NetSure 531 A41, NetSure 531 A91 Subrack Power System

User Manual

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Vertiv Tech provides customers with technical support. Users may contact the nearest Vertiv local sales office or service center.

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Safety Precautions

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

When operating 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.

BLVD

The system has battery low voltage disconnection (BLVD) function. BLVD means when the mains fail and batteries supply power, the controller cuts the load off when the battery voltage drops down to below 43.2V to prevent over-discharge. The BLVD voltage is settable. Refer to *ACU+ or NCU User Manual* for setting method.

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

The method of disabling BLVD is:

Set “BLVD Enable” item of the controller to “N”. Refer to *ACU+ or NCU User Manual* for setting method.

Notice

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

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

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 composition, configuration, and features.

The “power system” in this manual refers to the NetSure 531 A41 and NetSure 531 A91 series 19 inch subrack power system.

1.1 Composition And Configuration

System composition

The system consists of power distribution parts, rectifiers and controller. The internal structures of the systems are shown in Figure 1-1 to Figure 1-3.

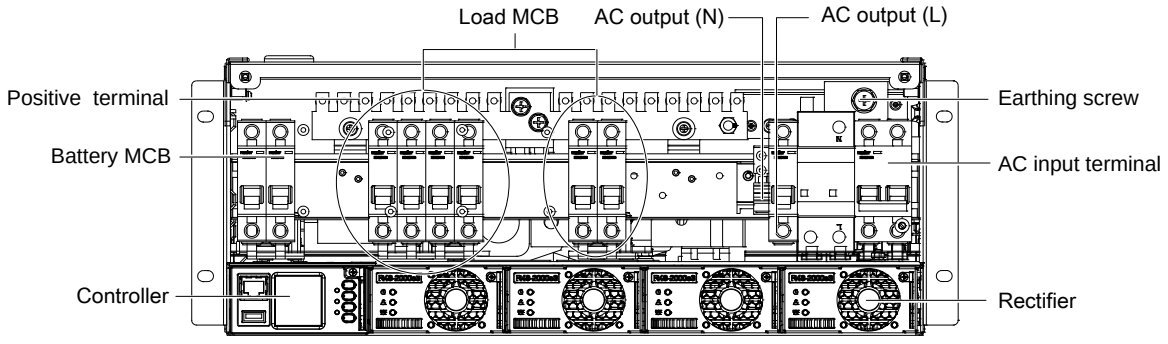


Figure 1-1 NetSure 531 A41-S1/S2 system structure

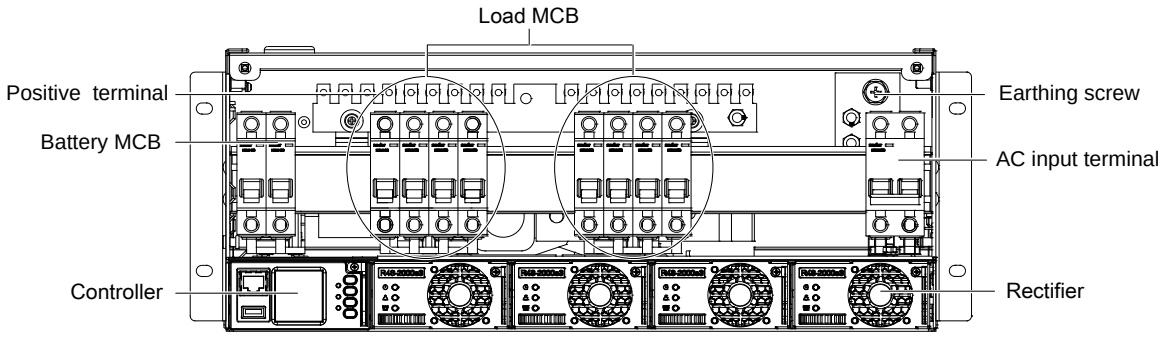


Figure 1-2 NetSure 531 A41-S3 system structure

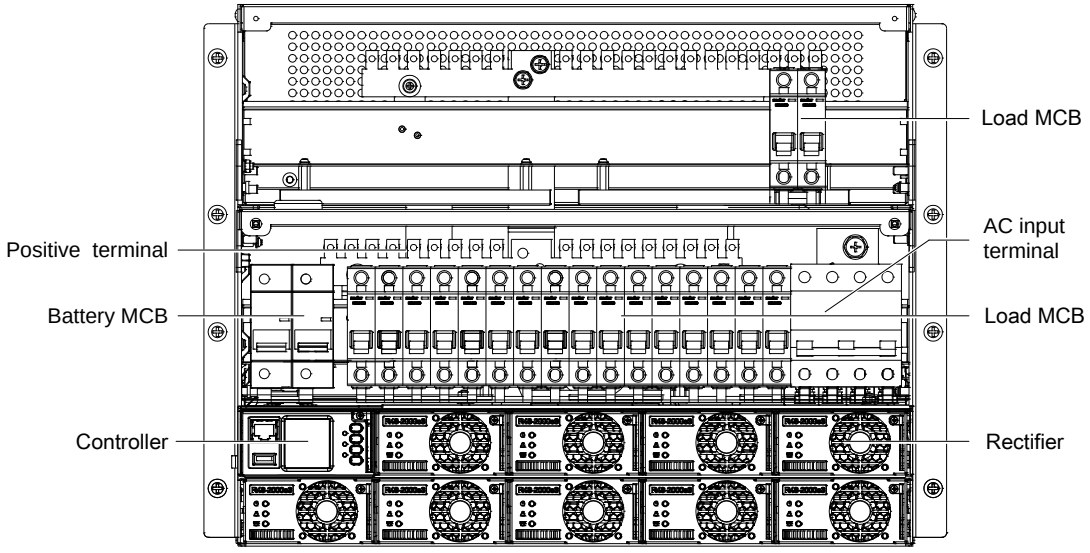


Figure 1-3 NetSure 531 A91-S1 system structure

System configuration

The configurations of the power system are described in Table 1-1.

Table 1-1 Configuration of fixed- configuration system

Item	NetSure 531 A41-S1/S2	NetSure 531 A41-S3	NetSure 531 A91-S1
Contorller	Model：M221S/M222S	Model：M820B/M830B	ModelM221S/M222S
Rectifier	Model: R48-2000e3 Max. configuration: 4 pieces	Model: R48-2000e3 Max. configuration: 4 pieces	Model: R48-2000e3 Max. configuration: 9 pieces
AC power distribution	L＋N＋PE/ 220Vac	L＋N＋PE/220Vac	3P＋N＋PE/380Vac
DC power distribution	BLVD load route: (PL) 1 × 16A/1P; 1 × 16A/1P; MCB LLVD load route： 1 × 63A/1P; 1 × 63A/1P, 2 × 32A/1P MCB	BLVD load route: (PL) 2 × 10A/1P; 2 × 32A/1P MCB LLVD load route： 2 × 63A/1P; 2 × 32A/1P MCB	BLVD load route: (PL) 5 × 63A/1P; 5 × 32A/1P; 8 × 10A/1P MCB LLVD load route：Not configured
AC output MCB	1 × 16A/1P	Optional	Optional
Battery MCB	2 × 63A/1P	2 × 63A/1P	2 × 125A/1P
AC SPD	1 piece	Optional	Optional
DC SPD	1 piece	Optional	Optional
Top cover	Optional	Optional	Optional
BLVD contorller mode	Controller automatic power-off	Controller automatic power-off	Controller automatic power-off
Notes: 1. Optional configuration: Temperature sensor and its cables, battery rack and battery cables 2. Controller automatic power-off: If a battery low voltage disconnection (BLVD) occurs, the controller will fully disconnect from the battery. At this moment, the controller is power-off, communication is failure, and the dry contact alarm is invalid. This control mode can effectively protect the battery against overdischarge due to BLVD. 3. Weight: Packaging included, rectifier and controller excluded			

1.2 Features

- The rectifier uses the active Power Factor Compensation (PFC) technology, raising the power factor to 0.99.
- Wide AC input voltage range: 85Vac ~ 300Vac.
- The rectifier uses soft switching technology, efficiency up to 96%.
- Ultra-low radiation. With advanced EMC design, the rectifier meets international standards such as CE, NEBS and YD/T983 standards. Both the conducted and radiated interference in an optimal state can reach Class B.
- The design of rectifier safety complies with UL, CE and NEBS standards.
- High power density.
- Rectifiers are hot pluggable. It takes less than 1min to replace a rectifier.
- Two over-voltage protection methods are optional: 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.
- Improved battery management: The management functions include the LLVD (optional), BLVD, temperature compensation, auto voltage regulation, stepless current limiting, battery capacity calculation and on-line battery test, etc.
- M221S and M222S support historical alarm record up to 200 pcs and historical record up to 1000 pcs. And M820B/M830B supports historical alarm record up to 3000 pcs and historical record up to 60000 pcs.
- 10 sets of battery test data records.
- Network design: Providing multiple communication ports (such as RS232, Modem, Ethernet and dry contacts), which enables flexible networking and remote monitoring. M820B/M830B support the USB communication interface.
- Improved lightning protection at AC side and DC side.
- Complete fault protection and fault alarm functions.
- NetSure 531 A41-S1 and NetSure 531 A41-S2 adopt the control mode of “Controller automatic power-off”, This way effectively prevents the storage battery from deeply discharging after system battery protection drops out and hence prevents the unattended outdoors and indoors server rooms from the damage due to the deep discharge.

Chapter 2 Installation Instruction

2.1 Safety Regulations

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

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

2. All external circuits that are below 48V and connected to the power system must comply with the requirements of SELV as defined in IEC 60950.

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

4. The power subrack 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 design should meet relevant industry standards.

It is recommended to use the RVVZ cables as AC cables. The cable should reach at least +70°C temperature durability. With cable length shorter than 30 meters, the Cross-Sectional Area (CSA) calculation should be based on the current density of 3.5A/mm^2. The suggested CSA value is no less than the Table 2-1.

Table 2-1 Load cable CSA selection

AC MCB rated current	Max. battery current	Min. cable CSA	Max. cable length
125A	105A	35mm^2	50mm^2
100A	80A	25mm^2	50mm^2
63A	58A	16mm^2	25mm^2

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: 0.5V, with max. CSA)
125A	105A	35mm^2	6 m
63A	50A	16 mm^2	5 m
Note: 1. 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. 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 selection

Load route rated current	Max. output current	Min. cable CSA	Max. cable length (volt drop: 0.5V, with min. CSA)	Max. cable CSA	Max. cable length (volt drop: 0.5V, with max. CSA)
100A	80A	25mm^2	14m	50mm^2	20m
63A	50A	16mm^2	9m	25mm^2	14m
32A	25A	10mm^2	11m	25mm^2	29m
16A	12A	6mm^2	14m	25mm^2	48m
10A	8A	6mm^2	23m	25mm^2	98m
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 overload does not work. 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 25mm^2.

AC and DC power distribution interface definition see Table 2-4.

Table 2-4 AC and DC power distribution interface definition

Connector name		Connector specifications	Wiring instructions
AC power distribution	AC input MCB	H type terminal, max. cable CSA 50mm^2 (63A < MCB rated current ≤ 125A) H type terminal, max. cable CSA 25mm^2 (MCB rated current ≤63A)	AC power line
	Grounding busbar	One M8 bolt, OT type wiring terminal, max. cable CSA 35mm^2	Connected to the grounding bar of the building
DC power distribution	Battery output MCB	H type terminal, max. cable CSA 25mm^2 (MCB rated current ≤63A) H type terminal, max. cable CSA 50mm^2 (63A < MCB rated current ≤ 125A)	Connected to the battery port
	Negative output MCB	H type terminal, max. cable CSA 25mm^2 (MCB rated current ≤63A) H type terminal, max. cable CSA 50mm^2 (63A < MCB rated current ≤ 125A)	Connected to the users load port
	Positive busbar	Terminal subrack terminal：cable CSA ≤ 50mm^2	Connected to the users load port

2.3 Mechanical Installation

Note

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

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 battery rack

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

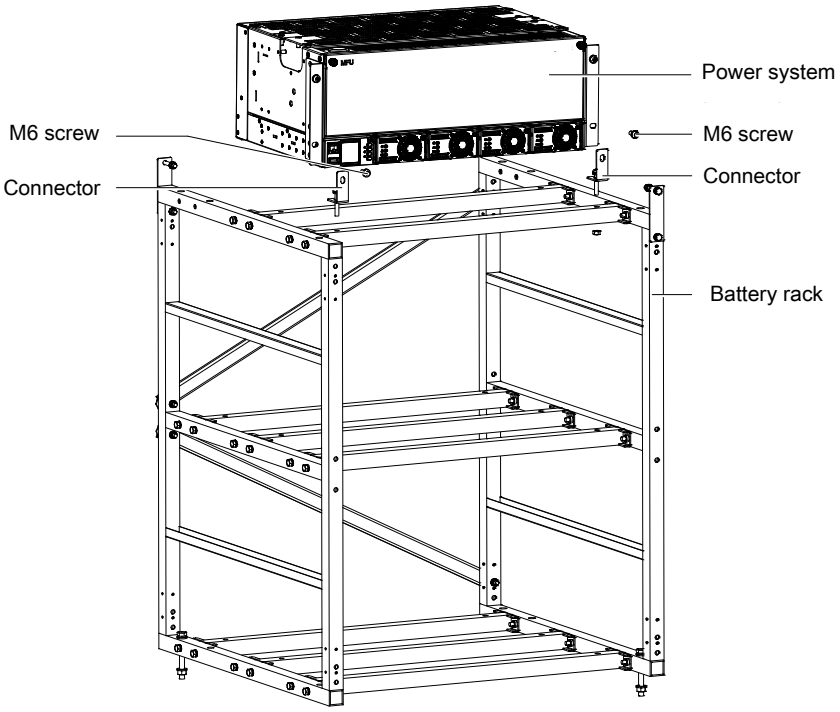


Figure 2-1 Cabinet and rack installation

Installed in cabient

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

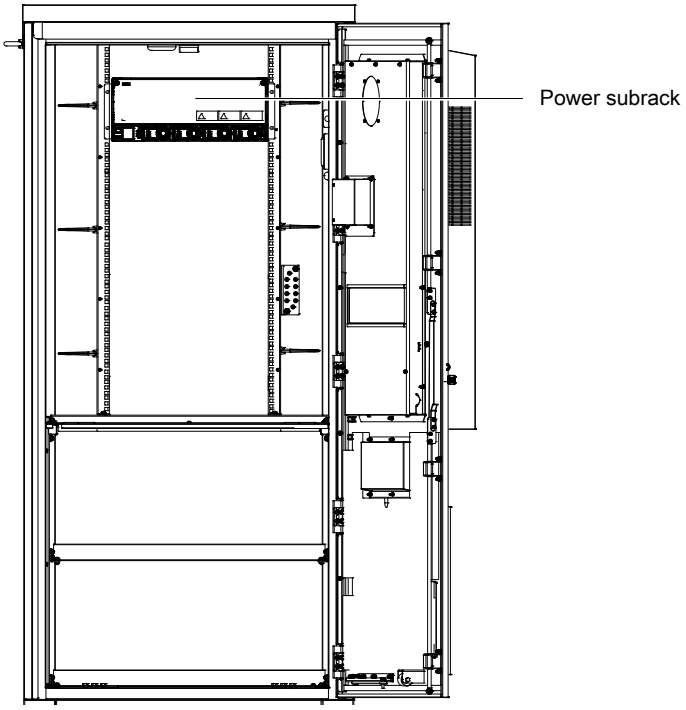


Figure 2-2 Installed in the cabinet system

The engineering graphics of the subrack power system as shown in Figure 2-3 to Figure 2-4.

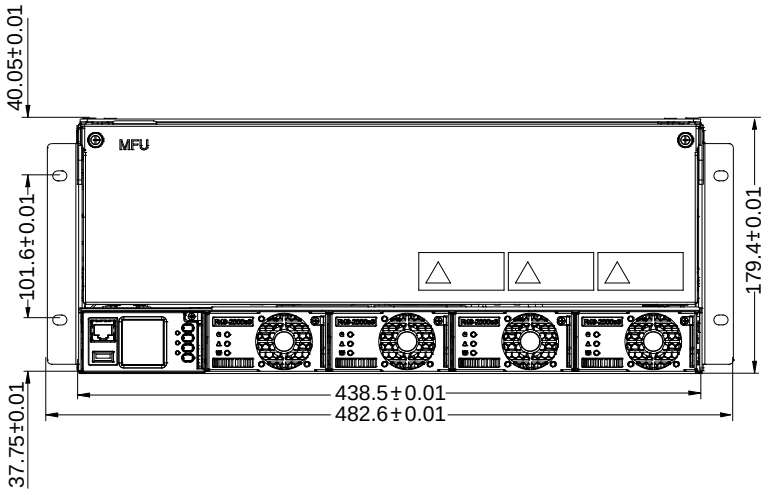


Figure 2-3 Installation size of NetSure 531 A41-S1/S2/S3 (unit: mm)

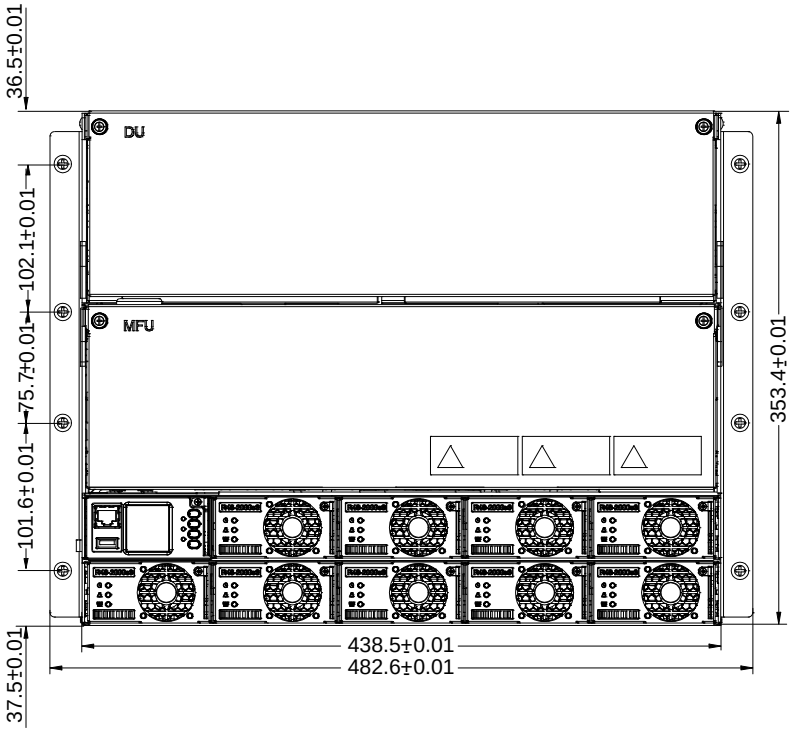


Figure 2-4 Installation size of NetSure 501 A91 (unit: mm)

Note

1. Tighten the captive screw of the MFU and DU Panel by the cross head screwdriver when there is no operation.
2. Also tighten the handle of the 501 modules 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

Epoxy board top cover and rubber ring top cover are optional for this system.

Note:

If the user requires the system to meet the CE certification, install the epoxy board top cover to be installed at a distance of 1.8 meters high above the ground.

Epoxy board top cover for DU unit cabling:

Cabling from the cable outlet area and then fixed to the cable-bundling plate and the top edge. As shown in the Figure 2-5.

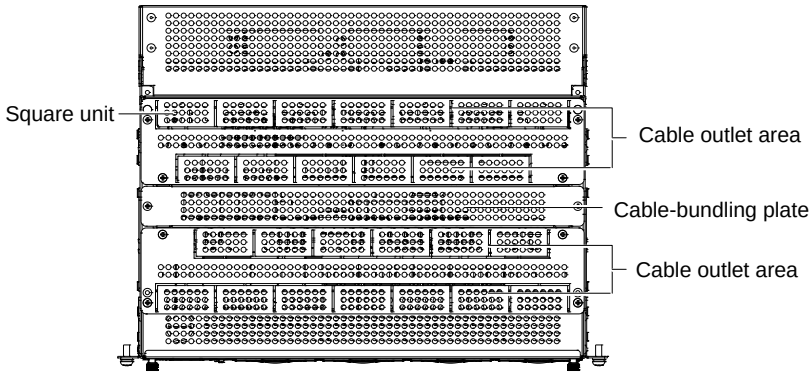


Figure 2-5 Cable entry Illustration of the DU unit

Epoxy board top cover for MFU unit cabling is shown in 2-6.

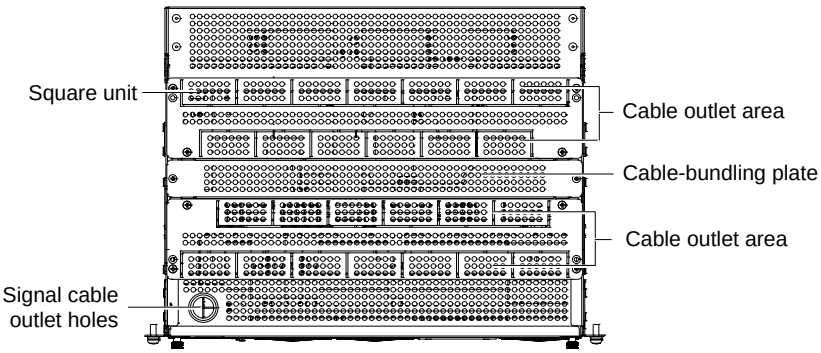


Figure 2-6 Cable entry Illustration of the MFU unit

Dismantle several square units of the cable outlet area on site according to the actual cable outlet space.

Rubber ring top cover for DU unit cabling:

Use the electrician's knife incise the "+" mark on the rubber unit. As shown in Figure 2-7.

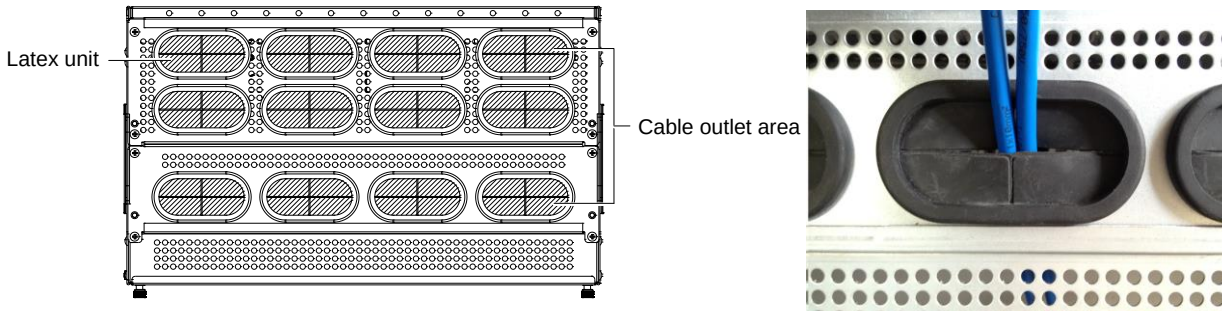


Figure 2-7 Cable entry Illustration of the DU unit

Rubber ring top cover for MFU unit cabling is shown in Figure 2-8.

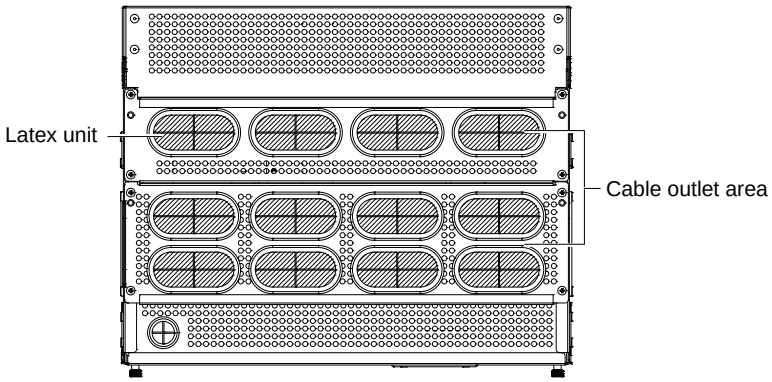


Figure 2-8 Cable entry Illustration of the MFU unit

Dismantle several square units of the cable outlet area on site according to the actual cable outlet space.

Cabling from 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 2-9.

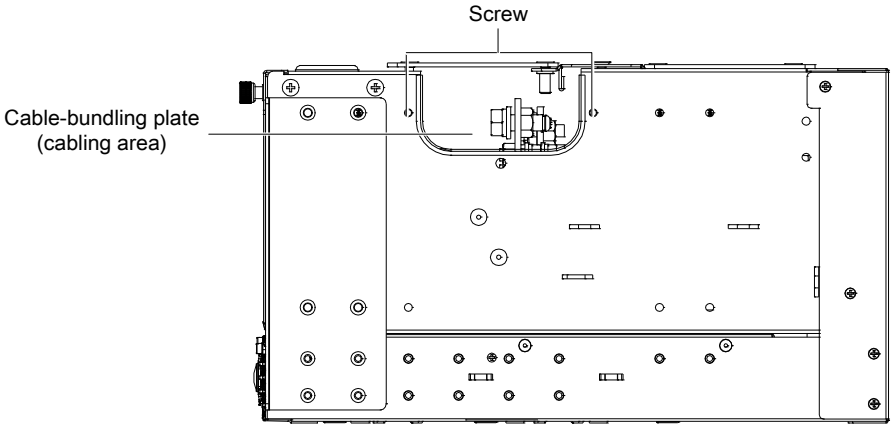


Figure 2-9 Side cable cabling Illustration

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.

Take the NetSure 531 A41 power system as an example, the positions of the terminals are shown in Figure 2-10.

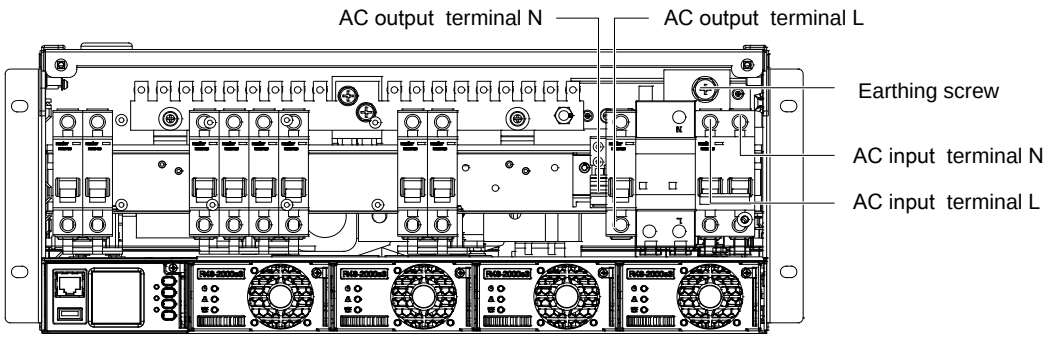


Figure 2-10 Illustration of the connection terminal

Note

1. If the AC input of the subrack is selected as terminal by user, there is no overcurrent and short circuit protection, and you should configure the overcurrent and short circuit protection in the previous level of the subrack. Please contact Vertiv Tech Ltd of local technical support for the device options.

2. Recommends that tightening torque of the users grounding screw is 10.78N*M.

3. If AC input of the system configured with SPD is single-phase, unplug the alarm terminal of the SPD before connecting the ground wire. Then connect the ground wire, and finally reinstall the alarm terminal of the SPD.

2.4.3 Connecting Load Cables

Connect the negative cable of the load to the upper terminal of load MCB. Connect the positive cable of the load to the DC positive busbar, as shown in Figure 2-11.

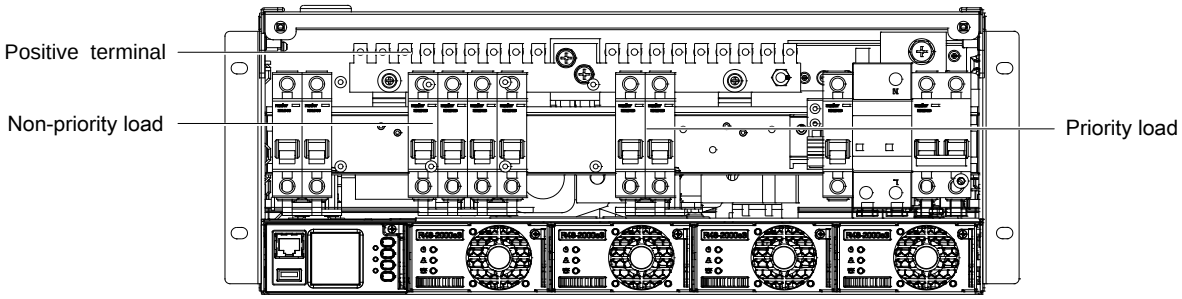


Figure 2-11 Illustration of the load cable connection terminal

2.4.4 Connecting Battery Cables

Note

The batteries may have dangerous current. When connecting the battery cables, observe the following rules:

1. Make sure all the battery MCBs are disconnected.

2. Make sure that the battery cables and the battery string are disconnected. You can also disconnect the battery cell connector to avoid live state or short circuit to the chassis of the power system after installation.

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

4. Never remove the battery cables at the top of the battery MCB when the battery input port of the power system is in live state.

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 2-12.

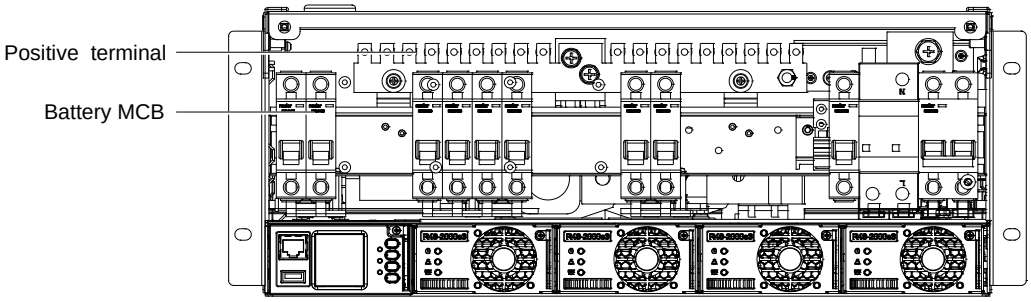


Figure 2-12 Illustration of the battery connection terminal

2.4.5 Connecting Signal Cables

There are two user interface board of the power system can optional, respectively the W2453X1 user interface board and IB2 user interface board. The W2453X1 user interface board is used together with the M221S monitoring unit or M222S monitoring unit only; and the IB2 user interface board is used together with the M820B/M830B monitoring unit only.

W2453X1 user interface board cable connection

Take the NetSure 531 A41-S1 power system as an example, the position of the user connector board (W2453X1) is shown in Figure 2-13.

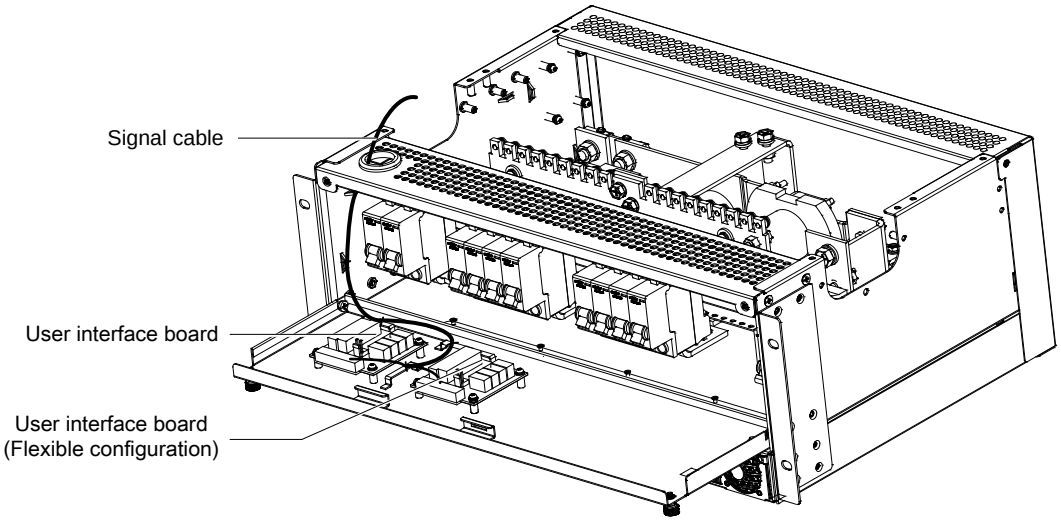


Figure 2-13 W2453X1 user interface board Illustration

At most two user connector boards are allowed in the power system. Standard cabinet is only configured with one user connector board.

With one user connector board configured, the power system provides three external digital signal input interfaces: DI2, DI3, DI4 (DI1 is used for DC SPD alarm. If no DC SPD is configured in the power system, DI1 is available) and four dry contact alarm output interfaces: DO1, DO2, DO3, DO4. With two user connector boards configured, the power system provides additional four dry contact alarm output interfaces: DO5, DO6, DO7, and DO8.

Active dry contact need to be connected to the digital input port of the W2453X1 user interface board. The specifications of the dry contact interface are as follows:

Digital inputs: opto-isolation, the alarm and power frequency is definable (high power level: 20V ~ 60V, low power level: less than 1V).

Digital output: relay isolation, Max.:30Vdc/1A, 125Vac/0.5A, 60W; Min.: 10uA@10Vdc, alarm is definable.

The functions of the interfaces are shown in Table 2-5.

Table 2-5 Nterface functions

Type	Default alarm	Description
Dry contact 1	AC power failure	/
Dry contact 2	DC overvoltage or DC undervoltage	Four-level DC voltage alarms
Dry contact 3	Rectifier alarm	Except rectifier lost and multi-rectifier alarm
Dry contact 4	Priority LLVD	/
Dry contact 5	Non-priority LLVD	Exist when the second user interface board is installed
Dry contact 6	/	Exist when the second user interface board is installed
Dry contact 7	/	Exist when the second user interface board is installed
Dry contact 8	/	Exist when the second user interface board is installed

With default settings, when the preceding alarms are generated, the contactors of the corresponding dry contacts should change their status, that is, the normally-open contactors close, and the normally-closed contactors open. All the status changes should be verified by a multimeter. After the alarms are removed, the dry contacts should resume.

The default settings of the dry contact alarms can be changed through the controller. The interfaces of the user connector board are shown in Figure 2-14.

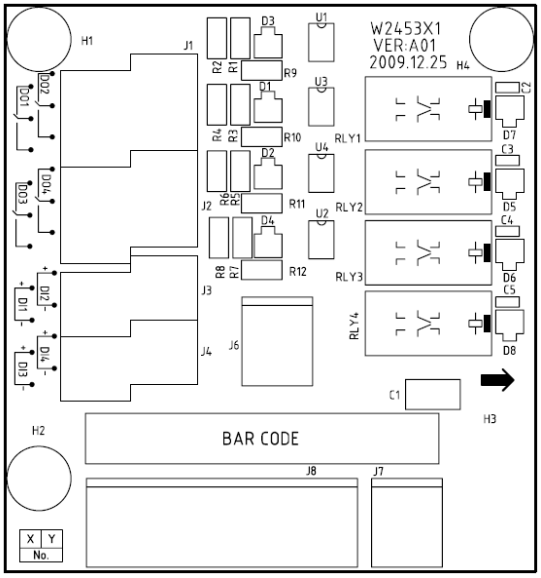


Figure 2-14 W2453X1 user connector board interface

IB2 user interface board

The external input and output signals are all connected to the IB2 user interface board. For the ports on the IB2 user interface board, see Figure 2-15.

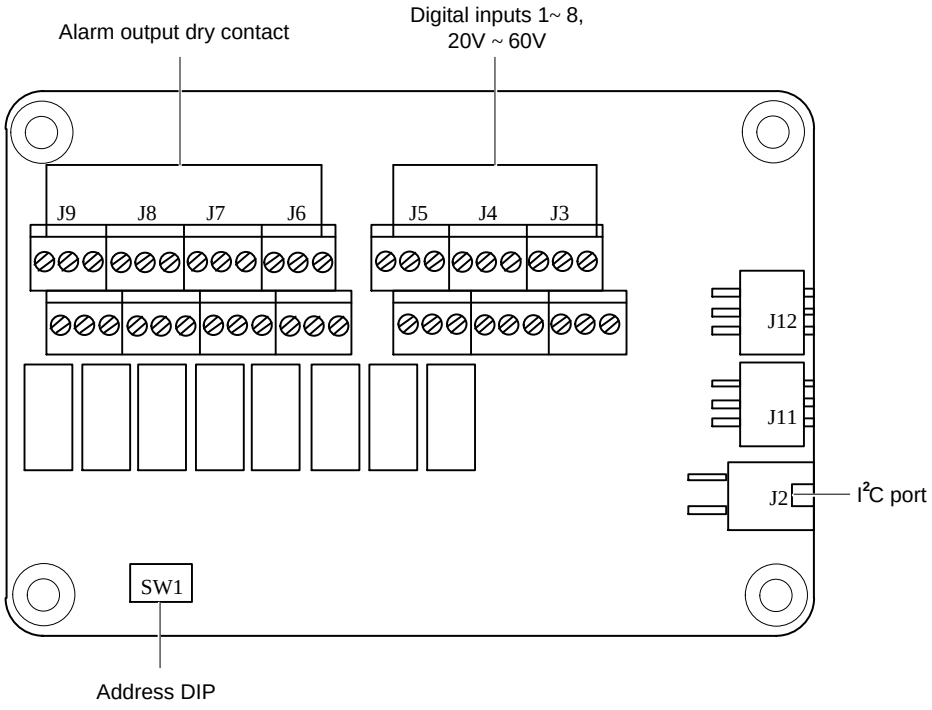


Figure 2-15 IB2 extension board port definition

Note

1. J11 and J12 are temperature sensor ports. They are not used here.

2. J2 is I^2C interface, and provides the power.

See Table 2-6 for the dry contact terminal definition.

Table 2-6 Dry contact terminal definition

Name of double-layer port	Pin No.	Pin name	Definition
J3	1	DI1-	Digital input 1-
	2	DI1+	Digital input 1+
	3	DI2-	Digital input 2-
	4	DI2+	Digital input 2+
	5	DI3-	Digital input 3-
	6	DI3+	Digital input 3+
J4	1	DI4-	Digital input 4-
	2	DI4+	Digital input 4+
	3	DI5-	Digital input 5-
	4	DI5+	Digital input 5+
	5	DI6-	Digital input 6-
	6	DI6+	Digital input 6+
J5	1	DI7-	Digital input 7-
	2	DI7+	Digital input 7+
	3	DI8-	Digital input 8-
	4	DI8+	Digital input 8+
	5	NA	/
	6	NA	/
J6	1	DO1_NC	NC contact of relay 1
	2	DO2_NC	NC contact of relay 2
	3	DO1_COM	Common contact of relay 1
	4	DO2_COM	Common contact of relay 2
	5	DO1_NO	NO contact of relay 1
	6	DO2_NO	NO contact of relay 2
J7	1	DO3_NC	NC contact of relay 3
	2	DO4_NC	NC contact of relay 4
	3	DO3_COM	Common contact of relay 3
	4	DO4_COM	Common contact of relay 4
	5	DO3_NO	NO contact of relay 3
	6	DO4_NO	NO contact of relay 4
J8	1	DO5_NC	NC contact of relay 5
	2	DO6_NC	NC contact of relay 6
	3	DO5_COM	Common contact of relay 5
	4	DO6_COM	Common contact of relay 6
	5	DO5_NO	NO contact of relay 5
	6	DO6_NO	NO contact of relay 6
J9	1	DO7_NC	NC contact of relay 7
	2	DO8_NC	NC contact of relay 8
	3	DO7_COM	Common contact of relay 7
	4	DO8_COM	Common contact of relay 8
	5	DO7_NO	NO contact of relay 7
	6	DO8_NO	NO contact of relay 8

The definition of dry contact function can be set through controller.

The specifications of the dry contact ports are as follows:

Digital inputs: 8-route, opto-isolation, the alarm and high/low level are definable (high level: 20V ~ 60V, low level: less than 1V).

Digital output: 8-route, relay isolation, maximum: 30Vdc 1A, 125Vac 0.5A; 60W; minimum: 10uA @ 10Vdc, alarm is definable.

Connecting Communication Signal Cable

The communication port of the M221S controller is shown in Figure 2-16. The M222S only provides the RS232 communication serial port, whereas the Ethernet port is not provided.

Figure 2-16 M221S controller communication port

The communication port of the M820B controller is shown in Figure 2-17.

Figure 2-17 M820B controller communication port

The communication port of the M830B controller is shown in Figure 2-18.

Figure 2-18 M830B controller communication port

Chapter 3 Commissioning

The more details of the controller please refer to the *ACU+ User Manual,* the NCU *User Manual* and the *LCU+ User Manual.* This chapter introduces procedures of installation testing. The corresponding safety rules shall be adhered to in the test.

3.1 Installation Check And Startup

Before the test, inform the chief manufacturer representative. Only 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 MCBs and cables. Are their models correct?	☐	
Check the bus bar connections, input and output cable connection, and connection between the power system and the system grounding.	☐	
Check the if the number and connections of the batteris are correct. Check the polarity of the battery string with a voltmeter.	☐	
Make sure all the cable connections are firm and reliable.	☐	

Startup preparations

	OK	Comments
Make sure that all the MCB are switched off.	☐	
Measure the AC input voltage. Make sure the input voltage is within the allowable range.	☐	Umin=___V
Check that the 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	☐	
Switch off unconnected battery MCBs. Check that the battery signal cables are connected to battery MCBs reliably, not loosened or suspended	☐	
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. The green LED on the rectifier will be on and the fan will start running after a certain delay. The controller 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 unplugging and inserting each rectifier. Check their output voltages.	☐	

3.2 Basic Settings

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

(The password of the M221S, M222S controller is: 2; the M820B controller is: 1 ;The User and password of the M830B controller is set by web, see *NetSure™ Control Unit (NCU) User Manual, UMM830B (Issue AA, June 3, 2014)*)

	OK	Comments
The system model has been set correctly in factory before delivery, check that the setting agrees with the actual system: (The path to check and set of the M221S, M222S controller: Settings→Bat. Settings→Basic Settings） (The path to check and set of the M820B controller: Settings→Battery→ Battery 1→Shunt Current/Shunt Voltage） (The path to check and set of the M830B controller: Settings→Batt Settings→ Batt 1→Shunt Current/Shunt Voltage）NetSure 531 A41-S1～S2: 48V/SET; Set the battery shunt coefficient for: 175A/25mV； NetSure 531 A41-S3: 48V/SET; Set the battery shunt coefficient for: 175A/25mV； NetSure 531 A91-S1: 48V/SET; Set the battery shunt coefficient for: 300A/25mV		
The DC over-voltage alarm point has been set correctly in factory before delivery, check that the setting agrees with the actual system: Set DC over-voltage alarm: 58V (The path to check and set of the M221S, M222S controller: Settings→DC Settings→OverVolt) (The path to check and set of the M820B controller: Settings→Power System→General→Over Voltage) (The path to check and set of the M830B controller: Login the web page to set)		
Check that the alarm mode is set to "High"		
The battery string number set at the controller should be the same as the number actually connected. (By default: 2) (The path to check and set of the M221S, M222S controller: Settings→ Bat. Settings→Basic Settings→Bat. Fuse) (The path to check and set of the M820B controller: Settings→ Battery→Basic→Num Batt Shunts) (The path to check and set of the M830B controller: Settings→ Batt Settings →Basic Settings →Num Batt Shunts)		
Set the battery capacity according to the actual capacity of the battery connected to the system. Default: 300Ah (The path to check and set of the M221S, M222S controller: Settings→ Bat. Settings→Basic Settings→Capacity) (The path to check and set of the M820B controller: Settings→ Battery→ Battery 1→Rated Capacity) (The path to check and set of the M820B controller: Settings→ Battery→ Battery 1→Rated Capacity)		
Set the charge current limit according to your needs. Setting range: 0.1~0.25C10. (By default: 0.1C10) (The path to check and set of the M221S, M222S controller: Settings→ Bat. Settings→Charge) (The path to check and set of the M820B controller: Settings→ Battery→Charge) (The path to check and set of the M830B controller: Settings→Batt Settings→Temp Comp)		
Set the controller according to the voltage suggested by the battery supplier. Floating Charge (FC) voltage range: 42V ~ Boost Charge (BC) voltage. Default: 53.5V. BC voltage range: FC voltage ~ 58V. By default: 56.4V. (The path to check and set of the M221S, M222S controller: Settings→ Bat. Settings→Charge) (The path to check and set of the M820B controller: Settings→ Battery→Charge→Float Voltage/EQ Voltage) (The path to check and set of the M830B controller: Settings→ Batt Settings→Charge→Float Voltage/EQ Voltage) For batteries that do not need BC, set the BC voltage to FC voltage plus 0.1V		
Put through the battery MCBs and connect the batteries		

Set the charge current limit according to your needs. Setting range: 0.1 C_{10}~0.25C_{10}. (By default: 0.1C10)

(The path to check and set of the M221S, M222S controller: Settings→ Bat. Settings→Charge)

(The path to check and set of the M820B controller: Settings→ Battery→Charge)

(The path to check and set of the M830B controller: Settings→ Batt Settings→Charge→Batt Curr Limit)

3.3 Alarm Check And System Operation Status Check

Alarm check

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

	OK	Comments
Pull out one rectifier. The “Rect N Com Failure” alarm should be triggered. Insert the rectifier in. The alarm should disappear. Repeat the same procedures on other rectifiers.		
Remove battery MCB 1. The “Batt1 Failure” alarm should be triggered. Put on the MCB. The alarm should be cleared. Repeat the same on battery MCB 2.		
Switch off a load MCB connected to a load route. The alarm “Load 1 Failure” should be triggered. Switch on the MCB, and the alarm should be cleared. Repeat the same on the other load MCBs.		
Remove all the battery input MCBs. Keep only one rectifier in operation. Through the controller, adjust the rectifier FC voltage to make it lower than the alarm point. The alarm “DC Voltage Low” should be triggered.		
Keep the rectifiers in operation. Set through the controller the battery management parameter to “Manual”. Enter the maintenance menu at the controller. Select “Disconnect” and confirm it. The battery protection contactor should be open, and the “BLVD” alarm should be displayed at the controller.		
Note: when the preceding alarms are generated, the controller will give alarms after approximately 3s.		

System operation status check

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

	OK	Comments
Check that the system type agrees with the actual system when the system operates		
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 bus bar 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 parameters.		
For the system configured with temperature sensor, the controller should be able to display the battery ambient temperature. Hold the probe of the temperature sensor with hand and watch the controller, which should diplay the change of temperature.		

3.4 Final Steps

	OK	Comments
Disconnect all test equipment from the system and make sure that materials irrelevant to the equipment have been all removed.		
Restore the equipment to its original condition and close the subrack door.		
Check and handover the equipment that the user has purchased.		
Note down all the operations taken, including time of the operation and name of the operator.		

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 Trouble Shooting

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

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

🕮 **Note**

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

4.1 Alarms Handling

The alarms are classified in four levels: critical alarm, major alarm, observation alarm and no alarm.

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

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

No alarm: if alarms are set as ‘no alarm’ by the users, when these alarms occur, no visible or audible indication will be generated and the system works normally.

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

As alarm of "Rect Lost" for example:

For M221S/M222S controller: MAIN MENU —> Settings —> Alarm —> Alarm Control —> Clear —> For the submenu of "Clear", you can select "Rect Lost" to clear corresponding alarm.

For M820B controller: MAIN MENU —> Manual —> Rectifier —> Clear Rect Lose.

For M830B controller: Settings—> Alarm Settings—> Clear Rect Lost. , you can select "Yes" to clear corresponding alarm.

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

Table 4-1 System setting parameter description

No.	Alarm	Handling method
1	Mains Failure	If the failure does not last long, the battery will power the load. If the cause is unknown or the failure lasts too long, a diesel generator is needed. Before using the generator power to supply the power system, it is suggested to run the generator five minutes to minimize the impact on the 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 rectifier will stop operation when the mains voltage is more than 530V. 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 304V, the output power of the rectifiers will be derated. And if lower than 260V, the rectifiers will stop working. If the mains voltage is under the AC under-voltage value, the mains grid should be improved
4	SPD failure	Check the SPD condition. If the SPD is damaged, replace it
5	DC Volt High	Check the DC over-vlotage value through the controller. If the set 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

No.	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 530V or under 260V. 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 fan
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	Batt Over Temp	1. Check if the battery compartment temperature is too high. If yes, cool down the battery compartment. 2. Check if there is battery internal fault. If yes, replace the faulty battery

4.2 Rectifier Fault Handling

The indicator description, fan and handling methods of all the rectifiers on the system are the same.

Alarm handling

The symptoms of usual rectifier faults include: Run indicator (green) off, Protection indicator (yellow) on, Protection indicator flash, Fault indicator (red) on and Fault indicator flash, as shown in Figure 4-1.

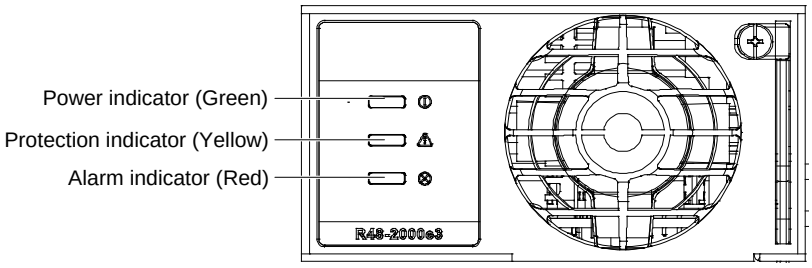


Figure 4-1 Rectifier indicator

The indicators are shown in Table 4-2.

Table 4-2 Indicator fault description

Symptom	Monitoring module alarms	Causes	Handling method
Run indicator off (green)	No alarm	No input/output voltage	Make sure there is input/output voltage
		Assistant power source of the rectifier fails	Replace the recitifier
Run indicator flash(green)	No alarm	The monitoing module performs operations upon the rectifier	No actions need to be taken
Protection indicator on (yellow)	Rect Protect	AC input voltage abnormal	Make sure the AC input voltage is normal
	Rect Protect	Fan blocked	Remove the object that blocks the fan
		Ventilation path blocked at the inlet or vent	Remove the object at the inlet or vent
		Ambient temperature too high or the inlet too close to a heat source	Decrease the ambient temperature or remove the heat source

Symptom	Monitoring module alarms	Causes	Handling method
Protection indicator on (yellow)	Load share Alarm	Current sharing imbalance	Check whether the rectifier communication is normal. If not, check whether the communication cable is in normal connection. If the communication is normal while the protection indicator is on, replace the rectifier
	Rect Protect	Power factor compensation internal under voltage or over voltage	Replace the rectifier
Protection indicator flash(yellow)	Rect Not Respond	Rectifier communication interrupted	Check whether the communication cable is in normal connection
Fault indictor on (red)	Rect HVSD	Rectifier over-voltage	Reset the rectifier. If the protection is triggered again, replace the rectifier
	Rect Failure	Two or more recitifiers have the same ID number	Contact Vertiv for maintenance
	Rect Failure	Average current of positive and negative deviations ≤ 1.2A	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
Fault indicator flash (red)	Rect Fan Fails	Fan fault	Replace the fan

Replacing R48-2000e3 rectifier

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

1. Place the Rectifier into an unoccupied mounting slot without sliding it in completely.

2. Loosen the captive fastener securing the top of the latch mechanism to the front of the Rectifier. Pull the top of the latch mechanism away from the Rectifier (this will retract the latch mechanism located on the underside of the Rectifier). Refer to Figure 4-2 for latch mechanism illustration.

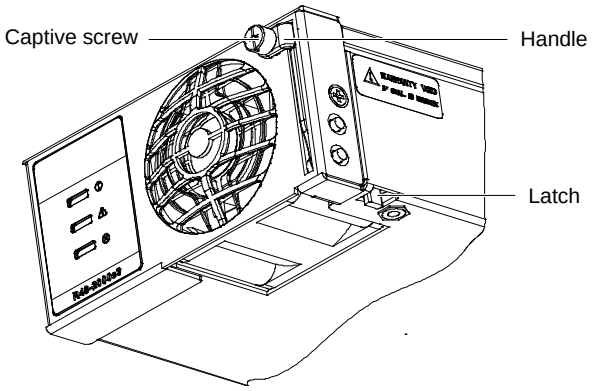


Figure 4-2 Installing a Rectifier

3. Push the Rectifier completely into the shelf.

Note

Surface temperature of the removed module is still high, hold the module to avoid falling.

4. Push the top of the latch mechanism into the front panel of the Rectifier and secure by tightening the captive fastener. This locks the Rectifier securely to the shelf.

5. Repeat the above steps for each Rectifier being installed in the system

6. After the Rectifiers are physically installed in the mounting shelf(s), they are ready for operation immediately after power is supplied to them.

7. Certain functions (i.e. rectifier current limit, rectifier addressing) may require adjustment when adding or replacing a Rectifier Module. Refer to the Power System documentation for instructions.

Appendix 1 Technical And Engineering Data

Table 1 Technical data

Parameter category	Parameter	Description
Environmental	Operating temperature	-5°C ~ +40°C
	Storage temperature	-40°C ~ +70°C
	Relative humidity	5%RH ~ 95%RH
	Altitude	≤ 2,000m (derating is necessary above 2,000m)
	Polution level	Level 2
	Others	No conductive dust or erosive gases. No possibility of explosion
AC input	AC input system	NetSure 531 A41-S1/S2/S3: L＋N＋PE/220Vac; NetSure 531 A91-S1: 3P＋N＋PE/380Vac
	AC input type	TN, TT
	Input voltage range	85 Vac ~ 300Vac
	Input AC voltage frequency	45Hz ~ 65Hz
	Max input current	NetSure 531 A41-S1/S2 ≤ 58A; NetSure 531 A41-S3 ≤ 48A; NetSure 531 A91-S1 ≤ 36A
	Power factor	≥ 0.99
	Over-voltage level	Level II
DC output	Standard output DC voltage	-48Vdc
	Rated output DC voltage	-53.5Vdc
	Output DC voltage	-43.2Vdc ~ -57.6Vdc
	Maximum output current	NetSure 531 A41: If battery MCB: 2 × 63A/1P, the DC load output ≤ 100A, battery charging current ≤ 38A; If battery MCB no less than: 3 × 63A/1P or 2 × 80A/1P or 2 × 100A/1P or 2 × 125A/1P, the DC load output ≤ 120A, battery charging current ≤ 18A; NetSure 531 A91: If battery MCB: 2 × 125A/1P, the DC load output ≤ 200A, battery charging current ≤ 115A; If battery MCB no less than: 3 × 100A/1P or 3 × 125A/1P or 4 × 80A/1P, the DC load output ≤ 250A, battery charging current ≤ 65A Note: System full load output at +40℃. Output power derates about 2% when temperature increases 1℃.
	Voltage set-point accuracy	≤ 1%
	Maximum dfficiency	≥ 95%
	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	Default: 280 ± 5Vac, cofigurable 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	Default: 180 ± 5Vac, configurable through controller
	AC input under-voltage alarm recovery point	Default: 190 ± 5Vac, 10Vac higher than the AC input under-voltage alarm point
	AC input over-voltage protection point	305 ± 5Vac by default, cofigurable through controller 295 ± 5Vac by default, Lower than the AC input voltage protection point 10Vac
	AC input over-voltage protection recovery point	NetSure 531 A91, NetSure 501 A91: 295 ± 5Vac by default, 10Vac lower than the AC input over-voltage alarm point NetSure 701 A41: 285 ± 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

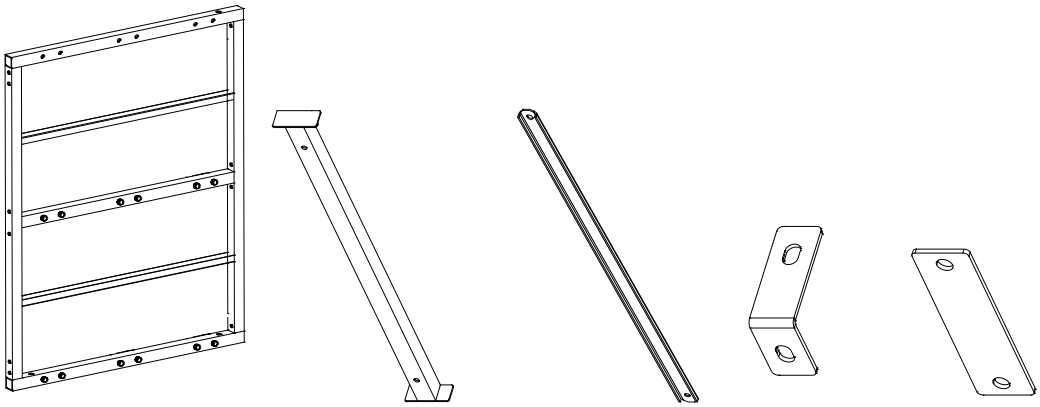
Parameter category	Parameter	Description
DC output alarm and protection	DC output over-voltage alarm point	Default: -58.0 ± 0.2Vdc, configurable through controller
	DC output over-voltage recovery point	Default: -57.5 ± 0.2Vdc, 0.5Vdc lower than the over-voltage alarm point
	DC output under-voltage alarm point	Default: -45.0 ± 0.2Vdc, 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 proteciton point	Default: -59.0 ± 0.2Vdc, configurable through controller
	LLVD	Default: -44.0 ± 0.2Vdc, configurable through controller
	BLVD	Default: -43.2 ± 0.2Vdc, 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 outputs 100% power 132Vac input, The rectifier outputs 1400W power 93Vac input, The rectifier outputs 1000W power 85Vac input, The rectifier low pressure power off
	Output delay	Output voltage can rise slowly upon rectifier start up. The rise time is configurable
	Fan speed adjustable	Rectifier fan speed can be set to half or full speed
	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, 59V 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 derating	Temperature below 55°C, outputs full power At 55°C to 65°C, output power is Linear decline in 1,800W; At 65°C to 70°C, output power is Linear decline in 1,500W; At 70°C to 80°C, output power is Linear decline in 0W
EMC	Conducted emission	Class A EN55022
	Radiated emission	
	Harmonic current emission	Class A EN61000-3-12
	Voltage fluctuation and flash	EN61000-3-11
	Immunity to EFT	Level 4 EN/IEC 61000-4-4
	Immunity to ESD	Level 3 EN/IEC 61000-4-2
	Immunity to surges	Level 4 EN/IEC 61000-4-5
	Immunity to radiation	Level 2 EN/IEC 61000-4-3
	Immunity to conduction	Level 2 EN/IEC 61000-4-6
Lightning protection features	At AC side	The AC input side can withstand five times of simulated lightning voltage of 5Kv at 10/700μs, for the positive and negative polarities respectively. It can withstand five times of simulated lightning surge current of 20Ka at 8/20μs, for the positive and negative polarities respectively. The test interval is not smaller than 1 minute. It can also withstand one event of simulated lightning surge current of 40Ka at 8/20μs

Parameter category	Parameter		Description
Others	Safety regulation		Conform to IEC60950-1 standards
	Acoustic noise		≤ 60db (A) (When the ambient temperature is lower than25°C)
	Insulation resistance		At temperature of 15°C ~ 35°C and relative humidity not bigger than 90%RH, apply a test voltage of 500Vdc. The insulation resistances between AC circuit and earth, DC circuit and earth, and AC and DC circuits are all not less than 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: 50Hz, 3,000Vac; or 4,242Vdc; DC circuit to earth: 50Hz, 2,500Vac; or 3,535Vdc; AC to DC circuits: 50Hz, 1,000Vac; or 1,414Vdc; Assistant circuit (not directly connected to the host circuit): 50Hz, 500Vac. For all the three tests above, there should be no breakdown or flashover within 1min, with leakage current not bigger than 10Ma;
	MTBF		> 200,000hr
	ROHS		Compliant with R5 requirement
Mechanical	Dimensions (mm)(W×D×H)	Maximum dimensions of the subracks	NetSure 531 A41-S1/S2/S3: 483 × 310 × 178 NetSure 531 A91-S1: 483 × 310 × 356
		Controller:	M221S/M222S/ M820B/M830B: 87 × 212 × 42
		Rectifier	84.5 × 252.5 × 42
	Weight (kg)	Subrack (with rectifiers and controller)	NetSure 531 A41-S1/S2/S3: ≤ 25; NetSure 531 A91-S1: ≤ 40
		Subrack (without rectifiers and controller):	NetSure 531 A41-S1/S2/S3: ≤ 12; NetSure 531 A91-S1: ≤ 20

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

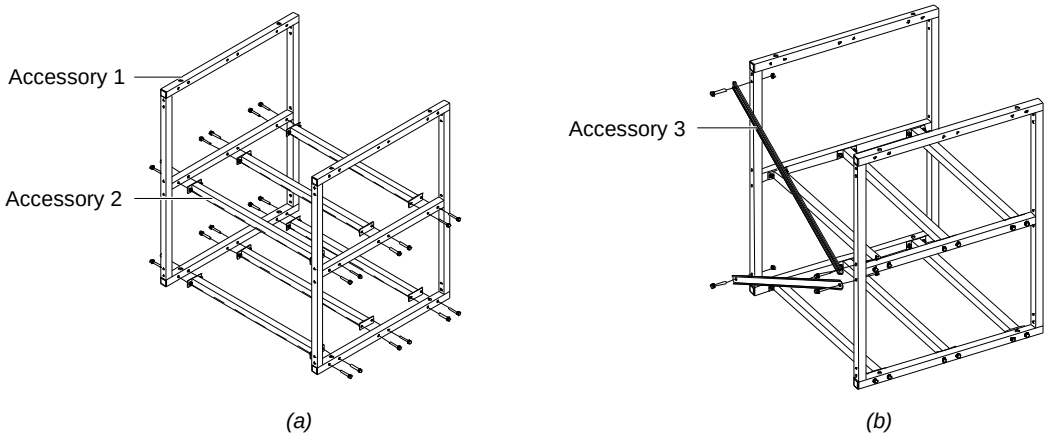
Battery rack / Accessory	Two-layer battery rack	Four-layer battery rack
Accessory 1	2	4
Accessory 2	8	14
Accessory 3	2	4
Accessory 4	2	2
Accessory 5	0	2
Expansion bolt	4 pieces	4 pieces
Fastener	1 set	1 set

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.

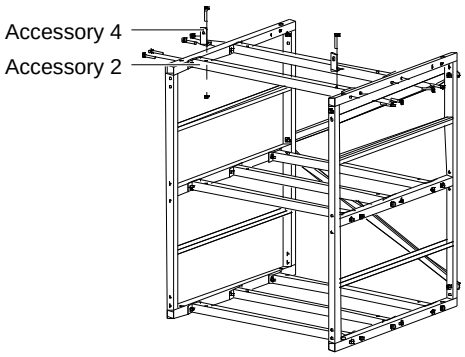


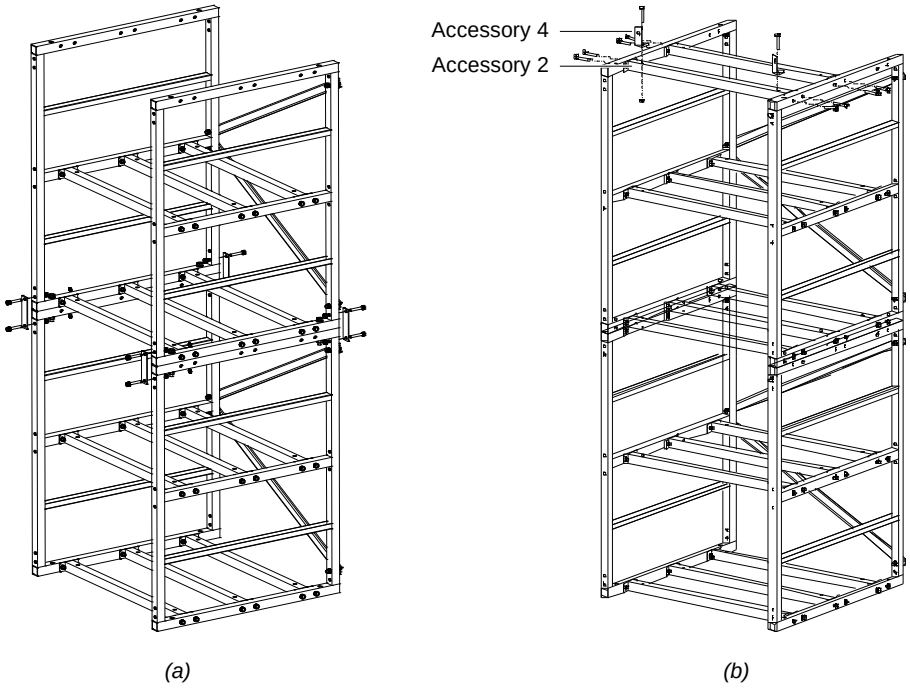
Figure 3 Installation procedure of accessory 2 and accessory 4

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).

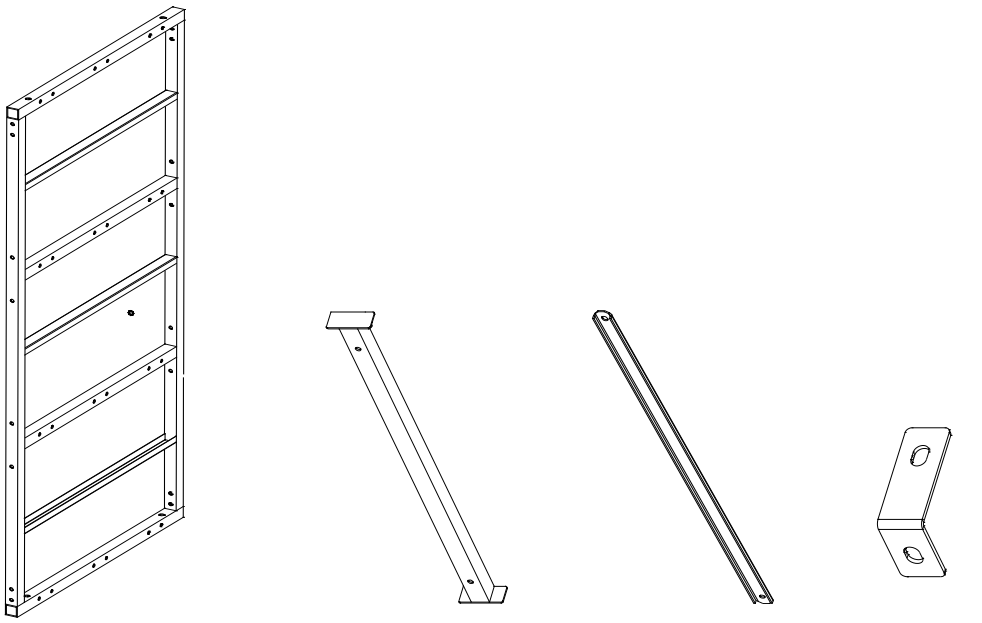


(a) *(b)*

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*

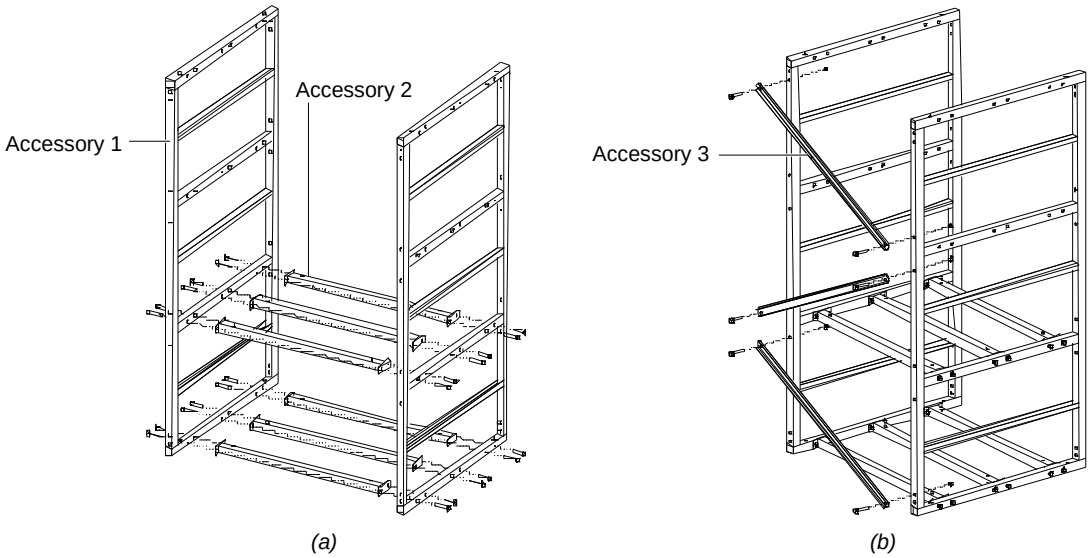
Figure 5 Accessory

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.

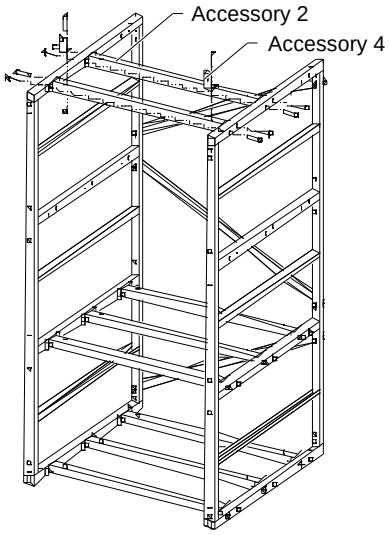


Figure 7 Installation procedure of accessory 2 and accessory 4

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.

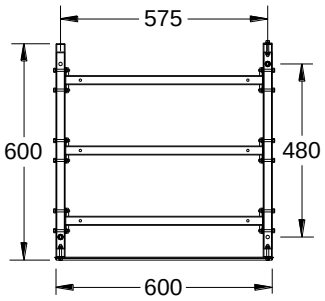


Figure 8 Installation dimensions (unit: mm)

2. Fix the subrack power system onto the top of the battery rack. Refer to 2.3 Mechanical Installation.

Appendix 3 Wiring Diagram

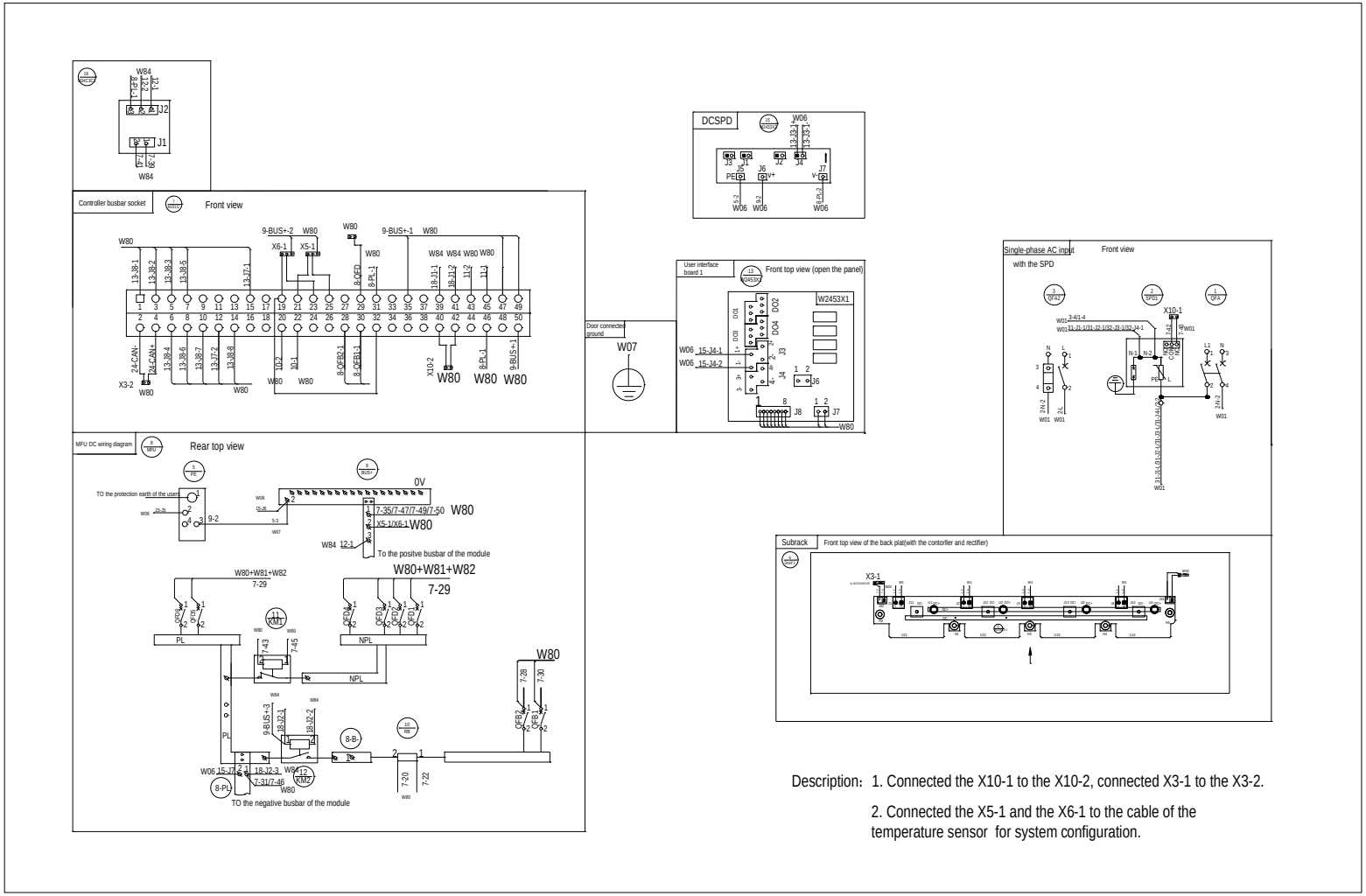


Figure 9 NetSure 531 A41-S1 wiring diagram

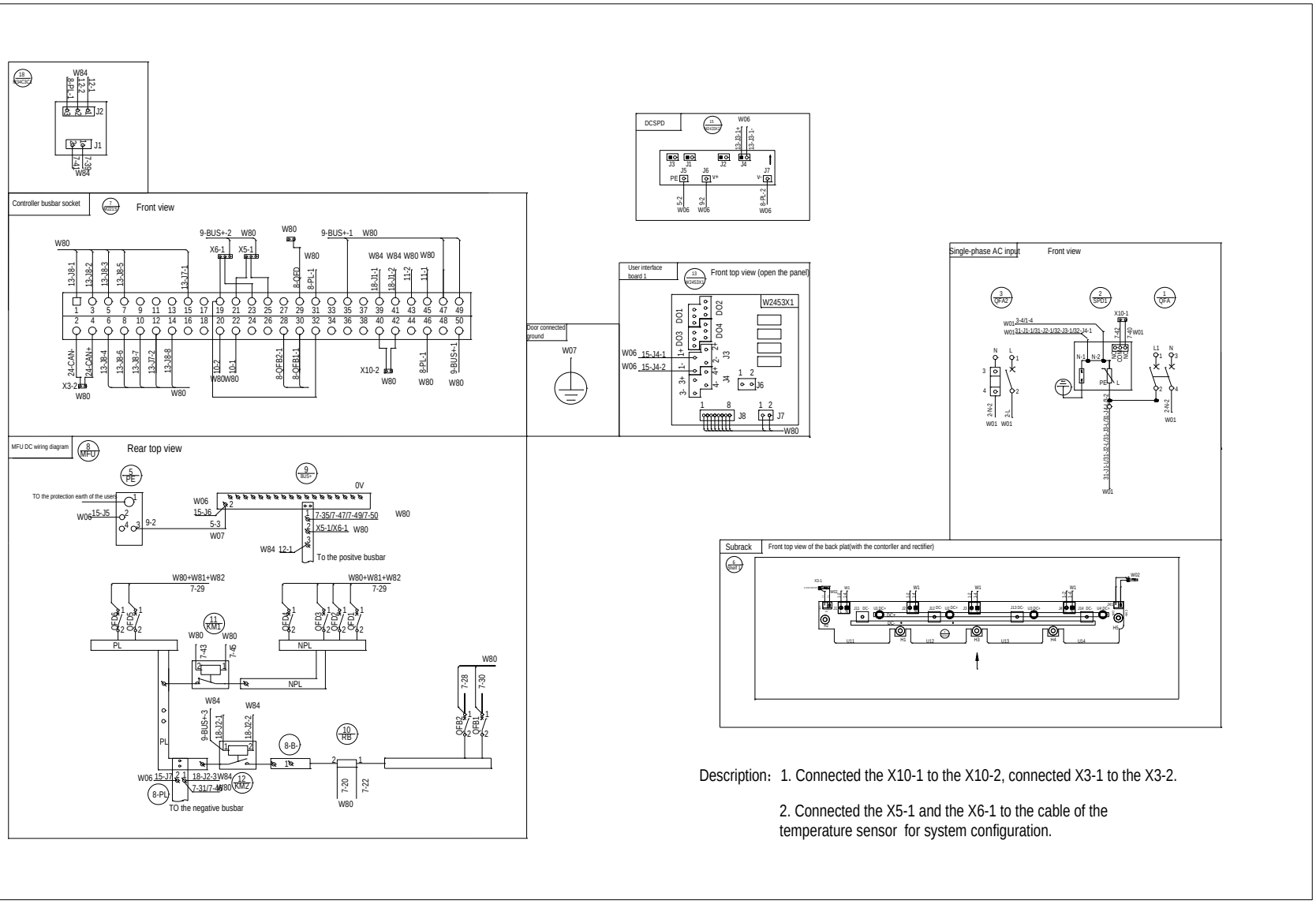
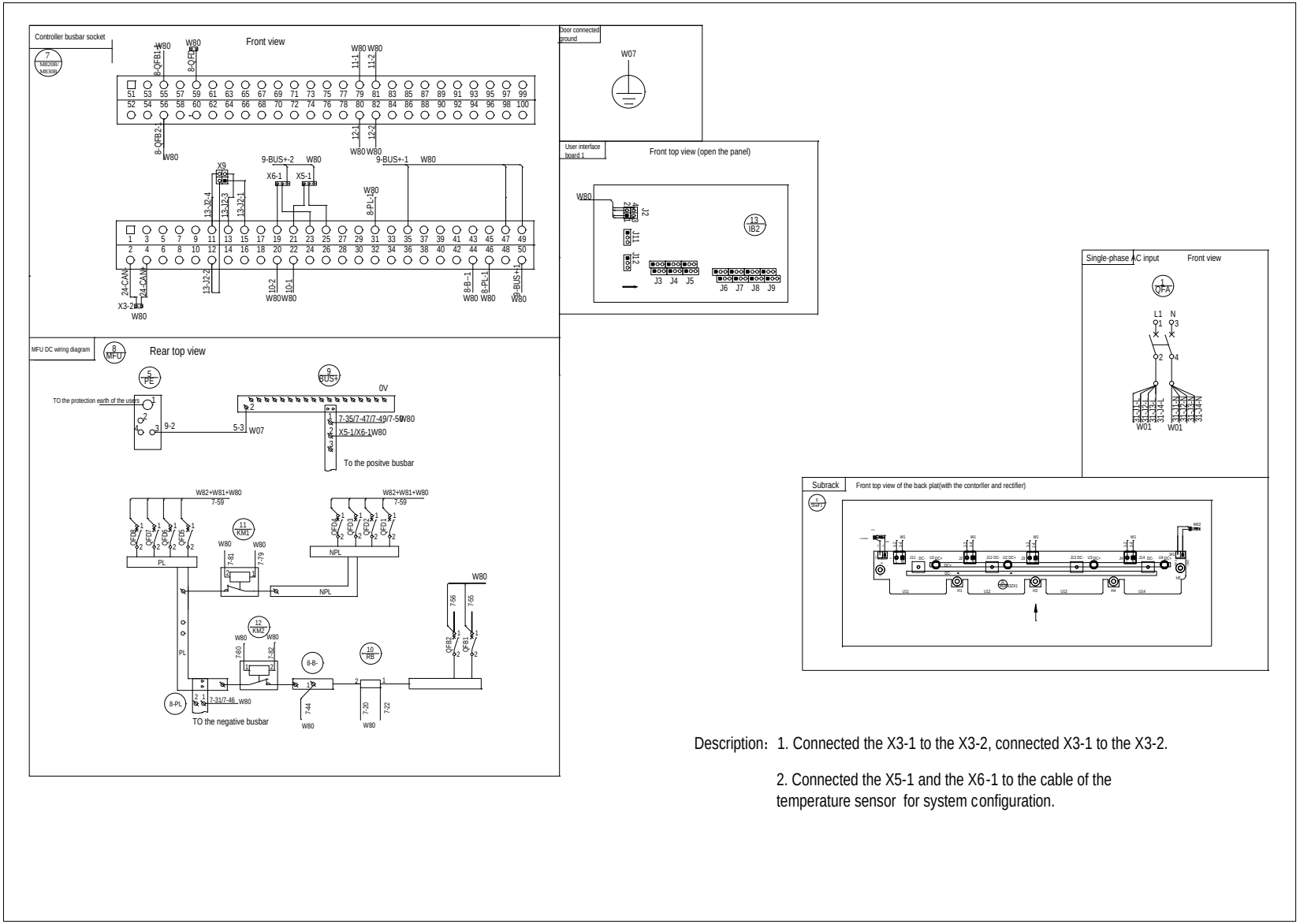


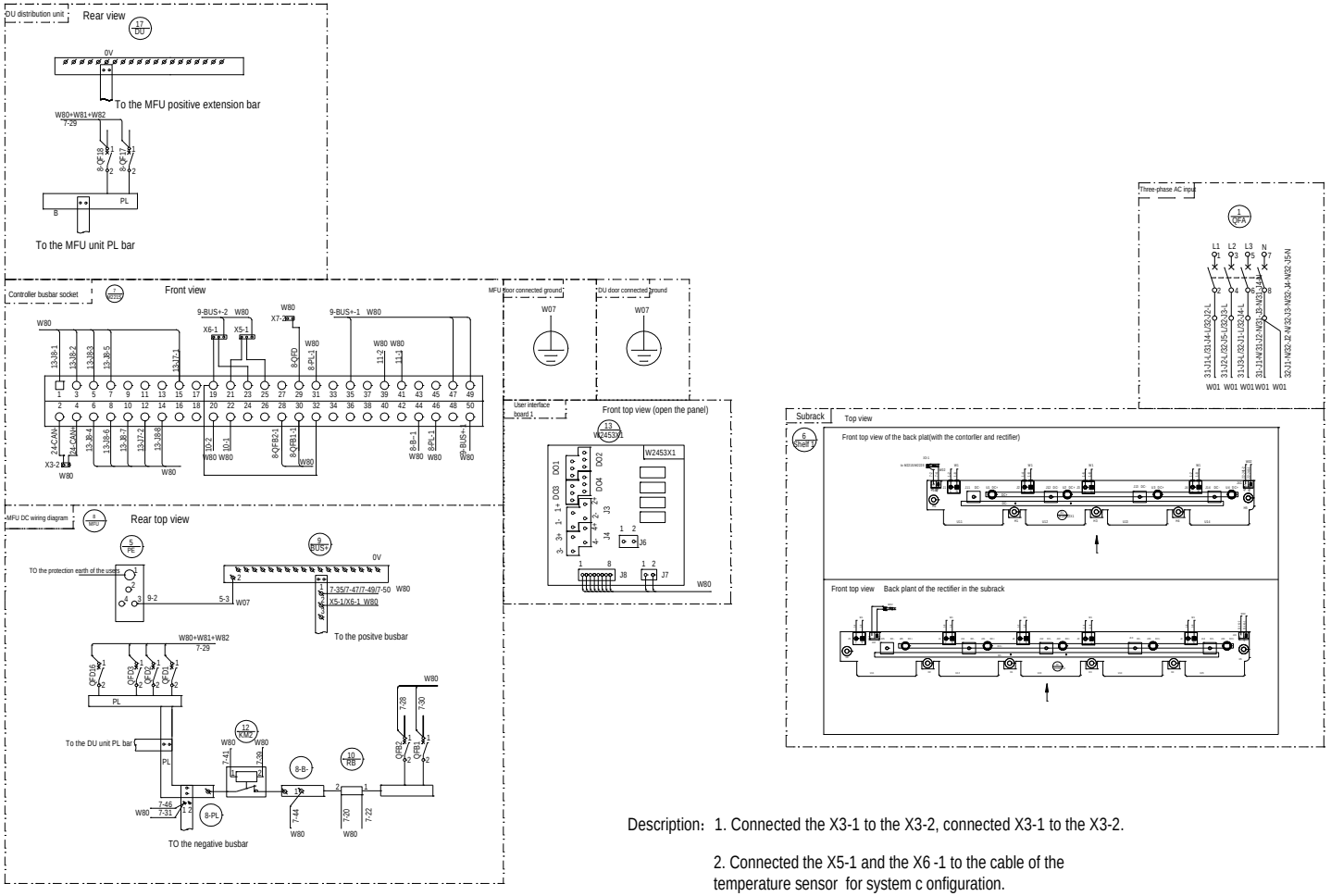
Figure 10 NetSure 531 A41-S2 wiring diagram



Description：1. Connected the X3-1 to the X3-2, connected X3-1 to the X3-2.

2. Connected the X5-1 and the X6-1 to the cable of the temperature sensor for system configuration.

Figure 11 NetSure 531 A41-S3 wiring diagram



Description：1. Connected the X3-1 to the X3-2, connected X3-1 to the X3-2.

2. Connected the X5-1 and the X6 -1 to the cable of the temperature sensor for system c onfiguration.

Figure 12 NetSure 531 A91-S1 wiring diagram

Appendix 4 Schematic Diagram

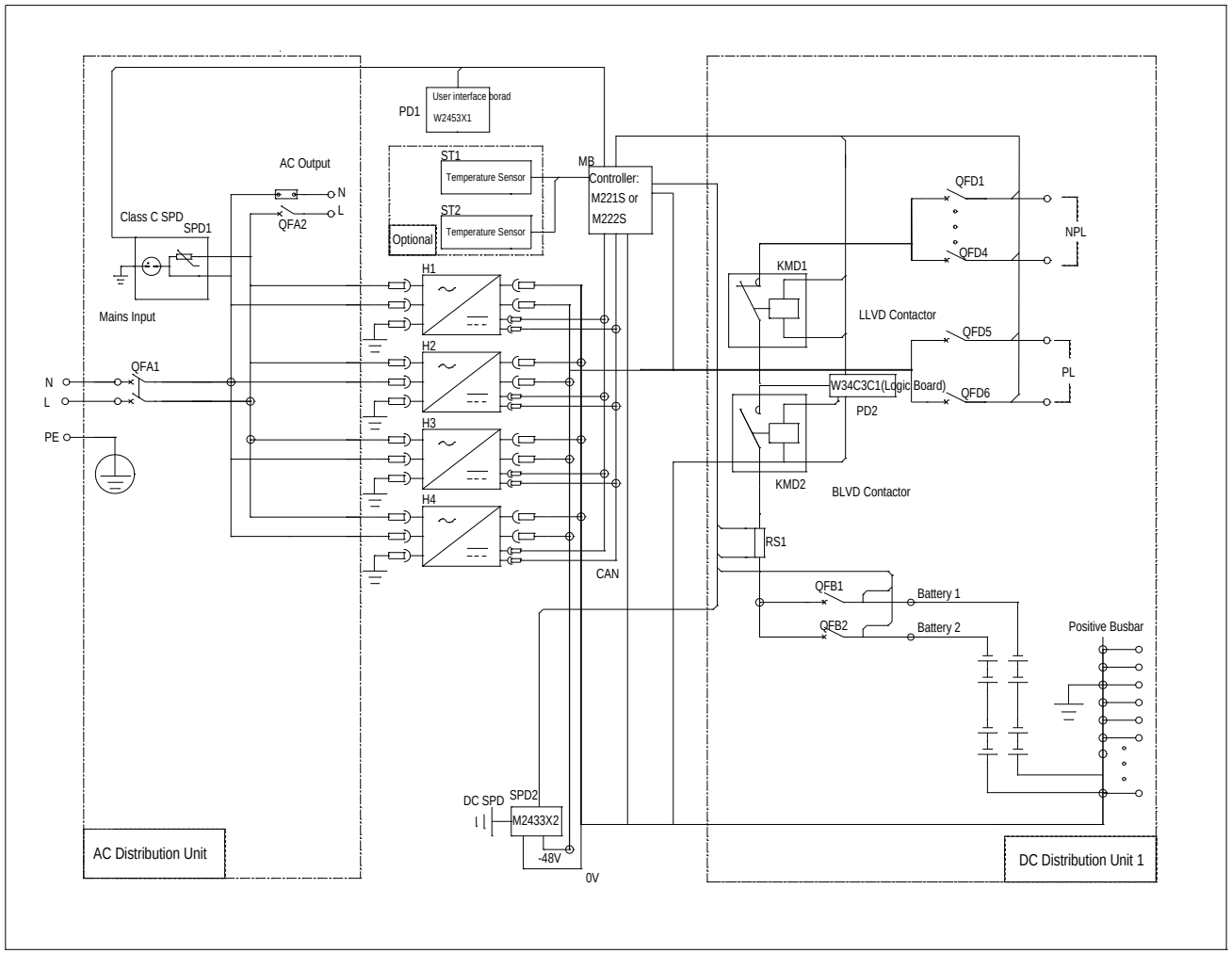


Figure 13 Schematic diagram of NetSure 531 A41-S1

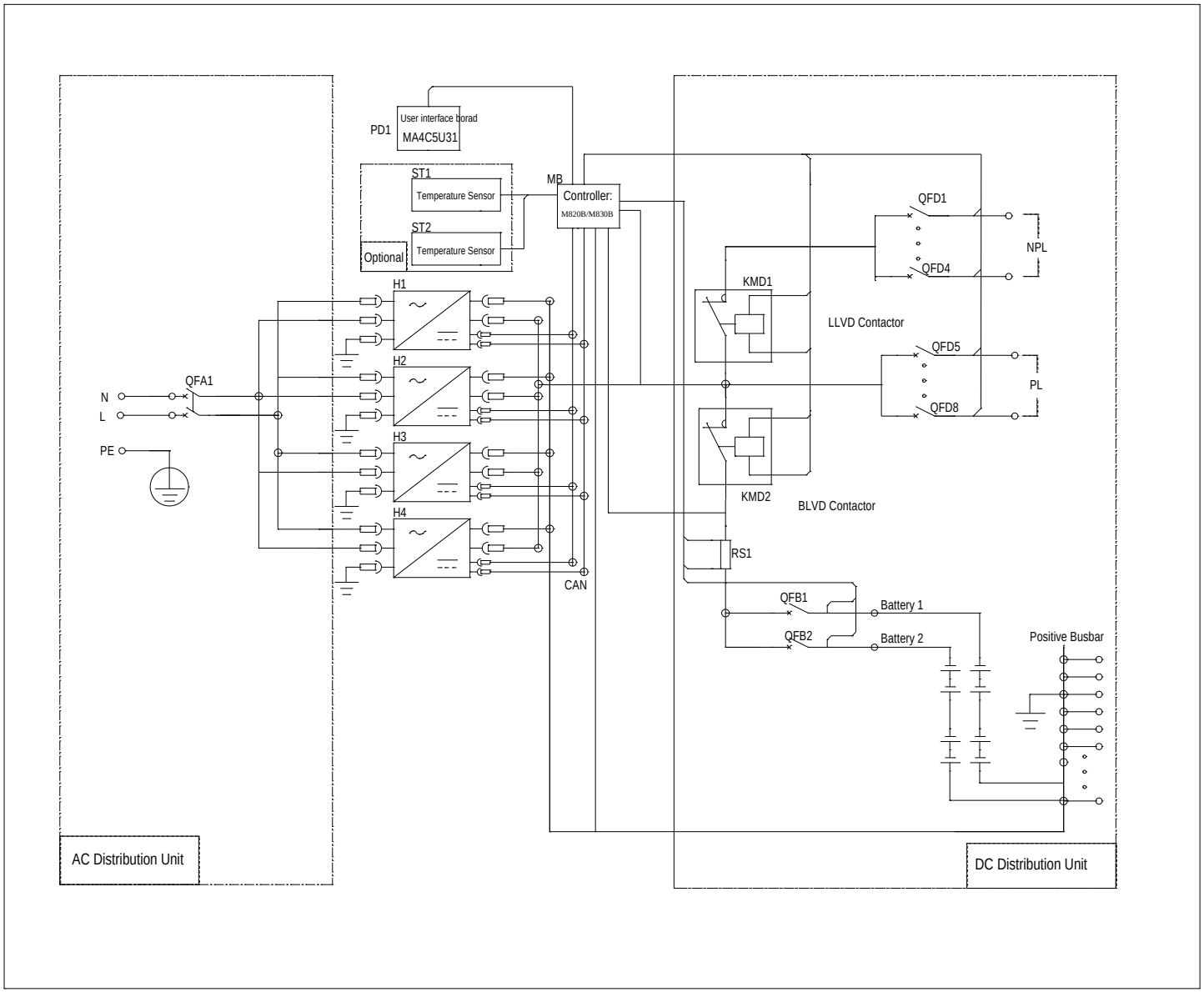


Figure 14 Schematic diagram of NetSure 531 A41-S3

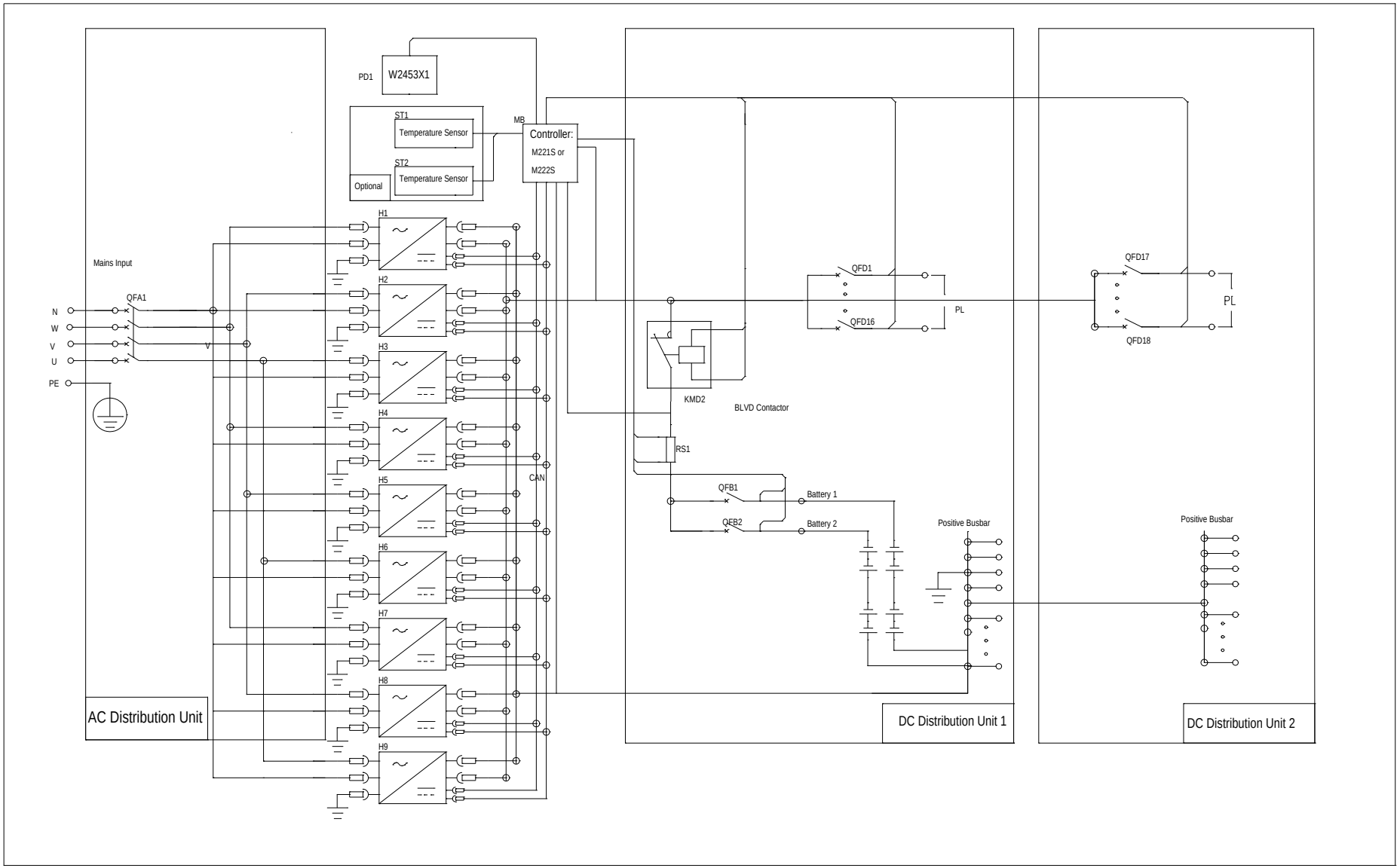


Figure 15 Schematic diagram of NetSure 531 A91-S1

Appendix 5 Glossary

Abbreviation	Full word
Amb.Temp	Ambient Temperature
Batt	Battery
BC	Boost Charging
BLVD	Battery Lower Voltage Disconnection
Cap	Capacity
CommMode	Communication Mode
CurrLimit	Current Limit
CycBC	Cyclic Boost Charging
Con Alarm Voice	Control Alarm Voice
ECO	Energy Conservatio
Hist Alarm	Historical alarm
HVSD	High Voltage Shutdown
InitParam	Initialize Parameters
InitPWD	Initialize Password
LLVD	Load Low Voltage Disconnection
LVD1	Low Voltage Disconnection-1（LLVD）
LVD2	Low Voltage Disconnection-2（BLVD）
MCB	Miniature Circuit Breaker
Ph-A	Phase A
PWD	Password
Rect	Rectifier
Shunt coeff	Shunt Coefficient
SM	Supervision module (controller)
SPD	Surge Protection Device
SW Version	Software Version
Sys	System
Temp	Temperature
Temp Comp	Temperature Compensation
Volt	Voltage