Contents

Chapter 1 Product Introduction

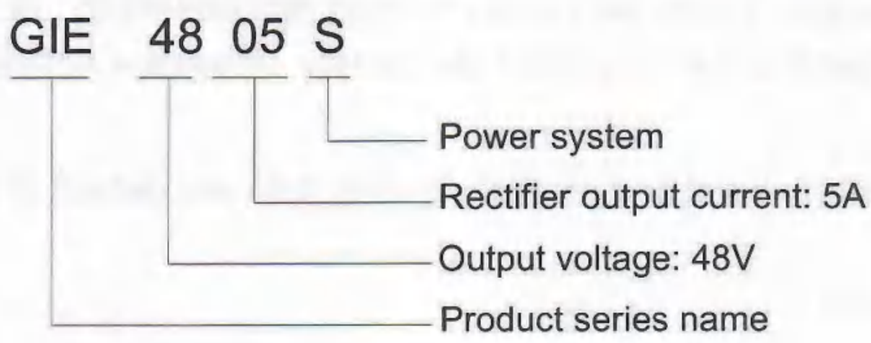
1.1 Overview

Emerson GIE4805S power supply system is designed for powering small program controlled exchange, access network, transmission equipment, mobile communication, earth station of satellite communication and microwave communication equipment as well as other communication equipment.

1.1.1 Function And Performance

- Designed with 19-inch 1U standard and with good compatibility.
- Hot swappable function of rectifier and power system controller (short as “controller” hereinafter).
- High power factor up to 0.95.
- Perfect battery auto-management function such as float charging conversion, current limiting, BLVD (battery low voltage disconnection) management and so on.
- Designed with an RS232 port for communication with the host to achieve alarm report and remote control.

1.1.2 Model Information



1.1.3 Appearance

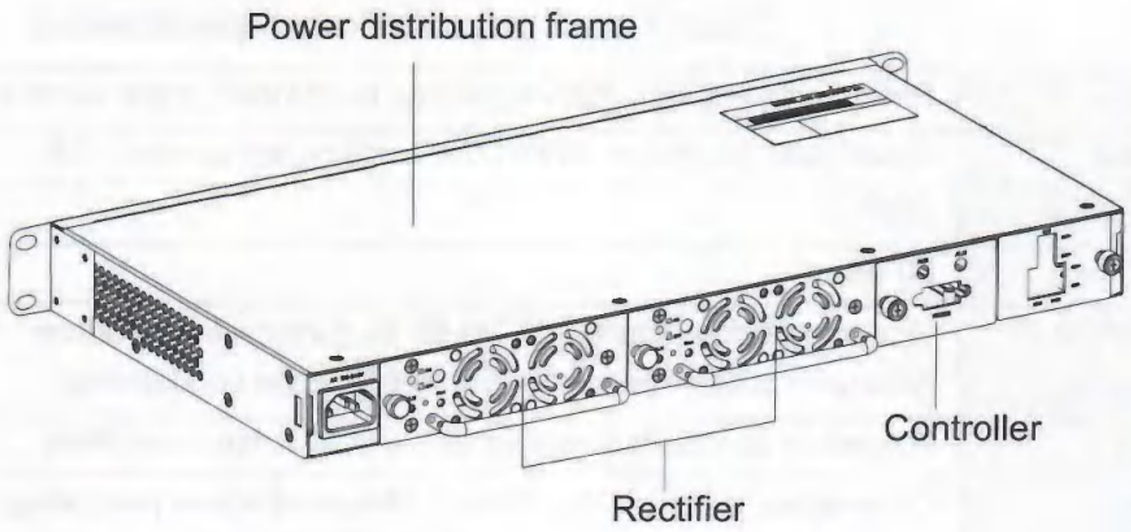


Figure 1-1 System appearance

1.1.4 Full Configuration

1. Two HRS300-9000B rectifiers
2. One PSM-B3A controller
3. One Power Distribution frame

1.1.5 Operating Theory

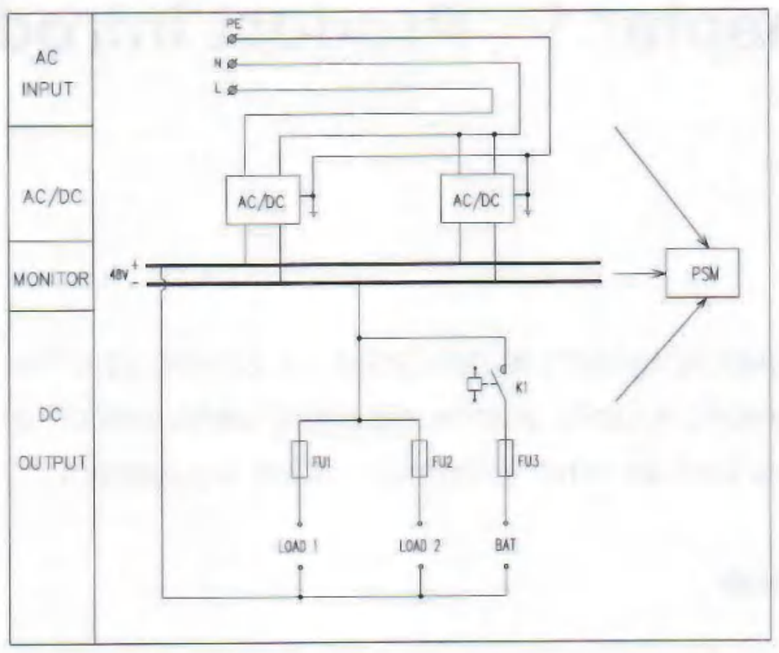


Figure 1-2 System operating principle

As shown in Figure 1-2, one AC power is fed to the rectifiers through a backboard. The DC outputs of the rectifiers are connected through the backboard of the system with fuse protection, providing two DC outputs and one battery circuit for users. Under normal condition, the controller controls the operation of the rectifiers, battery circuit and load according to the preset parameters and user commands, and monitors the operating status and data. When power failure occurs, the battery connected to the system begins to power the load and so see to it that the battery has been connected to the system before power failure occurs. Under the condition that the AC mains fail and the battery begins to discharge due to the power failure, the controller should report the alarm signal of AC mains failure. With the discharging of battery, battery terminal voltage begins to drop and when it drops below 46V, the controller will report DC under-voltage alarm. When the battery voltage reaches 43.5V, BLVD circuit (for BLVD protection) disconnects the battery from the load to protect the battery. When the AC mains recover, the system restores to normal work.

Note: The above battery alarm point and protection point data are default of the system.

1.1.6 Technical Specifications

The technical specifications of the system including electrical performance, efficiency, mechanical parameters, environmental requirements, and so on are listed in Table 1-1.

Table 1-1 System technical specifications

AC input	Rated input voltage: 220Vac(90Vac to 264Vac); Input current: <8.4A; Frequency: 47Hz to 63Hz
DC output	Rated output voltage: 54V±0.5V; Total output current: 10A
Efficiency	≥80%
Power factor	≥0.95
Environmental requirements	Operating temperature: -5°C to 55°C; Storage temperature: -50°C to 70°C Altitude: <3000m; Humidity: 5% to 95% (non condensing)
Cooling	Forced air convection cooling with a built-in fan in rectifiers
Mechanical parameters	Dimensions (H × D × W): 42mm×240mm×436mm (excluding handle) 42mm×240mm×482mm (including handle); Weight: <10kg
Battery input (optional)	Working in float charging mode, a string of batteries are connected in parallel with the output of the rectifiers through a 10A fuse and form the DC 48V bus-bar in the system. The rated input voltage of the battery is 48V and the rated capacity is 7Ah or 12Ah
MTBF	The Mean Time Between Failure (MTBF) is used to evaluate the reliability level of the product. The MTBF value of the system should be higher than 150,000 hours (Bellcore TR-332 predicting method) Estimated condition: normal temperature 25°C, resistive load.
Transient load response	When the load is changed from 25% to 50% to 25% rated load or changed from 50% to 75% to 50% rated load, recovery time is shorter than 200μs and the over-shoot is lower than 0.5%.
DC output noise	Peak-peak noise voltage: ≤200mV (within 20MHz)
Voltage regulation precision	≤ ± 5%

Safety	Input conducted emission (CE) EN55022 CLASS B Radiation emission (RE) EN55022 CLASS B Note：in the RE test, two turns ferrite cores should be added to for the communication cables between the controller and the host. The model of the the ferrite core is E04SR200935A of SEIWA factory. The characteristic of the ferrite core is shown in Figure 1-3. Electric-static discharge (ESD) EN61000-4-2 Level 3 B Surge immunity (SURGE) EN61000-4-5 Level 4 B Current harmonic EN61000-3-2 A Voltage fluctuation and flicker EN61000-3-3 Electro-transient pulse tolerance (EFT) EN61000-4-4 Level 3 B
Insulation resistance	The insulation resistance between DC parts, AC parts and enclosure should be higher than 10MΩ with 500Vac testing voltage.
Insulation voltage	Apply 4242Vdc power between AC input and DC output for 1 minute, there should be no breakdown nor arc, apply 2121Vdc power between AC input and enclosure for 1 minute, there should be no breakdown nor arc; apply 707Vdc power between DC output and enclosure for 1 minute, there should be no breakdown nor arc. (The leakage current is less than 10mA)

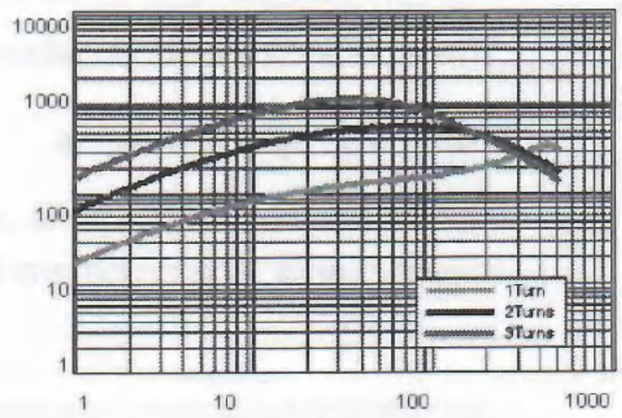


Figure 1-3 Characteristic of E04SR200935A ferrite core

1.2 Component Introduction

1.2.1 Power Distribution Frame

The power distribution frame is an important part of the system. It provides all system electrical interfaces. The AC input socket, DC output socket, battery socket and communication port are located on the front panel of the frame, as shown in Figure 1-4.

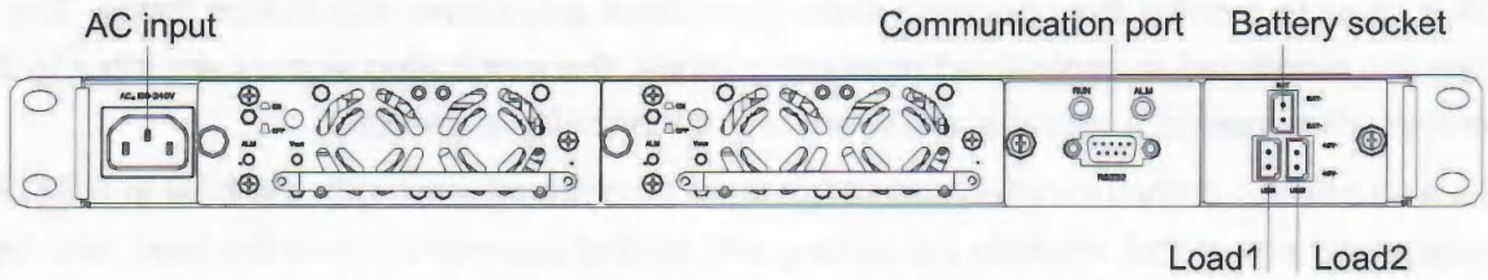


Figure 1-4 System interfaces

1.2.2 HRS300-9000B Rectifier

HRS300-9000B rectifier rectifies 110V/200V mains supply to 48Vdc output. The rectifier has high power factor. It has the functions of output over-voltage protection, short-circuit protection, overload protection, over-temperature protection, current- sharing functions and so on.

Appearance

The appearance of the rectifier is shown in Figure 1-5.

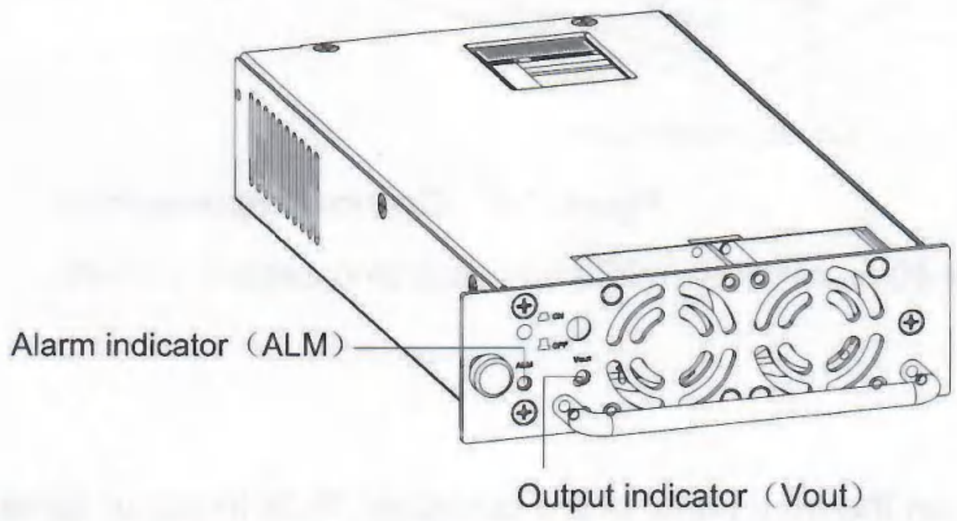


Figure 1-5 HRS300-9000B rectifier appearance

Indicator

There are two indicators on the front panel of the rectifier: Vout indicator (green) and ALM indicator (red).

The Vout indicator is on when the rectifier operates normally.

The ALM indicator is on when the rectifier has malfunctions.

Technical specifications

The technical specifications of the rectifier, including input, output, efficiency, mechanical parameters, environmental requirements, and so on are listed in Table 1-2.

Table 1-2 HRS300-9000B rectifier technical specifications

AC input	AC input rated voltage: 220V, 50Hz Operating voltage range: 90V to 264V Power network frequency range: 47Hz to 63 Hz
DC output	Float charging voltage: 54.5V±0.5V; Output current rated value: 5A
Mechanical parameters	Dimensions:40.5mm×117mm×218mm(excluding handle) Weight:≤1.5kg
Efficiency	≥80%
Power factor	AC input power factor ≥0.95 (Input voltage220Vac, rated load).
Environmental requirements	Operating temperature: -5°C to 55°C; Altitude: ≤3000m
Cooling	Forced air convection cooling
Protection functions	Output over-voltage protection: The rectifier alarms and shuts down to protect and lock itself in order to protect the load equipment when the DC output voltage reaches 61V±1V Current-limiting protection: The maximum current limit is 6.5A Short-circuit protection: Auto recoverable Over-temperature protection: Auto recoverable

1.2.3 PSM-B3A Controller

PSM-B3A is used to monitor the operating state of rectifiers and power distribution frame. The power distribution parameters are monitored in centralized monitoring mode, the monitoring signals are input to the controller directly. The controller will generate a visual alarm when any abnormality is detected.

PSM-B3A also has the communication report function. It communicates with the host in RS232 mode according to the inter-corporation protocol, accepts the setting and control commands from the host, and reports the detected state and physical parameters to the host in order to facilitate centralized management.

Appearance

The appearance of PSM-B3A is shown in Figure 1-6.

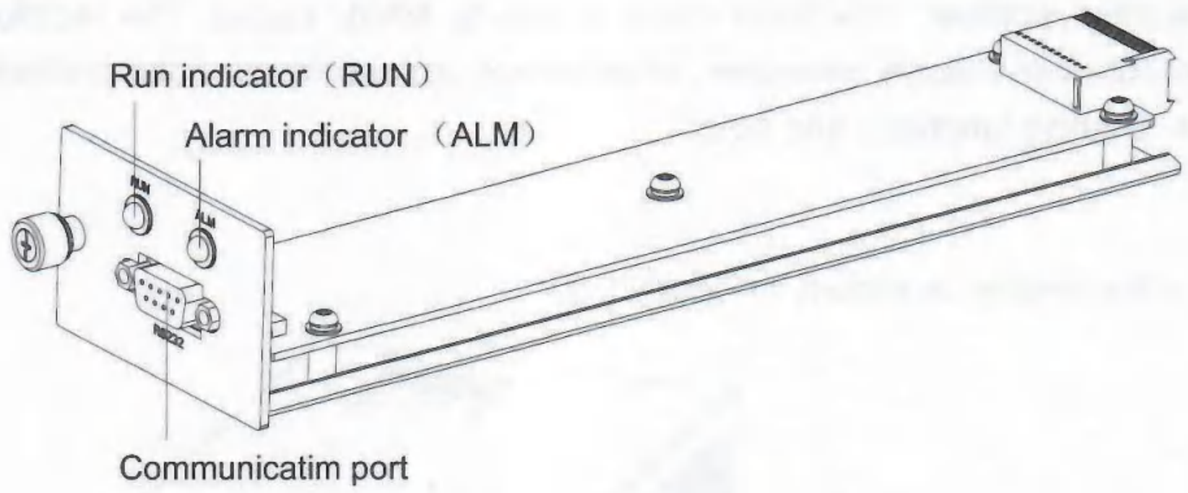


Figure 1-6 Controller appearance

1. Dimensions (H×W×D): 40.5mm×64mm×228mm(excluding captive screws)
2. Weight: ≤0.6kg

Indicator

There are two indicators on the front panel of the controller: RUN indicator (green) and ALM indicator (red).

The RUN indicator is on when the controller operates normally.

The ALM indicator is on when the controller has malfunctions.

Functions

1. Communication with host

The alarm and state information sent to the host by the controller include: mains supply available/unavailable alarm state, output DC over/under-voltage alarm state, two load fuse connection/disconnection alarm state, batter power-on and LVD alarm state, battery fuse connection/disconnection alarm state, two rectifiers alarm state, current-limiting enabled/disabled state, system control mode and charging state.

Control commands sent to controller by the host include: controller resetting and default parameter recovery.

Configuration parameters sent to controller by the host and fed back to the host by the controller include: channels and capacity of battery strings, charging current limit coefficient, number of rectifiers and their addresses, version information, system control mode, charging state, float charging voltage, battery LVD state, battery LVD voltage and DC over/under-voltage alarm point.

The RS232 communication port is the DB9 connector on the front panel of the controller, as shown in Figure 1-6.

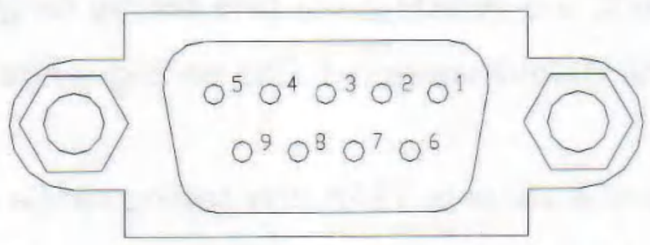


Figure 1-6 RS232 communication port

The definitions of the pins are listed in Table 1-3.

Table 1-3 Definitions of the RS232 pins

Pin	Definition	Pin	Definition
Pin1	-	Pin6	Batter under-voltage alarm
Pin2	Receive	Pin7	AC power supply failure
Pin3	Send out	Pin8	Common
Pin4	-	Pin9	Rectifier failure
Pin5	GND	-	-

2. Control functions

The controller will control the ALM indicator to give visual alarm when any abnormality is detected. It can also close or open the corresponding alarm dry contact to trigger the user' optional alarm equipment when the rectifiers have any abnormality or AC power fails or the system is under the DC over/under-voltage alarm state.

The alarm dry contacts share the DB9 connector with communication port.

All the alarm dry contacts can be parallel connected according to user actual situation, for example there are two dry contact alarm interfaces, Pin6 and Pin7 can be parallel connected together, the BLVD under-voltage alarm and the mains failure alarm share one alarm. If there is only one dry contact alarm interface, Pin6, Pin7 and Pin9 can be parallel connected together to output one alarm.

The electrical parameters of alarm dry contact interface: the max non-destructive voltage is 60Vdc and the max load current is 300mA.

3. Detection

The controller detects the power distribution frame parameters and rectifier parameters in real time.

1) Power distribution frame parameters: AC input state, two load fuse states, battery fuse state, DC output state and BLVD state.

2) Rectifier parameters: Operating states.

4. Automatic battery management

The controller has simple battery management function. With this function, the controller can control the rectifier to float charge the battery in current limiting mode. When the battery capacity is less than 17Ah or the charging current limit coefficient is less than 0.2, the charging current limit is 1.7A to 2A, otherwise the charging current limit is 2.8A to 3.2A. When the system has no controller or the controller is disabled, the power system can still charge the battery and the current limit is 1.7A to 2A.

5. Power-off protection

When the controller is powered off, the set configuration parameters remain unchanged. To make use of the default configuration and control state after power-off, the host can send default configuration recovery command.

6. Hot swapping

The controller is hot swappable, you can replace the damaged unit without shutting down the system.

Parameter Configuration

The host can get following parameters from the controller through the communication with the controller: version information, system control mode, charging state, float charging voltage, battery string LVD protection enabled state, battery string LVD voltage, DC output over/under-voltage alarm point, charging current limit coefficient, channels and capacity of battery strings, number of rectifier and their addresses.

The following parameters can be configured from the host:

1. Charging current limit coefficient, the default is 0.1 (the setting range is 0.1V to 0.25V)

2. Channels of battery strings, the default value is 1 (the setting range is 0 or 1. Note: when there is a battery, it must be set to 1)

3. Battery string capacity, the default value is 12Ah (the setting range is 7Ah to 30Ah)

4. Number of rectifiers, the default value is 2 (the setting range is 0 to 2)

5. Address of rectifiers (the setting range is 1 or 2)

📖 **Note**

1. In general, users can operate the system according to the default values set by the manufacturer instead of setting them again.

2. When using 3A current to charge the battery, the battery capacity should be more than 17Ah, and the current limit coefficient should be more than 0.2.

3. The setting of the battery capacity must be accordant with the actual capacity.

1.3 Background Monitoring

Users can program monitoring software of the host by themselves according to the communication protocol provided by manufacturer, and perform remote data acquisition and remote control functions through the controller in order to achieve unattended operation. Users can perform centralized monitoring and automatic management over power supply system with RS232 communication lines through monitoring software at the monitoring center.

If communication protocols are fully accomplished, users can request for the following information or conduct the following control:

Remote data acquisition

The configuration parameters and states that can be queried by the host include: AC mains normal/failure state, output DC over/under-voltage state, two load fuse state, BLVD alarm state, battery fuse state, rectifier operating state, current limit state, channels and capacity of battery strings, charging current limit coefficient, number of rectifiers and their addresses, version information, system control mode, charging state, float charging voltage, BLVD protection state, BLVD voltage, DC output over/under voltage alarm point.

Remote control

Through the host, you can remotely reset the controller and restore the default value.

Parameters setting

The parameters that can be set through the host include: charging current limit coefficient, channels and capacity of battery strings, number and addresses of rectifiers.

Chapter 2 Installation And Testing

2.1 Installation Conditions

2.1.1 Environment

The environmental requirements for the installation place of the system are listed in Table 2-1.

Table 2-1 Environmental conditions

Environmental conditions	Recommended range
Operating temperature	-5°C to 55°C
Storage temperature	-50°C to 70°C
Relative humidity	≤95%RH, non condensing
Sunlight	No direct irradiation
Dust	EN60950 2 class
Corrosive particles	No contamination, such as salt, acid, smoke, and so on
Altitude	≤3000m
Insects, pests, white ants	None
Mildew	None

There is a fan inside the rectifier and an extra fan is not necessary. At least a 20mm clearance should be reserved at two sides of the rectifier to ensure reliable operation.

The dust in the equipment room should be non-conductive, non- ferromagnetic and non-corrosive. The equipment room should be built away from the industry and enterprises that emit harmful gases.

The dust filter should be regularly cleaned.

Note

1. The maximum ambient temperature around the system must not exceed 55°C.
2. The system is intended to operate at an altitude up to 3000m.

2.1.2 Power Supply

The AC power supply system should use AC mains supply as the power source. If conditions permit, backup DC power of battery and diesel engine generator should be provided in accordance with the power supply type.

AC power supply system comprising AC mains supply and backup diesel engine generator should adopt centralized power supply mode. The low-voltage AC power supply system adopts single-phase three-wire system; the earth line should be reliably earthed. AC power cable should use copper-core cable. The cross-sectional area of the power cable should be selected based on the load. In case the distance between cables is less than 30m, economical current density should be adopted to calculate the cross-sectional area of the cable, and the economical current density should be 2.5A/mm^2.

Outdoor power cables should be buried underground directly or in sleeves and routed separate from signal cables.

2.1.3 Safety Protection Requirement

To prevent the high lightning voltage from damaging the rectifier through the power supply cable, Class C or B SPD should be installed to the cable before the cable enters the system.

2.2 Installation Procedures

The rectifiers and controller had already been installed in the power distribution frame in factory, as shown in Figure 2-1. You just need to install the power distribution frame.

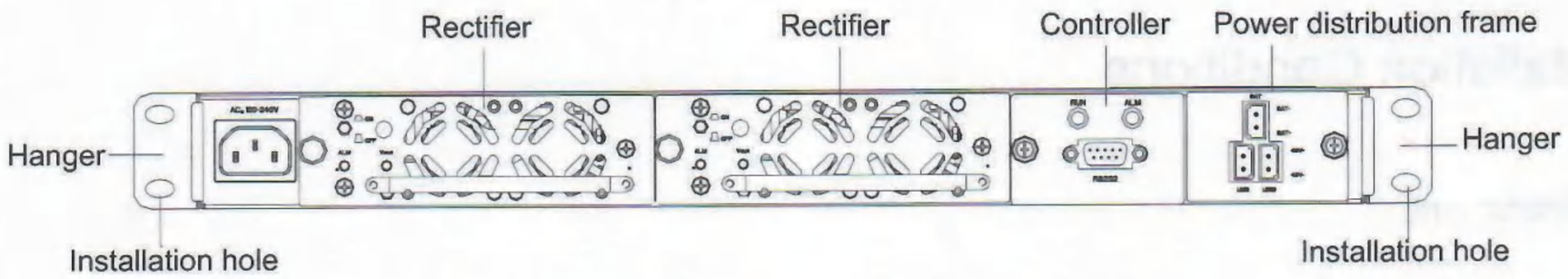


Figure 2-1 Front panel of the system

2.2.1 Installing Power Distribution Frame

1. Insert the frame into user cabinet.
2. Use the Phillips screws to fix the frame through its installation holes.

The specific installation sizes are shown in Figure2-2.

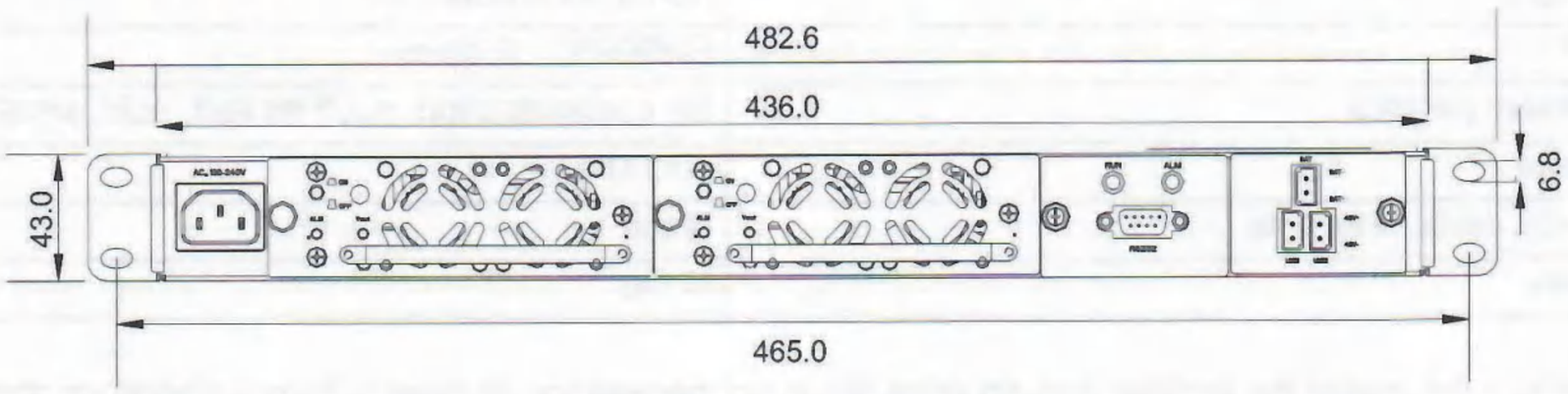


Figure 2-2 Installation size

2.2.2 Connecting Electrical Cables

Electrical cable connection include connection of AC input cables, load output cables, battery cables, and communication cables. The input socket, load output sockets, battery socket and communication ports are located at the front panel of the power distribution frame, as shown in Figure1-4.

1. Connecting the AC input cables

Circuit breaker should be connected to the input terminal additionally (the capacity should be less than 32A and 32A/220V is recommended) to ensure the AC power enters into the system after the protection control. The AC input socket is located in the left side of the front panel. It can be inserted with matched single-phase three-wire AC plug. Among the input single-phase three wires, the earth line must be reliably earthed.

Note

1. Circuit breaker should be connected to the input terminal additionally (the capacity should be bigger than 20A and less than 32A and 32A/220V is recommended) to ensure the AC power enters into the system after the protection control.

2. For the areas where thunder and lightning are frequent, AC power must be fed to the SPD box first to guarantee reliable operation of the power system.

The recommended SPD box: SPD23SZ single-phase surge protection device made by Emerson Network Power Co., Ltd.

3. The system is intended for use as a component part of other equipment. When installing the system or connecting the input and output, the relevant safety standards e.g.UL60950-1, IEC60950-1, EN60950-1, CAN/CSA-C22.2 No.60950-1-03 must be complied, especially the requirements for creepage distances, clearances and distance through insulation between Live parts and earth or SELV circuit.

4. The earth wire must be adequately locked against accidental loosening.

2. Connecting the load cables

The connection terminals of load cables of the system are located in the right side of the front panel DC output sockets [LOAD 1] and [LOAD 2], as shown in Figure 2-3, which can be plugged in matched connector. The specifications and models of the load cables should be selected based on the load capacity. The cable layout should meet the engineering requirements. Pay attention to that the plug is upper positive and lower negative.

The rated current of the DC output sockets [LOAD 1] and [LOAD 2] is 8A. The total current of [LOAD1], [LOAD2] and [BAT] should be less than 10A.

3. Connecting the load cables

The battery connection terminals of the system are located in the right side of the front panel battery input socket [BAT], as shown in Figure 2-3, which can be plugged in with matched connector. The specifications and models of the battery cables should be selected based on the battery capacity and the cable layout should meet the engineering requirements. Pay attention to that the plug is upper negative and lower positive.

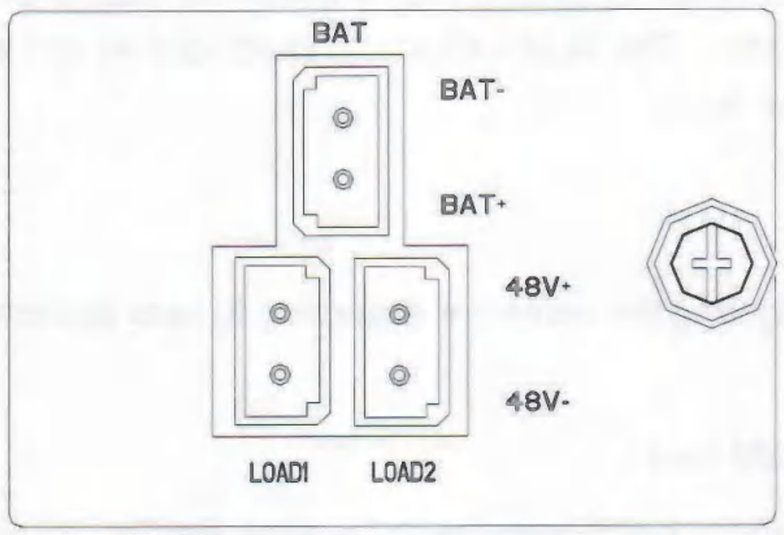


Figure 2-3 DC output panel

The rated current of the battery input socket [BAT] is 8A.

4. Connecting the communication cables

The communication of the system with the host adopts RS232 mode. Connect one end of the communication cable to the communication port of the monitoring unit; connect the other end of the communication cable to the port at the host. The TX, RX and GND of the port respectively correspond to the RX, TX and GND of the communication port on the controller panel.

Note

The system has no in-line fuse. For safety operation, an external input breaker 32 A/250 Vac must be employed in line for safety before installation.

2.3 Installation Check

After the system installation, a thorough check should be conducted. The checklist is given in Table 2-2.

Table 2-2 Installation checklist

Device checked	Key point
Power distribution frame	Stability check
Rectifiers and controller	Stability check and fastness check
Input cable and output cable	Fastness check

2.4 Testing

2.4.1 System Testing

The power system has been strictly tested at factory before delivery; still you need to check the following points before power on:

1. Test the resistance of AC input to enclosure with a multimeter to ensure there should be no short circuit.
2. Pay attention to the polarity directions of the AC input cable, load cable and battery cable.

2.4.2 AC Power Testing

1. Supply AC power to the system. After switching on two rectifiers, the Vout indicator of the rectifiers should turn on, and the RUN indicator of the controller should flash continuously.

If the rectifier is not switched on after the AC power-on, the ALM indicator on the controller front panel should turn on.

2. If the above proves satisfactory, it shows that the AC distribution unit of the system operates normally.

3. When the system is operating normally, cut off the mains supply, all indicators of the rectifiers will turn off, meanwhile the system should switch to battery supply condition with no power interruption to load, and the controller should maintain normal operation, The ALM indicator should light on and alarm information “AC mains failure” be displayed on the screen of the host.

2.4.3 Controller Testing

Test the controller after configuring the controller according to user system configuration and battery management requirements.

Under-voltage alarm and LVD test

Cut the AC power and the battery supply powers to the load, set the DC under-voltage alarm point and BLVD voltage to higher values (in order to shorten the test time, but after the test, the original values must be restored) through the host, such information as battery under-voltage alarm, load and BLVD states can be browsed. The host should indicate DC under-voltage through its monitoring software. The ALM indicator of the controller should turn on. Battery is power-off when the bus-bar voltage is lower than BLVD voltage. After restoring the AC power, the above alarm disappears. (If the condition is unavailable, the testing is not necessary).

Battery fuse broken alarm

Connect the battery; remove the fuse in the circuit, the host should correctly indicate the corresponding battery fuse broken alarm through the host software. Re-install the fuse and the alarm disappears. (Disconnect the AC input power and the battery branch circuit before removing the fuse).

Load fuse broken alarm

Connect the load; remove the corresponding fuse in the circuit, the host should correctly indicate the corresponding load fuse broken alarm through host software. Re-install the fuse and the alarm disappears. (Disconnect the AC input power and the battery branch circuit before removing the fuse).

📖 **Note**

1. After testing, be sure to restore the original system settings.

2. If testing condition is unavailable, it is allowable for user not to test the controller, for it has been strictly tested before delivery.

3. The parameters of controller have been set to defaults before delivery.

2.5 Operation

2.5.1 Power-on Operation

After installation and testing, the power system is ready for use. When necessary, it can be put into normal operation just after the system is powered on. Switch on two rectifiers after AC power-on, the output voltage is immediately established and then connect the load to the system. The power-on process of the system is shown as follows:

Start → Check the system cables → AC power on → Switch on the rectifiers →Connect the load → End

2.5.2 Operating Information Check

After having been powered on, the simple operating information of the system can be checked through indicators on the panel of the controller. If a host is available, the operating information can be checked directly through it.

Note

1. When the AC main is unavailable, the system continues to operate relying on the battery. After checking for some time, the controller will report battery under-voltage alarm, and the operating time is limited, and the controller prompts the urgent recovery of the mains for normal operation.

2. Do not touch the system when it is in operation because the output has hazardous energy.

3. The system output exceeds 240VA,do not touch the output and the wire when installing.

4. The output power of the system must not exceed the rated given on the system, and the total output current must not exceed 10A.

Chapter 3 Maintenance And Troubleshooting

3.1 Handling Special Conditions

The AC power failure is the most common phenomenon in the system operation. If the time of power interruption is not long, the battery can automatically power the load. If the power failure reason is unknown or the time of power interruption is too long, diesel generator should be started.

To prevent the transient of diesel generator from affecting the system, connect the generator to the system at least 2 minutes after the generator starts when its operation becomes stable.

3.2 Troubleshooting

Since the system adopts modular design, the failure of a part or unit will not affect the work of other parts or units.

3.2.1 Handling AC power Distribution Failure

The AC power of the system is input through the AC socket. Normally there is no malfunction in the socket. If external AC power supply is normal while there is no AC power supply in the system, power off the system and remove the cover board of the system, check whether the internal cable is broken. If the problem cannot be solved, professional staff or service personnel of Emerson Company should be notified for prompt maintenance.

3.2.2 Handling DC Power Distribution Failure

If the rectifiers of the system work normally while the system has no DC output, check whether the fuses as shown in Figure 3-1 are normal, If the fuse is broken, power off the system then replace it（disconnect the AC input power and battery branch circuit）. If the problem cannot be solved, notify service personnel of Emerson Company for maintenance.

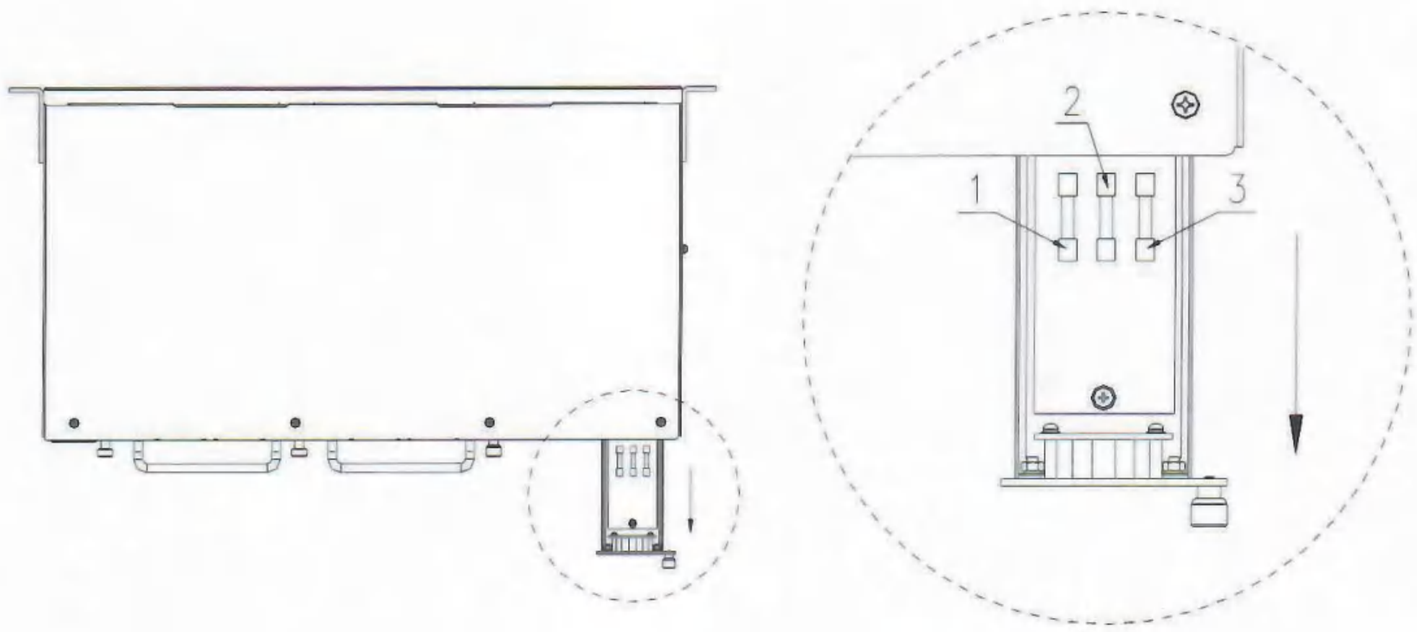


Figure 3-1 Rectifier fuse(top view)

Corresponding relations between fuse and load:

Fuse1 corresponds to load 1 branch circuit (LOAD 1).

Fuse 2 corresponds to load 2-branch circuit (LOAD 2).

Fuse 3 corresponds to battery branch circuit (BAT).

Note

1. Only trained professionals are allowed to replace the fuse after disconnecting the AC input power and battery branch circuit.
2. The old fuse should only be replaced by the fuse manufactured by BEL Company (type 5HT10, 10A/250V).

3.2.3 Handling Rectifiers Failure

The rectifiers are hot swappable, so damaged rectifiers can be replaced without shutting down the equipment.

Upon abnormities, the rectifiers may need to be pulled out and plugged in. To pull out a rectifier, remove the fixing screw on the front panel and then pull it out by the handle. The replacement is finished when plugging a new rectifier into the system.

Phenomenon: the Vout indicator and ALM indicator are off.

Solution:

1. Check that the AC input socket is connected correctly.
2. Check that the rectifiers are plugged in reliably.
3. Check that the switch of the rectifier is on.
4. Check that the fuse in the rectifier is normal; replace the fuse or the rectifier when the fuse is broken.

Phenomenon: The Vout indicator is off and the ALM indicator is on when the system is in operation.

Solution:

1. If it is due to rectifier over-heat protection, service is not necessary, the rectifier can restore to normal work when the temperature inside the rectifier reduces to the normal level.
2. If it is due to rectifier over-voltage protection, the rectifier can work normally after power it on again.

3.2.4 Handling Controller Failure

Communication failure

Check that the communication cables are connected correctly and reliably and check that the baud rate setting of the controller parameters is correct.

Other failure

The controller should be removed from the system when its malfunction affects the safety of DC power supply. At this moment pay attention to the battery management and maintenance.

📖 **Note**

The controller isn't intended be repaired by service personnel in case of failure or component defect. Failure controller should be sent back to the manufacturer for repair.
