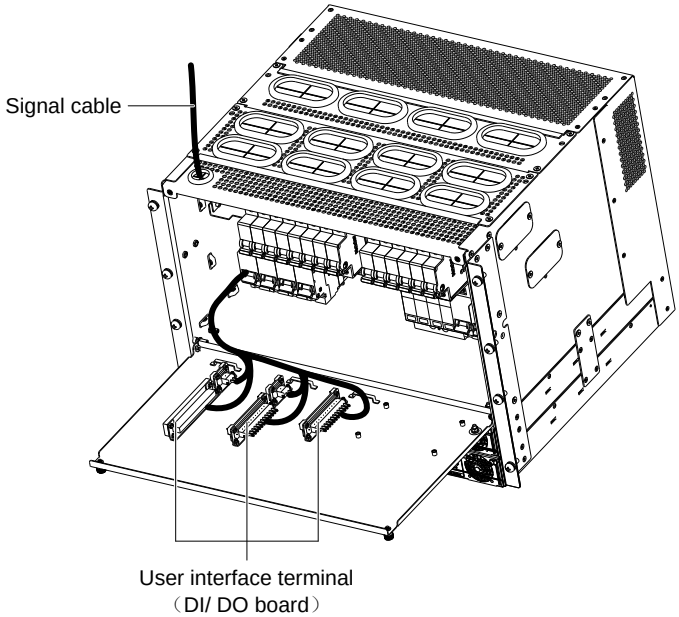


Figure 2-11 Netsure 731 A91-S2 user interface board illustration

Connecting Communication Signal Cable

The communication port of M530B controller is shown in Figure 2-12.

Figure 2-12 M530B controller communication port

Chapter 3 Commissioning

The controllers can be used in the power system are M830B、M530B. This section introduces commissioning after installation. During installation test, the corresponding safety rules should be adhered to. The system has been tested before out of the factory, user doesn't need to test on site.

3.1 Installation Check and Startup

Before the test, inform the chief manufacturer representative. Only 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 may 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, battery 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 the models correct?	☐	
Check the busbar 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 the controller module. 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 communication and alarm cables are connected to the signal transfer board.	☐	
Check that the temperature sensor, if any, has been installed.	☐	
Check that the battery string circuit is not closed.	☐	
Connect the disconnected batteries to the battery string circuit.	☐	
Make sure that the MCB disconnected to the battery cables are switched off. Check the battery signal cables connection and MCB cables connection.	☐	
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 48 ~ 51V/battery. If the voltage of certain cell is lower than 2.0V, that cell must be replaced.	☐	Umin＝ V
Check with an ohmmeter that there is no short circuit between the positive & negative 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. Insert one rectifier. The green LED on the rectifier will be on and the fan will start running after a certain delay. The controller module will show that the power supply voltage is 53.5V.	☐	
Check the system voltage and busbar polarity with a voltmeter. The voltage difference between the measured value and displayed value should be less than±0.2V.	☐	
Start and stop each rectifier of the system by inserting and unplugging the rectifier. Check their output voltages.	☐	

3.2 Basic Settings

When the system is put into service for the first time, the parameters of controller 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 controller module display system operation information and control the output.

M830B controller password is 640275. System parameter settings are shown in Table 3-1.

Table 3-1 M830B controller paremeter settings

Parameter	Path	Default settings
Capacity	NCU home page—Settings—Battery charge—Battery 1 capacity	300Ah
LVD1 enabled	LCD—Settings—LVD Settings—LVD1 enabled	Enabled
LVD2 enabled	LCD—Settings—LVD Settings—LVD2 enabled	Enabled
LVD1	LCD—Settings—LVD Settings—LVD1 Volt	44.0V
LVD2	LCD—Settings—LVD Settings—LVD2 Volt	43.2V
AC Fail Required	Web—Advanced Settings—System—LVD Group—AC Fail Required	Y
Num Batt Shunts	LCD—Settings—Bat. Settings—Basic Settings—Num Batt Shunts	1
Batt shunts settings	LCD—Settings—Bat. Settings—Basic Settings—Battery 1—Shunt Current/Shunt Voltage	600A/25mV
Contactor type	Web—Settings—LVD—Contactor type	Monstabillity
Walk-in	LCD→Settings→Rect Settings→Walk-in on	Y
Walk-in T	LCD→Settings→Rect Settings→Walk-in T	128S
Note: The above battery protection voltage should be set according to the battery manufacturer's requirements. The battery capacity should be set according to the actual configuration.		

M530B controller password is 640275. System parameter settings are shown in Table 3-2.

Table 3-2 M530B controller main paremeter settings

Parameter	Path	Default settings
System Type	Quick Settings →System Type	48V/SET
Capacity	Quick Settings →Capacity	150Ah
LVD2	Settings→Bat. Settings→LVD Settings →LVD2 Volt	43.2V
LVD1	Settings→Bat. Settings→LVD Settings →LVD1 Volt	44.0V
Batt shunts settings	Settings → Basic Settings → Batt Shunts 1	N
Batt shunts settings	Settings → Basic Settings → Batt Shunts 2	Y
BLVD contactor	Bat. Settings → LVD Settings → BLVD Volt	43.2V
AC Phase	Settings→Input Settings→AC PH	3-PH
Walk-in	Settings→Rect Settings→Walk-in on	N
Walk-in T	Settings→Rect Settings→Walk-in T	8S
Note: The above parameters need to be adjusted according to the actual situation.		

3.3 Alarm Check And System Operation Status Check

Alarm check

Check that all functional unit can trigger alarms that can be displayed on the controller.

	OK	Comment
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	☐	
Switch off battery MCB 1. The 'Batt1 Failure' alarm should be triggered. Switch on the MCB. The alarm should be cleared. Repeat the same on battery MCB 2, MCB 3 and MCB 4.	☐	
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 MCBs. Keep only one rectifier in operation. Through the controller module, adjust the rectifier FC voltage to make it lower than the alarm point. The alarm 'DC Voltage Low' should be triggered	☐	

	OK	Comment
Keep the rectifiers in operation. Set through the controller module the battery management parameter to 'Manual'. Enter the maintenance menu at the controller module. Select 'Disconnect' and confirm it. The battery protection contactor should be open, and the 'BLVD' alarm should be displayed at the controller module Note: when the preceding alarms are generated, the controller module will give alarms after approximately 3s.	☐	

System operation status check

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

	OK	Comments
The system model is correct.	☐	
The controller should display the correct AC voltage	☐	
The controller should be able to display the DC voltage. The difference between the displayed voltage and that measured at the busbar should be less than 1%	☐	
The controller should display the battery current. The difference between the displayed and measured battery current should be less than 1%	☐	
Check the number of the rectifier through the controller . The number should be consistent with the actual number.	☐	
Check the voltage, current, current limiting point of rectifiers through the controller. They should agree with the actual parameter.	☐	
For the system configured with temperature sensor, the controller should be able to diaplay the battery ambient temperature. Hold the probe of the temperature sensor with hand and watch the controller which should display the change of temperature.	☐	

3.4 Final Steps

	OK	Comments
Make sure that materials irrelevants to the equipment have been all removed.	☐	
Rehabilitate the power equipment and close the cabinet door.	☐	
Fill in the installation report and hand it over to the user.	☐	
Record all the operations in the file , including operation time and operator name.	☐	

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 Troubleshooting

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

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

📖 Note

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

4.1 Controller Alarms And Fault Handling

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

Major alarm: This type of alarms have strong impacts on the system performance. Whenever these alarms are generated, users are supposed to handle them immediately. The red major alarm indicators will be on.

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 yellow observation alarm indicators will be on.

No alarm: If alarms are set as ‘no alarm’ by the users, when these alarms occur, the green alarm indicators will be on and the system works normally.

If an unnecessary alarm occurs during the operation of the controller, set it according to the following method.

Take the alarm of ‘Rect Lost’ for example:

For M830B controller: MAIN MENU —> Settings —> Alarm—>Clear Module Loss Alarm. For the submenu of "Clear", you can select "Rect Lost" to clear corresponding alarm.

For M530B controller: MAIN MENU —> Settings —> Alarm—> Alarm Control—> Clear. For the submenu of ‘Clear’, you can select ‘Rect Lost’ to clear corresponding alarm.

The handling methods of normal alarms are given in Table 4-1.

Table 4-1 Alarm description and action to correct

Index	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 power to supply the subrack power system, it is suggested to run the generator at least five minutes to minimize the impact on the subrack power system
2	AC Voltage High	Check if the AC over-voltage value is too low. If yes, change the value. A mild over-voltage does not affect the system operation. However, the rectifiers will stop working operation when the mains voltage is more than 305V. If the mains voltage is above the AC over-voltage value, the mains grid should be improved
3	AC Voltage Low	Check if the AC Under- voltage point is too high. If yes, change the value. When the mains voltage is lower than 176V, the output power of the rectifiers will be derated. And if lower than 80V, the rectifiers will stop working. If the mains voltage is under the AC under-voltage value, the mains grid should be improved
4	SPD alarm	Check the SPD condition. If the SPD is damaged, replace it
5	DC Volt High	Check the DC over-voltage value through the controller. If the setting value is inappropriate, correct it. Otherwise, find out the rectifier that has caused the alarm: 1. Ensure that the batteries can operate normally. 2. Switch off the AC input of all rectifiers. 3. Power on the rectifiers one by one. 4. If the over-voltage protection is triggered when a certain rectifier is powered on, that rectifier is the faulty one. Replace it

Index	Alarm	Handling method
6	DC Volt Low	1. Check if the alarm is caused by mains failure, if yes, disconnect some loads to prolong the operation of the whole system. 2. Check the DC under-voltage value set through the controller. If the set value is inappropriate, correct it. 3. Check if any rectifier is inoperative, or has no output current. If yes, replace it. 4. Check if the total load current exceeds the total rectifier current during float charge. If yes, disconnect some loads or add more rectifiers to make the total rectifier current bigger than 120% of the total load current with one redundant rectifier.
7	Load Fuse Alarm, Batt Fuse Alarm	Check if the corresponding MCB is switched off. If the MCB is open, find out the fault and remove it. Otherwise, the alarm circuit is faulty. Please contact Vertiv.
8	LVD2	1. Check if there is mains failure, and the battery voltage is lower than the value of 'LVD2'. 2. Check whether the battery is disconnected from the system manually.
9	Rect Failure	The rectifier with the fault indicator (red) on is faulty. Power off the rectifier, and then power it on after a while. If the alarm persists, replace the rectifier.
10	Rect Protect	Check if the mains voltage is above 305V or under 80V. If the mains voltage is under the AC under-voltage value or above the AC over-voltage value, the mains grid should be improved.
11	Rect Fan Fails	Pull out the rectifier to check if the fan is obstructed. If yes, clean it and push the rectifier back. If the fan is not obstructed or if the fault persists after cleaning, replace the rectifier.
12	Rect Not Respond	Check if the communication cable is connected properly between rectifier and controller. If yes, restart the rectifier. If the alarm persists, replace the rectifier.
13	High temperature	Check if the temperature of the temperature sensor is too high. If yes, find the causes and cool down the battery compartment.

Controller fault handling

The symptoms of usual controller faults include: power indicator(green) off. LCD doesn't display(if connected to the host system, it may cause an external alarm). Check whether the system bus voltage is normal. If not, check whether the terminal of the controller is in normal connection. If both are in normal, the controller is faulty, please see the following procedures to replace the controller.

M830B replacement:

1. Check the new controller for damage.

2. Security preparation

Put one end of the effective grounding strap at the wrist and the other end attached to a suitable ground.

3. Loosen the captive screw of the controller, as shown in Figure 4-1

Figure 4-1 M830B Controller replacement

4. Push the new controller into the system and tighten the captive screw of the controller

5. After controller startup, refer to *3.2 Basic Settings*

M530B controller replacement：

1. Check the new controller for damage.

2. Security preparation

Put one end of the effective grounding strap at the wrist and the other end attached to a suitable ground.

3. Loosen the captive screw of the controller, as shown in Figure 4-2.

Figure 4-2 M530B Controller replacement

4. Push the new controller into the system and tighten the captive screw of the controller

5. After controller startup, refer to *3.2 Basic Settings*

4.2 Rectifier Fault Handling

Alarm handling

The symptoms of usual rectifier faults include: power indicator (green) off, protection indicator (yellow) on, protection indicator blink , fault indicator (red) on and fault indicator blink, the indicator locations as shown:

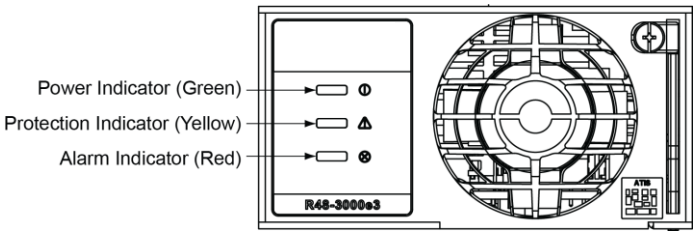


Figure 4-3 Local Indicator Locations

Table 4-2 Rectifier Troubleshooting

Symptom	Related alarm	Possible cause(s)	Suggested action(s)
Power Indicator (Green) Off	No alarm	1. No input/output voltage.	Make sure that there is input/output voltage
		2. Internal input fuse open.	Replace the rectifier
Power Indicator (Green) flashing	No alarm	The rectifier is being identified by the controller	
Protection（yellow）	Rect protection	AC input voltage abnormal	Make sure the AC input voltage is normal
	Rect over temperature	1. Fan blocked	1. Remove the object that blocks the fan
		2. Ventilation path blocked at the inlet or vent	2. Remove the object at the inlet or vent
		3. Ambient temperature too high or the inlet too close to a heat source	3. Decrease the ambient temperature or remove the heat source
	Rect protection	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
	Rect protection	Power factor compensation internal under voltage or over voltage	Replace the rectifier
Protection indicator flash (yellow)	Rect communication fail	Rectifier communication fail	Check whether the communication cable is in normal connection

Symptom	Related alarm	Possible cause(s)	Suggested action(s)
Fault indicator on(red)	Rect HVSD	Rectifier over-voltage	Reset the rectifier. If the protection is triggered again, replace the rectifier
	Rect fail	Rectifier module addresses contradictory.	Replace the rectifier module.
	Severe load sharing imbalance.	positive and negative deviations of average current ≤ 2.5A	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 rectifie
Fault indicator flash (red)	Rect Fan Fails	Fan fault	Replace the fan.

R48-3000e3/R48-3500e3 Replacement

Rectifier modules can be inserted or removed with power applied (hot swappable).

📖 Note:

Each rectifier module locks into a module mounting shelf by means of a latch located on the bottom of the module. The latch and rectifier module handle are interactive. Pushing the handle up into the module's front panel causes the latch to extend to the locking position; pulling the handle down out from the module's front panel causes the latch to retract.

DANGER!

Take care when removing a rectifier module that was in operation, as rectifier module surfaces could be very hot.

WARNING!

To prevent damage to the latching mechanism, ensure the handle is in the open position when installing or removing a rectifier module. NEVER hold the handle in the closed position when installing a rectifier module into a shelf.

Procedure

Refer to Figure 4-4 as this procedure is performed.

1. Performing this procedure may activate external alarms. Do one of the following. If possible, disable these alarms. If these alarms cannot be easily disabled, notify the appropriate personnel to disregard any alarms associated with this system while this procedure is performed.

2. Loosen the captive screw on the module's handle. Pull the handle down out from the module's front panel (this will also retract the latch mechanism).

3. Grasp the handle and pull firmly to remove the module from the shelf.

4. Place the replacement rectifier module into the mounting position without sliding it in completely.

5. Loosen the captive screw on the module's handle. Pull the handle down out from the module's front panel (this will also retract the latch mechanism).

6. Push the module completely into the shelf.

7. Push the handle up into the module's front panel. This will lock the module securely to the shelf. Tighten the captive screw on the handle.

8. Certain functions (i.e. rectifier current limit, rectifier addressing) may require adjustment when adding or replacing a rectifier module.

9. After the rectifier modules are physically installed in the mounting shelf(s), they are ready for operation immediately after power is supplied to them. Verify that the rectifiers are operating normally.

10. Enable the external alarms, or notify appropriate personnel that this procedure is finished.

11. Ensure that there are no local or remote alarms active on the system.

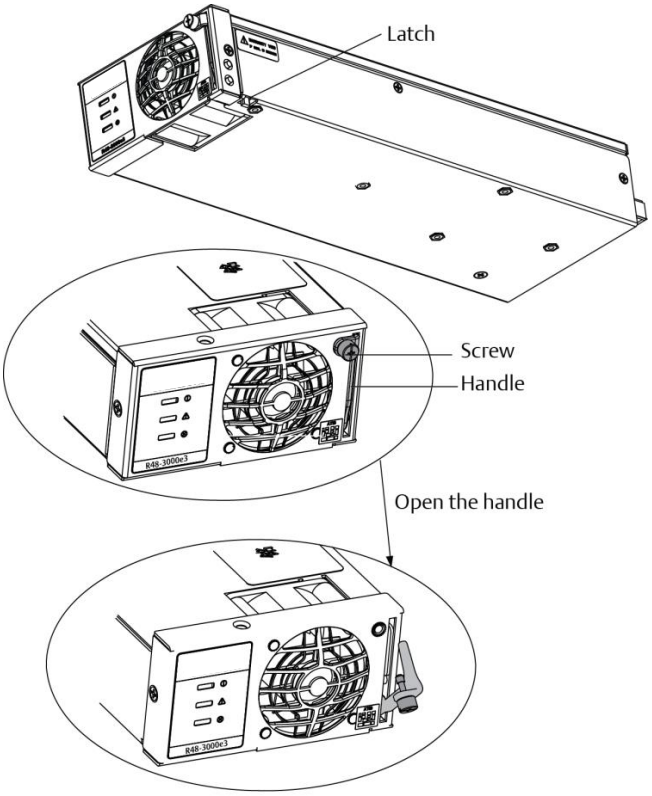


Figure 4-4 Installing Rectifier

4.2.1 Rectifier Fan Replacement

Each Rectifier uses a fan (P/N:32010485) for cooling. If fan replacement should become necessary, perform the following procedure.

Refer to Figure 4-4 as this procedure is performed.

Warning WARNING!

In a system with NO redundant Rectifier, battery must have sufficient reserve to power the load(s) while the Rectifier is removed for fan replacement.

Note:

When performing any step in this procedure that requires removal of existing hardware, retain all hardware for use in subsequent steps.

Procedure

1. Performing this procedure may activate external alarms. Do one of the following. If possible, disable these alarms. If these alarms cannot be easily disabled, notify the appropriate personnel to disregard any alarms associated with this system while this procedure is performed.
2. Remove the Rectifier from the shelf. Refer to a previous procedure for step-by-step instructions.
3. On this Rectifier; remove the front panel by removing the screws securing the front panel to the chassis, and by unplugging the fan from the printed circuit card.
4. For proper orientation of the new fan, observe the location of the fan wires and the air flow arrows on the old fan.
5. Remove the old fan from the front panel by removing the two screws and clips securing the fan.
6. Install the new fan onto the front panel using the two screws and clips previously removed. Ensure the fan wires and air flow arrows match the orientation of the old fan.
7. Install the front panel with the new fan onto the chassis by plugging the fan cable into the printed circuit card, and securing the front panel with the screws previously removed.

8. Replace the Rectifier into the shelf. Refer to the previous procedure for step-by-step instructions.
9. Enable the external alarms, or notify appropriate personnel that this procedure is finished.
10. Ensure that there are no local or remote alarms active on the system.

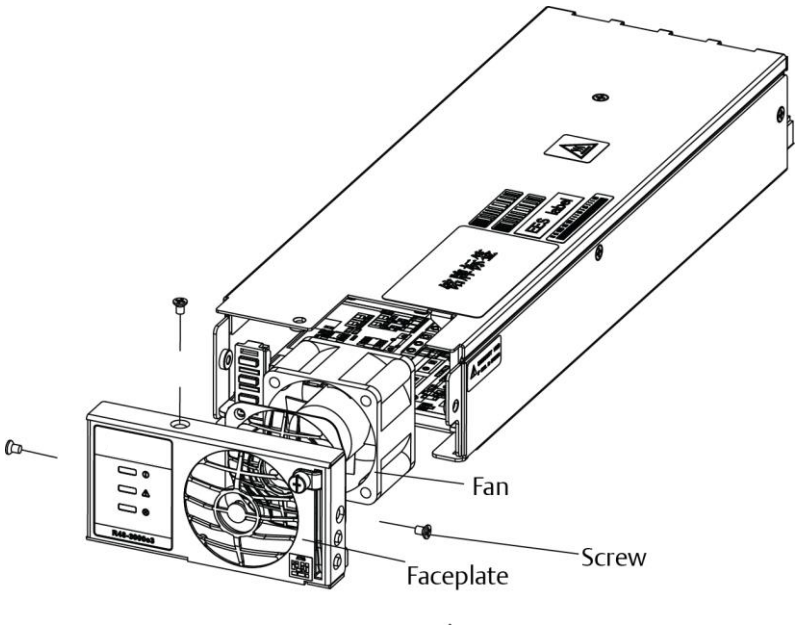


Figure 4-5 Fan replacement

Appendix 1 Technical And Engineering Data

Table 1 Technical data

Parameter category	Parameter	Description
Environmental	Operating temperature	-5℃ ~ +40℃
	Storage temperature	-40℃ ~ +70℃
	Relative humidity	5%RH～95%RH
	Altitude	≤2000m(derating is necessary above 2,000m)
	Polution level	Level 2
	Others	No conductive dust or erosive gases. No possibility of explosion
AC input	AC input system	3P＋N＋PE/380V;
	AC input type	TN，TT
	Input voltage range	85Vac ~ 305Vac（Module phase voltmeter）
	Input AC voltage frequency	45Hz ~ 65Hz
	Maximum input current	64A（With 3500e3 module） 55A（With 3000e3 module）
	Power factor	≥0.99
	Overvoltage level	Level Ⅱ
DC output	Nominal output voltage	-48Vdc
	Rated output voltage	-53.5Vdc（If it is used for outdoor，the rated voltage is -54V）
	Output DC voltage	-43.2 ~ -57.6Vdc
	Maximum output current	DC load output ≤ 400A/58V Battery charging current ≤ 143A/58V（With 3500e3 module） DC load output ≤ 400A/58V Battery charging current ≤ 66A/58V（With 3000e3 module） Note: in 45℃, full load output, above 45℃, the power derating 2% per ℃.
	Voltage set-point accuracy	≤1%
	Maximum efficiency	≥95.3%
	Noise (peak-peak) (rated output)	≤200mV（0 ~ 20MHz）
	Weighted noise (rated output)	≤2mV（300 ~ 3400Hz）
AC input alarm and protection	AC input over-voltage alarm point	M830B: Default: 275 ± 5Vac, configurable through controller M530B: Default: 280 ± 5Vac, configurable through controller
	AC input over-voltage alarm recovery point	Default: 270 ± 5Vac, 10Vac lower than the AC input over-voltage alarm point
	AC input under-voltage alarm point	M830B : Default: 165 ± 5Vac, configurable through controller M530B: Default: 180 ± 5Vac, configurable through controller
	AC input under-voltage alarm recovery point	M830B: Default: 170 ± 5Vac, 5Vac higher than the AC input under-voltage alarm point M530B: Default: 190 ± 5Vac, 10Vac higher than the AC input under-voltage alarm point
	AC input over-voltage protection point	Default: 307 ± 2.5Vac. The return difference ≥ 10Vac and can not exceed 15V, configurable through controller
	AC input over-voltage protection recovery point	295 ± 5Vac by default, 10Vac lower than the AC input over-voltage alarm point
	AC input under-voltage protection point	Default: 80 ± 5Vac, configurable through controller
	AC input under-voltage protection recovery point	Default: 95 ± 5Vac, 10Vac higher than the AC input under-voltage alarm point

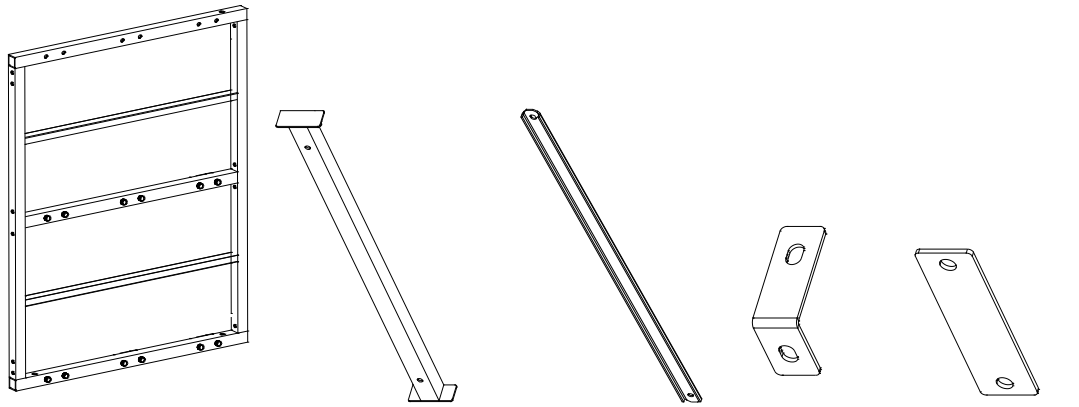
Parameter category	Parameter	Description
DC output alarm and protection DC output alarm and protection	DC output over-voltage alarm point	Default: -58.5 ± 0.3Vdc, configurable through controller
	DC output over-voltage recovery point	Default: -58 ± 0.2Vdc, 0.5Vdc lower than the over-voltage alarm point
	DC output under-voltage alarm point	Default: -45.0 ± 0.3Vdc, configurable through controller
	DC output under-voltage recovery point	Default: -45.5 ± 0.2Vdc, 0.5Vdc higher than the under-voltage alarm point
	DC output over-voltage protection point	Default: -58.5 ± 0.2Vdc, configurable through controller
	LLVD	Default: -44.0 ± 0.3Vdc, configurable through controller
	BLVD	Default: -43.2 ± 0.3Vdc, configurable through controller
Rectifier	Current sharing	The rectifiers can work in parallel and share the current. The unbalanceness is better than ± 5%.
	Derate by input (at 45°C)	176Vac input, The rectifier output is 100% power 85Vac~154Vac input, the rectifier adopts two-stage linear power limiting. Below 80Vac，the rectifier low pressure power off.
	Walk-in	The output voltage can rise slowly when the rectifier start up. The walk in time is configurable through the controller.
	Fan speed adjustable	Rectifier fan speed can be set to auto or full speed.
	Over-voltage protection	The rectifier provides over-voltage hardware and software protection. The hardware protection point is 59.5V ± 0.5V, and it requires manual resetting to restore operation. The software protection point is between 56V and 59V (0.5V above output voltage, 58.5V by default), and can be set through the controller 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 controller), 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 controller, or by removing the rectifier from system
	Temperature power limiting	The rectifiercan start in -40°C; For R48 3000e3 moudle: Below 45°C, the rectifier with full power (3000 W) output. From 45°C ~55°C, the rectifier with linearly derating to 2900W. From 55°C ~65°C, the rectifier with linearly derating to 2250W. From 65°C ~70°C, the rectifier with linearly derating to 0W. For R48 3500e3 moudle: Below 45°C, the rectifier with full power (3500 W) output. From 45°C ~55°C, the rectifier with linearly derating to 3380W. From 55°C ~65°C, the rectifier with linearly derating to 2625W. From 65°C ~70°C, the rectifier with linearly derating to 0W.
EMC	Conducted emission	Class A EN300386（ClassB is met when configuring 3500e3 module and M830B controller）
	Radiated emission	
	Harmonic current emission	EN61000-3-12
	Voltage fluctuation and flash	EN61000-3-11
	EFT	Level 4 EN/IEC 61000-4-4
	ESD	Level 3 EN/IEC 61000-4-2
	Surges	Level 4 EN/IEC 61000-4-5
	Radiation	Level 3 EN/IEC 61000-4-3
	Conduction	Level 3 EN/IEC61000-4-6

Parameter category	Parameter	Description	
Lightning protection features	At AC side	The AC input side 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 least two modules per phase)	
	At DC side	The DC input side 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. (At least two modules)	
Others	Safety regulation	Conform to IEC60950-1 standards	
	Acoustic noise	≤ 60db (A) (When the ambient temperature is lower than 25°C)	
	Insulation resistance	At temperature of 25°C ± 5°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 2MΩ	
	Insulation strength	(Remove the SPD, controller and rectifiers from the system before the test.) AC loop to DC loop can withstand 50Hz. AC to DC circuits: 3,000Vac; or 4,242Vdc for one minute, leak curren≤10mA , without puncturing and electric arcing; AC circuit to earth: 50Hz, 1,500Vac; or 2,121Vdc for one minute, leak curren≤10mA , without puncturing and electric arcing ; DC circuit to earth: 50Hz, 500Vac; or 707Vdc for one minute, leak curren≤10mA , without puncturing and electric arcing ; Auxiliary circuit without connecting to the main circuit directly: 50Hz,500Vac; or 707Vdc for one minute, leak curren≤10mA , without puncturing and electric arcing ;	
	MTBF	> 200,000hr	
	ROHS	Compliant with R6 requirement	
Mechanical	Dimensions (mm)	Standard dimensions of the subracks:	352mm×483mm×400
		Controller:	M830B: 43.4mm×210.3mm×85.9mm M530B: 43mm×86mm×210mm
		Rectifier:	R48-3000e3: 41mm×84.5mm×330mm R48-3500e3:41mm×84.5mm×330mm
	Weight (kg)	Subrack (package,rectifier and controller are all included)	≤60;
		Subrack (without package,rectifier and controller included)	≤40;

Appendix 2 Installation Instruction Of Battery Rack

1. Installation Instruction Of Two-Layer And Four-Layer Battery Rack

Packing list



Accessory 1 *Accessory 2* *Accessory 3* *Accessory 4* *Accessory 5*

Figure 1 Accessory

Table 2 Packing list of the battery rack

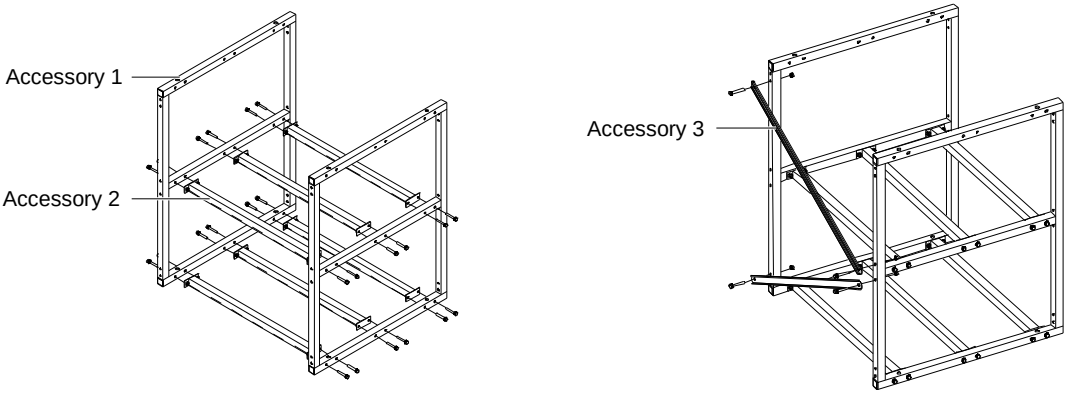
Battery rack / Accessory	Two-layer battery rack	Four-layer battery rack
Accessory 1	2	4
Accessory 2	8	14
Accessory 3	2	4
Accessory 4	2	2
Accessory 5	0	2
Expansion bolt	4 pieces	4 pieces
Fastener	1 set	1 set

Installation procedures

1. Installation procedures of two-layer battery rack

1) Install accessory 1 and accessory 2 according to Figure 2 (a).

2) Install accessory 3 according to Figure 2 (b).



(a) *(b)*

Figure 2 Installation procedure of accessory 1 ~ accessory 3

3) Install accessory 2 and accessory 4 according to Figure 3.

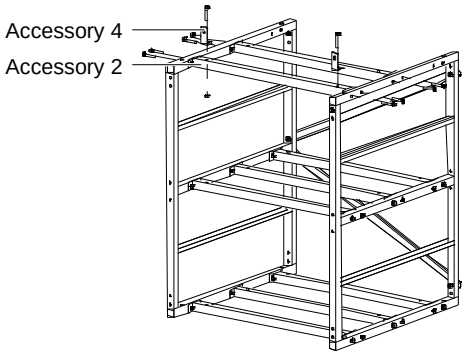


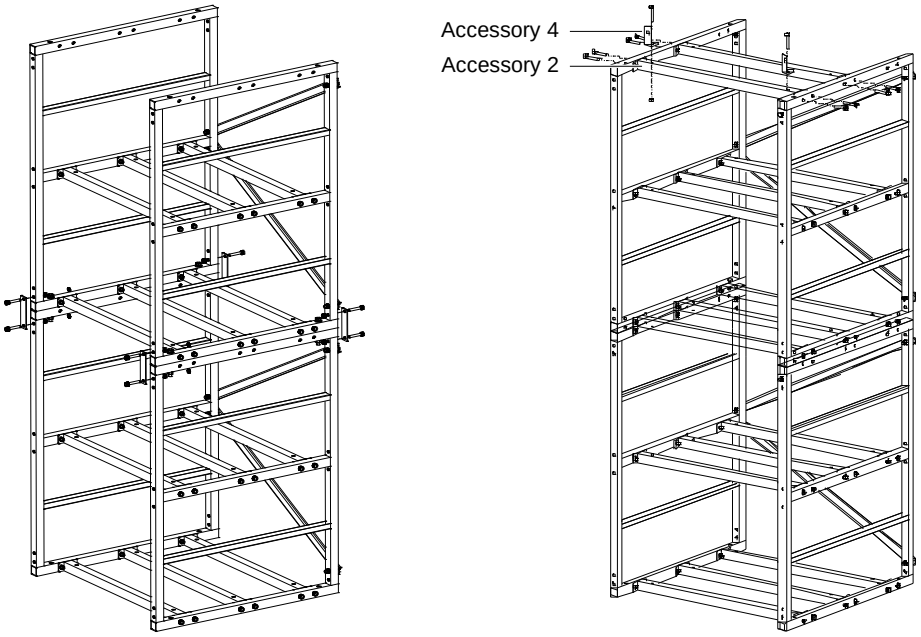
Figure 3 Installation procedure of accessory 2 and accessory 4

2. Installation procedures of four-layer battery rack

1) Install accessory 1, accessory 2 and accessory 3 according to Figure 2 (a) and Figure 2 (b).

2) Install accessory 5 according to Figure 4 (a).

3) Install accessory 2 and accessory 4 according to Figure 4 (b).

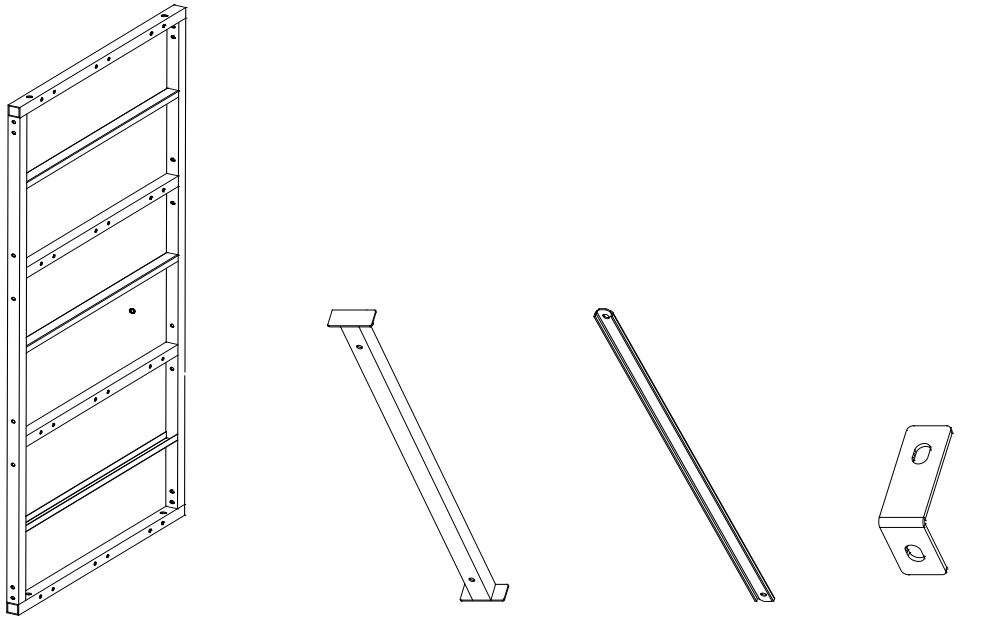


(a) *(b)*

Figure 4 Installation procedure of accessory 2, accessory 4 and accessory 5

2. Installation Instruction Of Three-Layer Battery Rack

Packing list



Accessory 1 *Accessory 2* *Accessory 3* *Accessory 4*

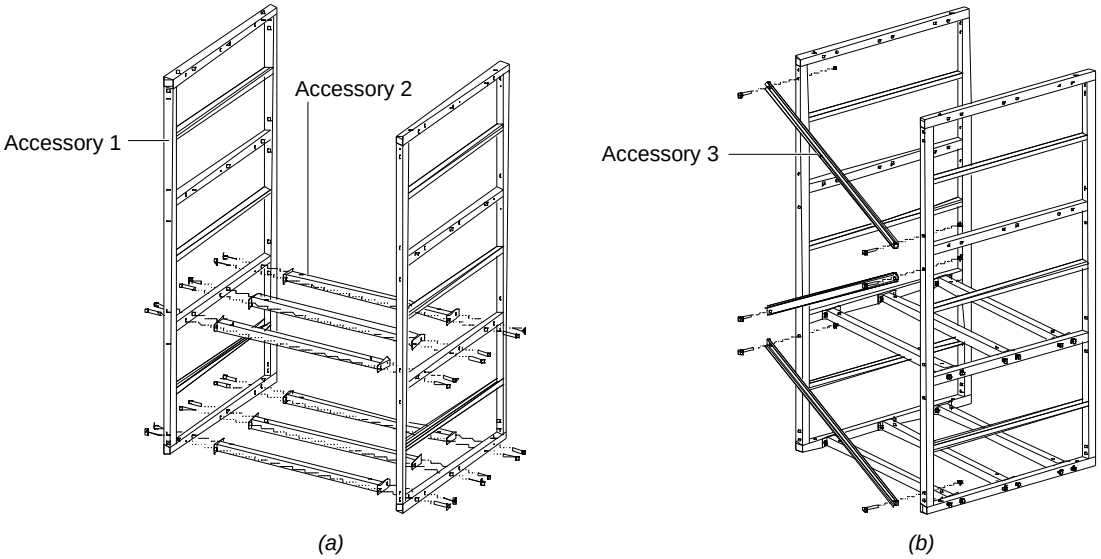
Figure 5 Accessory

Table 3 Packing list of the battery rack

Accessory	Accessory number
Accessory 1	2
Accessory 2	6
Accessory 3	3
Accessory 4	2
Expansion bolt	4 pieces
Fastener	1 set

Installation procedures

1. Install accessory 1 and accessory 2 according to Figure 6 (a).
2. Install accessory 3 according to Figure 6 (b).



(a) *(b)*

Figure 6 Installation procedure of accessory 1 ~ accessory 3

3. Install accessory 2 and accessory 4 according to Figure 7.

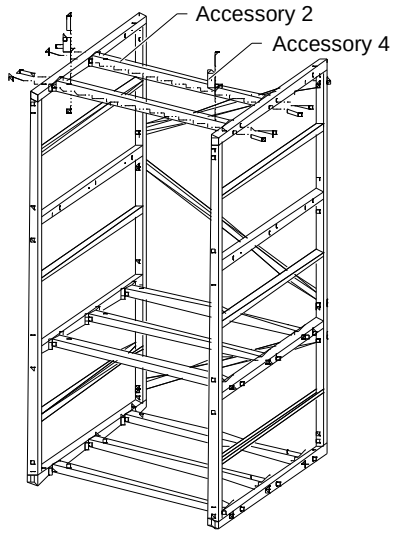


Figure 7 Installation procedure of accessory 2 and accessory 4

3. Fixing The Battery Rack

1. Fix the battery rack to the ground according to the installation dimensions shown in Figure 8. The fixing bolts are accessories.

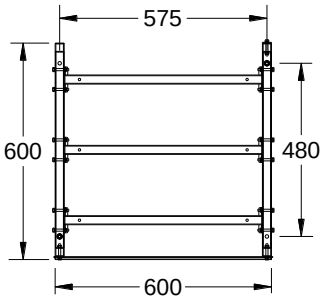
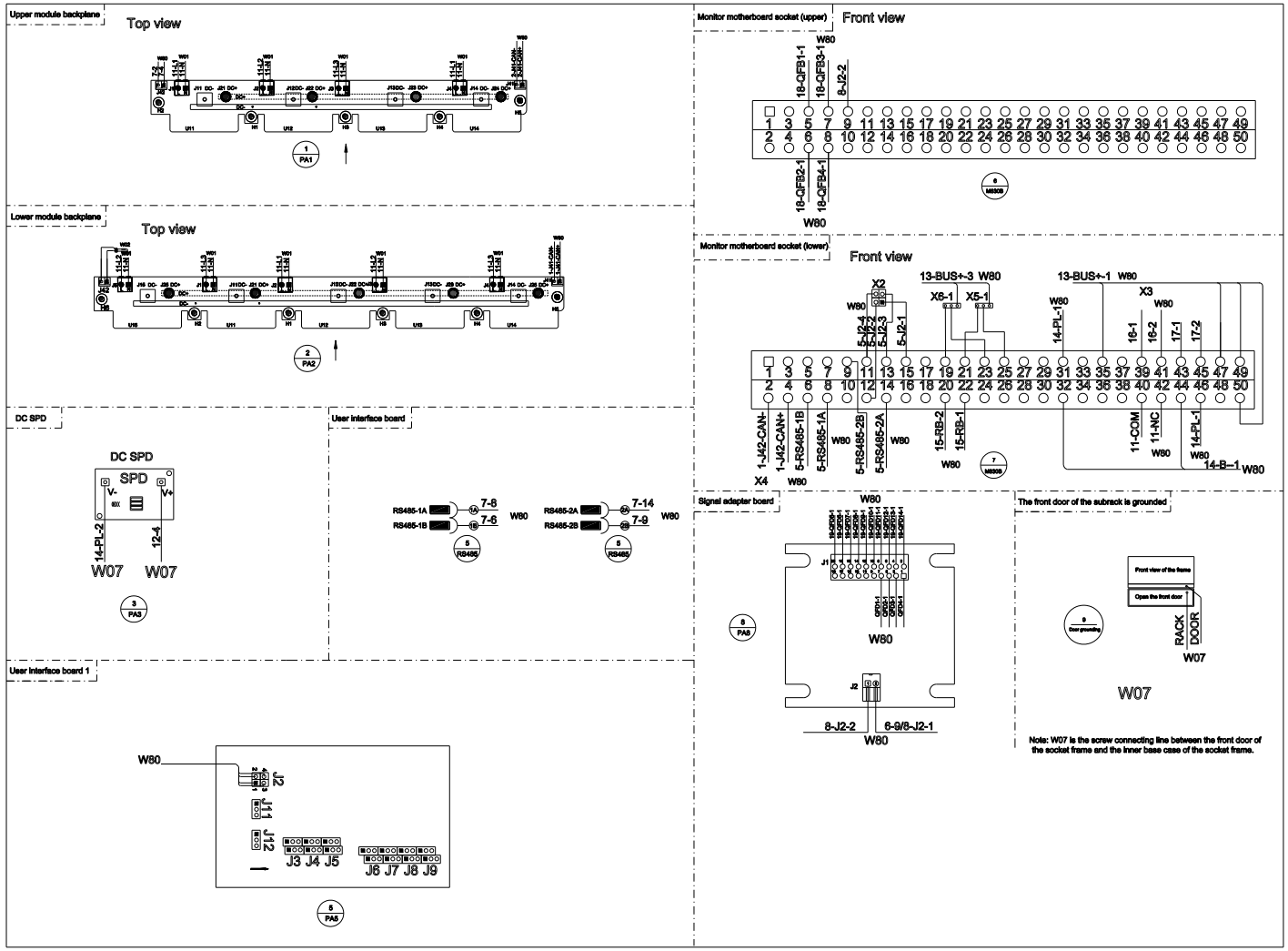


Figure 8 Installation dimensions (unit: mm)

2. Fix the subrack subrack power system onto the top of the battery rack. Refer *to2.3 Mechanical Installation*

Appendix 3 Wiring Diagram



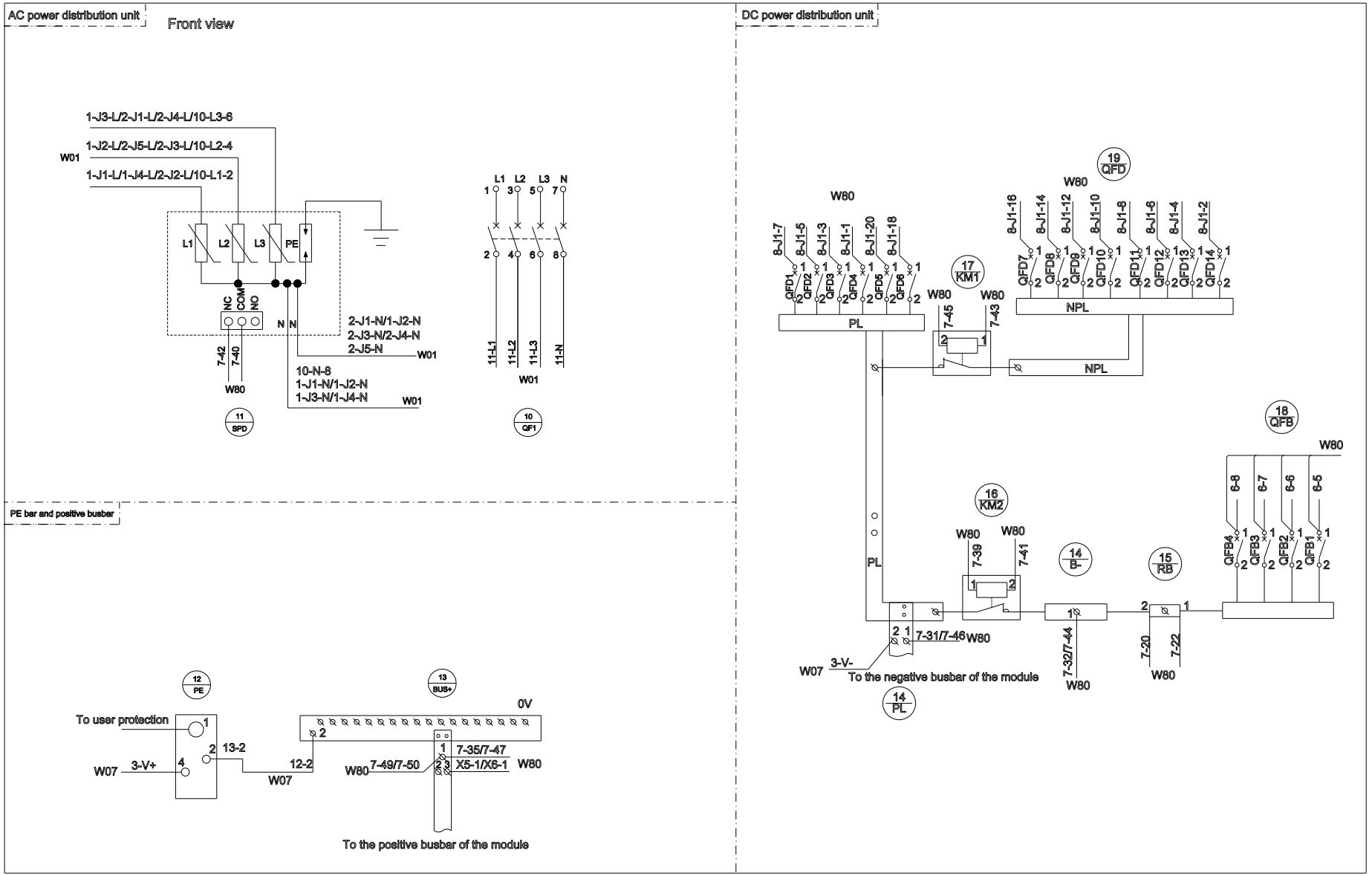
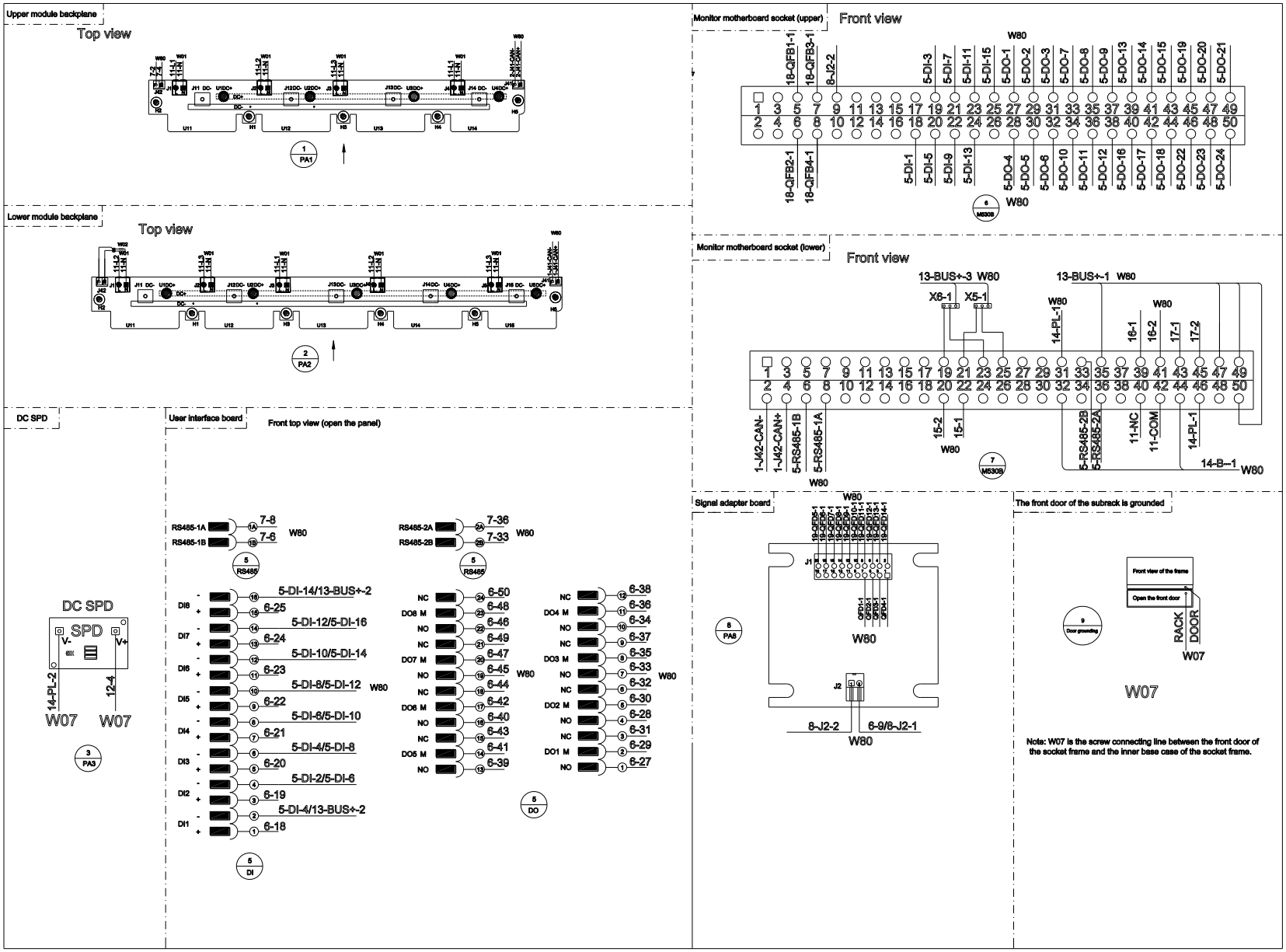


Figure 1 NetSure 731 A91-S1/S3 wiring diagram


Upper module backplane
Top view
1
PA1
Lower module backplane
Top view
2
PA2
DC SPD
DC SPD
SPD
V-
V+
14-PL-2
12-4
W07
W07
3
PA3
User interface board
Front top view (open the panel)
RS485-1A
RS485-1B
7-8
7-6
W80
5
RS485
RS485-2A
RS485-2B
7-36
7-33
W80
5
RS485
DI8
DI7
DI6
DI5
DI4
DI3
DI2
DI1
5-DI-14/13-BUS+-2
6-25
5-DI-12/5-DI-16
6-24
5-DI-10/5-DI-14
6-23
5-DI-8/5-DI-12
6-22
5-DI-6/5-DI-10
6-21
5-DI-4/5-DI-8
6-20
5-DI-2/5-DI-6
6-19
5-DI-4/13-BUS+-2
6-18
W80
5
DI
NC
DO8 M
NO
NC
NC
DO7 M
NO
NC
NC
DO6 M
NO
NC
DO5 M
NO
6-50
6-48
6-46
6-49
6-47
6-45
6-44
6-42
6-40
6-43
6-41
6-39
W80
NC
DO4 M
NO
NC
NC
DO3 M
NO
NC
NC
DO2 M
NO
NC
DO1 M
NO
6-38
6-36
6-34
6-37
6-35
6-33
6-32
6-30
6-28
6-31
6-29
6-27
W80
5
DO
Monitor motherboard socket (upper)
Front view
W80
18-QFB1-1
18-QFB3-1
8-J2-2
5-DI-3
5-DI-7
5-DI-11
5-DI-15
5-DO-1
5-DO-2
5-DO-3
5-DO-7
5-DO-8
5-DO-9
5-DO-13
5-DO-14
5-DO-15
5-DO-19
5-DO-20
5-DO-21
18-QFB2-1
18-QFB4-1
5-DI-1
5-DI-5
5-DI-9
5-DI-13
5-DO-4
5-DO-5
5-DO-6
5-DO-10
5-DO-11
5-DO-12
5-DO-16
5-DO-17
5-DO-18
5-DO-22
5-DO-23
5-DO-24
W80
6
M530B
Monitor motherboard socket (lower)
Front view
13-BUS+-3 W80
13-BUS+-1 W80
X6-1
X5-1
W80
W80
14-PL-1
16-1
16-2
17-1
17-2
1-J42-CAN-
1-J42-CAN+
5-RS485-1B
5-RS485-1A
W80
15-2
15-1
W80
5-RS485-2B
5-RS485-2A
11-NC
11-COM
14-PL-1
14-B--1
W80
7
M530B
Signal adapter board
W80
J1
W80
J2
8-J2-2
6-9/8-J2-1
W80
8
PA8
The front door of the subrack is grounded
Front view of the frame
Open the front door
RACK
DOOR
W07
9
Door grounding
W07
Note: W07 is the screw connecting line between the front door of the socket frame and the inner base case of the socket frame.

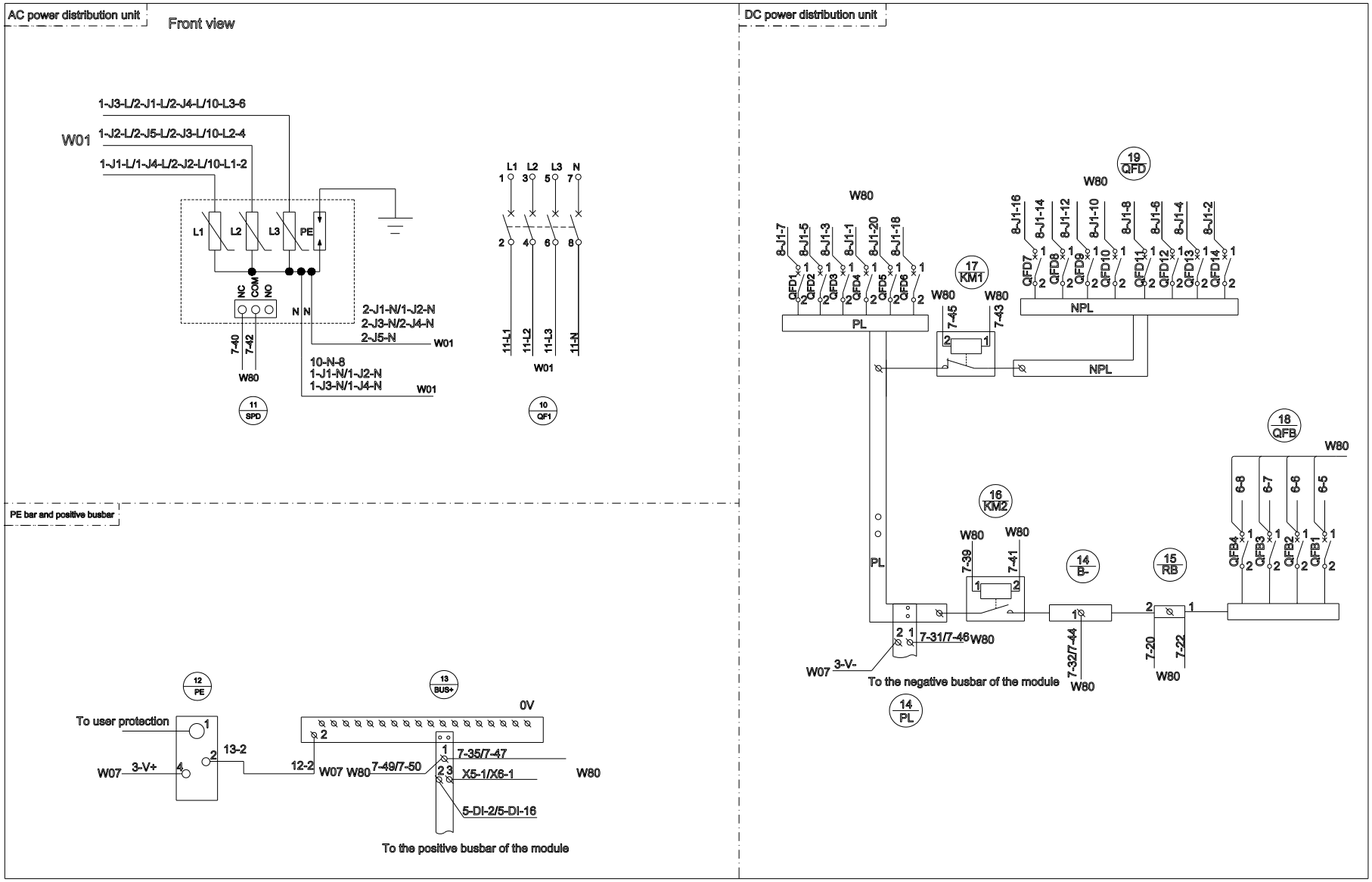


Figure 2 NetSure 731 A91-S2 wiring diagram

Appendix 4 Schematic Diagram

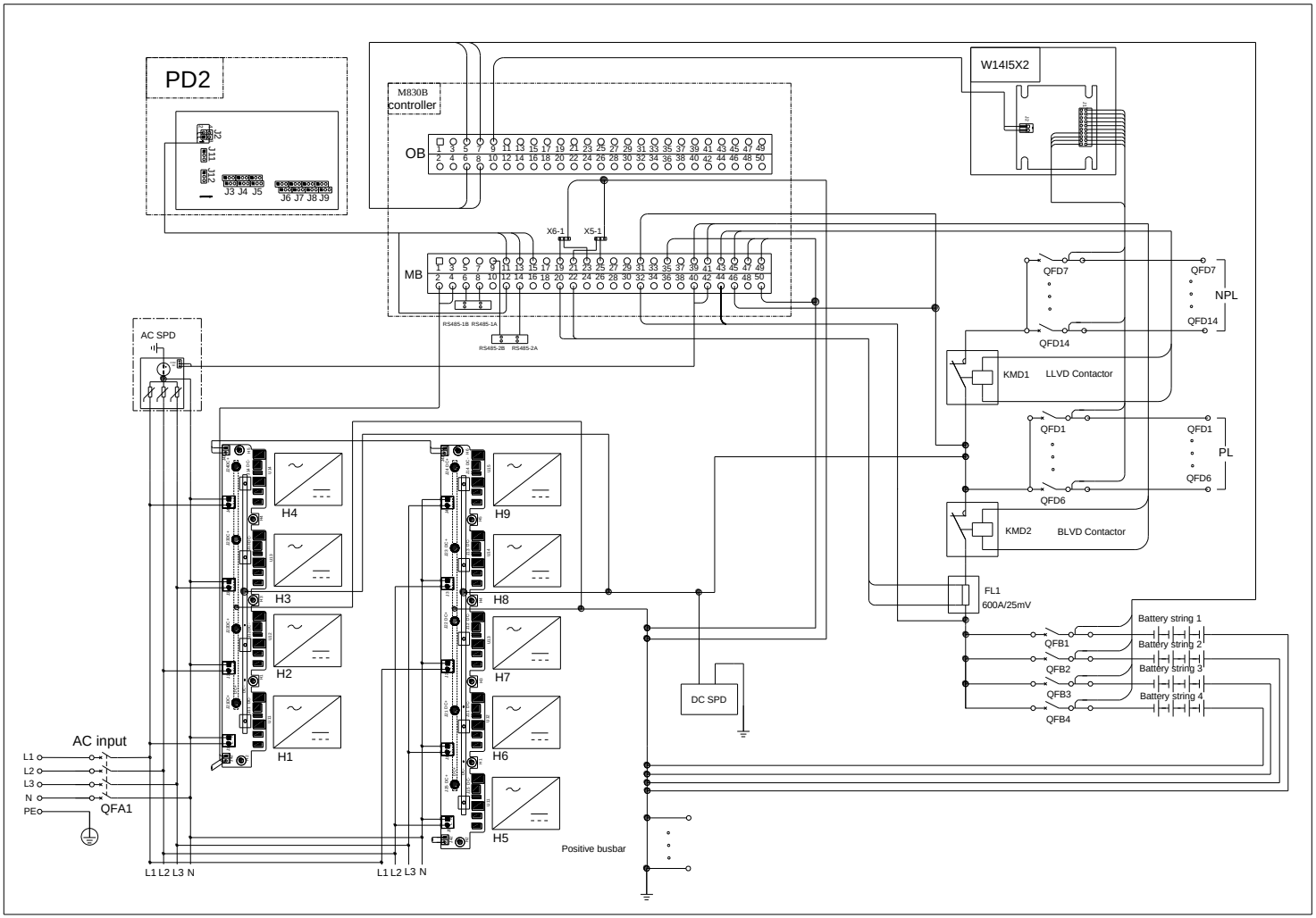


Figure 3 Schematic diagram of NetSure 731 A91 S1/S3

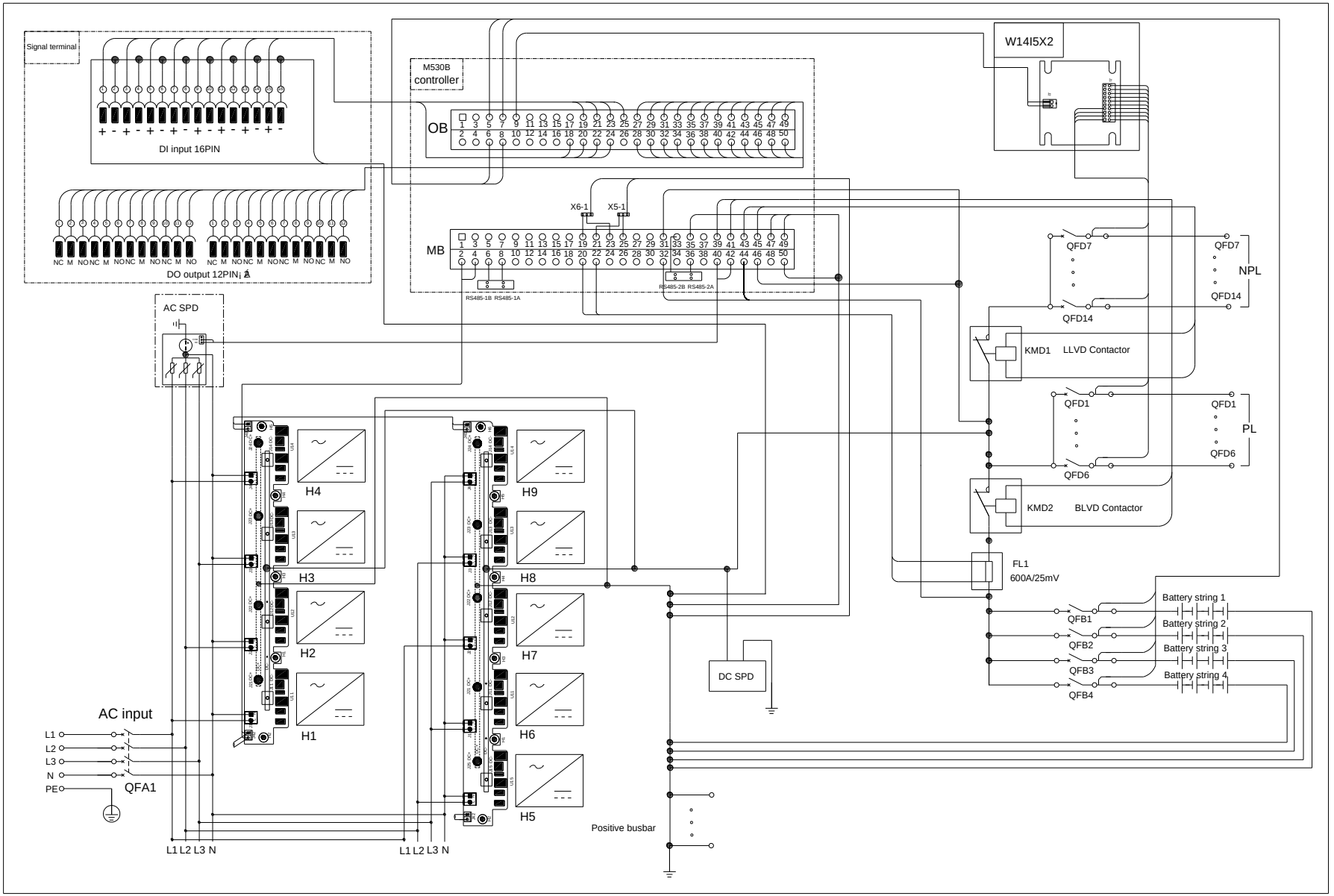


Figure 4 Schematic diagram of NetSure 731 A91 S2