

# **NetSure 211 C46 Embedded Power Supply System User Manual**

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# Safety Precautions

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

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

## Electrical Safety

### I. Hazardous voltage

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

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

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

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

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

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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.

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### II. Tools

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

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### III. Thunderstorm

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

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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

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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.

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## V. Short circuit

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

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

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

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

Use insulated tools.

In live operation, keep the arm, wrist and hand tense, so that when the tool in operation slips, the movement of the human body and tool is reduced to a minimum.

## BLVD

The power supply system has battery low voltage disconnection (BLVD) function. BLVD means when battery voltage drops down to 43.2V, the power supply system cuts the load off to prevent over-discharge.

BLVD is enabled before delivery, which means that if power outage lasts for a long time or the power supply 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 to ensure reliability of the power supply.

The method of disabling BLVD is:

Set 'BLVD disabled' parameter through the monitoring module main menu → Settings (password: 1) → LVD → BLVD.

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The advantage of BLVD is protecting the batteries from over-discharge. The disadvantage of 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 disabling BLVD is prolonging the power supply of priority loads. The disadvantage is that disabling cannot prevent unwanted power failure due to misoperation or power supply system failure.

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## Others

### I. Safety

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 **Note**

When replacing power input fuses of monitoring module and power distribution units, use the same type fuses to meet the safety requirement.

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### II. Sharp object

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 **Warning**

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

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### III. Power cable

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 **Note**

Please verify the cable labels before connection.

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### IV. Signal cables

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 **Note**

The signal cables should be routed at least 150mm away from power cables.

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## Chapter 1 Overview

This chapter introduces model description, composition and configuration, and features of NetSure 211 C46 embedded power supply system (abbreviated as 'system' hereinafter).

### 1.1 Model Description

The model description of the system is given in Figure 1-1.

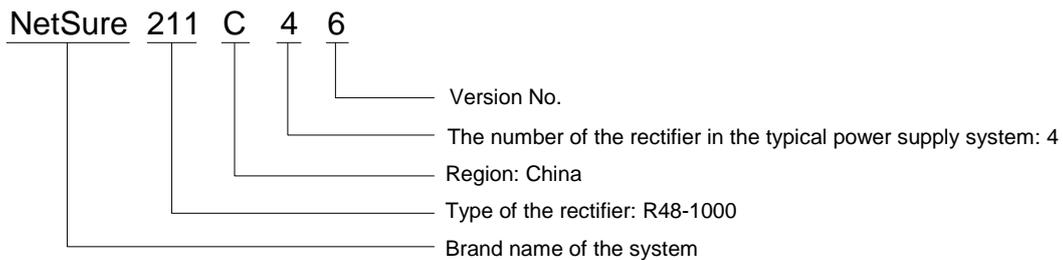


Figure 1-1 Model description

### 1.2 Composition And Configuration

The appearance of the system is shown in Figure 1-2.

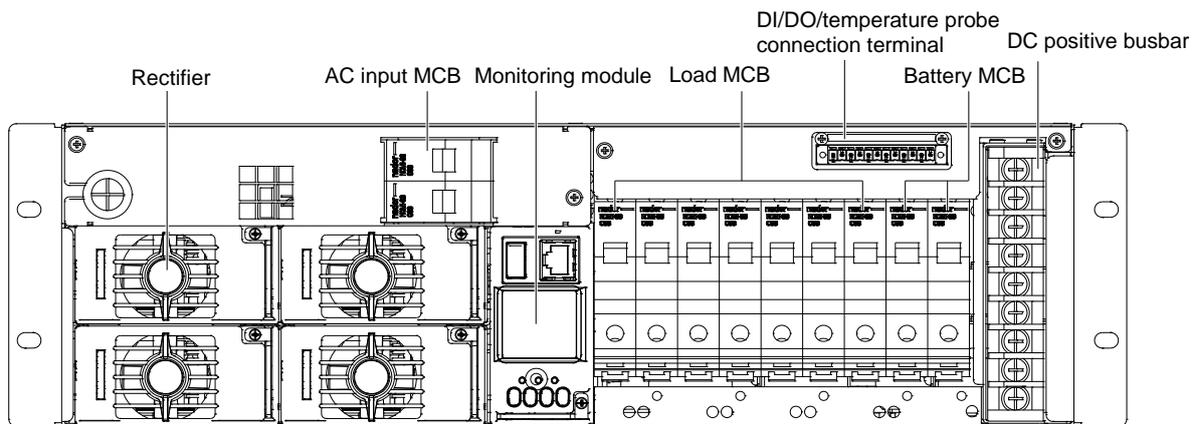


Figure 1-2 Appearance of the system

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

Table 1-1 Configuration of the system

Component	Configuration
Rectifier	Model: R48-1000 Standard configuration: 4 pieces
Monitoring module	Model: M522B, M523B or M221B Standard configuration: 1 piece
AC power distribution	AC input mode: L + N + PE/220V
DC power distribution	Seven load MCBs: 4 × 16A/1P, 2 × 32A/1P, 1 × 50A/1P
Battery routes	Two battery MCBs: 1 × 30A/1P,
Others	Two digital input ports, two dry contact output ports, two temperature sensor ports

The monitoring module is available in three different models. Their configurations are listed in Table 1-2.

Table 1-2 Configuration of the monitoring module

Models	Configuration
M522B	2D + 2DO, LCD display, network port, RS232 port
M523B	2DI + 2DO, LCD display, RS232 port
M221B	2DI + 2DO, no LCD display, three indicators indicating operation status of the system, RS232 port

## 1.3 Features

- The rectifier uses the active Power Factor Compensation (PFC) technology, raising the power factor to 0.99.
- The system has wide AC input voltage range: 90Vac ~ 290Vac.
- The rectifier uses soft switching technology, raising the efficiency to 91%.
- 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.
- The rectifier safety design complies with UL, CE and NEBS standards.
- The rectifier is of high power density.
- The rectifier is hot pluggable. It takes less than 1min to replace a rectifier.
- The rectifier has two over-voltage protection methods: hardware protection and software protection. The latter one also has two optional modes: lock-out at the first over-voltage and lock-out at the second over-voltage.
- The monitoring module has perfect battery management. The management functions include battery low voltage disconnection (BLVD), temperature compensation, auto voltage regulation, stepless current limiting, battery capacity calculation, on-line battery test, and so on.
- The monitoring module can save up to 200 pieces of historical alarm records, and 10 sets of battery test data records.
- The monitoring module is of network design. With an RS232 port, Ethernet, dry contacts and other communication ports provided, flexible networking is enabled to achieve remote monitoring and unattendance.
- The system has complete fault protection and fault alarm functions.

## Chapter 2 Installation Instruction

This chapter introduces installation and cable connection. Before installation, please read through safety regulations, and then follow the instructions provided in this chapter to carry out the installation and cable connection.

### 2.1 Safety Regulations

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

1. Only the adequately trained personnel with satisfactory knowledge of the power system can carry out the installation. The most recent revision of these safety rules and local safety rules in force shall be adhered to during the installation.
2. All external circuits that are below -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 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 system.
5. The wiring of the power distribution cables should be arranged carefully so that the cables are kept away from the maintenance personnel.

### 2.2 Preparation

#### Unpacking inspection

The equipment should be unpacked and inspected after it arrives at the installation site. The inspection shall be done by representatives of both the user and Emerson Network Power Co., Ltd.

To inspect the equipment, you should 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. Select the AC cable Cross-Sectional Area (CSA) according to Table 2-1.

Table 2-1 AC cable CSA selection

Connector	AC cable CSA
AC connection block	4mm <sup>2</sup> ~ 6mm <sup>2</sup>

The CSA of DC cable depends on the current flowing through the cable, the allowable voltage drop and load peak current. The recommended load peak current is 1/2 to 2/3 of MCB or fuse capacity.

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

Table 2-2 Battery cable CSA selection

Battery fuse rated current	Max. battery current	Min. cable CSA	Max. cable length (allowable voltage drop: 0.5V)	Max. cable CSA	Max. cable length (volt drop: 0.5V, with max. CSA)
63A	63A	10mm <sup>2</sup>	4m	16mm <sup>2</sup>	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 Load cable CSA 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)
16A	16A	4mm <sup>2</sup>	7m	6mm <sup>2</sup>	10m
32A	32A	6mm <sup>2</sup>	5m	10mm <sup>2</sup>	9m
50A	50A	10mm <sup>2</sup>	6m	16mm <sup>2</sup>	9m

Note:  
The specs are applicable at ambient temperature of 25°C

The CSA of the system earth cable should be the same as that of the largest power distribution cable and not less than 4mm<sup>2</sup>.

The RS232 cable is shown in Figure 2-1.

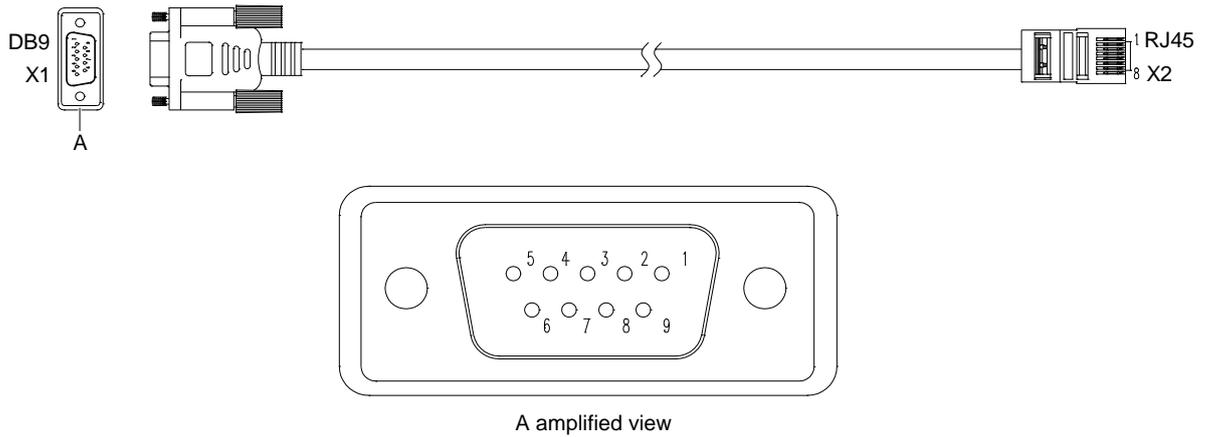


Figure 2-1 RS232 cable

The definition of the RS232 cable connector is shown in Table 2-4. Users should make RS232 cable according to the description in Table 2-4.

Table 2-4 Definition of the RS232 cable connector

DB9	RJ45
X1.2	X2.3
X1.3	X2.6
X1.4	X2.7
X1.5	X2.4 & X2.5
X1.6	X2.2
X1.7	X2.8
X1.8	X2.1

## 2.3 Mechanical Installation

1. Install brackets.

Fix the brackets on the power supply subrack with bolts. Users can choose proper installation position according to actual instance.

2. Install the power supply subrack.

Fix the subrack in the cabinet with fixing screws. The installation dimensions are shown in Figure 2-2.

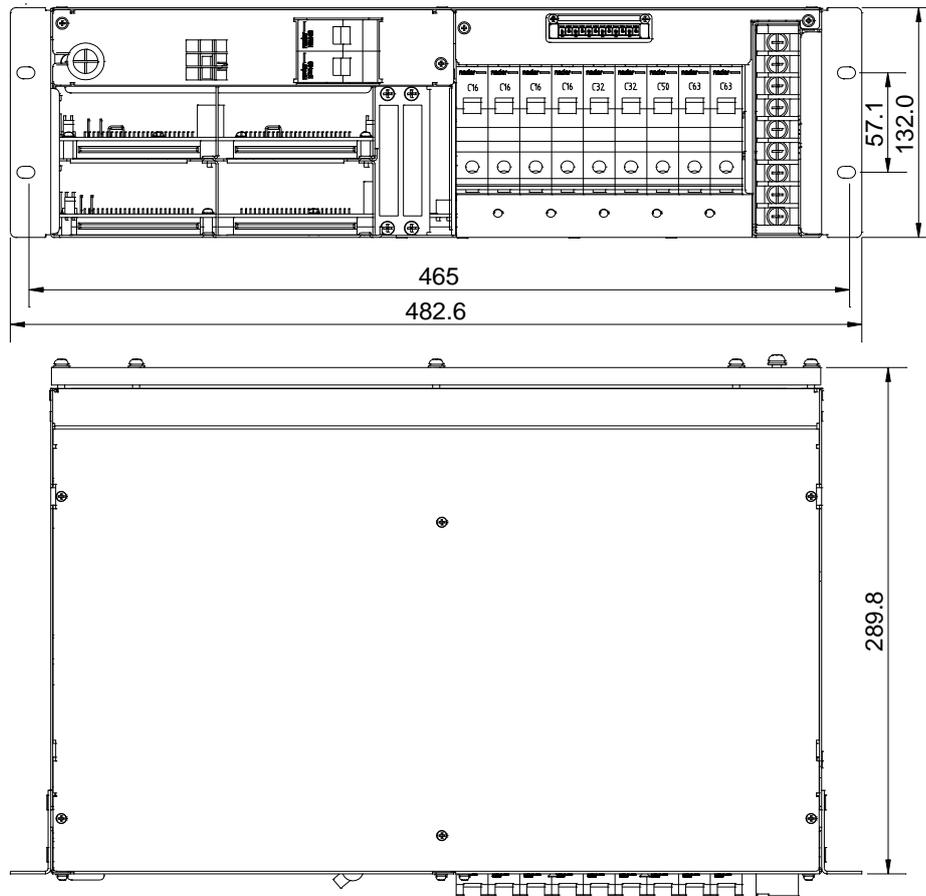


Figure 2-2 Installation dimensions (unit: mm)

## 2.4 Electrical Installation

### 2.4.1 Connecting Power Cables



#### Danger

1. Switch off all MCBs and fuses before the electrical connection.
2. Only the qualified personnel shall do the power cable connection.
3. The batteries may have dangerous current. Before connecting battery cables, make sure that the battery fuses at the system side and the battery MCBs at the battery side are switched off. If there are no battery MCBs at the battery side, you should disconnect any one of the connectors between battery cells to avoid live state of the system after installation.
4. Be careful not to reversely connect the battery. Otherwise, both the battery and the system will be damaged!

The positions of connection terminals are shown in Figure 2-3.

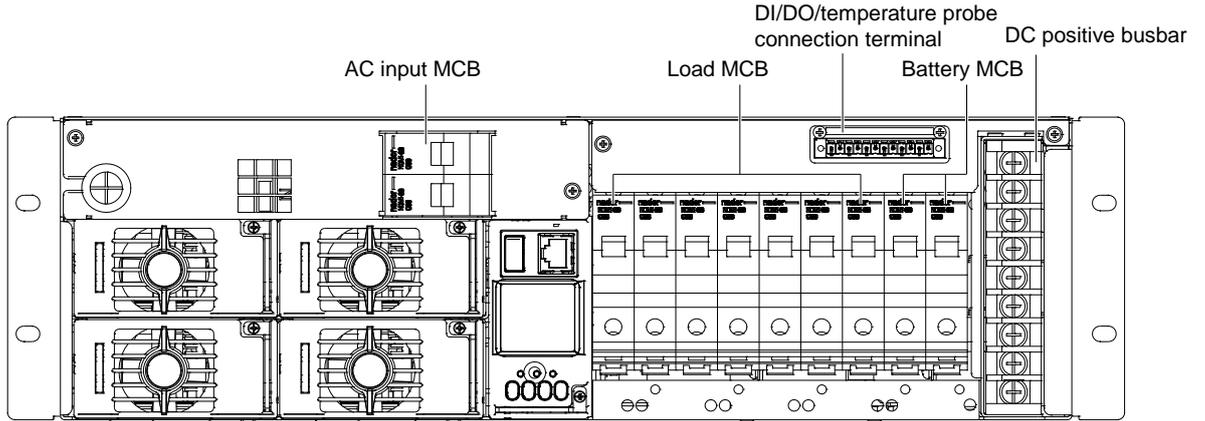


Figure 2-3 Connection terminals

Refer to Table 2-5 to connect the input and output cables.

Table 2-5 Connection descriptions of input and output cables

Cable	Connection	
	From	To
AC input cable	AC power	AC input terminals
DC output cable	DC output terminals	Load MCBs
Battery cable	Battery string	Battery MCBs

After the cable connections, reinstall the plastic cover of the AC input terminals.

### 2.4.2 Connecting Signal Cables

The position of the DI/DO/temperature probe connection terminal is shown in Figure 2-3, and the screen print is shown in Figure 2-4.

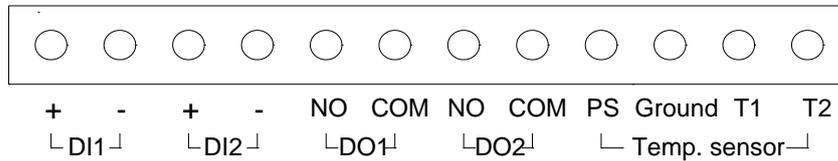


Figure 2-4 DI/DO/temperature probe connection terminal

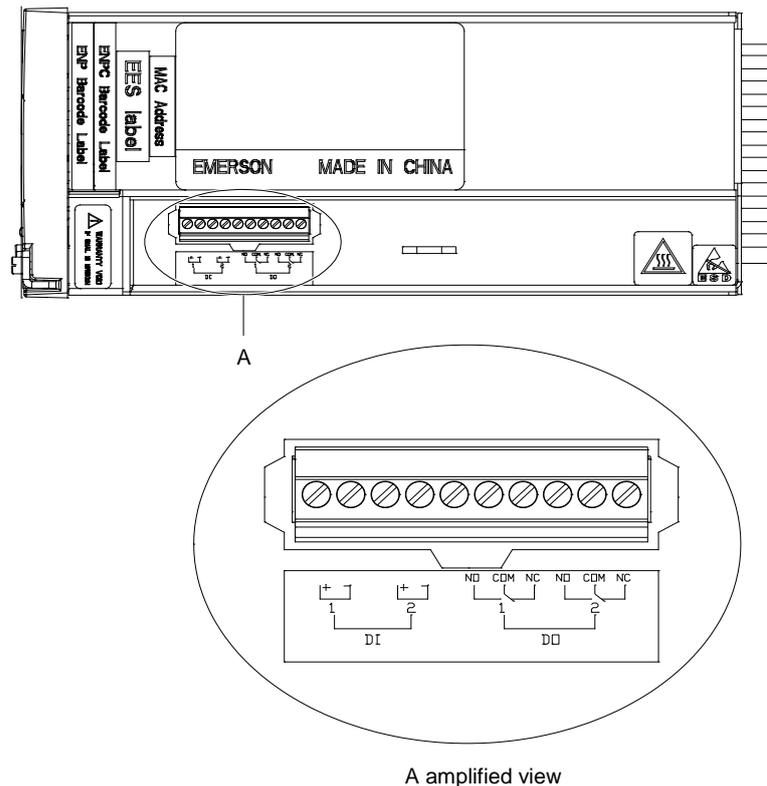
Connection method:

Peel one end of the signal cable and insert it into the DI/DO/temperature probe connection terminal. Fasten the connection by tightening the screw on the terminal.

 **Note**

The output dry contacts are normally open by default. If users want to use normally-closed contacts, they need to pull out the monitoring module and change the NO-COM connections to NC-COM connections at the dry contact socket. The position and definition of the dry contact socket is shown in the following figure.

The default associations of the relays are: critical alarm associating with DO1, and major alarm associating with DO2.



## Chapter 3 Installation Testing

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

### 3.1 Installation Check And Startup

Before the test, inform the chief manufacturer representative. Only the trained electrical engineer shall conduct the system testing. Remove metal objects that may cause shortcircuit, such as rings, watches, and so on.

During operation, watch out for hazardous voltage, and avoid personnel injury and property damage. Before the test, ground the equipment properly. Installation check must be done before testing, then the batteries can be charged for the first time.

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

Check the system according to the following items listed below.

#### Installation check

Check item	OK	Comments
Verify all the MCBs, fuses and cables	<input type="checkbox"/>	
Verify the system grounding, input and output cable connection	<input type="checkbox"/>	
Verify the battery cell number, connection, and battery string polarities	<input type="checkbox"/>	
Make sure all the cable connections are firm and reliable	<input type="checkbox"/>	
Make sure all the communication cables and alarm cables are connected to the monitoring module. Check That the temperature sensor, if any, has been installed correctly	<input type="checkbox"/>	

#### Startup preparations

Check item	OK	Comments
Make sure that all the MCB are switched off and all the fuses are removed	<input type="checkbox"/>	
Measure the AC input voltage. Make sure the input voltage is within the allowable range	<input type="checkbox"/>	Umin=___V
Check that the battery string circuit is not closed	<input type="checkbox"/>	
Connect the disconnected batteries to the battery string circuit	<input type="checkbox"/>	
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 2.0V/cell ~ 2.1V/cell or 48V/battery ~ 51V/battery. If the voltage of certain cell is lower than 2.0V, that cell must be replaced	<input type="checkbox"/>	Umin=___V
Check with an ohmmeter that there is no short circuit between the positive & negative distribution busbars, or between the positive & negative battery poles (Note: Pull out all modules before the check and restore them after the check)	<input type="checkbox"/>	

#### Startup

Check item	OK	Comments
Switch on the system AC input MCB, and the monitoring module should display the correct voltage and current values	<input type="checkbox"/>	
The green indicator on the rectifier should turn will be on and the fan should will start running. After a certain delay, the monitoring module should show that the power supply voltage is 53.5V	<input type="checkbox"/>	
Check the system voltage and busbar polarity with a voltmeter. The voltage difference between the measured value and displayed value should be less than $\pm 0.3V$	<input type="checkbox"/>	
Start and stop each rectifier by inserting and unplugging the rectifiers. Check their output voltages	<input type="checkbox"/>	

## 3.2 Basic Settings

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

To change the settings, enter the main menu → Settings (password: 1) → Battery Settings → Batt. Selection submenu, set the 'Mode' parameter to 'Manual', and then return to the submenus of Battery Settings menu to set the parameters. For detailed setting method, see *SCU + Series Monitoring Module User Manual*.

Check item	OK	Comments
The system model has been set correctly in factory before delivery, check that the setting agrees with the actual system (48V/SET)		
The battery string number set at the monitoring module should be the same as the number actually connected (Default: 2)		
Set the battery capacity according to the total capacity of all the battery connected to the system. Default: 300Ah		
Configure the temperature compensation coefficient according to the battery manufacturer's requirement. Setting range: 0mV/°C ~ 500mV/°C. Default: 72mV/°C (if no temperature sensor is installed, do not set this parameter)		
Set the charge current limit according to your needs. Setting range: 0.1C <sub>10</sub> ~ 0.25C <sub>10</sub> (Default: 0.1C <sub>10</sub> )		
Set the monitoring module according to the voltage suggested by the battery supplier. Float Charge (FC) voltage range: 42V ~ Boost Charge (BC) voltage. Default: 53.5V. BC voltage range: FC voltage ~ 58V. Default: 56.4V		
For batteries that do not need BC, set the BC voltage to FC voltage plus 0.1V		
Measure the battery voltage with a multimeter and record it. Enter main menu → Maintenance (password: 1) → RectTrim submenu. Set the output voltage of the rectifier to the value of the battery voltage. Insert the battery fuse. Set the output voltage of the rectifier to 53.5V		
Enter the Batt. Selection submenu. Set the 'Mode' parameter to 'Auto'		
Note*: if the capacity of the battery is smaller than 50Ah, set the 'Capacity' to 50Ah		

## 3.3 Alarm Check And System Operation Status Check

### Alarm check

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

Check item	OK	Comments
Pull out one rectifier, and the 'Rect N Com Failure' alarm should be triggered. Insert the rectifier in, and the alarm should disappear. Repeat the same procedures on other rectifiers		
Switch off battery MCB 1, and the 'Batt1 Failure' alarm should be triggered. Switch on battery MCB 1, and the alarm should be cleared. Repeat the same on battery MCB 2		
Switch off a load MCB connected to load, and the alarm 'Load Fuse N Failure' should be triggered. Switch on the load MCB, and the alarm should be cleared. Repeat the same on other load MCBs		
Switch off all the battery MCBs. Keep only one rectifier in operation. Through the monitoring module, adjust the rectifier FC voltage to make it lower than the alarm point. The alarm 'DC Voltage Low' should be triggered		
Keep the rectifiers in operation. Set through the monitoring module the battery management parameter to 'Manual'. Enter the maintenance menu at the monitoring module. Select 'Disconnect' and confirm it. The battery protection contactor should be open, and the 'BLVD' alarm should be displayed at the monitoring module		
Note: The monitoring module will give alarms approximately 10s after the alarms are triggered. Enter main menu → Operation to view the alarm information		

**System operation status check**

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

Check item	OK	Comments
The system model is correct (48V/SET)	<input type="checkbox"/>	
The monitoring module should display the correct AC voltage	<input type="checkbox"/>	
The difference between the voltage displayed by the monitoring module and the actual value should be less than $\pm 0.3V$	<input type="checkbox"/>	
The difference between the battery current displayed by the monitoring module and the actual value should be less than 1%	<input type="checkbox"/>	
Check the number of the rectifier through the monitoring module. The number should be consistent with the actual number	<input type="checkbox"/>	
Check the voltage, current, current limiting point of rectifiers through the monitoring module. They should agree with the actual parameters	<input type="checkbox"/>	
For the system configured with temperature sensor, the monitoring module should display the battery ambient temperature. Hold the probe of the temperature sensor and watch the monitoring module, which should display the change of temperature	<input type="checkbox"/>	

**3.4 Final Steps**

Check item	OK	Comments
Make sure that materials irrelevant to the equipment have been all removed	<input type="checkbox"/>	
Fill in the installation report and hand it over to the user	<input type="checkbox"/>	
Fill in the parameter table on the cabinet door	<input type="checkbox"/>	

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 Alarm Handling

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

The maintenance personnel must have adequate knowledge about the 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 system can maintain the inner part of the system.

### 4.1 Handling Alarms

The monitoring module alarms are classified in four types: 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 monitoring module will turn on the alarm indicator and generate audible alarm.

**Observation:** When this type of alarm is raised, the system maintains normal output for a while. If the alarm occurs during watch time, it should be handled immediately. If the alarm occurs during non-watch-time, handle it at the beginning of the watch time. The monitoring module will only turn on the alarm indicator.

**No alarm:** In case of an alarm set as 'no alarm' by the users, no visual or audible alarm will be generated and the system will work normally.

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

Table 4-1 Troubleshooting

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 should be started. Before using the generator's power, it is suggested to run the generator five minutes to stabilize the power output
2	AC Voltage High	Check if the AC Over-voltage point is too low. If yes, reset 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 305V. Therefore, if the power supply voltage is often high, consult with the power grid maintenance personnel to improve it.
3	AC Voltage Low	Check if the AC Under- voltage point is too high. If yes, reset the value. When the mains voltage is lower than 176V, the output power of the rectifiers will be derated. If the power supply voltage is often low, consult with the power grid maintenance personnel to improve it.
4	DC Volt High	1. Check the system DC output voltage and value of 'Over' set through the monitoring module. If the set value is improper, correct it. 2. Find out the rectifier that has caused the alarm. First of all, ensure that the batteries can operate normally. Then switch off the AC input of all rectifiers. Power on the rectifiers one by one. If the over-voltage protection is triggered when a certain rectifier is powered on, that rectifier is the faulty one, replace it
5	DC Volt Low	1. Check the system DC output voltage and value of 'Under' set through the monitoring module. If the set value is improper, correct it. 2. Check if the alarm is caused by mains failure. If yes, disconnect certain loads to prolong the operation of the whole system. 3. Check if the alarm is due to rectifier fault, find out the faulty rectifier and replace it. 4. Compare the total load current with the total rectifier current during float charge. If the former is bigger than the latter, disconnect partial loads, or add several rectifiers, with at least one rectifier redundant, to make the total rectifier current bigger than 120% of the total load current
6	Load Fuse Alarm/ Batt Fuse Alarm	Check if the MCB or fuse of the route is switched off. If the MCB is open, find out the fault and remove it. Or check the voltage at the alarm fuse. If the voltage is almost 0V, the fuse is normal. Otherwise, the alarm loop is faulty. Please contact Emerson

No.	Alarm	Handling method
7	LVD2	1. Check if there is a mains failure, and the battery voltage is lower than the 'BLVD' value, or the battery discharge time is more than the 'BLVD Time'. 2. Check if someone manually disconnected the battery from the system
8	Rect Failure	The red indicator on the rectifier will turn on. 1. Reset the rectifier by powering it off and then on again. 2. If the alarm persists, replace the rectifier
9	Rect Protect	Check if the mains voltage is outside the range of 80V (AC under-voltage point) ~ 295V (AC over-voltage point). If the power supply is often outside this range, consult with the power grid maintenance personnel to improve it
10	Rect Fan Fails	1. Check whether the rectifier fan is still working. 2. If the fan stands still, check whether the fan is blocked or not. If yes, clean it; if not, or if the fault persists after the fan is cleaned, replace it (see 4.2 Handling Rectifier Fault)
11	Rect Not Respond	Check if the communication between rectifier and monitoring module failed. If the communication is normal, restart the rectifier by pulling it out and pushing back in. If the alarm persists, replace the rectifier
12	Batt Over Temp	1. Check if there is a battery internal fault. If yes, replace the battery. 2. Check if the battery room temperature is too high. If yes, cool down the battery room

## 4.2 Handling Rectifier Fault

### Handling indicator fault

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

The indicators are shown in Figure 4-1 and handling methods of the rectifier faults are given in Table 4-2.

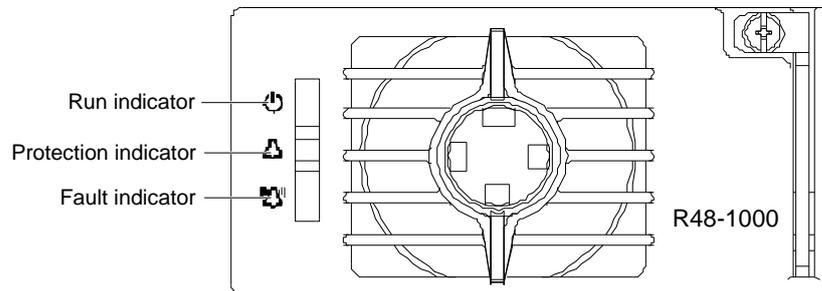


Figure 4-1 Rectifier indicator

Table 4-2 Handling methods of the rectifier faults

Symptom	Monitoring module alarms	Causes	Handling methods	
Run indicator off	No alarm	No input/output voltage	Make sure there is input/output voltage	
		Assistant power source of the rectifier fails	Change the position of the faulty module with normal module. If the faulty module cannot work normally, replace it	
Run indicator blinks	No alarm	The monitoring module performs operations upon the rectifier		
Yellow indicator on	Rect over temp	AC input voltage abnormal	Make sure the AC input voltage is normal	
		Over-temperature protection due to:	Fan blocked	Remove the object that blocks the fan
			Ventilation path blocked at the inlet or vent	Remove the object at the inlet or vent
Ambient temperature too high or the inlet too close to a heat source	Decrease the ambient temperature or remove the heat source			

Symptom	Monitoring module alarms	Causes	Handling methods
Yellow indicator on	Rect protect	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
		Power factor compensation internal under-voltage or over-voltage	Change the position of the faulty module with normal module. If the faulty module cannot work normally, replace it
		AC input over-voltage	Ensure AC input voltage normally
Yellow indicator blinks	Rect Not Respond	Rectifier communication interrupted	Check whether the communication cable is in normal connection
Red indicator on	Rect HVSD	Rectifier over-voltage	Reset the rectifier. If the protection is triggered again, replace the rectifier
	Rect Failure	Two or more rectifiers have the same ID number	Contact Emerson for maintenance
		Serious current sharing imbalance (current imbalance > ± 3%)	Check whether the rectifier communication is normal. If not, check whether the communication cable is in normal connection. If the communication is normal while the protection indicator is on, replace the rectifier
Red indicator blinks	Rect Fan Fails	Fan fault	Replace the fan

### Replacing rectifier fan

If the rectifier fan is faulty, it should be replaced. Refer to Figure 4-2, for the replacing procedures:

1. Use a Phillips screwdriver to remove the two fixing screws and pull out the front panel.
2. Unplug the power cable of the fan and remove the fan.
3. Plug in the new fan.
4. Install the new fan, with fan blowing-direction inward.
5. Replace the front panel.

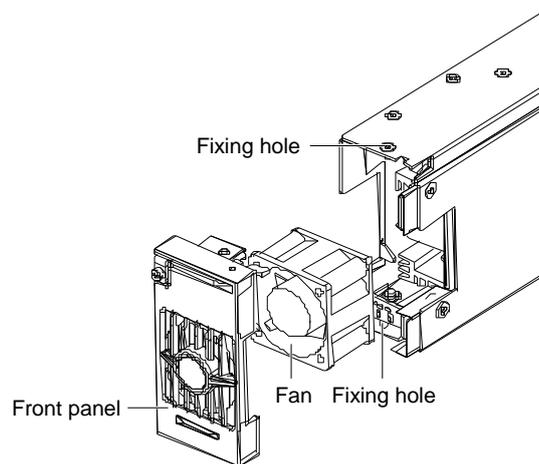


Figure 4-2 Disassembling the front panel

### Replacing rectifier

1. Take a new rectifier and check it for any damage.
2. Loosen the fixing screw of the handle of the rectifier with a Phillips screwdriver.
3. Press the rectifier handle to pop it out. Pull out the faulty rectifier from the rack by grabbing its handle.

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

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

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

5. Check that the new rectifier works normally.

You should make sure that:

- 1) The monitoring module recognizes the new rectifier.
- 2) The new rectifier shares current with other rectifiers.
- 3) When this new rectifier is pulled out, there is a corresponding alarm and the monitoring module displays the alarm.

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

6. Push the handle back into the front panel to lock the rectifier.
7. Fix the fixing screw of the handle of the rectifier with a Phillips screwdriver.

## Appendix 1 Technical Data

Table 1 Technical data

Parameter category	Parameter	Description
Environmental	Operating temperature	-5°C ~ 40°C
	Storage temperature	-40°C ~ 70°C
	Relative humidity	≤ 90%RH
	Altitude	≤ 2000m (derating is necessary above 2000m)
	Pollution level	Level 2
	Others	No conductive dust or erosive gases. No danger of explosion
AC input	Input phase voltage	220Vac
	Input voltage range	90Vac ~ 290Vac
	Input frequency	45Hz ~ 65Hz
	Max input current	Single phase, input current of each rectifier ≤ 7A
	Power factor	≥ 0.99
	Over-voltage level	Level 2
DC output	Rated output voltage	-53.5Vdc
	Output voltage range	-42.3Vdc ~ -57.6Vdc
	Output current	80A
	Total regulation	≤ ±1%
	Efficiency	≥ 90%
	Noise (peak-peak)	≤ 200mV
	Weighted noise	≤ 2mV
AC input alarm and protection	AC input over-voltage alarm point	Default: 280Vac ± 10Vac, configurable through monitoring module
	AC input over-voltage alarm recovery point	15Vac lower than the AC input over-voltage alarm point
	AC input under-voltage alarm point	Default: 180Vac ± 10Vac, configurable through monitoring module
	AC input under-voltage alarm recovery point	15Vac higher than the AC input under-voltage alarm point
	AC input over-voltage protection point	Default: 305Vac ± 5Vac
	AC input over-voltage protection recovery point	10Vac lower than the AC input over-voltage protection point
	AC input under-voltage protection point	Default: 80Vac ± 5Vac
	AC input under-voltage protection recovery point	15Vac higher than the AC input under-voltage protection point
DC output alarm and protection	DC output over-voltage alarm point	Default: 57.6Vdc ± 0.2Vdc, configurable through monitoring module
	DC output over-voltage alarm recovery point	0.5Vdc lower than the over-voltage alarm point
	DC output under-voltage alarm point	Default: 45.0Vdc ± 0.2Vdc, configurable through monitoring module
	DC output under-voltage alarm recovery point	0.5Vdc higher than the under-voltage alarm point
	BLVD point	Default: 43.2Vdc ± 0.2Vdc, configurable through monitoring module
Rectifier	Current sharing	The imbalance is better than ± 5% rated output current. Test current range: 10% ~ 100% rated current. The imbalance is better than ± 3% rated output current. Test current range: 50% ~ 100% rated current
	Derate by input (45°C)	Input voltage: 176Vac ~ 290Vac, rectifier max. output power: 50% rated power, 1000W Input voltage: 90Vac ~ 176Vac, rectifier output power: linear derating power

Parameter category	Parameter	Description	
Rectifier	Output delay	Output voltage can rise slowly upon rectifier start up. The rise time is configurable	
	Fan speed	Rectifier fan speed can be adjusted automatically	
	Over-voltage protection	<p>The rectifier provides over-voltage hardware and software protection. The hardware protection point is between 59V and 60V, and manual resetting is required to restore operation. The software protection point is between 56V and 59V (required to be 0.5Vdc higher than the output voltage, default: 59Vdc), and can be set through the monitoring module.</p> <p>There are two software protection modes, which can be selected through the software at the host:</p> <ol style="list-style-type: none"> <li>1. Lock out at the first over-voltage</li> </ol> <p>Once the output voltage reaches protection point, the rectifier will shut down and hold that state. Manual resetting is required to restore the operation.</p> <ol style="list-style-type: none"> <li>2. Lock out at the second over-voltage</li> </ol> <p>When the output voltage reaches the software protection point, the rectifier will shutdown, and restart automatically after 5s. If the over-voltage happens again within a set time (default: 5min. Configurable through monitoring module), the rectifier will shut down and hold that state. Manual resetting is required to restore the operation.</p> <p>Manual resetting: Resetting can be done manually through the monitoring module, or by removing the rectifier from system</p>	
	Temperature derating	<p>-20°C ~ 45°C, 1000W.</p> <p>45°C ~ 75°C, linear derating.</p> <p>&gt; 75°C, 0W</p>	
EMC	CE	Class A EN55022	
	RE		
	Immunity to EFT	Level 4 EN61000-4-4	
	Immunity to ESD	Level 3 EN61000-4-2	
	Immunity to Surges	Level 4 EN61000-4-5	
	Acoustic noise	≤ 55dB (A) (When the ambient temperature is 25°C)	
	Insulation resistance	At temperature of 20°C ~ 30°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	<p>(Rectifiers and monitoring module from the system before the test.)</p> <p>AC to DC circuits: 50Hz, 3000Vac (RMS).</p> <p>AC circuit to earth: 50Hz, 2500Vac (RMS).</p> <p>DC circuit to earth: 50Hz, 1000Vac (RMS).</p> <p>Assistant circuit (not directly connected to the host circuit): 50Hz, 500Vac (RMS).</p> <p>For all the three tests above, there should be no breakdown or flashover within 1min, with leakage current not bigger than 10mA</p>		
ROHS	Compliant with R5 standard		
Mechanical	Size (W xD xH) (mm)	System	437 x 289 x 132
		Rectifier	86.5 x 241.1 x 40.8
	Weight (kg)	System	≤ 13
		Rectifier	≤ 1.5

# Appendix 2 Wiring Diagram

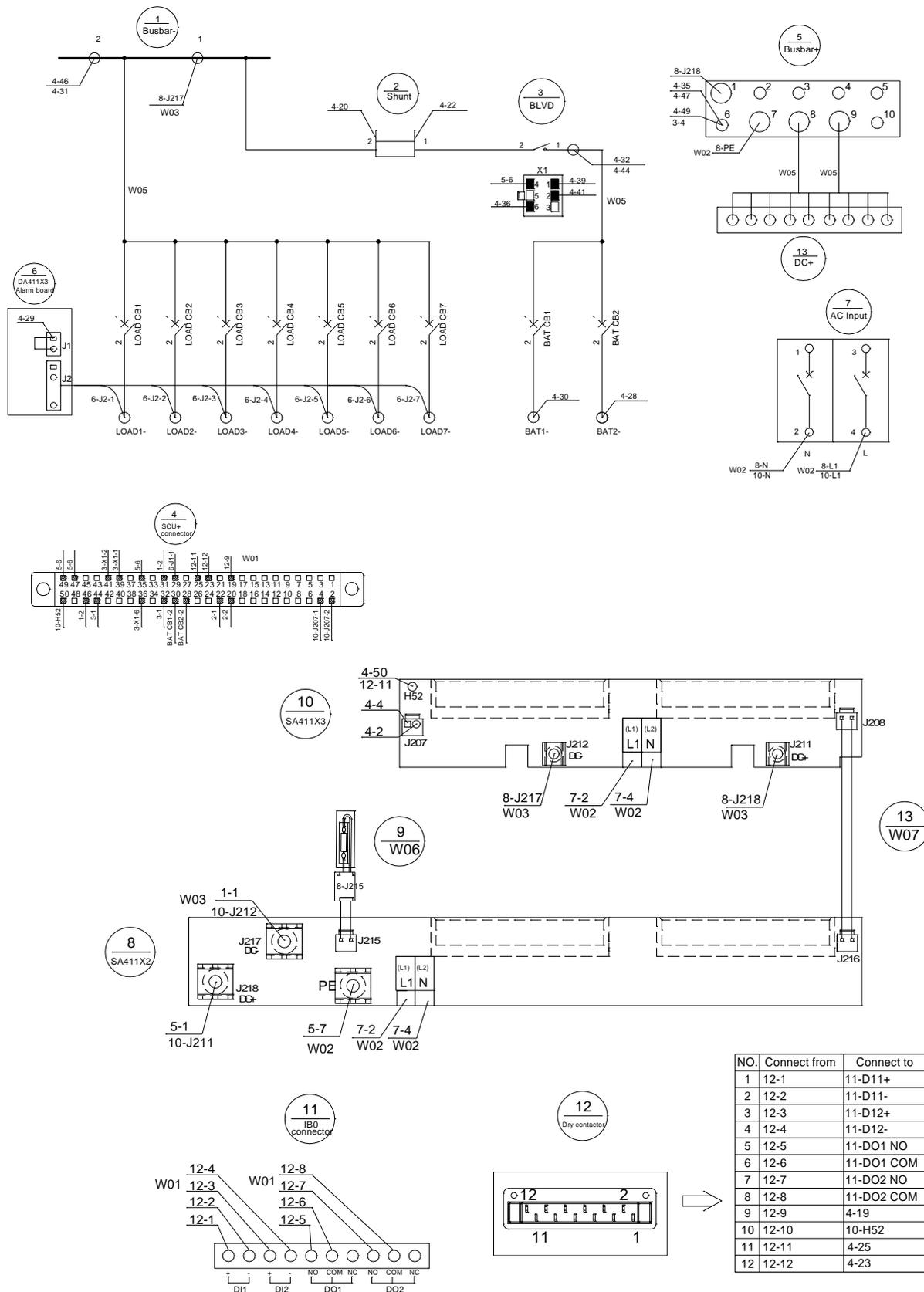


Figure 1 Wiring diagram of the system

## Appendix 3 Glossary

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