



NetSure™ -48 VDC Power System

Installation and User Manual

Specification Number: PLM80142

The information contained in this document is subject to change without notice and may not be suitable for all applications. While every precaution has been taken to ensure the accuracy and completeness of this document, Vertiv assumes no responsibility and disclaims all liability for damages resulting from use of this information or for any errors or omissions. Refer to other local practices or building codes as applicable for the correct methods, tools, and materials to be used in performing procedures not specifically described in this document.

The products covered by this instruction manual are manufactured and/or sold by Vertiv. This document is the property of Vertiv and contains confidential and proprietary information owned by Vertiv. Any copying, use or disclosure of it without the written permission of Vertiv is strictly prohibited.

Names of companies and products are trademarks or registered trademarks of the respective companies. Any questions regarding usage of trademark names should be directed to the original manufacturer.

Technical Support Site

If you encounter any installation or operational issues with your product, check the pertinent section of this manual to see if the issue can be resolved by following outlined procedures.

Visit <https://www.vertiv.com/en-us/support/> for additional assistance.

TABLE OF CONTENTS

Admonishments Used in this Document	v
Important Safety Instructions	vi
Safety Admonishments Definitions.....	vi
Safety and Regulatory Statements.....	vi
Déclarations de Sécurité et de Réglementation.....	vi
1 System Description	1
1.1 Overview Illustration.....	2
1.2 Dimensions.....	3
1.3 Specifications.....	4
1.4 Items Ordered Separately.....	5
1.4.1 Rectifier Modules.....	5
1.4.2 Load Lead Assembly for 10A GMT Fuse Positions.....	6
1.4.3 GMT Load Distribution Fuses.....	6
1.4.4 Bullet Nose-Type Battery Disconnect and Load Distribution Circuit Breakers.....	7
1.4.5 Temperature Probe.....	7
2 Installation Acceptance Checklist	9
3 Installing the System	10
3.1 General Requirements.....	10
3.2 Securing the Power/Distribution Shelf to the Equipment Cabinet.....	10
3.3 Installing Circuit Breakers and Fuses.....	10
3.3.1 GMT Load Distribution Fuses.....	10
3.3.2 Bullet Nose-Type Battery Disconnect and Load Distribution Circuit Breakers.....	11
4 Making Electrical Connections	12
4.1 Important Safety Instructions.....	12
4.2 Wiring Considerations.....	12
4.3 Power/Distribution Shelf Frame Grounding Connection.....	12
4.4 AC Input and AC Input Equipment Grounding Connections.....	13
4.5 External Interface Connections.....	14
4.5.1 Digital Inputs.....	14
4.5.2 Relay Outputs.....	14
4.6 Ethernet Connection.....	19
4.7 Load Connections.....	20
4.7.1 To GMT Fuse Positions.....	20
4.7.2 To Bullet Nose-Type Load Distribution Circuit Breaker Positions.....	21
4.8 CO Ground Connection.....	24
4.9 Battery Connections.....	24
4.10 Important Safety Instructions.....	24
4.10.1 To Bullet Nose-Type Circuit Breaker Positions.....	24
5 Installing Rectifier Modules and Initially Starting The System	25
5.1 Installing the Rectifier Modules.....	25
5.2 Initially Starting, Configuring, and Checking System Operation.....	26
5.2.1 Initial Startup Preparation.....	26

5.2.2	Initially Starting the System.....	26
5.2.3	SCU+ Initialization.....	26
5.2.4	Verifying the Configuration File.....	28
5.2.5	Checking System Status.....	28
5.2.6	Configuring the SCU+ Identification of Rectifier Modules.....	28
5.2.7	SCU+ Alarm Relay Check.....	29
5.2.8	Final Steps.....	35
6	Operating Procedures.....	35
6.1	Rectifier Module.....	35
6.2	SCU+ (Standard Control Unit Plus).....	35
7	Maintenance.....	35
7.1	System Maintenance Procedures.....	35
8	Troubleshooting and Repair.....	36
8.1	Contact Information.....	36
8.2	Supporting Documents.....	36
8.3	Troubleshooting Information.....	36
8.3.1	General.....	36
8.4	Replacement Information.....	36
8.4.1	Replacement Assemblies.....	36
8.5	Replacement Procedures.....	37
8.5.1	Replacing a Rectifier Module.....	37
8.5.2	Clearing a Rectifier Communications Fail Alarm after Removing a Rectifier.....	37
8.5.3	Replacing a GMT Distribution Fuse.....	37
8.5.4	Distribution Unit Replacement.....	37

Admonishments Used in this Document



DANGER! Warns of a hazard the reader **will** be exposed to that will **likely** result in death or serious injury if not avoided. (ANSI, OSHA)



WARNING! Warns of a potential hazard the reader **may** be exposed to that **could** result in death or serious injury if not avoided. This admonition is not used for situations that pose a risk only to equipment, software, data, or service. (ANSI)



CAUTION! Warns of a potential hazard the reader **may** be exposed to that **could** result in minor or moderate injury if not avoided. (ANSI, OSHA) This admonition is not used for situations that pose a risk only to equipment, data, or service, even if such use appears to be permitted in some of the applicable standards. (OSHA)



ALERT! Alerts the reader to an action that **must be avoided** in order to protect equipment, software, data, or service. (ISO)



ALERT! Alerts the reader to an action that **must be performed** in order to prevent equipment damage, software corruption, data loss, or service interruption. (ISO)



FIRE SAFETY! Informs the reader of fire safety information, reminders, precautions, or policies, or of the locations of fire-fighting and fire-safety equipment. (ISO)



SAFETY! Informs the reader of general safety information, reminders, precautions, or policies not related to a particular source of hazard or to fire safety. (ISO, ANSI, OSHA)

Important Safety Instructions

Safety Admonishments Definitions

Definitions of the safety admonishments used in this document are listed under “Admonishments Used in this Document” on page v.

Safety and Regulatory Statements

Refer to Section 4154 (provided with your customer documentation) for Safety and Regulatory Statements.

Déclarations de Sécurité et de Réglementation

Reportez-vous à la Section 4154 (fourni avec les documents de votre client) pour les déclarations de sécurité et de réglementation.

1 System Description

The Vertiv™ NetSure™ PLM80142 DC Power System is a complete integrated power system containing rectifiers, intelligent control, metering, monitoring, and distribution. This power system consists of the following mounted in a 2RU high by 19" wide shelf.

- **1000W Rectifier Modules**

The shelf accommodates three (3) 1000W Rectifier Modules.

- The Rectifier Modules provide load power, battery float current, and battery recharge current during normal operating conditions. The Rectifier Modules are designed to provide constant power. They are designed with the latest patented switch-mode technology using DSP (Digital Signal Processing) functionality for efficient operation. This means that, within the normal operating ambient temperature range and input voltage range, the maximum available output power is a constant 1000W. Within these ranges, the Rectifier Modules operate in one of three modes, depending upon load demands. Transition between modes is completely automatic. If ambient temperature rises above or input voltage falls below acceptable values, Rectifier Modules continue to operate but at derated output power levels.

1. **Constant Voltage Mode:** For any initial output voltage setting from 42 to 58 volts, output voltage remains constant regardless of load. This is the normal operating condition, in which loads are being supplied and batteries are float charged. Rectifier Modules operate in the Constant Voltage Mode unless load increases to the point where the product of load current and output voltage is approximately 1000W.
2. **Constant Power Mode:** As load increases above approximately 1000W (non-adjustable), output current continues to increase, but output voltage decreases as required to maintain constant output power. Rectifier Modules operate in the Constant Power Mode unless load continues to increase to the point where the current limit setting is reached.
3. **Constant Current Mode:** If load increases above the current limit setting, output voltage decreases linearly to maintain output current at current limit.

- **SCU+ (Standard Control Unit Plus) Controller**

The SCU+ Controller provides Rectifier Module and optional Low Voltage Battery Disconnect (LVBD) or Low Voltage Load Disconnect (LVLVD) control, metering functions, monitoring functions, and local/remote alarms. The SCU+ contains an LCD display and keypad for local access. It provides connection for binary inputs, programmable relay outputs, and a charge control function. The controller also supports rectifier temperature compensation if the system is equipped with a temperature probe, and ambient air temperature monitoring if equipped with a second temperature probe. The SCU+ also provides Ethernet connection and SNMP capability.

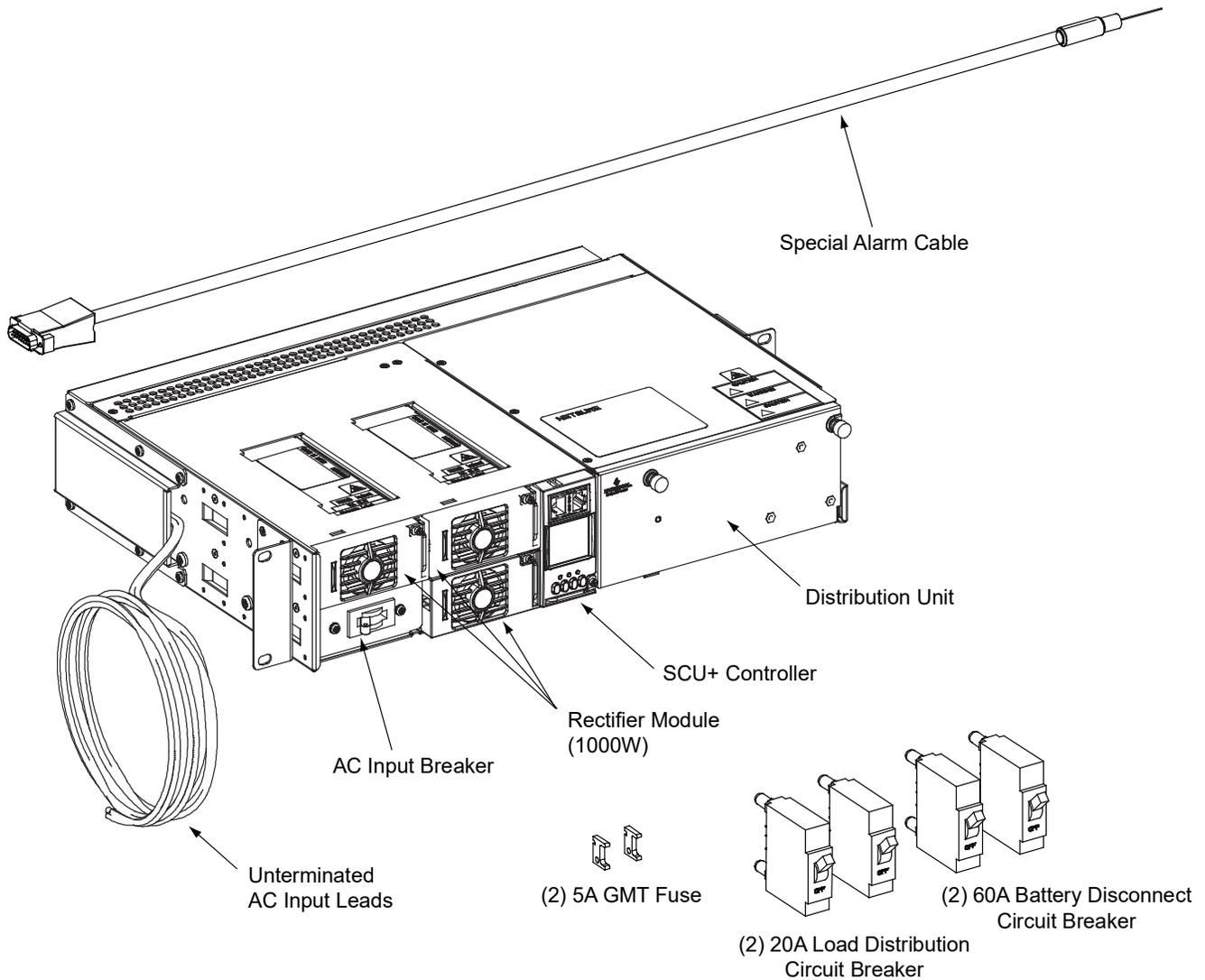
- **Distribution Unit**

The Distribution Unit consists of Low Voltage Battery Disconnect (LVBD), a battery shunt, two (2) bullet nose-type circuit breaker load distribution positions, two (2) bullet nose-type circuit breaker battery disconnect positions, and five (5) GMT fuse load distribution positions.

- **AC Input Breaker**

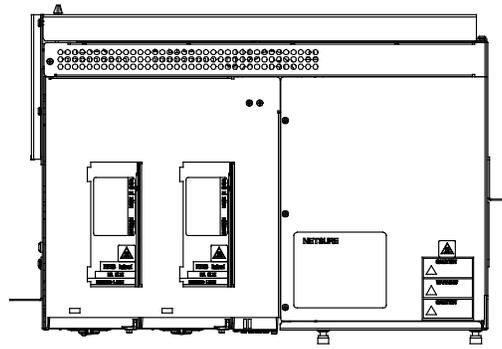
The shelf includes a front accessed 25A AC input circuit breaker which is internally connected to all rectifier module positions.

1.1 Overview Illustration

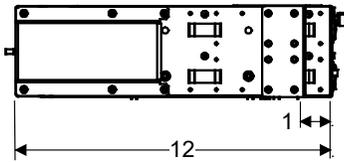


DISTRIBUTION UNIT
 (5) GMT Fuse Load Positions
 (2) Bullet-Nose Circuit Breaker Load Positions
 (2) Bullet-Nose Circuit Breaker Battery Disconnect Positions
 Low Voltage Battery Disconnect (LVBD)

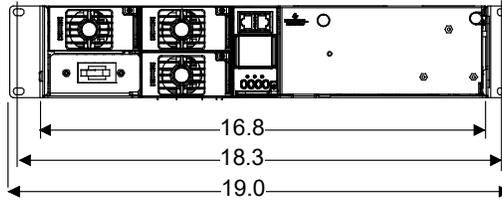
1.2 Dimensions



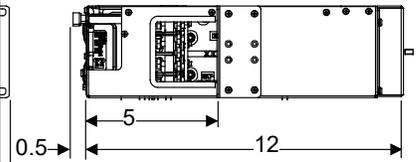
Top View



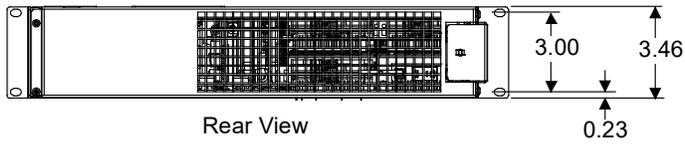
Left Side View



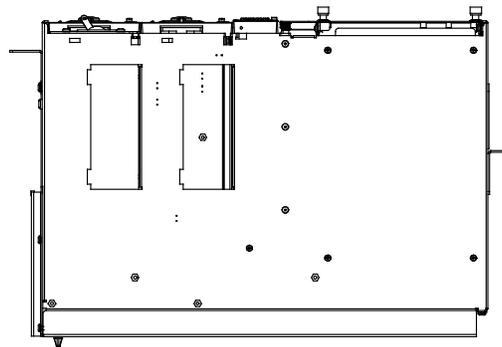
Front View



Right Side View



Rear View



Bottom View

Notes:

1. All dimensions are in inches, unless otherwise specified.
2. Weight in LBS.
Net: 30
Shipping:
3. Finish: Front Panels are Gray
Shelf is Galvaneal.

1.3 Specifications



NOTE! For all rectifier specifications, refer to the separate Rectifier User Manual (UM1R481000). For all controller specifications, refer to the Controller User Manual (UM1M521B). For factory settings of all configurable Controller parameters, refer to the Configuration Drawing (C-drawing) supplied with your Power System.

Input Ratings

Input Voltage: Nominal 120 volts AC, single phase, 3-wire, 50/60 Hz, with an operating range of 100 to 132 volts. Acceptable input frequency range is 45 to 65 Hz.

Input Current: 18.3A @ 120Vac.

Output Ratings

Output Voltage: -48 Volts DC.

Output Capacity: See the following table.

System DC Output Current @ 120Vac Input	
+40°C (+104°F)	+65°C (+149°F)
31.2A	18.9A

Environmental Ratings

Operating Ambient Temperature Range (Specification Compliant):

- 40°C (-40°F) to +65°C (+149°F) with derating output.
- 40°C (-40°F) to +40°C (+104°F) with full power performance.

Storage Ambient Temperature Range: -40°C (-40°F) to +75°C (+167°F).

Humidity: This Power System is capable of operating in an ambient relative humidity range of 0% to 90%, non-condensing.

Altitude: 2000 m (6560 ft) at full power (power limited for heights above 2000 m).

Mounting:

This product is intended only for installation in a Restricted Access Location on or above a non-combustible surface.

This product must be located in a Controlled Environment with access to Craftspersons only.

This product is intended for installation in Network Telecommunication Facilities (CO, vault, hut, or other environmentally controlled electronic equipment enclosure).

This product is intended to be connected to the common bonding network in a Network Telecommunication Facility (CO, vault, hut, or other environmentally controlled electronic equipment enclosure).

19" wide rack (1" or 1 3/4" multiple drillings) mounting.

The right mounting angle is positioned for 5" front projection. The left mounting angle is positioned for 1" front projection.

Ventilation Requirements: Rectifier and mounting shelf ventilating openings must not be blocked and temperature of air entering rectifiers must not exceed rated Operating Ambient Temperature Range stated above.

Compliance Information

Surge Protection: Compliance with EN61000-4-5 (2kV Line to Line, 2kV Line to Earth). Capable of withstanding surges per ANSI/IEEE C 62.41 1980 Category B3 across the input terminals.



NOTE! This level of protection is a widely used standard for telecommunications power equipment. As with all such equipment, it is the end user's responsibility to provide an adequately sized Surge Suppression Device at the commercial power service entrance of the building that reduces all incoming surges to levels below the classes/categories stated for the equipment.

EMC: Complies with the Low-Voltage Directive, 73/23/EEC. Complies with Emissions and Immunity requirements as specified in GR 1089 Core Issue 4.

EMC		
	Emissions	Test Level
EN 55022: 1998 CFR 47 – Part 15 GR-1089 Issue 4	Conducted	Class B
	Radiated	Class B
Immunity		
GR-1089 Issue 4	EN 61000-4-2 Electrostatic Discharge	8kV / 15kV
	EN 61000-4-4 Electric Fast Transients	0.25kV / 0.5kV
	Radiated Immunity	8.5V/m
	Conducted Immunity	89dBuA
	Surge IEEE C62.41	2kV / 6kV

Standard Features

AC Input Connections: The shelf is equipped with unterminated AC input leads which are factory connected to the internal AC input circuit breaker and all Rectifier Module mounting positions.

Battery Connections: Battery and battery return leads terminated in two-hole lugs are connected to threaded studs located inside the Distribution Unit. Battery leads are brought into the right side (as viewed from the front) of the shelf.

Load Connections: Load distribution (circuit breakers, if furnished) and load return leads terminated in two-hole lugs are connected to threaded studs located inside the Distribution Unit. Load leads are brought into the right side (as viewed from the front) of the shelf and are accessible from the front of the shelf.

Load distribution (GMT fuses) and load return leads are connected to receptacles located inside the Distribution Unit. Load leads are brought into the right side (as viewed from the front) of the shelf and are accessible from the front of the shelf.

Alarm and Monitoring Connections: Relay output and digital input leads are connected to screw-type terminal blocks located on the Customer Interface Board located inside the shelf. A special alarm relay cable is provided. The leads of the special alarm cable enter the right side (as viewed from the front) of the shelf and are accessible from the front of the shelf.

1.4 Items Ordered Separately

1.4.1 Rectifier Modules

Each shelf holds up to three (3) Rectifier Modules.

Rectifier Modules must be ordered separately by P/N 1R481000.

1.4.2 Load Lead Assembly for 10A GMT Fuse Positions

Each P/N 535206 provides one (1) GMT fuse load lead assembly.

Five (5) P/N 535206 are required per shelf.

Each P/N 535206 provides 12' long, 16 AWG, load and load return leads that are terminated on one end with the appropriate mating connector to plug into a single 10A GMT fuse connector on the Distribution Unit and are left un-terminated at the remaining end for connection into customer loads.

1.4.3 GMT Load Distribution Fuses

The Distribution Unit holds up to five (5) 0-10A GMT load distribution fuses. See **Table 1.1**.

Table 1.1 GMT Fuses

Ampere Rating	P/N	Fuse Color
18/100 GMT-A	248610301	--
1/4	248610200	Violet
1/2	248610300	Red
3/4	248610500	Brown
1-1/3	248610700	White
2	248610800	Orange
3	248610900	Blue
5	248611000	Green
7-1/2	248611300	Black-White
10	248611200	Red-White
Replacement Dummy Fuse	248872600	---
Replacement Safety Fuse Cover	102774	--

1.4.4 Bullet Nose-Type Battery Disconnect and Load Distribution Circuit Breakers

The Distribution Unit holds up to two (2) bullet nose-type battery disconnect circuit breakers and up to two (2) bullet nose-type load distribution circuit breakers. See **Table 1.2**.

Table 1.2 Bullet Nose-Type Circuit Breakers

Ampere Rating	P/N	
	Electrical Trip ¹ (White Handle)	Electrical/ Mechanical Trip ² (Black Handle)
1	102272	101596
3	102273	101597
5	102274	101598
10	102275	101599
15	102276	101600
20	102277	101601
25	102278	101602
30	102279	101603
35	102280	101604
40	102281	101605
45	121998	121997
50	102282	101606
60	102283	101607
70	102284	101608
75	102285	101609
80	121996	121995
100	102286	101610

See **Table 4.4** for recommended wire sizes and lugs.

Circuit Breaker Alarm Operation:

¹ Provides an alarm during an electrical trip condition only.

² Provides an alarm during an electrical or manual trip condition.

Note that Electrical Trip only circuit breakers are not typically used for battery disconnect circuit breakers.

1.4.5 Temperature Probe



Two Temperature Probes can be connected to this system. One to provide Battery Charge Temperature Compensation and the other to monitor ambient air temperature. Each probe plugs into the IB2 Board.

The Temperature Probe used for Battery Charge Temperature Compensation is mounted near the battery to sense battery ambient temperature. This allows the Controller to automatically increase or decrease the output voltage of the system to maintain battery

float current as battery ambient temperature decreases or increases, respectively. Battery life can be extended when an optimum charge voltage to the battery with respect to temperature is maintained.

Optional Temperature Probe, P/N 04118246 (shelf side half) and P/N 04118247 (probe side half, 9 ft. long)

The Temperature Probe consists of two pieces that plug together to make a complete probe. When ordered, P/N 04118246 (3 feet long) is pre-wired to the shelf and P/N 04118247 (9 feet long) is shipped loose. Total length: 12 ft.

Optional Temperature Probe, P/N 04118246 (shelf side half) and P/N 04116740 (probe side half, 30 ft. long)

The Temperature Probe consists of two pieces that plug together to make a complete probe. When ordered, P/N 04118246 (3 feet long) is pre-wired to the shelf and P/N 04116740 (30 feet long) is shipped loose. Total Length: 33 ft.

2 Installation Acceptance Checklist

Provided below is an Installation Acceptance Checklist. This checklist helps ensure proper installation and initial operation of the system. As the procedures presented in Sections “*Installing the System*” through *Installing Rectifier Modules and Initially Starting The System*” of this document are completed, check the appropriate box on this list. If the procedure is not required to be performed for your installation site, also check the box in this list to indicate that the procedure was read. When installation is done, ensure that each block in this list has been checked. Some of these procedures may have been factory performed for you.



NOTE! *The system is not powered up until the end of this checklist.*



NOTE! *Some of these procedures may have been performed at the factory for you.*

Installing the System

- Power/Distribution Shelf Secured to Equipment Cabinet
- Fuses Installed
- Circuit Breakers Installed

Making Electrical Connections

- Power/Distribution Shelf Frame Grounding Connection Made
- AC Input and AC Input Equipment Grounding Connections Made
- External Interface Connections Made
- Digital Inputs
- Relay Outputs
- Temperature Probes
- Ethernet Connection Made (if required)
- Load Connections Made
- CO Ground Connection Made
- Battery Connections Made

Installing Rectifier Modules and Initially Starting the System

- Rectifier Modules Installed
- System Started, Configured, and Checked

3 Installing the System

3.1 General Requirements

- This product is intended only for installation in a Restricted Access Location on or above a non-combustible surface.
- This product must be located in a Controlled Environment with access to Craftspersons only.
- This product is intended for installation in Network Telecommunication Facilities (CO, vault, hut, or other environmentally controlled electronic equipment enclosure).
- This product is intended to be connected to the common bonding network in a Network Telecommunication Facility (CO, vault, hut, or other environmentally controlled electronic equipment enclosure).
- The installer should be familiar with the installation requirements and techniques to be used in securing the Power/Distribution Shelf to an equipment cabinet.
- Rectifier and mounting shelf ventilating openings must not be blocked and temperature of air entering rectifiers must not exceed rated Operating Ambient Temperature Range found in *System Description* on page 1 under “Specifications”.

3.2 Securing the Power/Distribution Shelf to the Equipment Cabinet

The shelf is designed to be mounted in a standard 19” wide cabinet frame having 1” or 1 3/4” multiple drillings. Refer to “Dimensions” under *System Description* for overall dimensions.



NOTE! Refer to the General Requirements section at the beginning of this document for Ventilation Requirements.

Procedure

1. Secure shelf mounting angles to equipment cabinet at two (2) locations per side. Use grounding washers at one (1) location per side. Proper orientation of grounding washers enables teeth to dig into paint for a secure ground connection. Torque connections to 70 in-lbs.



NOTE! Compliance with Telcordia GR-1089-CORE requires that prior to mounting the Power/Distribution Shelf to the equipment rack:

- All paint must be removed from the front surface of each equipment rack rail where it mates with a shelf-mounting bracket, so that good metal-to-metal contact can be established between the shelf and rack.
- The shelf-to-rack mating surfaces must be cleaned.
- Electrical anti-oxidizing compound must be applied to the shelf-to-rack mating surfaces.

3.3 Installing Circuit Breakers and Fuses

3.3.1 GMT Load Distribution Fuses

Restrictions

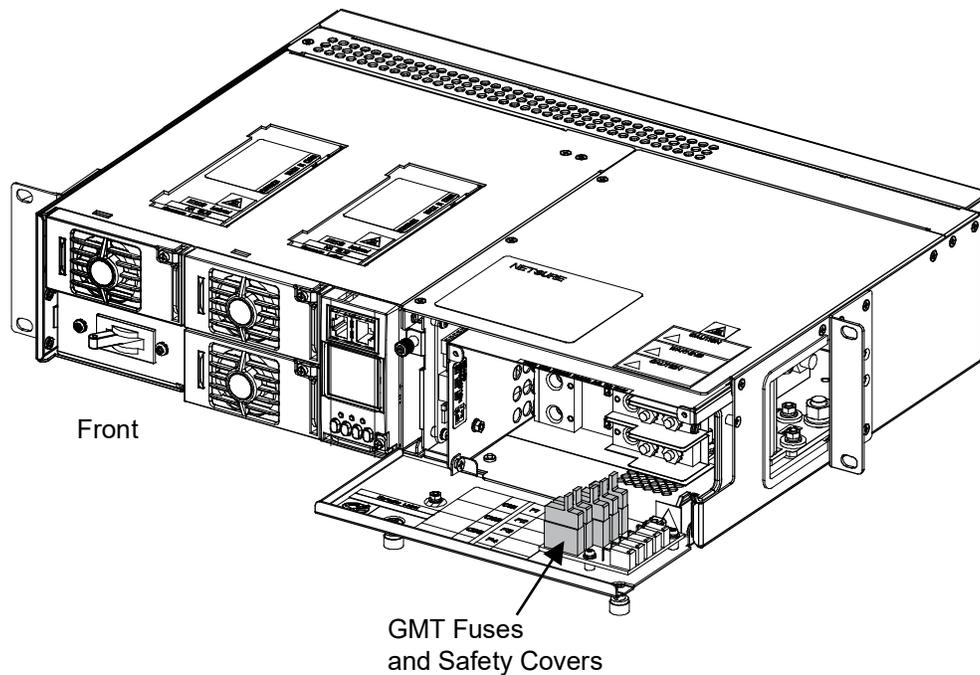
When used for power distribution, load should not exceed 80% of device rating, except 10 ampere fuses, for which load should not exceed 70% of device rating.

Procedure

Refer to **Figure 3.1**.

1. Open the Distribution Unit's front access panel.
2. Install correctly sized GMT fuses into the fuseholders located inside the Distribution Unit, as required. If a dummy fuse is installed, first remove the dummy fuse. Install a safety fuse cover over each GMT fuse.
3. When finished, close the Distribution Unit's front access panel.

Figure 3.1 Installing GMT Load Distribution Fuses

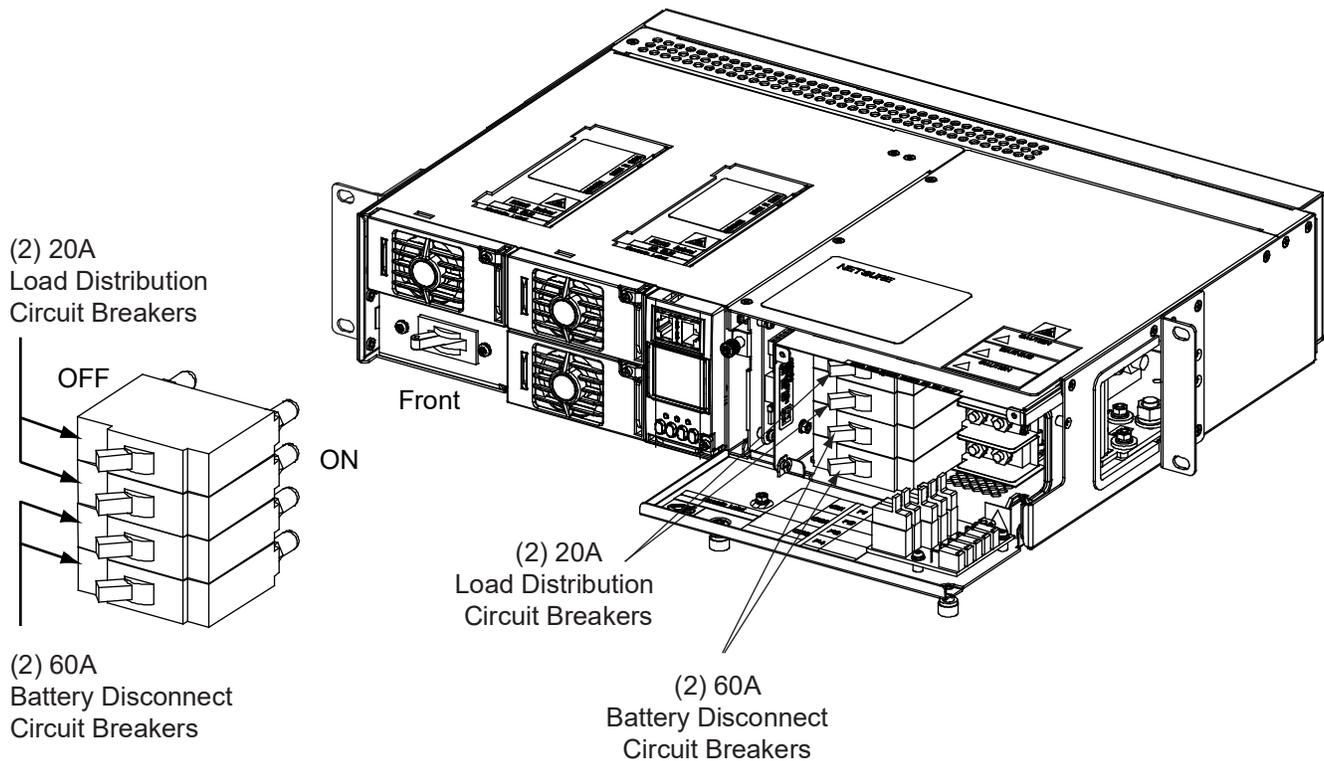


3.3.2 Bullet Nose-Type Battery Disconnect and Load Distribution Circuit Breakers

Procedure

Refer to **Figure 3.2**.

1. Open the Distribution Unit's front access panel.
2. Install correctly sized bullet nose-type circuit breakers into the mounting positions located inside the Distribution Unit, as required. Orient the circuit breaker with the ON position to the right. Ensure the alarm contact on the back of the circuit breaker makes contact with the alarm terminal on the mounting circuit card.
3. When finished, close the Distribution Unit's front access panel.

Figure 3.2 Installing Bullet-Nose-Type Battery Disconnect and Load Distribution Circuit Breakers

4 Making Electrical Connections

4.1 Important Safety Instructions



DANGER! Adhere to the “Important Safety Instructions” presented at the front of this document.

4.2 Wiring Considerations

All wiring and branch circuit protection should follow the current edition of the American National Standards Institute (ANSI) approved National Fire Protection Association's (NFPA) National Electrical Code (NEC), and applicable local codes. For operation in countries where the NEC is not recognized, follow applicable codes.

Refer to drawing 031110100 for lug crimping information. Refer to drawings 031110200 and 031110300 for additional lug information.

4.3 Power/Distribution Shelf Frame Grounding Connection

For shelf grounding requirements, refer to the current edition of the American National Standards Institute (ANSI) approved National Fire Protection Association's (NFPA) National Electrical Code (NEC), applicable local codes, and your specific site requirements.

Procedure

1. The frame grounding connection to the shelf is made by using grounding washers with the mounting hardware used to secure the shelf to the equipment cabinet. Refer to the procedure “Securing the Power/Distribution Shelf to the Equipment Cabinet” under *Installing the System*. Ensure that the equipment cabinet is properly grounded.



NOTE! The DC return connection to this system can remain isolated from system frame and chassis (DC-I).

4.4 AC Input and AC Input Equipment Grounding Connections



DANGER! Adhere to the “Important Safety Instructions” presented at the front of this document.

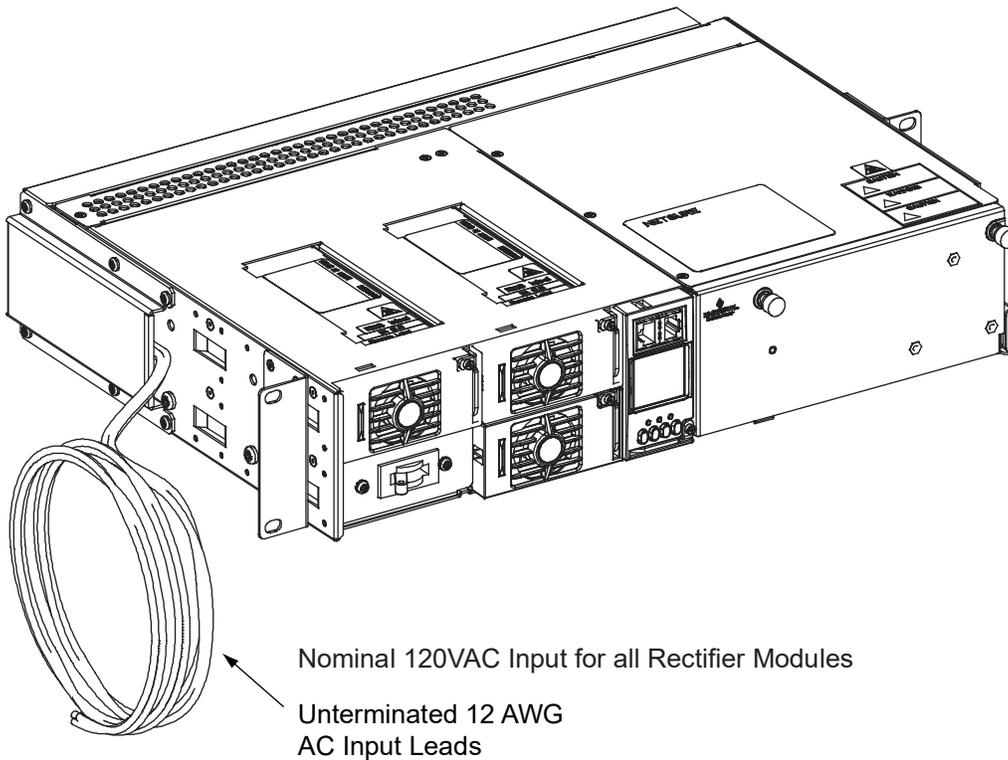
The shelf is equipped with unterminated AC input leads which are factory connected to the internal AC input circuit breaker and all Rectifier Module mounting positions.

Recommended external AC input branch circuit protective device rating is 25A. The protective device should be of the time-delay or high inrush type.

Procedure

1. Connect the AC input leads to a properly wired AC outlet or distribution box. Refer to **Figure 4.1**.

Figure 4.1 AC Input Connections



Connect to a properly wired AC outlet or distribution box.
 Connect Black wire labeled /L/ to Line.
 Connect Black wire labeled /N/ to Neutral.
 Connect Green-Yellow wire to Ground.

4.5 External Interface Connections



NOTE! A special alarm relay cable is furnished.

Digital inputs, relay outputs, and temperature probe(s) are connected to the Customer Interface (IB2) Board, which provides external interface with the SCU+ Controller. Refer to **Figure 4.2** for connector locations. Refer to **Table 4.1** and **Table 4.2** for pin-out information.

If required to access these connection points, loosen the captive fastener on the front of the SCU+ Customer Interface Board, and slide the board partially out of the shelf.

Procedure

Relay Outputs and Digital Inputs: Relay output and digital input leads are connected to screw-type terminal blocks located on the Customer Interface (IB2) Board mounted inside the shelf. Connect digital inputs as required per **Table 4.1**. Connect the special alarm relay cable per **Table 4.1**, **Table 4.2**, and **Table 4.3**. Recommended torque for the Digital Input and Relay Output terminal blocks is 2 in-lbs. Recommended Wire Size: 22 AWG for Loop Lengths Up to 200 ft., 18-20 AWG for Loop Lengths Over 200 ft.

4.5.1 Digital Inputs

- Connect up to eight (8) digital inputs to the Customer Interface (IB2) Board. Note that some of these inputs are factory connected, as listed in **Table 4.1**.
- Observe proper polarity per **Table 4.1**. For example, if an alarm being connected to input No. 1 uses a BR+ signal, the alarm lead must be connected on the + terminal of input 1 and a continuous 48V signal must be connected on the – terminal of input 1. Inversely, if alarm No. 1 uses a 48V signal, the alarm lead must be connected on the – terminal of input 1 and a continuous BR+ signal must be connected on the + terminal of input 1.
- The digital inputs can be configured to provide an alarm when the signal is applied (HIGH) or removed (LOW), as described in the separate SCU+ User Manual.

4.5.2 Relay Outputs

- The Customer Interface (IB2) Board provides eight programmable alarm relays with Form-C contacts. Refer to **Table 4.2** for pin-out information.



NOTE! The relay assigned to “Major Summary” alarm (relay 1 by default) will operate in the “Fail Safe Mode”. “Fail Safe Mode” means Relay 1 is de-energized during an alarm condition, opening the contacts between the C and NO terminals, and closing the contacts between the C and NC terminals.

The remaining 7 relays energize during an alarm condition, closing the contacts between the C and NO terminals, and opening the contacts between the C and NC terminals.

Temperature Probes: Up to two (2) temperature probes can be connected to the Customer Interface (IB2) Board. Refer to **Figure 3.1**. Each probe can be programmed to monitor ambient air temperature or battery temperature. A probe can also be designated to be used for the battery charge temperature compensation feature.

- Each Temperature Probe consists of two pieces. One piece is factory installed to the shelf and the other is shipped loose. Locate and install the shipped loose piece which consists of the Temperature Probe and mating connector to the piece factory installed in the shelf. The Battery Temperature Probe should be mounted on the top or side of a battery cell, in a convenient location, away from direct sources of heat or cold. To mount, peel the backing from the self-adhesive surface, and affix the probe to a clean, dry surface.

Table 4.1 Programmable Digital Inputs

Programmable Digital Input	IB2 Pin No.		Dedicated to...
1	J3-2	+	Internal Load Circuit Breaker / Fuse Alarm
	J3-1	-	
2	J3-4	+	Open Door Alarm
	J3-3	-	
3	J3-6	+	Internal AC Input Circuit Breaker Alarm
	J3-5	-	
4	J4-2	+	User Defined
	J4-1	-	
5	J4-4	+	User Defined
	J4-3	-	
6	J4-6	+	User Defined
	J4-5	-	
7	J5-2	+	User Defined
	J5-1	-	
8	J5-4	+	Emergency Stop
	J5-3	-	
--	J5-5		--
	J5-6		

Table 4.2 Programmable Relay Assignments

Programmable Relay Output	IB2 Pin No. (SCU+ or ACU+)		Special Cable Color Scheme	Alarms Assigned to this Relay (Default)
1*	J6-5	NO	--	Any Major Alarm
	J6-3	COM	--	
	J6-1	NC	--	
2	J6-6	NO	--	Any Minor Alarm
	J6-4	COM	--	
	J6-2	NC	--	
3	J7-5	NO	--	--
	J7-3	COM	--	
	J7-1	NC	--	
4	J7-6	NO	--	<u>Rectifier Alarm</u> Rectifier Lost Load Share Alarm Rect Not Respond Rect HVSD Rect AC Fail Rect Failure Rect Protect Rect Fan Fail Rect Derated Rect Temp Alarm
	J7-4	COM	W-BL	
	J7-2	NC	BL-W	
5	J8-5	NO	--	AC Failure Alarm
	J8-3	COM	W-O	
	J8-1	NC	O-W	
6	J8-6	NO	--	Open Door Alarm
	J8-4	COM	W-G	
	J8-2	NC	G-W	
7	J9-5	NO	--	DC Low #1 DC Low #2
	J9-3	COM	W-BR	
	J9-1	NC	BR-W	
8	J9-6	NO	--	AC Input Breaker Alarm
	J9-4	COM	W-S	
	J9-2	NC	S-W	



NOTE! *The controller relay assigned to “Major Summary” alarm (relay 1 by default) will operate in the “Fail Safe Mode”. “Fail Safe Mode” means Relay 1 is de-energized during an alarm condition, opening the contacts between the C and NO terminals, and closing the contacts between the C and NC terminals.

The remaining 7 relays energize during an alarm condition, closing the contacts between the C and NO terminals, and opening the contacts between the C and NC terminals.

Figure 4.2 External Interface Connections to IB2 Board

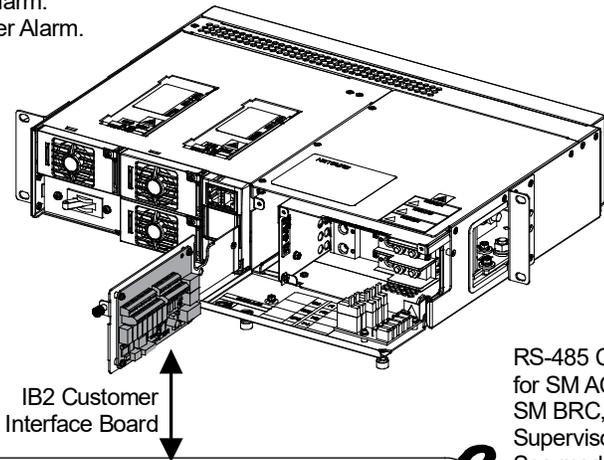
Notes

Digital Input 1 is factory wired to Load Breaker / Fuse Alarm.
 Digital Input 2 is customer wired to Open Door Alarm.
 Digital Input 3 is factory wired to AC Input Breaker Alarm.
 Digital Inputs 4 through 7 are User defined.
 Digital Input 8 is reserved for Emergency Stop.
 Digital Input 9 is not available in this system.

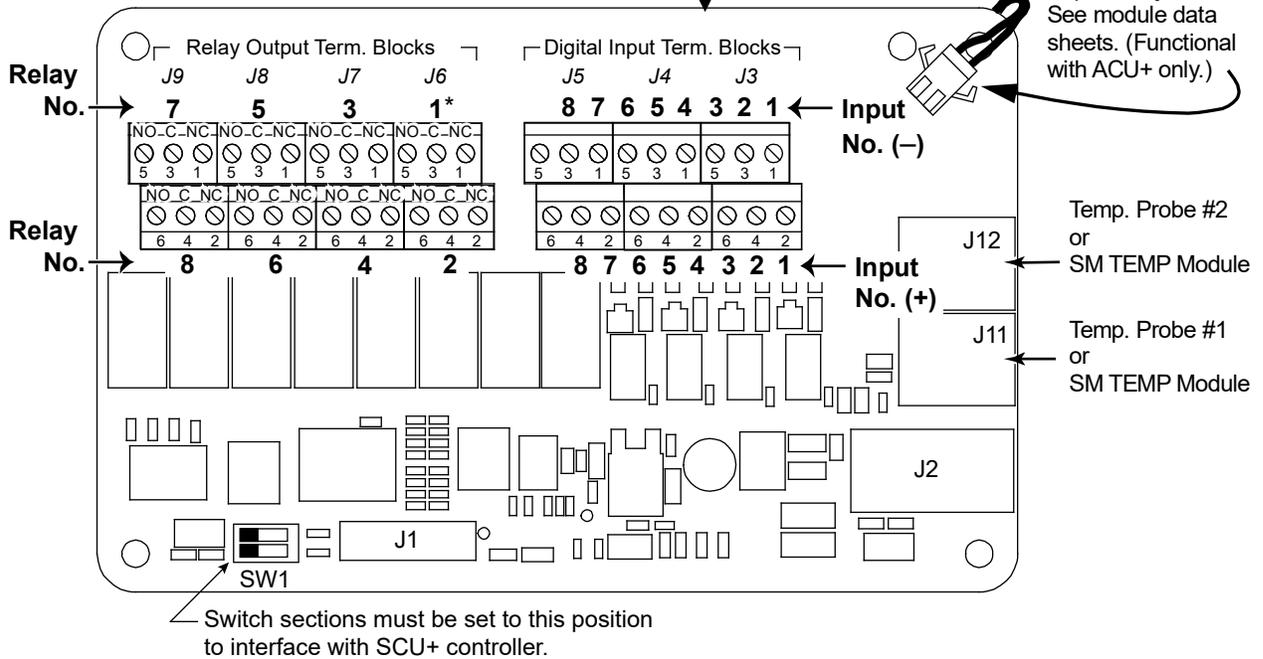
When ordered, Temperature Probe leads are factory connected to J11 and J12. These are labeled 1 and 2.

NC = Normally Closed
 COM = Common
 NO = Normally Open

All relay contacts are shown with the relay deenergized.



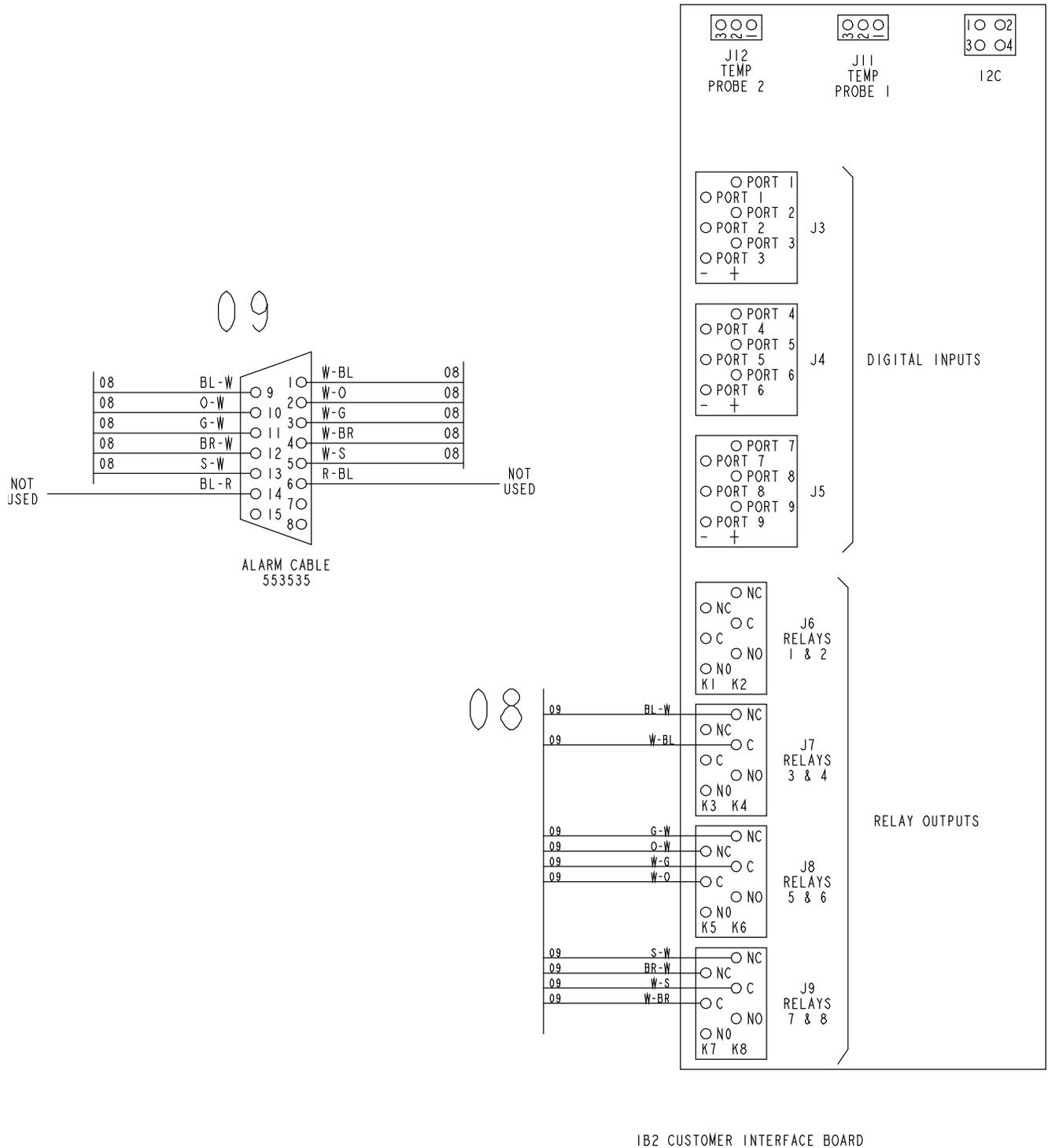
RS-485 Connection for SM AC, SM BAT, SM BRC, or SM IO Supervisory Modules. See module data sheets. (Functional with ACU+ only.)



* The relay assigned by the Controller to be the "Major Summary" alarm (relay 1 by default) will operate in the "Fail Safe Mode". "Fail Safe Mode" means Relay 1 is de-energized during an alarm condition, opening the contacts between the C and NO terminals, and closing the contacts between the C and NC terminals.

The remaining seven (7) alarm relays energize during an alarm condition, closing the contacts between the C and NO terminals, and opening the contacts between the C and NC terminals.

Figure 4.3 Special Alarm Cable Connections to IB2 Board



4.6 Ethernet Connection



NOTE! If the Web Interface is not being used with this system, skip this procedure.

The SCU+ provides a Web Interface via an Ethernet connection to a TCP/IP network. An RJ-45 10BaseT jack is provided on the front of the SCU+ for connection into a customer's network running TCP/IP. This jack has a standard Ethernet pin configuration scheme, twisted pair. Refer to **Figure 4.4** for location and **Table 4.3** for pin outs. Use shielded Ethernet cable (grounded at both ends). Note that the SCU+ RJ-45 jack is connected to chassis ground.



WARNING! The intra-building port(s) of the equipment or subassembly is suitable for connection to intra-building or unexposed wiring or cabling only. The intra-building port(s) of the equipment or subassembly **MUST NOT** be metallically connected to the interfaces that connect to the OSP or its wiring. These interfaces are designed for use as intra-building interfaces only (Type 2 or Type 4 ports as described in GR-1089-CORE, Issue 4) and require isolation from the exposed OSP cabling. The addition of Primary Protectors is not sufficient protection in order to connect these interfaces metallically to OSP wiring.

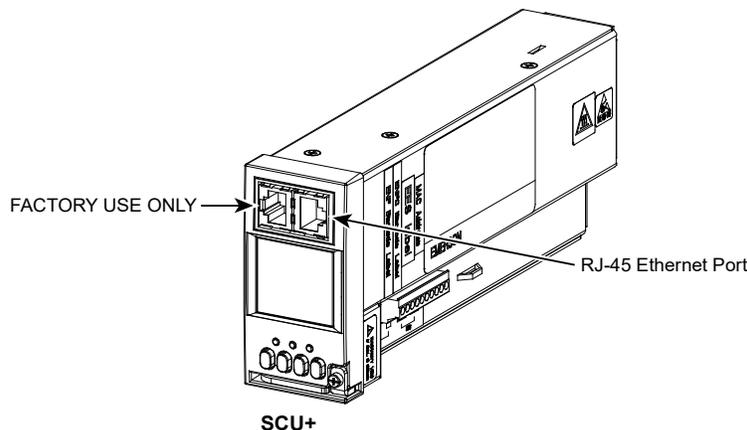
Table 4.3 SCU+ RJ-45 Ethernet Port

Port Pin Number	Name	Definition
1	Tx+	Write Signal +
2	Tx-	Write Signal -
3	Rx+	Read Signal +
4	--	no connection
5	--	no connection
6	Rx-	Read Signal -
7	--	no connection
8	--	no connection



NOTE! You can access the Web pages of the Power System locally by using a "crossover" cable connected directly between your PC and the SCU+.

Figure 4.4 SCU+ RJ-45 Ethernet Port



4.7 Load Connections

4.7.1 To GMT Fuse Positions

Restrictions

The rating of the distribution device determines the wire size requirements. Refer to the American National Standards Institute (ANSI) approved National Fire Protection Association's (NFPA) National Electrical Code (NEC) and applicable local codes.

The GMT fuse block has a 35A @ +40°C (+104°F) and a 21A @ +65°C (+149°F) maximum capacity. Maximum GMT fuse size is 10A. At +65°C (+149°F), a space is required between GMT fuses greater than 5A.

When used for power distribution, load should not exceed 80% of device rating, except 10 ampere fuses, for which load should not exceed 70% of device rating.

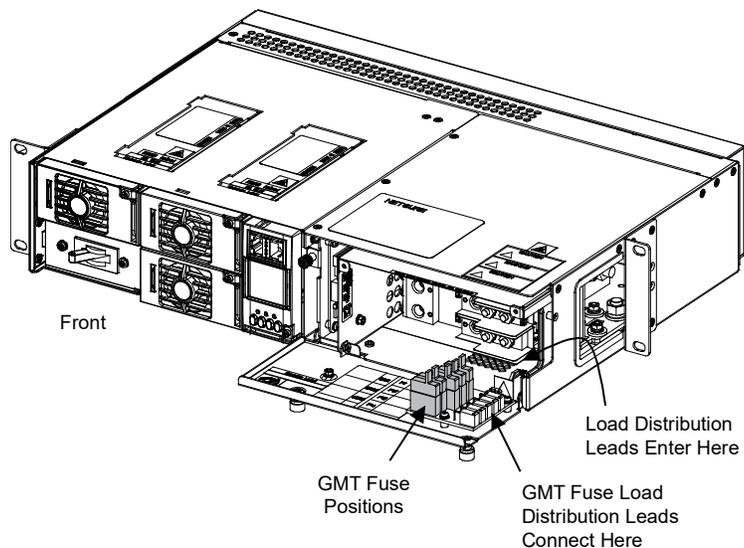
Procedure

Observe correct polarity as shown in **Figure 4.5** when connecting leads.

Load distribution (GMT fuses) and load return leads are connected to receptacles located inside the Distribution Unit. Load leads are brought into the right side (as viewed from the front) of the shelf and are accessible from the front of the shelf. Refer to **Figure 4.5**.

1. Use P/N 535206 GMT Fuse Load Lead Assemblies. Provides 12' long, 16 AWG, load and load return leads that are terminated on one end with the appropriate mating connector to plug into the system's GMT fuse connector and are left un-terminated at the remaining end for connection into customer loads. Consists of housing Molex P/N 39-01-2025 and terminals P/N 44476-3112 [loose] or 44476 3111 [reel].

Figure 4.5 Load Connections to GMT Fuse Positions



-48V on Left (Black Lead),
Return on Right (White Lead)
as viewed from side with door
closed.

Use P/N 535206 GMT fuse load lead assembly.
Provides mating connector and 12' unterminated
load and load return leads.

4.7.2 To Bullet Nose-Type Load Distribution Circuit Breaker Positions

Restrictions

The rating of the distribution device determines the wire size requirements. Refer to the American National Standards Institute (ANSI) approved National Fire Protection Association's (NFPA) National Electrical Code (NEC) and applicable local codes. For wire size and lug selection, refer to **Table 4.4**.

Maximum wire size is 6 AWG when all four (4) circuit breaker positions are used. 4 AWG or 2 AWG can be used, but the number of breaker positions will be reduced as follows:

- 4 AWG: 3 breakers max. (2 load/1 battery or 1 load/2 battery). Use 6 AWG for CO Ground.
- 2 AWG: 2 breakers max. (1 load/1 battery). Use 6 AWG for CO Ground.

For 4 AWG and 2 AWG wire, install a customer supplied flat washer between the lug and the nut supplied on the termination.

For other available lugs, refer to drawings 031110100 through 031110300.

Maximum distribution current is 18.9A at @ +65°C (+149°F) and 31.2A @ +40°C (+104°F).

Maximum load distribution or battery circuit breaker size is 75A @ +65°C (+149°F).



CAUTION! In an ambient of +65°C (+149°F), a circuit breaker with a rating greater than 45 amperes SHALL HAVE an empty mounting position between it and any other overcurrent protective device. There are no restrictions in an ambient of +40°C (+104°F).

Procedure



DANGER! Ensure correct polarity when connecting load leads.

Load distribution (circuit breakers) and load return leads terminated in two-hole lugs are connected to threaded studs located inside the Distribution Unit. Load leads are brought into the right side (as viewed from the front) of the shelf and are accessible from the front of the shelf. Observe proper polarity when connecting leads. Refer to **Table 7.1**.



NOTE! 10-32 studs (w/ hardware) on 5/8" centers are provided for these connections. Recommended torque is 20 in lbs when using the supplied hardware.

When connecting 4 or 2 AWG lugs, use a customer provided flat washer under the supplied nut.

Table 4.4 Recommended Battery and Load Distribution Wire Size and Lug Selection (Bullet Nose-Type Circuit Breaker)

Circuit Breaker Amperage	Recm 90°C Wire Size ⁽¹⁾						
	14 AWG	12 AWG	10 AWG	8 AWG	6 AWG	4 AWG	2 AWG
	Loop Length (feet) ⁽²⁾						
1, 3, 5, 10A	37 ^(3,4,5)	58 ^(3,4,5)	93 ^(3,4,5)	148 ^(3,4,5)	236 ^(3,4,5)	--	--
15A	24 ^(3,4)	39 ^(3,4,5)	62 ^(3,4,5)	99 ^(3,4,5)	157 ^(3,4,5)	--	--
20A	--	29 ^(3,4)	46 ^(3,4,5)	74 ^(3,4,5)	118 ^(3,4,5)	--	--
25A	--	--	37 ^(3,4)	59 ^(3,4,5)	94 ^(3,4,5)	--	--
30A	--	--	31 ^(3,4)	49 ^(3,4,5)	78 ^(3,4,5)	--	--
35A	--	--	--	42 ^(3,4)	67 ^(3,4,5)	107 ^(3,4)	--
40A	--	--	--	37 ^(3,4)	59 ^(3,4,5)	94 ^(3,4)	--
45A	--	--	--	33 ^(3,4)	52 ^(3,4)	83 ^(3,4)	--
50A	--	--	--	29 ⁽³⁾	47 ^(3,4)	75 ^(3,4)	--
60A	--	--	--	--	39 ^(3,4)	62 ^(3,4)	99 ^(3,4)
70A	--	--	--	--	--	53 ^(3,4)	85 ^(3,4)
75A	--	--	--	--	--	50 ^(3,4)	79 ^(3,4)
80A	--	--	--	--	--	47 ^(3,4)	74 ^(3,4)
90A	--	--	--	--	--	41 ⁽³⁾	66 ^(3,4)
100A	--	--	--	--	--	--	59 ^(3,4)
Recommended Crimp Lug ⁽⁶⁾							
2-hole	245390100	245390100	245390100	245346600	245346500	245346800	245346900

¹ Wire sizes are based on recommendations of the American National Standards Institute (ANSI) approved National Fire Protection Association's (NFPA) National Electrical Code (NEC). Table 310-16 for wire rated at 90 °C conductor temperature operating in ambient temperatures of 40 °C, 50°C, and 65°C was used. For other operating ambient temperatures, refer to the NEC. For operation in countries where the NEC is not recognized, follow applicable codes.

² Recommended wire sizes are sufficient to restrict voltage drop to 1.0 volt or less at listed branch current for the loop lengths shown. Loop length is the sum of the lengths of the positive and negative leads.

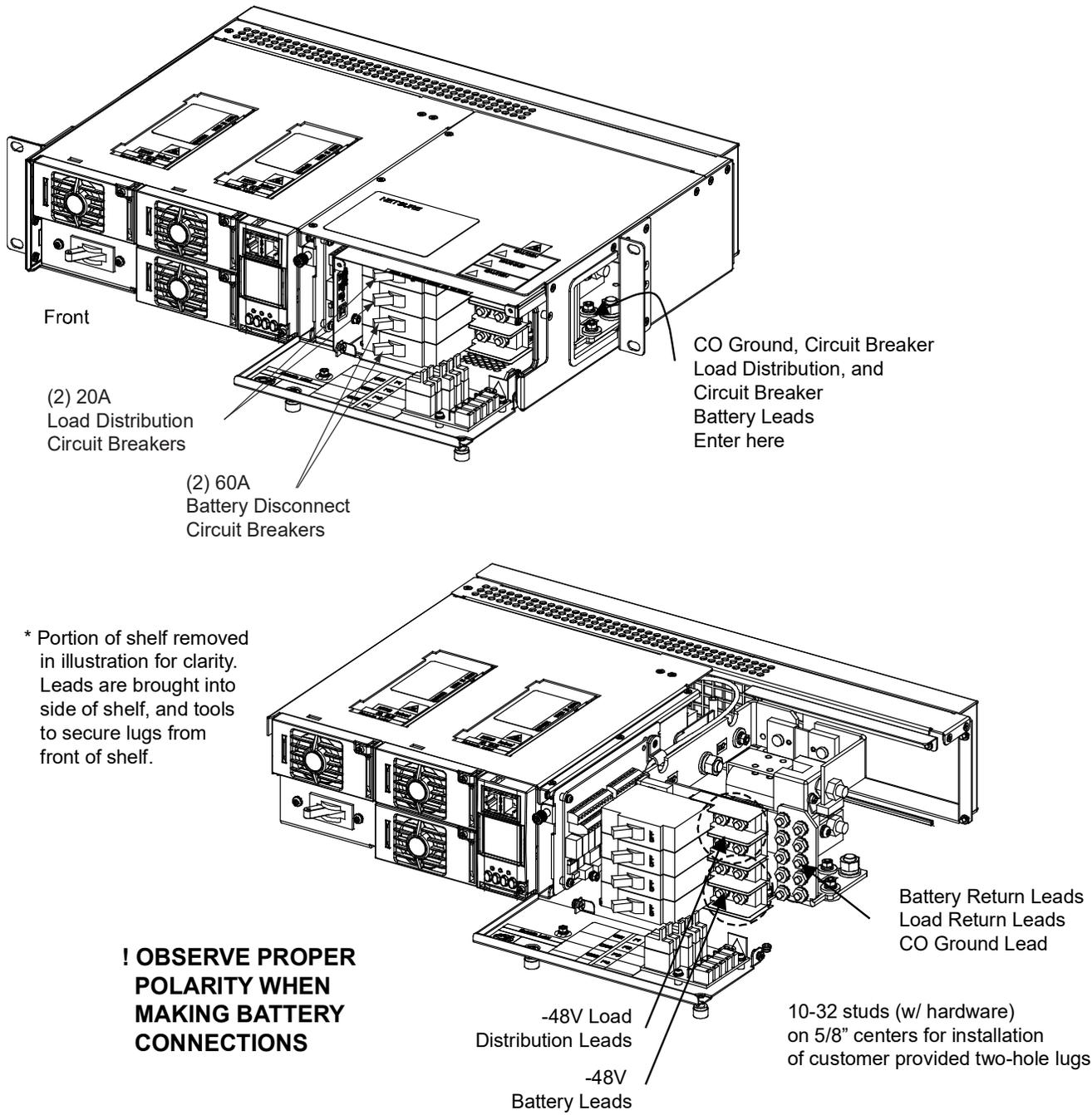
³ Wire Size / Loop Length Combination Calculated using 40°C Ambient Operating Temperature.

⁴ Wire Size / Loop Length Combination Calculated using 50°C Ambient Operating Temperature.

⁵ Wire Size / Loop Length Combination Calculated using 65°C Ambient Operating Temperature.

⁶ Two-hole lugs are 10-32 bolt clearance on 5/8" centers. Refer to drawing 031110100 for lug crimping information.

Figure 4.6 Load Connections to Bullet Nose-Type Distribution Circuit Breaker Positions Battery Connections to Bullet Nose-Type Circuit Breaker Positions CO Ground Connection



4.8 CO Ground Connection

Procedure

Two 10-32 studs on 5/8" centers with hardware are provided on the Return Bus for CO Ground wiring. A CO ground lead terminated in a two-hole lug can be connected as shown in **Table 7.1**.

Recommended CO ground wire size is 6 AWG.

Recommended lug is 245346500 (2-hole, 10-32 clearance holes, 5/8" centers).



NOTE! 10-32 studs (w/ hardware) on 5/8" centers are provided for this connection. Recommended torque is 20 in lbs when using the supplied hardware.

4.9 Battery Connections

4.10 Important Safety Instructions



DANGER! Adhere to the "Important Safety Instructions" presented at the front of this document.

4.10.1 To Bullet Nose-Type Circuit Breaker Positions

Restrictions

The rating of the distribution device determines the wire size requirements. Refer to the American National Standards Institute (ANSI) approved National Fire Protection Association's (NFPA) National Electrical Code (NEC) and applicable local codes. For wire size and lug selection, refer to **Table 4.4**.

Maximum wire size is 6 AWG when all four (4) circuit breaker positions are used. 4 AWG or 2 AWG can be used, but the number of breaker positions will be reduced as follows:

- 4 AWG: 3 breakers max. (2 load/1 battery or 1 load/2 battery). Use 6 AWG for CO Ground.
- 2 AWG: 2 breakers max. (1 load/1 battery). Use 6 AWG for CO Ground.

For 4 AWG and 2 AWG wire, install a customer supplied flat washer between the lug and the nut supplied on the termination.

For other available lugs, refer to drawings 031110100 through 031110300.

Maximum distribution current is 18.9A at @ +65°C (+149°F) and 31.2A @ +40°C (+104°F).

Maximum load distribution or battery circuit breaker size is 75A @ +65°C (+149°F).



CAUTION! In an ambient of +65°C (+149°F), a circuit breaker with a rating greater than 45 amperes SHALL HAVE an empty mounting position between it and any other overcurrent protective device. There are no restrictions in an ambient of +40°C (+104°F).

Procedure



DANGER! Ensure correct polarity when connecting battery leads.

Battery and battery return leads terminated in two-hole lugs are connected to threaded studs located inside the Distribution Unit. Battery leads are brought into the right side (as viewed from the front) of the shelf and are accessible from the front of the shelf. Refer to **Figure 4.6**. Observe proper polarity when connecting leads.



NOTE! 10-32 studs (w/ hardware) on 5/8" centers are provided for these connections. Recommended torque is 20 in lbs when using the supplied hardware.

When connecting 4 or 2 AWG lugs, use a customer provided flat washer under the supplied nut.

5 Installing Rectifier Modules and Initially Starting The System

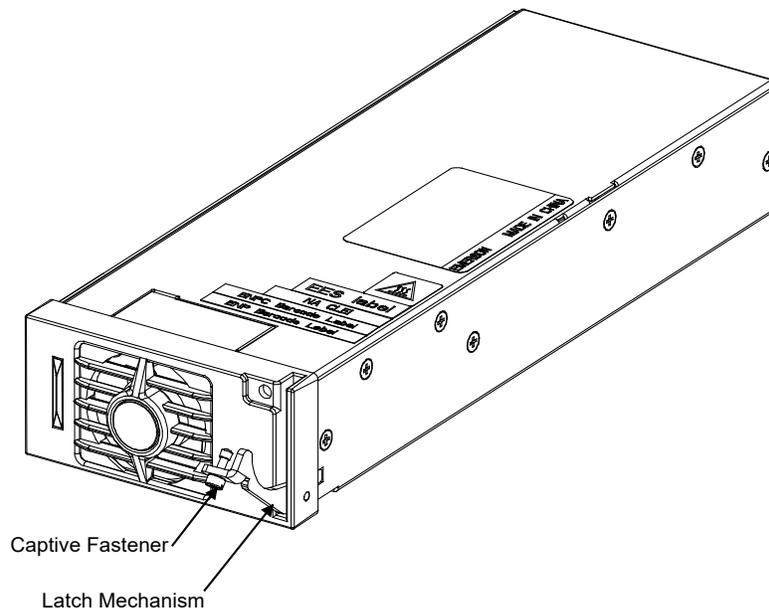
5.1 Installing the Rectifier Modules

Rectifier Modules are hot swappable. They can be installed with the system operating. Refer to **Figure 5.1** as this procedure is performed.

Procedure

1. Place the Rectifier Module 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 Module. Pull the top of the latch mechanism away from the Rectifier Module (this will retract the latch mechanism located on the underside of the Rectifier Module).
3. Push the Rectifier Module completely into the shelf. Push the top of the latch mechanism into the front panel of the Rectifier Module, and secure by tightening the captive fastener. This locks the Rectifier Module securely to the shelf.
4. Repeat the above steps for each Rectifier Module being installed in the system.
5. After the Rectifier Modules are physically installed in the mounting shelf(s), they are ready for operation immediately after power is supplied to them.

Figure 5.1 Latch Mechanism on the Rectifier Module



5.2 Initially Starting, Configuring, and Checking System Operation

5.2.1 Initial Startup Preparation

- Ensure that all blocks for Sections “*Installing the System*” and “*Making Electrical Connections*” in the Installation Acceptance Checklist, on page 9, have been checked.
- Refer to the separate SCU+ User Manual supplied with your Power System for complete Controller operating information.
- Refer to the Configuration Drawing (C-drawing) supplied with your Power System for the values of your system’s adjustable parameters.

5.2.2 Initially Starting the System

Procedure

1. Apply DC input power to the system by closing the external DC disconnect(s) or protective device(s) that supplies battery power to the system, if furnished.

Close the system’s internal battery disconnect circuit breakers.
2. Apply AC input power to the system by closing the external AC disconnects or protective devices that supplies power to the shelf(s).

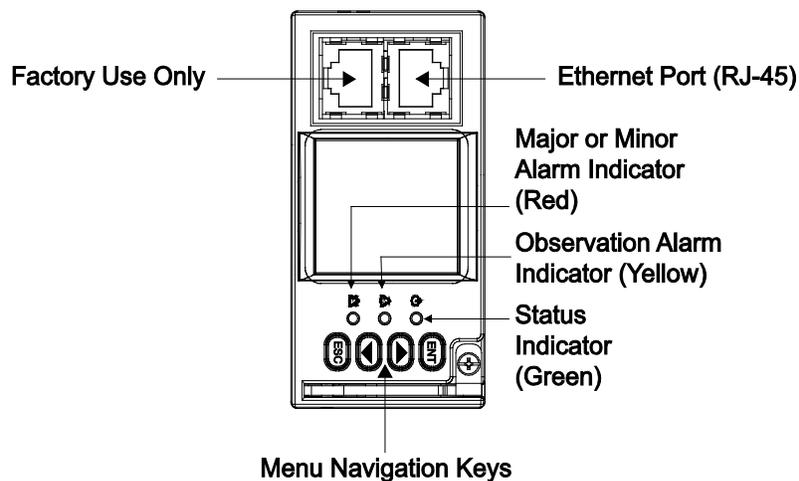
Close the system’s internal AC input circuit breaker.

The rectifiers start and supply power to the loads.

5.2.3 SCU+ Initialization

Refer to **Figure 5.2** for locations of the SCU+ local indicators and navigation keys.

Figure 5.2 SCU+ Local Indicators and Navigation Keys



Procedure

1. After the SCU+ is powered on, the language screen appears.

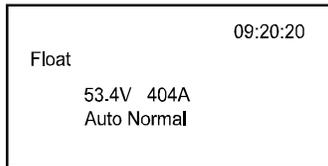


Press the “▲” or “▼” key to select the desired language. Press the **ENT** key to confirm the selection. If no key is pressed within 10 seconds, the SCU+ selects the displayed language automatically.

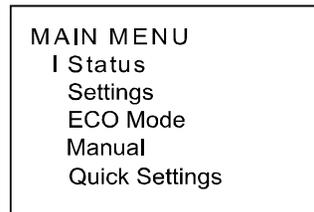
- The SCU+ displays ‘Wait . . .’ as it performs an initialization routine. The SCU+ has a ‘System Type’ parameter that was pre-programmed for your specific system. This setting determines the initial configuration of the SCU+ parameters such as output voltage and alarm levels.



- Once initialized, the Main screen is displayed.



- System information is displayed in multiple screens. Repetitively press the “▲” or “▲” key to view other system information screens one by one.
- From the Main screen, press **ENT** to go to the “Main Menu” screen.



- From the Main Menu, select a submenu by repetitively pressing the “ ” or “ ” key on the screen. The selected submenu will be indicated by the cursor. Press **ENT** to open the submenu.



NOTE! Repeatedly press the “ESC” key to return in reverse order level by level from any submenu until the Main screen appears.

- Verify and set the SCU+ controller as required for your application. Refer to the separate SCU+ User Manual for procedures.

5.2.4 Verifying the Configuration File

Your SCU+ was programmed with a configuration file that sets all adjustable parameters. The version number of the configuration file can be found on the Configuration Drawing (C-drawing) that is supplied with your Power System documentation, and on a label located on the SCU+. You can verify that the correct configuration file has been loaded into your SCU+ by performing the following procedure.

Procedure

1. With the Main screen displayed, press ESC. A screen displays the software version and configuration version number.
2. Press ESC to return to the Main screen.

5.2.5 Checking System Status

Procedure

1. Observe the status of the indicators located on the Rectifier Modules and SCU+. If the system is operating normally, the status of these is as shown in **Table 5.1**.

Table 5.1 Status and Alarm Indicators

Component	Indicator	Normal State
Rectifier Modules	Power (Green)	On
	Protection (Yellow)	Off
	Alarm (Red)	Off
SCU+	Status (Green)	On
	Observation (Yellow)	Off
	Major or Minor Alarm (Red)	Off

5.2.6 Configuring the SCU+ Identification of Rectifier Modules

When Rectifier Modules are all installed prior to applying power to the system, the order in which the SCU+ identifies the Rectifier Modules is by serial number (lowest serial number is Rect 1, next lowest is Rect 2, etc.).

If you prefer the SCU+ to identify the Rectifier Modules by position in the shelf, perform the following procedure.

Procedure

1. With the Main screen displayed, press ENT to go to the Main Menu. Navigate to and select “Settings” (ENT).
2. If a password screen opens, a password must be entered to allow user to make adjustments. If the password was previously entered and has not yet timed out, skip this step and proceed to step 3. Otherwise, to enter the password, press the right (up) arrow key repeatedly until “3” is displayed (default password is “3”); then press ENT. (Note: If you have been assigned a unique user name and password, follow this procedure to enter your personal information.)
3. With the Settings menu screen displayed, navigate to and select “Rectifier” (ENT).
4. Navigate to “R-Posi #” (# is used here to represent the rectifier identification number). Press ENT. The rectifier position number is highlighted, and the green LED on one rectifier starts flashing. This is the rectifier currently identified by the SCU+ as rectifier #.
5. Use the up or down keys to change the position number for the flashing rectifier. Press ENT. The position number of the next rectifier is highlighted, and the green LED on that rectifier starts flashing.
6. Repeat Step 5 for all remaining rectifiers in the system.

7. When you have finished selecting identification numbers for the last rectifier, repeatedly press ESC to return to the Main Menu.

5.2.7 SCU+ Alarm Relay Check

The following procedures can be used to verify operation of the external alarm relays in a Power System equipped with an SCU+ with the factory default configuration. Note that alarm relays on an SCU+ with a custom configuration may operate differently.

Checking the AC Fail Alarm and AC Input Breaker Alarm



NOTE! Battery must be connected during this procedure.

1. Verify system is operating and no alarms are present.
2. Open the internal AC input breaker that supplies power to all of the rectifier modules.
 - a) **Requirement:** An audible alarm sounds. Alarm will be silenced in Requirement d.
 - b) **Requirement:** “Power” indicator on subject rectifier modules goes from green to off.
 - c) **Requirement:** SCU+ “Major/Minor” alarm indicator goes from off to red.
 - d) **Requirement:** SCU+ displays “Alarm”. Then the Alarm screen displays automatically. “Mains Failure Major Alarm” is displayed. “AC Input Breaker Alarm” is displayed.
 - e) **Requirement:** External “AC Fail” (Relay 5), “AC Input Breaker Alarm” (Relay 8), and “Major” (Relay 1) alarms activate.
3. Return the internal AC input breaker to the ON position.
 - a) **Requirement:** “Power” indicator on subject rectifier modules goes from off to green.
 - b) **Requirement:** SCU+ “Critical/Major” alarm indicator goes from red to off.
 - c) **Requirement:** Press ESC repeatedly to return to the Main screen. SCU+ displays “Normal”.
 - d) **Requirement:** All external alarms deactivate.

Checking Rectifier Alarm

1. Verify system is operating and no alarms are present.
2. Pull one Rectifier Module half way out of the shelf. To do this, first loosen the captive fastener securing the top of the latch mechanism to the front of the Rectifier Module. Pull the top of the latch mechanism away from the Rectifier Module (this will retract the latch mechanism located on the underside of the Rectifier Module). Refer to **Figure 5.1** for latch mechanism illustration.
 - a) **Requirement:** An audible alarm sounds.
 - b) **Requirement:** SCU+ “Major/Minor” alarm indicator goes from off to red.
 - c) **Requirement:** SCU+ displays “Alarm”. Then the Alarm screen displays automatically. “Rect ## Comm Fail Minor Alarm” is displayed.
 - d) **Requirement:** External “Rectifier” (Relay 4) and “Minor” (Relay 2) alarms activate.
3. Pull a second Rectifier Module half way out of the shelf, as described in Step 2.
 - a) **Requirement:** An audible alarm sounds. You can press ENT to cancel.

- b) **Requirement:** SCU+ “Major/Minor” alarm indicator stays red.
 - c) **Requirement:** There are three alarms. SCU+ displays “**Multi Rect Alarm Major**”. Press left arrow once. SCU+ displays “**Rect ## Comm Fail Minor**”. Press left arrow once. Press left arrow once more. SCU+ displays “**Rect ## Comm Fail Minor**”.
 - d) **Requirement:** External “Rectifier” (Relay 4) alarm remains in alarm state and “Major” (Relay 1) alarm activates.
4. Reinstall both rectifier modules. Refer to Installing the Rectifier Modules at the beginning of this document.
- a) **Requirement:** “Power” indicator on subject rectifier(s) goes from off to green.
 - b) **Requirement:** SCU+ “Critical/Major” alarm indicator goes from red to off.
 - c) **Requirement:** Press ESC repeatedly to return to the Main screen. SCU+ displays “**Normal**”.
 - d) **Requirement:** All external alarms deactivate.

Checking System Over Voltage Alarm 1 and Over Voltage Alarm 2

1. Verify system is operating and no alarms are present.
2. Record the system voltage displayed on the SCU+ Main screen.
3. Press ENT to go to the Main Menu. Select “Settings” (ENT).
4. If a password screen opens, a password must be entered to allow user to make adjustments. If the password was previously entered and has not yet timed out, skip this step and proceed to step 5. Otherwise, to enter the password, press the right (down) arrow key repeatedly until “3” is displayed (default password is “3”); then press ENT. (*Note: If you have been assigned a unique user name and password, follow this procedure to enter your personal information.*)
5. With the Settings menu screen displayed, navigate to “DC” (ENT) / “Over Volt 1”. Record the displayed voltage setpoint.
6. Press the Enter (ENT) key; then use the arrow keys to adjust the “Over Voltage 1” value to two volts below the system voltage recorded in step 2. Press ENT.
 - a) **Requirement:** An audible alarm sounds. The alarm will be silenced in Requirement c.
 - b) **Requirement:** SCU+ “Major/Minor” alarm indicator goes from off to red.
 - c) **Requirement:** Press ESC repeatedly to return to the Main screen. SCU+ displays “**Alarm**”.

To see the specific alarm, press ENT to display the Main Menu. Navigate as follows: “Status” (ENT), “Active Alarm” (ENT), “DC Over Volt 1 Major”.
 - d) **Requirement:** External “Major” (Relay 1) alarms activate.
7. Without readjusting the “Over Voltage 1” setpoint, press the ESC key repeatedly to return to the Main screen. Then navigate as follows: **Settings** (ENT) / **DC** (ENT) / **Over Volt2**. Record the displayed voltage setpoint.
8. Press the Enter (ENT) key; then use the arrow keys to adjust the “Over Voltage 2” value to one volt below the system voltage recorded in step 2. Press ENT.
 - a) **Requirement:** An audible alarm sounds. Alarm will be silenced in Requirement d.
 - b) **Requirement:** The “DC Over Volt 1” alarm retires.
 - c) **Requirement:** SCU+ “Major/Minor” alarm indicator stays red.

- d) **Requirement:** Press ESC repeatedly to return to the Main screen. SCU+ displays “Alarm”.

To see the specific alarm, press ENT to display the Main Menu. Navigate as follows: “Status” (ENT), “Active Alarm” (ENT), “DC Over Volt 2 Major”.

- e) **Requirement:** External “Major” (Relay 1) alarm remains active.

9. Press ESC repeatedly to return to the Main screen. Navigate to “Settings” (ENT) / “DC” (ENT) / “Over Volt 2”.
10. Press ENT; then use the arrow keys to adjust the “Over Voltage 2” setting to the value recorded in step 7. Press ENT.



NOTE! High Voltage 2 alarm will retire, and High Voltage 1 alarm will activate. The audible alarm will be silenced in the next step.

11. Use arrow keys to scroll up to “Over Volt 1”.
12. Press ENT; then use the arrow keys to adjust the “Over Voltage 1” setting to the value recorded in step 5. Press ENT.
- a) **Requirement:** SCU+ “Major/Minor” alarm indicator goes from red to off.
- b) **Requirement:** Press ESC repeatedly to return to the Main screen. SCU+ displays “Normal”.
- c) **Requirement:** All external alarms deactivate.

Checking System Under Voltage Alarm 1 and Under Voltage Alarm 2

1. Verify system is operating and no alarms are present.
 2. Record the system voltage displayed on the SCU+ Main screen.
 3. Press ENT to go to the Main Menu. Select “Settings” (ENT).
 4. If a password screen opens, a password must be entered to allow user to make adjustments. If the password was previously entered and has not yet timed out, skip this step and proceed to step 5. Otherwise, to enter the password, press the right (up) arrow key repeatedly until “3” is displayed (default password is “3”); then press ENT. (Note: If you have been assigned a unique user name and password, follow this procedure to enter your personal information.)
 5. With the Settings menu screen displayed, navigate to “DC” (ENT) / “Under V1”. Record the displayed voltage setpoint.
 6. Press the Enter (ENT) key; then use the arrow keys to adjust the “Under Voltage 1” value to two volts above the system voltage recorded in step 2. Press ENT.
 - a) **Requirement:** An audible alarm sounds. The alarm will be silenced in Requirement c.
 - b) **Requirement:** SCU+ “Major/Minor” alarm indicator goes from off to red.
 - c) **Requirement:** Press ESC repeatedly to return to the Main screen. SCU+ displays “Alarm”.

To see the specific alarm, press ENT to display the Main Menu. Navigate as follows: “Status” (ENT), “Active Alarm” (ENT), “DC Under V1 Major”.
 - d) **Requirement:** External “DC Under Voltage” (Relay 7) and “Major” (Relay 1) alarms activate.
7. Without readjusting the “Under Voltage 1” setpoint, press the ESC key repeatedly to return to the Main screen. Then navigate as follows: Settings (ENT) / DC (ENT) / **Under V2**. Record the displayed voltage setpoint.
8. Press the Enter (ENT) key; then use the arrow keys to adjust the “Under Voltage 2” value to **one volt above** the system voltage recorded in step 2. Press ENT.

- a) **Requirement:** An audible alarm sounds. Alarm will be silenced in Requirement d.
- b) **Requirement:** The “DC Under V1” alarm retires.
- c) **Requirement:** SCU+ “Major/Minor” alarm indicator stays red.
- d) **Requirement:** Press ESC repeatedly to return to the Main screen. SCU+ displays “Alarm”.

To see the specific alarm, press ENT to display the Main Menu. Navigate as follows: “Status” (ENT), “Active Alarm” (ENT), “DC Under V2 Major”.

- e) **Requirement:** External “DC Under Voltage” (Relay 7) remains active, and “Major” (Relay 1) alarm remains active.
9. Press ESC repeatedly to return to the Main screen. Navigate to “Settings” (ENT) / “DC” (ENT) / “Under V2”.
 10. Press ENT; then use the arrow keys to adjust the “Under Voltage 2” setting to the value recorded in step 7. Press ENT.
 11. Use arrow keys to scroll up to “Under V1”.
 12. Press ENT; then use the arrow keys to adjust the “Under Voltage 1” setting to the value recorded in step 5. Press ENT.
 - a) **Requirement:** SCU+ “Major/Minor” alarm indicator goes from red to off.
 - b) **Requirement:** Press ESC repeatedly to return to the Main screen. SCU+ displays “Normal”.
 - c) **Requirement:** All external alarms deactivate.

Checking Circuit Breaker/Fuse Alarm



NOTE! An open battery disconnect circuit breaker will not activate the fuse/circuit breaker alarm unless a battery (or temporary test load) is connected to the system battery terminals.

1. Verify system is operating and no alarms are present.
2. Open the front door of the Distribution Unit at the right-hand side of the shelf.



NOTE! The following procedure is to be used only with circuit breakers that provide an alarm indication when manually placed to the OFF (open) position (black handle). Electrical trip alarm circuit breakers (white handle) cannot be easily tested in the field.

3. Do one of the following: (1) Remove a good fuse or a dummy fuse from a GMT fuse position, and replace it with a blown fuse, or (2) Place the handle (if black) of a circuit breaker in the OFF (open) position.
 - a) **Requirement:** SCU+ “Major/Minor” alarm indicator goes from off to red.
 - b) **Requirement:** SCU+ displays “Alarm”.

To see the specific alarm, press ENT to display the Main Menu. Navigate as follows: “Status” (ENT), “Active Alarm” (ENT), “Load Fuse Brkr Major”.

- c) **Requirement:** External “Major” (Relay 1) alarms activate.
4. Do one of the following: (1) Replace the blown GMT fuse with a known good fuse (or a dummy fuse), or (2) place the handle of the circuit breaker in the ON (closed) position.
 - a) **Requirement:** SCU+ “Major/Minor” alarm indicator goes from red to off.
 - b) **Requirement:** Press ESC repeatedly to return to the Main screen. SCU+ displays “Normal”.

- c) **Requirement:** All external alarms deactivate.

High Voltage Shutdown Check

The following procedures can be used to verify operation of the rectifier high voltage shutdown circuit and associated alarms.

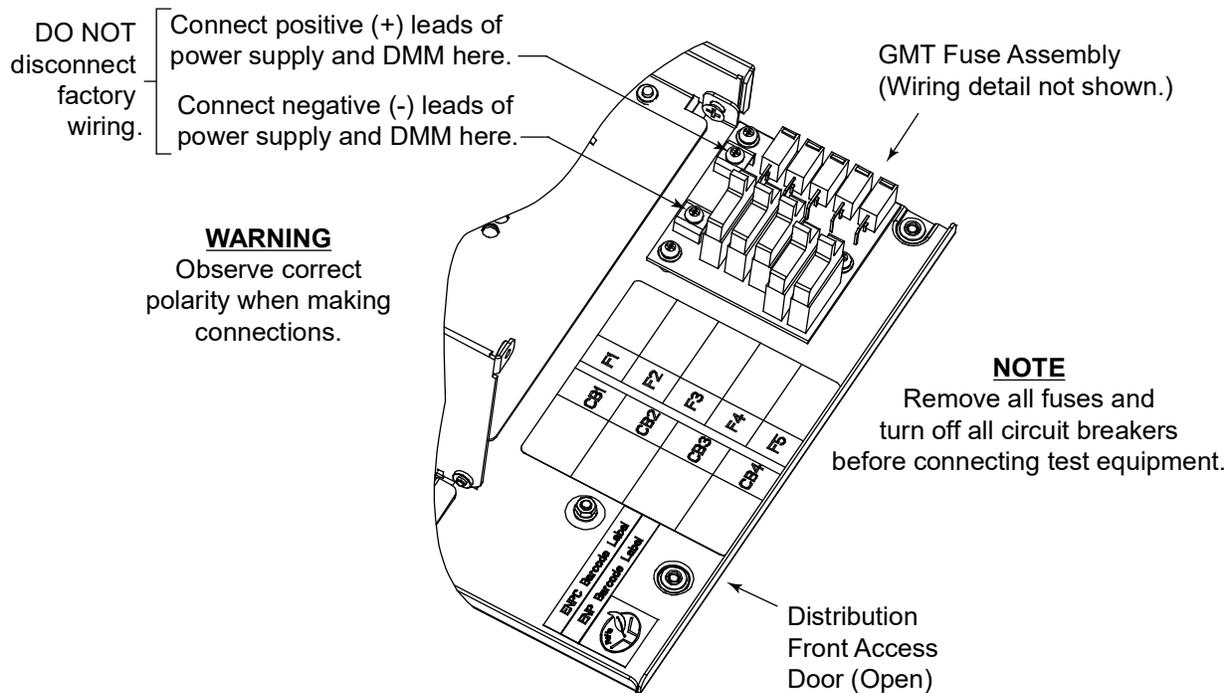


CAUTION! This procedure will cause loss of output power to all system loads. Therefore, perform this procedure only at the time of the initial startup, or when critical loads are not being supplied.

The following test equipment is required for this test procedure.

- External DC power supply, with output adjustable from 0-60VDC at one amp minimum.
- Digital multimeter, capable of measuring 0-60 VDC.

Figure 5.3: Test Equipment Connection Locations for HVSD Test Procedure



Procedure:

1. Verify system is operating and no alarms are present.
2. With the Main screen displayed, press **ENT** to go to the Main Menu. Select **“Settings”** (ENT).
3. If a password screen opens, a password must be entered to allow user to make adjustments. If the password was previously entered, and has not yet timed out, skip this step and proceed to step 4. Otherwise, to enter the password, press the right (up) arrow key repeatedly until “3” is displayed (default password is “3”); then press ENT. (*Note: If you have been assigned a unique user name and password, follow this procedure to enter your personal information.*)
4. With the Settings menu screen displayed, navigate to **“Rectifier”** (ENT) / **“HVSD”**. Record the displayed voltage setpoint (factory default = 59.0 VDC).

5. Press ESC repeatedly to return the Main screen.



NOTE! Performing the next step will result in a visual and audible “Load Fuse Breaker” alarm and “Critical” alarm if the shelf is equipped with “manual trip” breakers (black handle). Press any key to silence the audible alarm.

6. Open all load circuit breakers present in the shelf.
7. Remove all load fuses present in the shelf.



NOTE! Performing the next step will result in a visual and audible “Battery Breaker” alarm and “Critical” alarm if the shelf is equipped with “manual trip” battery disconnect breakers (black handle). Press any key to silence the audible alarm.

8. Open the internal or external battery disconnect(s) or protective device(s).
9. Connect a Digital Multimeter, adjusted to indicate 0-60VDC, to the terminals shown in **Figure 5.3**, observing correct polarity.
10. Ensure the leads of the external DC power supply do not short or contact any conductive object. Turn on the supply and adjust the voltage to the rectifier float setting (factory default = 54.0VDC).



WARNING! When making connections in the next step, do not allow the external power supply leads to short or contact any other conductive object. Observe correct polarity to avoid possible equipment damage.

11. Connect the variable DC power supply to the terminals shown in **Figure 5.3**, observing correct polarity.
12. Adjust the voltage of the external supply slightly above the rectifier high voltage shutdown setting, as recorded in step 4.
 - a) **Requirement:** An audible alarm sounds.
 - b) **Requirement:** On each Rectifier Module, the “Alarm” indicator goes from off to red.
 - c) **Requirement:** If not already red, SCU+ “Major/Minor” alarm indicator goes from off to red.
 - d) **Requirement:** SCU+ screen displays “Alarm”.

To see the specific alarm, press **ENT** to display the Main Menu. Navigate as follows: “**Status**” (ENT), “**Active Alarm**” (ENT). The following alarms will be displayed as the down arrow is repeatedly depressed: “**MultiRect Alarm Major**”, “**Rect 3 HVSD Minor**” (if Rect 3 is present), “**Rect 2 HVSD Minor**” (if Rect 2 is present), “**Rect 1 HVSD Minor**”, and “**DC Over Volt2 Major**”. (*Note: If circuit breaker alarms are active, these will also be displayed.*)

- e) **Requirement:** External “Major” (Relay 1) and “Rectifier” (Relay 4) alarms activate.
13. Reduce output of DC power supply to 54.0 volts.
14. Pull one Rectifier Module half way out of the shelf. To do this, first loosen the captive fastener securing the top of the latch mechanism to the front of the Rectifier Module. Pull the top of the latch mechanism away from the Rectifier Module (this will retract the latch mechanism located on the underside of the Rectifier Module). Refer to **Figure 5.1** for latch mechanism illustration.
15. After all LEDs on the Rectifier Module have extinguished, reinstall the Rectifier Module.
16. Repeat Steps 14) and 15) for each of the remaining Rectifier Modules.
 - a) **Requirement:** Rectifier Modules restart. On each Rectifier Module, the “Power” indicator goes from off to green and “Alarm” indicator goes from red to off.
17. Turn off and remove all test equipment.

18. Close the internal or external battery disconnect(s) or protective device(s).
19. Close all load circuit breakers present in the shelf.
20. Install all load fuses removed from the shelf.
 - a) **Requirement:** SCU+ “Major/Minor” alarm indicator goes from red to off.
 - b) **Requirement:** Press ESC repeatedly to return to the Main screen. SCU+ displays “Normal”.
 - c) **Requirement:** All external alarms deactivate.

5.2.8 Final Steps

1. Verify the Distribution Unit door is closed and secured.
2. Verify all Rectifier Modules and the Controller are fully seated, latched, and the latch handle screws secured.
3. Verify there are no external alarms, and the local indicators are as shown in **Table 5.1**.

6 Operating Procedures

6.1 Rectifier Module

Refer to the Rectifier User Manual (UM1R481000).

6.2 SCU+ (Standard Control Unit Plus)

Refer to the separate SCU+ User Manual (UM1M521BNA) supplied with your Power System.

7 Maintenance

7.1 System Maintenance Procedures



DANGER! Adhere to the “Important Safety Instructions” presented at the front of this document.

The maintenance procedures listed in **Table 7.1** should be performed and recorded at the recommended interval to ensure continual system operation.

The table references specific section in these instructions that help in performing these procedures.

Table 7.1: Maintenance Procedures to be Performed at 6-Month Intervals

PROCEDURE	REFERENCED IN
Check Ventilation Openings for Obstructions such as Dust, Papers, Manuals, etc.	--
Inspect and Tighten All Installer's Connections	<i>Making Electrical Connections.</i>

8 Troubleshooting and Repair

8.1 Contact Information

Refer to Section 4.15.4 (provided with your customer documentation) for support contact information.

8.2 Supporting Documents

For rectifier troubleshooting, repair and replacement instructions, refer to the Rectifier User Manual (UM1R481000).

For controller troubleshooting, repair and replacement instructions, refer to the separate Controller User Manual (UM1M521BNA) supplied with your Power System. Refer also to this section.

For factory settings of all configurable Controller parameters, refer to the Configuration Drawing (C-drawing) supplied with your Power System.

8.3 Troubleshooting Information

8.3.1 General

This system is designed for ease in troubleshooting and repair. The various indicators, as described in the separate Controller and Rectifier User Manuals, are designed to isolate failure to a specific element. Once the faulty element has been identified, refer to the next sections, "REPLACEMENT INFORMATION" and "REPLACEMENT PROCEDURES".

Troubleshooting Alarm Conditions on the SCU+ Controller

The SCU+ controller displays alarm conditions as listed in the Available Alarms section of the separate Controller User Manual. Programmable external alarm relays are also available. **Table 4.2** list the factory default alarm relay configurations and are referenced on the Configuration Drawing (C-drawing) supplied with your Power System.

The SCU+'s Active Alarm and Alarm History submenus allows the user to view alarm details. Refer to the separate SCU+ User Manual to access these menus.

8.4 Replacement Information

8.4.1 Replacement Assemblies

When a trouble symptom is localized to a faulty Rectifier Module or Controller, that particular device should be replaced in its entirety. Other than a Rectifier Module fan replacement, no attempt should be made to troubleshoot or repair individual components on any Rectifier Module or Controller. Refer to the separate Controller or Rectifier Module User Manuals for replacement procedures.

Refer to **Table 8.1** for replacement part numbers.

Table 8.1 Replacement Module Part Numbers

Item	Part Number
1000W Rectifier Module	1R481000
Rectifier Module Fan	32010156
SCU+ Controller Module	1M521BNA* * Also specify the appropriate SCU+ configuration file. Refer to the configuration file label on your existing SCU+ Controller.

8.5 Replacement Procedures



DANGER! Adhere to the “Important Safety Instructions” presented at the front of this document.

8.5.1 Replacing a Rectifier Module

Refer to the separate Rectifier Module User Manual for a rectifier replacement procedure. Before replacing any Rectifier Modules, note the following:

8.5.2 Clearing a Rectifier Communications Fail Alarm after Removing a Rectifier

Refer to the Rectifier Module User Manual included in this Power System User Manual for a rectifier replacement procedure.

If a Rectifier Module is removed from the system, a Rectifier Communications Failure alarm is generated. If the Rectifier Module will not be replaced, the alarm should be cleared as described in the following procedures.

Procedure

1. Press ENT to go to the Main Menu. Select “**Settings**” (ENT).
2. If a password screen opens, a password must be entered to allow user to make adjustments. If the password was previously entered and has not yet timed out, skip this step and proceed to step 3. Otherwise, to enter the password, press the right (up) arrow key repeatedly until “3” is displayed (default password is “3”); then press ENT. (*Note: If you have been assigned a unique user name and password, follow this procedure to enter your personal information.*)
3. With the Settings menu screen displayed, navigate to “**Alarm**” (ENT), “**Alarm Control**” (ENT), “**Clear History**” (ENT). “**History**” is highlighted.
4. Use the up or down arrows to cycle thru the list to “**Rect Comm**”. Press ENT to clear the alarm.
5. Return to the main screen by repeatedly pressing ESC (escape).

8.5.3 Replacing a GMT Distribution Fuse

If a GMT distribution fuse opens, replace with the same type and rating. Refer to **Table 1.1** for fuse replacement part numbers.

Refer to **Figure 3.1** as this procedure is performed.

Procedure

1. Adhere to the “Important Safety Instructions” presented at the front of this document. This procedure exposes the Distribution Unit. BATTERY VOLTAGE is present on the Distribution Unit.
2. Performing this procedure may activate external alarms. Do one of the following. If possible, disable these alarms. If these alarms cannot be easily disabled, notify the appropriate personnel to disregard any future alarms associated with this system.
3. Open the Distribution’s Unit front access panel.
4. Replace the open GMT fuse. Ensure a safety cover is installed over the new fuse.
5. Close the Distribution’s Unit front access panel.
6. Enable the external alarms or notify appropriate personnel that this procedure is finished.
7. Ensure that there are no local or remote alarms active on the system.

8.5.4 Distribution Unit Replacement

If the Distribution Unit should need to be replaced, replace the complete Power/Distribution Shelf.

This page intentionally left blank.

Connect with Vertiv on Social Media



<https://www.facebook.com/vertiv/>



<https://www.instagram.com/vertiv/>



<https://www.linkedin.com/company/vertiv/>



<https://www.twitter.com/vertiv/>



Vertiv.com | Vertiv Headquarters, 505 N Cleveland Ave, Westerville, OH 43082, USA

© 2023 Vertiv Group Corp. All rights reserved. Vertiv™ and the Vertiv logo are trademarks or registered trademarks of Vertiv Group Corp. All other names and logos referred to are trade names, trademarks or registered trademarks of their respective owners. While every precaution has been taken to ensure accuracy and completeness here, Vertiv Group Corp. assumes no responsibility, and disclaims all liability, for damages resulting from use of this information or for any errors or omissions.