

***Product Manual
J85500E-4***

***Select Code 167-792-158
Comcode 108135021
Issue 2
September 1998***

***Lucent Technologies
Galaxy Power System 2408
(GPS 2408)***

Notice:

Every effort was made to ensure that the information in this document was complete and accurate at the time of printing. However, information is subject to change.

Table of Contents

1 Introduction

<i>General</i>	<i>1 - 1</i>
<i>Architecture</i>	<i>1 - 1</i>
<i>Applications</i>	<i>1 - 2</i>
<i>Customer Training</i>	<i>1 - 2</i>
<i>Customer Service</i>	<i>1 - 2</i>
<i>Technical Support</i>	<i>1 - 2</i>
<i>Product Repair and Return</i>	<i>1 - 3</i>
<i>Warranty Service</i>	<i>1 - 3</i>

2 Product Description

<i>Galaxy Power System Overview</i>	<i>2 - 1</i>
<i>Plant Configuration</i>	<i>2 - 3</i>
<i>Plant Specifications</i>	<i>2 - 5</i>
<i>Galaxy Rectifier Controller</i>	<i>2 - 6</i>
<i>Circuit Boards</i>	<i>2 - 7</i>
<i>596B3 Rectifier</i>	<i>2 - 10</i>
<i>Features</i>	<i>2 - 11</i>
<i>Rectifier Specifications</i>	<i>2 - 13</i>
<i>596B3 Rectifier Control and Monitoring</i>	<i>2 - 15</i>
<i>596B3 Rectifier Status Messages</i>	<i>2 - 16</i>
<i>Rectifier Shelf</i>	<i>2 - 16</i>
<i>ES682H Converter</i>	<i>2 - 16</i>
<i>Converter Shelf</i>	<i>2 - 16</i>
<i>Features</i>	<i>2 - 17</i>
<i>Converter Specifications</i>	<i>2 - 19</i>
<i>AC Input Panel</i>	<i>2 - 19</i>
<i>24-volt DC Distribution Panel</i>	<i>2 - 20</i>
<i>48-volt DC Distribution Panel</i>	<i>2 - 20</i>
<i>Battery Connection Panel</i>	<i>2 - 20</i>
<i>Low Voltage Battery Disconnect</i>	<i>2 - 21</i>

3 Ordering Information

<i>Standard Configurations</i>	<i>3 - 1</i>
<i>Custom Configurations</i>	<i>3 - 3</i>

<i>Field Mounted Equipment</i>	3 - 3
<i>Field Mounted Equipment</i>	3 - 10
<i>Spare Parts</i>	3 - 13
<i>Documentation</i>	3 - 14
4 Safety	
<i>Safety Statements</i>	4 - 1
<i>Warning Statements And Safety Symbols</i>	4 - 3
<i>Precautions</i>	4 - 4
5 Installation	
<i>General</i>	5 - 1
<i>Installation Tools and Hardware</i>	5 - 1
<i>Unpacking and Handling</i>	5 - 2
<i>Frame Installation</i>	5 - 4
<i>Cable Routing Strategy</i>	5 - 4
<i>Frame Ground</i>	5 - 5
<i>Central Office Ground</i>	5 - 5
<i>Getting Started</i>	5 - 5
<i>Connecting AC</i>	5 - 7
<i>Connecting Loads</i>	5 - 11
<i>Installing Rectifiers and Converters</i>	5 - 11
<i>Removing Rectifiers and Converters</i>	5 - 11
<i>Turning Up the Plant</i>	5 - 12
<i>Setting Rectifier Slot ID</i>	5 - 13
<i>Lamp Test</i>	5 - 13
<i>Installing Batteries</i>	5 - 14
<i>Setting the Plant Configuration</i>	5 - 14
<i>Voltage Calibration</i>	5 - 15
<i>Testing Plant Thresholds</i>	5 - 16
<i>Testing Rectifiers and Load Share</i>	5 - 17
<i>Testing Temperature Compensation</i>	5 - 18
<i>Testing Additional Alarms</i>	5 - 18
<i>Testing High Voltage Shutdown</i>	5 - 19
<i>Discharge Test</i>	5 - 20
6 Maintenance	
<i>Safety Warnings</i>	6 - 1
<i>Power Unit Fans</i>	6 - 1
<i>Maintenance</i>	6 - 1
<i>Converter Fan Replacement Procedure</i>	6 - 2
<i>Rectifier Fan Replacement Procedure</i>	6 - 2

7 Troubleshooting

<i>Safety Warnings</i>	<i>7 - 1</i>
<i>Troubleshooting Flowcharts</i>	<i>7 - 1</i>
<i>Rectifier</i>	<i>7 - 2</i>
<i>Converter</i>	<i>7 - 5</i>

8 Product Warranty

List of Figures

<i>Figure 2-1: Block Diagram of the GPS 2408</i>	<i>2 - 2</i>
<i>Figure 2-2: Isometric View of the GPS 2408 7-foot Plant Configuration</i>	<i>2 - 3</i>
<i>Figure 2-3: Front and Side Views of the GPS 2408 42-inch Plant Configuration</i>	<i>2 - 4</i>
<i>Figure 2-4: Galaxy Rectifier Controller in the GPS 2408 Plant</i>	<i>2 - 9</i>
<i>Figure 2-5: 596B3 Rectifier</i>	<i>2 - 10</i>
<i>Figure 2-6: ES682H Converter</i>	<i>2 - 17</i>
<i>Figure 5-1A: 7-foot Frame Mounting Footprint</i>	<i>5 - 2</i>
<i>Figure 5-1B: 12IR125 Battery Stand Mounting Footprint</i>	<i>5 - 2</i>
<i>Figure 5-1C: VR250E Battery Stand Mounting Footprint</i>	<i>5 - 3</i>
<i>Figure 5-1D: VR375E Battery Stand Mounting Footprint</i>	<i>5 - 3</i>
<i>Figure 5-2: Floor Mounting Detail</i>	<i>5 - 4</i>
<i>Figure 5-3: Top View of the GPS 2408 Plant</i>	<i>5 - 6</i>
<i>Figure 5-4: AC Cable Routing</i>	<i>5 - 6</i>
<i>Figure 5-5: Galaxy Power System Distribution Components</i>	<i>5 - 9</i>
<i>Figure 5-6: Contactor Control Board</i>	<i>5 - 10</i>
<i>Figure 5-7: Front Panel of Galaxy Rectifier Controller</i>	<i>5 - 20</i>
<i>Figure 5-8: Galaxy Rectifier Controller Alarm Identification</i>	<i>5 - 21</i>
<i>Figure 5-9.1: Galaxy Rectifier Controller Configuration Parameters (1 of 2)</i>	<i>5 - 22</i>

<i>Figure 5-9.2: Galaxy Rectifier Controller Configuration Parameters (2 of 2)</i>	<i>5 - 23</i>
<i>Figure 7-1.1: Rectifier Troubleshooting Flowchart (Sheet 1 of 3)</i>	<i>7 - 2</i>
<i>Figure 7-1.2: Rectifier Troubleshooting Flowchart (Sheet 2 of 3)</i>	<i>7 - 3</i>
<i>Figure 7-1.3: Rectifier Troubleshooting Flowchart (Sheet 3 of 3)</i>	<i>7 - 4</i>
<i>Figure 7-2.1: Converter Troubleshooting Flowchart (Sheet 1 of 3)</i>	<i>7 - 5</i>
<i>Figure 7-2.2: Converter Troubleshooting Flowchart (Sheet 2 of 3)</i>	<i>7 - 6</i>
<i>Figure 7-2.3: Converter Troubleshooting Flowchart (Sheet 3 of 3)</i>	<i>7 - 7</i>

List of Tables

<i>Table 2-A: GPS 2408 Plant Specifications</i>	<i>2 - 5</i>
<i>Table 2-B: 596B3 Rectifier Specifications</i>	<i>2 - 13</i>
<i>Table 2-C: 596B3 Rectifier Control and Monitoring</i>	<i>2 - 15</i>
<i>Table 2-D: 596B3 Rectifier Status Messages</i>	<i>2 - 16</i>
<i>Table 2-E: ES682H Converter Specifications</i>	<i>2 - 19</i>
<i>Table 3-A: Standard Configurations for GPS 2408</i>	<i>3 - 1</i>
<i>Table 3-B: Plant Type</i>	<i>3 - 3</i>
<i>Table 3-C: Controller Types</i>	<i>3 - 4</i>
<i>Table 3-D: AC Input Selections</i>	<i>3 - 5</i>
<i>Table 3-E: Battery/Load Disconnect Options</i>	<i>3 - 5</i>
<i>Table 3-F: DC Distribution Panel for Field Mounted Protectors</i>	<i>3 - 5</i>
<i>Table 3-G: Plug-in Circuit Breakers for 24V and 48V Distributions</i>	<i>3 - 6</i>
<i>Table 3-H: AT Type Plug-in Fuses for 24V Distribution</i>	<i>3 - 7</i>
<i>Table 3-I: Lugs and Hardware Kits for 24V Distribution</i>	<i>3 - 7</i>
<i>Table 3-J: GMT Type Fuses for Converter Output (48V) Distribution</i>	<i>3 - 10</i>
<i>Table 3-K: Lugs for Converter Output Distribution</i>	<i>3 - 10</i>
<i>Table 3-L: Type of Battery and Battery Disconnect</i>	<i>3 - 10</i>
<i>Table 3-M: Unigy Battery Adapter Kit</i>	<i>3 - 11</i>
<i>Table 3-N: Battery Temperature Modules</i>	<i>3 - 12</i>
<i>Table 3-O: Type and Quantity of Rectifiers and Converters</i>	<i>3 - 12</i>
<i>Table 3-P: AC Input Recommendations</i>	<i>3 - 12</i>
<i>Table 3-Q: Terminal Lugs for AC Service</i>	<i>3 - 13</i>

<i>Table 3-R: Lugs and Hardware (3/8-inch Stud Size) for Battery Connection</i>	<i>3 - 13</i>
<i>Table 3-S: Spare Parts</i>	<i>3 - 13</i>
<i>Table 3-T: Product Documentation</i>	<i>3 - 14</i>
<i>Table 5-A: Torque Settings</i>	<i>5 - 8</i>

1 Introduction

General

The Galaxy Power System (GPS) 2408 was developed by Lucent Technologies to support 24-volt wireless applications for worldwide markets. The GPS 2408 combines forced fan-cooled switchmode rectifiers and converters, microprocessor control technologies, load and battery disconnect/reconnect options, and dc distribution options in a modular front-access design. The system modularity and front access to all components ensure simple installation and easy maintenance, allowing the system to expand in capacity and software features as the user's needs grow.

This product manual (Select Code 167-792-158) gives a general product description that will familiarize the user with the main components of the GPS 2408 and provides an understanding of the installation, operation, and maintenance of the system.

Architecture

The GPS 2408 **plant** is configured to operate from a nominal 208/220/240-volt, three-phase, three-wire delta or wye, 50/60-hertz, plus earth ground source. The plant **rectifiers** operate phase to phase from this three-phase source.

The GPS 2408 accommodates eight +24-volt, 100-ampere 596B3 rectifiers, providing a maximum plant capacity of 800 amperes at 24 volts, and two 48-volt, 8.5-ampere dc-dc converters that provide 17 amperes at 48 volts. Distribution facilities provide for 42 fuses or circuit breakers for the 24-volt output and two circuit breakers and four GMT fuses for the 48-volt output.

The GPS 2408 is mounted in the top half of a seven-foot frame or in a half-height frame designed to mount on top of a battery stand.

The GPS 2408 is specifically designed for operation with Lucent Technologies 12IR125, 2VR375, 2VR250E, and UNIGY II batteries. It will also operate with other valve-regulated batteries.

Applications

With 800-ampere capacity, distribution flexibility, and universal ac input capability, the GPS 2408 supports wireless power system applications ranging from base station to the environmentally controlled remote site (hut and vault).

Customer Training

Lucent Technologies offers customer training on many Power Systems products. For information call 1-972-284-2163. This number is answered from 8:00 a.m. until 4:30 p.m., Central Time Zone (Zone 6), Monday through Friday.

Customer Service

For customers in the United States, Canada, Puerto Rico, and the US Virgin Islands, call 1-800-THE-1PWR (1-800-843-1797). Services provided through this contact include initiating the spare parts procurement process for out of service emergencies, ordering Lucent Technologies documents, and providing other product and service information.

For other customers worldwide, call 001-972-840-0382. This number is answered from 8:00 a.m. until 4:30 p.m., Central Time Zone (Zone 6), Monday through Friday.

Technical Support

Technical support for Lucent Technologies customers is available around the world during the normal product warranty period and also while specific contractual agreements extend this service.

For customers in the United States, Canada, Puerto Rico, and the US Virgin Islands, call 1-800-CAL-RTAC (1-800-225-7822) to contact a product specialist to answer your technical questions and assist in troubleshooting problems.

For other customers worldwide, contact your local field support center or your sales representative to discuss your specific needs.

***Product Repair
and Return***

Repair and return service is provided for Lucent Technologies customers around the world. For customers in the United States, Canada, Puerto Rico, and the US Virgin Islands, call 1-800-255-1402 for information on returning of products for repair.

For other customers worldwide, contact your sales representative to discuss your particular circumstances.

***Warranty
Service***

For warranty service worldwide, contact your Warranty Service Manager (WSM). The WSM serves specific customer-groups, who have taken ownership of the product. For product conformance issues prior to customer ownership, contact your local customer service.

2 *Product Description*

Galaxy Power System Overview

A basic block diagram of the Galaxy Power System 2408 is shown in Figure 2-1. It illustrates the arrangement and interconnections of the system components from the ac input to the dc output. The power system accepts alternating current from a commercial utility or a standby ac power source and rectifies it to produce dc power for the using equipment. The system's control and alarm functions interact with the rectifiers and the office. In addition, the system provides overcurrent protection and charge, discharge, and distribution facilities. Battery reserve automatically provides a source of dc power if the commercial or standby ac fails. Battery reserve can be engineered to supply dc power for a specific period of time. In normal practice, battery capacity is sized to provide 3 to 8 hours of reserve time.

AC Input connects the commercial and/or standby ac power sources to the rectifiers within the system and provides overcurrent protection.

Rectifiers convert an ac source voltage into the 24-volt dc voltage required to charge and float the batteries and to power the plant converters and the using equipment.

Converters convert the 24-volt dc rectifier output into -48-volt dc voltage required to power the using equipment.

Controller provides the local and remote control, monitoring, and diagnostic functions required to administer the power system.

Batteries provide energy storage for an uninterrupted power feed to the using equipment during loss of ac input or rectifier failure.

DC Distribution provides overcurrent protection, connection points for the using equipment, and bus bars to interconnect the rectifiers, batteries, and dc distribution.

Battery Connection Module provides connection points for the battery strings through a contactor and current monitoring shunt.

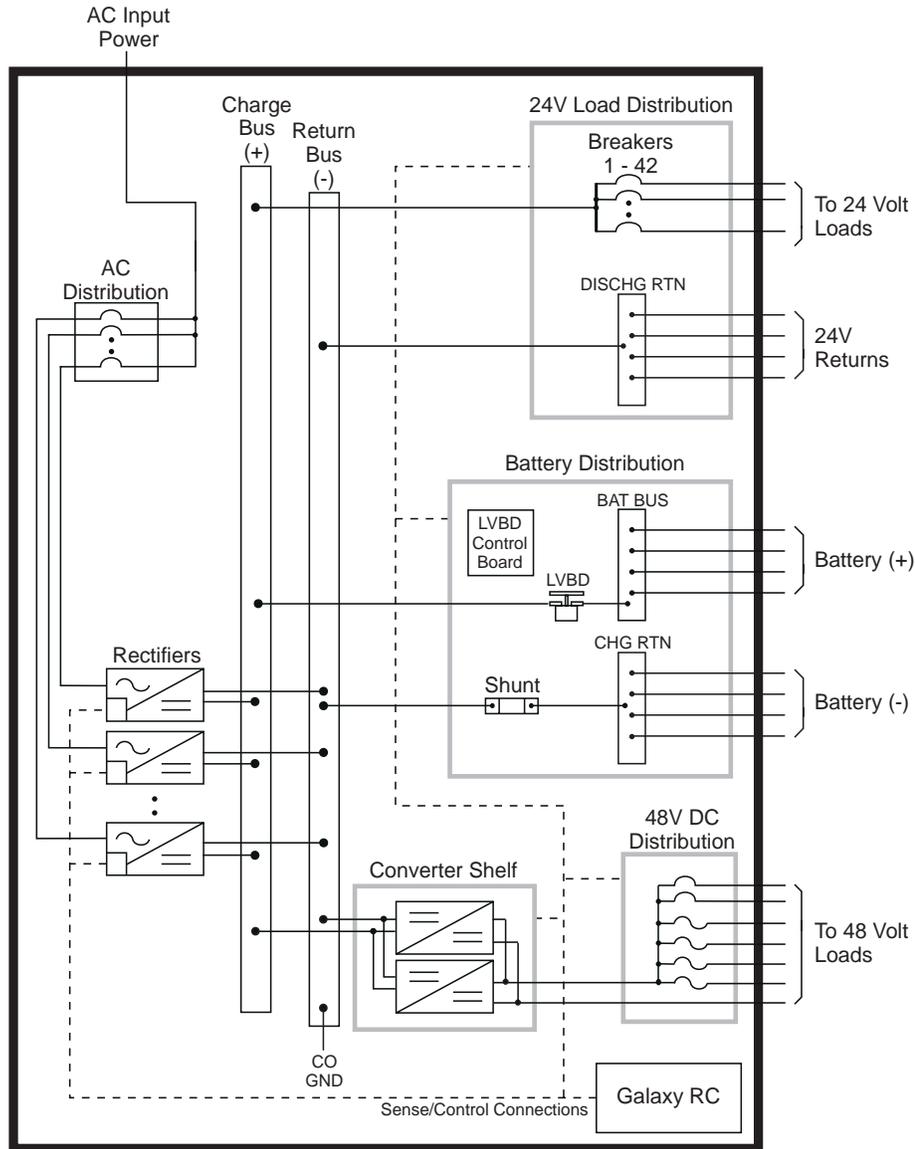


Figure 2-1: Block Diagram of the GPS 2408

**Plant
Configuration**

Figure 2-2 shows an isometric view of the GPS 2408 plant with the 7-foot frame. Figure 2-3 is an isometric view of the 42" frame. The plant requires front access only for installation and maintenance, allowing installation against walls, in back-to-back line-ups, or in line-ups with other cabinets. System components are mounted in the top half of a seismic network bay frame. The plant is composed of an ac input panel, rectifier shelves and rectifiers, converter shelves and converters, dc distribution panels, and battery connection panels. These components are described in the following paragraphs. Specifications for the plant, rectifiers, and converters are given in tables at the end of this section.

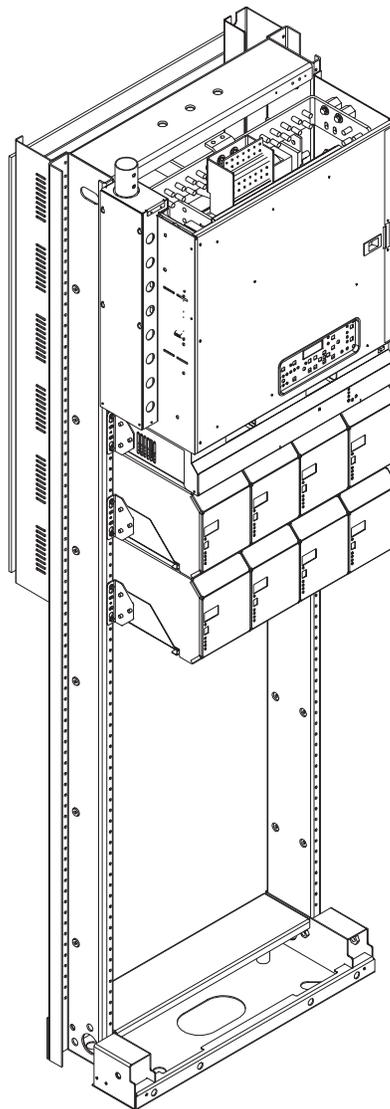


Figure 2-2: Isometric View of the GPS 2408 7-foot Plant Configuration

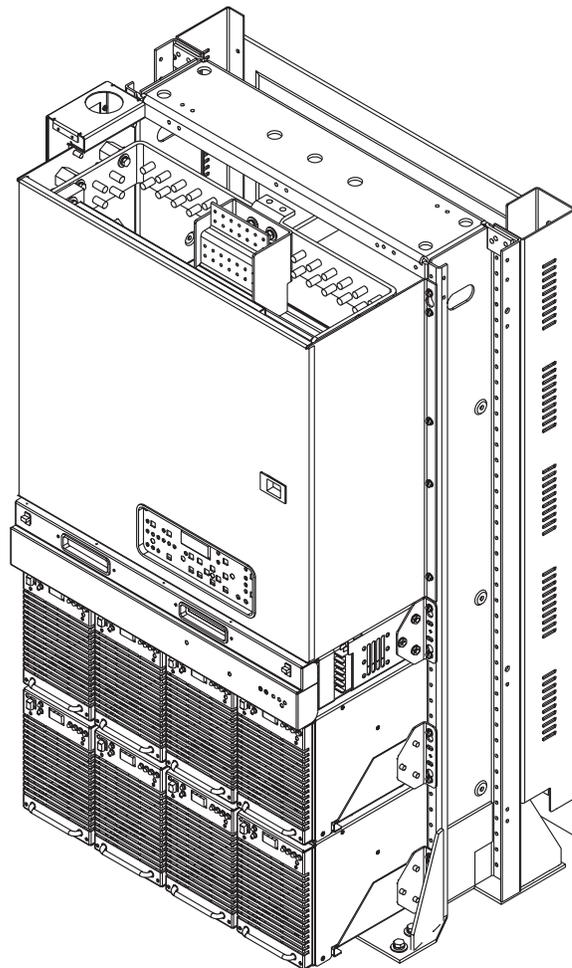


Figure 2-3: Front and Side Views of the GPS 2408 42-inch Plant Configuration

**Plant
Specifications**

Table 2-A: GPS 2408 Plant Specifications

Plant input voltage	3-phase, 3-wire wye or delta (Note 1) 176-264 Vac phase-phase or individual 176-264V feed to rectifiers
Plant input current	75 amperes per phase, 3-phase bulk feed (Note 2)
Plant output voltage ranges	24-volt output: 22-28 Vdc 48-volt output: 48-52Vdc
Plant output current ranges	24-volt output: 0 to 800 amperes (Note 3) 48-volt output: 0 to 17 amperes
DC distribution at 24 volts	42 plug-in slots for KS-23616 circuit breakers or AT-type fuses. See Tables 3-G and 3-H.
DC distribution at 48 volts	2 plug-in slots for KS-23616 circuit breakers. 4 plug-in slots for WP-90247 (GMT) fuses. See Table 3-J.
Maximum discharge current	1000 amperes
Maximum recharge current	Installed plant 24-volt rectifier capacity minus plant 24-volt load
Low voltage battery disconnect	Configurable threshold. See Figure 5-9. Refer to Galaxy RC product manual for more information.
Altitude	-50 to 4000 meters (Note 4)
Operating ambient temperature	0°C to 45°C
Operating relative humidity	5% to 95%

Table 2-A: GPS 2408 Plant Specifications

Radiated and conducted emissions	C.I.S.P.R. 22 Class A
Electromagnetic immunity	3 volts/meter
Earthquake rating	Zone 4, upper floors
Approval marks	UL, CUL
CE Marked	CE marked to demonstrate compliance with the European Union's electromagnetic compatibility and low-voltage directives.
Width	25.5 inches (648 mm)
Height	84 inches (2134 mm) or 42 inches (1067 mm)
Depth	19 inches (485 mm)
Weight	380 pounds

Note 1: AC service for this plant must be provided with a 208/220/240-volt, 3-phase, 3-wire plus protective earth ground service (3W+PE).

Note 2: The current is based on three rectifiers per phase operating at full load and 176Vac 3-phase input.

Note 3: The 24-volt current capacity must be reduced by the current required to operate the ES682H converters (Table 2-E).

Note 4: For altitudes between 1500 and 4000 meters, de-rate the maximum temperature by 0.656°C per 100 meters.

Galaxy Rectifier Controller

The Galaxy Rectifier Controller (Galaxy RC) monitors and controls the GPS 2408. System operating voltages, alarm thresholds, and other configuration parameters are managed by the Galaxy RC. The Galaxy RC can monitor and control up to 24 rectifiers and up to 8 converters via an isolated digital RS-485 serial control interface.

The Galaxy Rectifier Controller is mounted on the inside front door of the GPS 2408 plant with the control panel visible on the front of the door. See Figure 2-4.

NOTE Configuration of the Galaxy Rectifier Controller must be determined by personnel qualified and trained to configure your plant. Please contact your local Lucent Technologies Power Systems representative for the proper configuration.

The Galaxy Rectifier Controller product manual (Select Code 167-792-170) is furnished with every GPS 2408 plant. Refer to this manual for information regarding configuration and operation.

The Galaxy Rectifier Controller (Galaxy RC) provides the GPS 2408 plant with a wide range of control and monitoring features. The basic controller consists of a Control Board (BMY1) and a Control Panel (BMW1). These boards are mounted independently within the plant enclosure in a manner defined in the particular GPS series plant documentation. The controller issues only Power Major (PMJ) and Power Minor (PMN) office alarms off the Control Board TB1. The controller can be supplemented with a Enhanced Relay Board to provide two additional PMJ alarms, two additional PMN alarms, control inputs, and twelve other discrete alarms.

***Circuit Boards* Control Board (BMY1)**

The Control Board monitors and controls the GPS 2408, including rectifiers, converters, distribution, and contactors. It is the intelligence and memory of the system.

The Control Board has a 6-position terminal block (TB1) for user interface to the Power Major and Power Minor alarm relay contacts. All user output relays are isolated Form-C or transfer type, a combination of normally open and normally closed contacts with the middle or return contact in common. The de-energized state of these relays is the alarm condition. While the plant is operating normally, the alarm relays are energized and the normally closed contacts are open; an alarm condition results in a closure of the normally closed contact to the return contact and an opening of the normally open contact to the return contact.

TB2 is a 6-position terminal block for user interface to provide input signals for optional Rectifier On/Standby, Rectifier Holdoff, and Off-Line-Equalize Interlock features.

TB4 is a 6-position terminal block for user interface to an optional thermistor or 210E thermal probe expansion module system for battery thermal slope/step compensation.

Control Panel (BMW1)

The Control Panel interfaces with the control board via a 26-pin ribbon, which is designated J1. It provides comprehensive user interface with the Galaxy RC. It is used to view plant voltage and load, configure thresholds and parameters, view active alarms, and initiate certain plant operations. This interface consists of a 4-digit, 7-segment display, 16 keys, and 18 LEDs. The keys and LED displays are defined and explained in the Galaxy RC product manual.

Fuse Board (BNA1)

The Fuse Board serves as the interface between the plant and the controller. It provides all the fused power required by the controller and contactor drive boards. It also supplies fuse alarm and circuit breaker alarm information to the controller.

F01 through F12 are 1-1/3A fuses. The fuses are grouped to provide either a major or minor fuse alarm to the controller when blown. MNF (minor fuse alarm) consists of alarms F1 through F6. MJF (major fuse alarm) consists of alarms F7 through F12.

Enhanced Relay Board (BMU1)

The Enhanced Relay Board is an optional board for the Galaxy RC. When this optional board is added to a basic system, it provides a full set of office alarm contacts and several additional plant alarm input signals.

The Galaxy RC can monitor and control up to 24 rectifiers and up to 8 converters via an isolated digital RS-485 serial control interface.

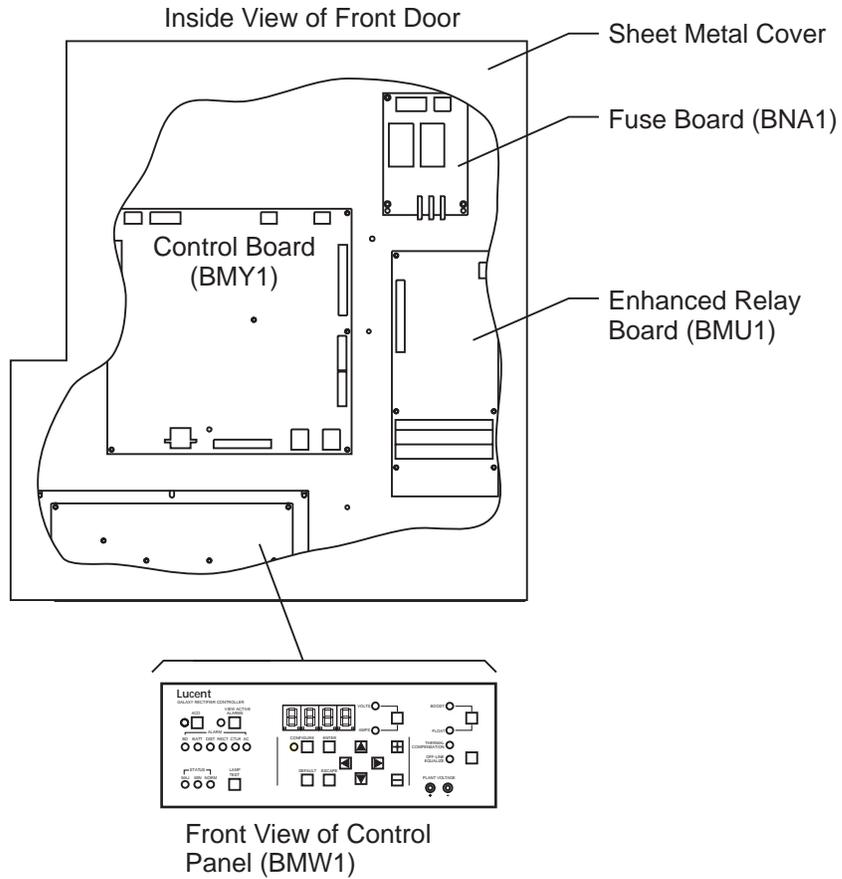


Figure 2-4: Galaxy Rectifier Controller in the GPS 2408 Plant

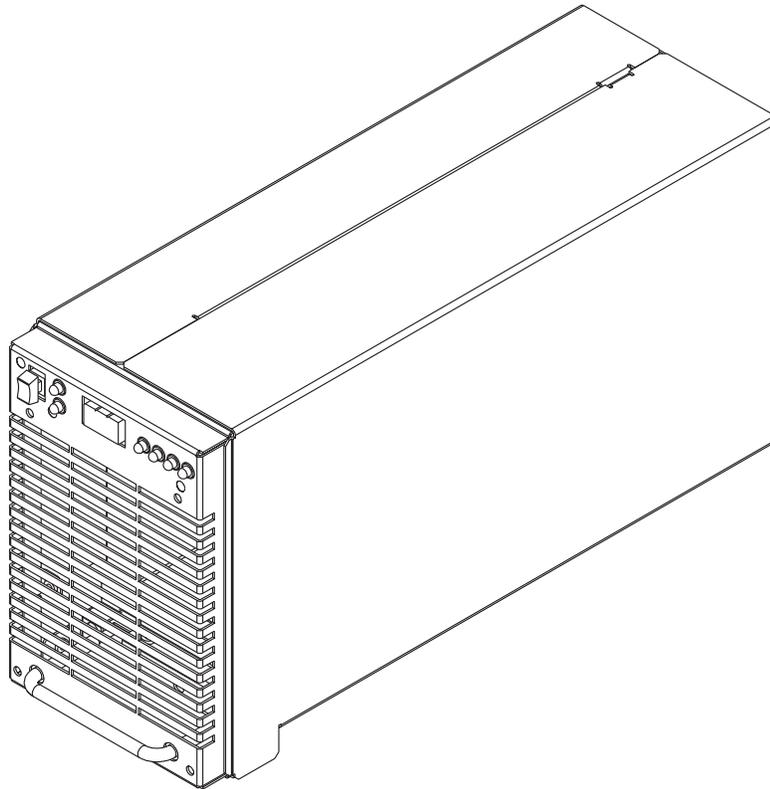


Figure 2-5: 596B3 Rectifier

596B3 Rectifier

The basic building block of the GPS 2408 is the forced fan-cooled, 100-ampere switchmode rectifier, model 596B3, which is shown in Figure 2-5. This rectifier provides +24-volt dc output from a 208/220/240-volt single-phase, 2-wire ac input. (See Table 2-B, “Rectifier Specifications.”) An ac input panel provides ac distribution to individual rectifiers.

The 596B3 rectifier is designed specifically for applications where dc power density, high efficiency, light weight, and ease of installation are important. The connectorized, front-access design of the rectifiers reduces installation time to minutes. Once installed, the controller determines the rectifier type and serial number and then sets the output current limit, float and boost voltages, and shutdown thresholds. Its logical address is established using the ID function on the ON/STBY/ID switch on the rectifier front panel.

Features **Output current “walk-in”:** This feature controls the time required for the rectifier to reach its configured current limit and set point voltage after being turned on. For loads less than 30 amperes, the output voltage immediately increases to the set point voltage. For loads of 30 amperes or greater, the output voltage gradually increases to the set point voltage. The time required is proportional to the load. For 100-ampere loads, the time required to reach set point voltage is approximately eight seconds. This feature minimizes the starting surge on the customer’s power source and is especially important with more limited power sources, such as an engine-driven alternator.

Current limit: The rectifier provides a constant output voltage up to its current limit set point, at which point it provides constant current. When the output current attempts to increase above the current limit setting, the current limit circuit overrides the voltage regulating signal and safely limits the output current of the rectifier. This current limit set point is adjustable via the controller from 30 to 110 amperes.

Selective high voltage shutdown (SHVSD): If the battery voltage exceeds the HVSD threshold established by the controller, the controller signals all plant rectifiers. All rectifiers that are delivering more than 10 amperes and are beyond ± 10 amperes of the controller-designated average load current will shut down.

Internal selective high voltage shutdown (ISHVSD): If the rectifier output voltage exceeds the HVSD threshold and the output current is greater than 10 amperes above the controller-designated average load current, the rectifier will shut down. If the controller has not communicated the average load to the rectifier, the rectifier shuts down if it is delivering more than 10 amperes.

This High Voltage Threshold is automatically determined and set by the controller based on the configured selective high voltage thresholds. The ISHVSD is a backup to the SHVSD.

Backup high voltage shutdown (BUHVSD): The 596B3 has a fixed high-voltage shutdown. In the float or boost modes, the shutdown threshold is 29.5 volts.

Restart: Following ISHVSD or BUHVSD, the rectifier attempts to restart; if unsuccessful, subsequent restarts are attempted. Following a third unsuccessful restart, the rectifier shuts down

and sends an RFA (Rectifier Failure Alarm) to the controller. After four seconds, the controller sends a restart signal to all plant rectifiers. The rectifiers that shut down due to high output voltage will attempt to restart. After three unsuccessful attempts by the rectifier to restart, the controller waits five minutes and then issues one additional restart signal.

Display meter: A four-digit front panel meter displays the rectifier current. Under certain no-power conditions, the display shows status messages. See Table 2-D.

Power switch: The power switch is a three-position switch located on the rectifier front panel. This switch, labeled ON/STBY/ID, serves two purposes:

1. **Control of the on-standby state of the rectifier.** With the power switch ON, the green ON indicator is illuminated while the rectifier is operating normally. While in standby, the yellow STBY indicator is illuminated.
2. **Uniquely identifying each rectifier for the controller.** By using the momentary position of the power switch, labeled ID, the unique logical address of the rectifier can be established.

Status indicators: In addition to the ON and STBY LEDs, four other LEDs on the 596B3 faceplate indicate the rectifier's condition:

Red ALM LED	The ALM LED when blinking indicates no communication to a controller. Once communication is established, the ALM LED is extinguished unless there is a rectifier failure.
Yellow LIM LED	Lights when the unit is in current limit.
Red FAN ALM LED	Lights when the fan inside the rectifier is not functioning properly.
Yellow BST LED	Indicates the rectifier is in BST mode. See Table 2-C.

Lamp test: The LED indicators are tested via a command from the controller.

Connectorized: Connectors at the rear of the rectifier provide the plant interfaces for the ac input, dc output, and control signals. Interconnection with the plant occurs as the rectifier is installed in the rectifier shelf.

*Rectifier
Specifications*

Table 2-B: 596B3 Rectifier Specifications

Voltage range	176 to 264 Vac, 2-wire, single phase
Input current	20 amperes, worst case (Note 1)
Frequency range	47 - 63 Hz
Power factor	> 0.98 for loads > 50%
Harmonic distortion	< 10% for loads > 50%
Output current	100 amperes
Float/Boost voltage	22 - 29.5 Vdc
Regulation	±0.5% (Note 5)
Ripple	50 mVrms
Noise	< 1mV Psophometric
Permanent overload	110A
Current limit set point	30A - 110A
Output voltage adjustment range	Up to 22 to 28 volts dc output at 100 percent of its rated output current and nominal input voltage
Width	133.35 mm
Height	203.2 mm (includes shelf)
Depth	501.65 mm (includes handles and shelf)
Weight	9.0 Kg
Efficiency	> 86% typical
Operating temperature	0°C to 45°C

Table 2-B: 596B3 Rectifier Specifications

Operating relative humidity	5% to 90%
Storage temperature	-45°C to 85°C
Storage relative humidity	5% to 90%
Altitude (Note 3)	-50 to 4000 meters (Note 2)
Dynamic response	5% maximum, 0.5% within 200mS
Automatic Load Sharing	Within 10 amperes
Audible noise	< 52dBA
EMC (Note 3)	EN 50081-1 EN 50081-2 EN 50082-1 EN 50082-2 EN 55022 EN 61000-3-2 EN 61000-3-3 EN 61000-4-2 IEC 1000-4-3 IEC 1000-4-5
Approval marks	UL Recognized to UL-1950 and TUV Certified to EN60950 including Amendments 1, 2, 3, and 4.
CE Marked	CE marked to demonstrate compliance with European low-voltage directives. (Note 4)

Note 1: Input current specified at input voltage of 175Vac, 3000 watts output, and an efficiency of 85%.

Note 2: For altitudes above 1500 meters, derate the temperature by .656° Celsius per 100 meters.

Note 3: Following the provisions of Council Directive 89/336/EEC and 73/23/EEC, as amended by Directive 93/68/EEC, on the approximation of the laws of the Member States relating to electromagnetic compatibility.

Note 4: The 596B3 rectifier is approved to IEC-950/EN 60950 by an EC Notified Body and has outputs classified as SELV.

Note 5: The controller continuously adjusts the rectifier voltage in the system.

**596B3 Rectifier
Control and
Monitoring**

Table 2-C: 596B3 Rectifier Control and Monitoring

Visual Indicators	
ON	Green LED
STBY (Standby)	Yellow LED
ALM (Alarm)	Red LED
LIM (Current Limit)	Yellow LED
Fan fail	Red LED
BST (Boost) mode	Yellow LED
Control Switches	
ON/STBY/ID	Rectifier operating, standby, or configuring address
Serial Interface Signaling (Controller to Rectifier)	
Remote Sense	
Load Share	
Voltage set points	
Current set points	
Selective high voltage shutdown set points	
Float/Boost mode	
High voltage shutdown	
ON/STBY	
Serial Interface Signaling (Rectifier to Controller)	
Rectifier current	
Serial number	
RFA (rectifier Fail Alarm)	
ON/STBY	
ACF (AC Fail Alarm)	
TA (Thermal Alarm)	
FAN FAIL	

**596B3 Rectifier
Status Messages****Table 2-D: 596B3 Rectifier Status Messages**

Display	Meaning
ACF	AC Fail
IP5	Boost setup timeout (RFA)
LS	Loadshare alarm (cannot loadshare) (RFA)
TA	Thermal alarm
FSE	Output fuse blown (RFA)
IP6	Boost imbalance (RFA)
IP7	Boost HVSD (RFA)
ICS	Internal current share (RFA)
TR	Remote standby
LO	Low output voltage alarm (RFA)
SEN	Temperature sensor failure (RFA)
HO	High Output

Rectifier Shelf Each rectifier shelf accommodates four 596B3 100-ampere rectifiers.

**ES682H
Converter**

ES682H converters, shown in Figure 2-6, are designed specifically for applications where size, weight, and ease of installation and maintenance are of overriding importance.

Each unit is equipped with field-replaceable, self-contained cooling fans. Thermal alarm circuitry offers additional protection by shutting the power unit down and providing an alarm when the internal temperature threshold is exceeded (See Table 2-D.) Forced air cooling improves the reliability of power units by maintaining their internal temperatures very close to the outside ambient temperature.

Converter Shelf The converter shelf accommodates two ES682H 8.5-ampere converters. The converters can be installed easily in the field.

Converter Interface Control Circuit:

Inside the front door of the converter shelf is the Converter Interface Control Circuit (CICC). Through this circuit the Galaxy RC controls and monitors the converters. Converter physical addressing, status LEDs for normal operations, converter fail, and distribution alarms, are also provided. See Figure 5-5.

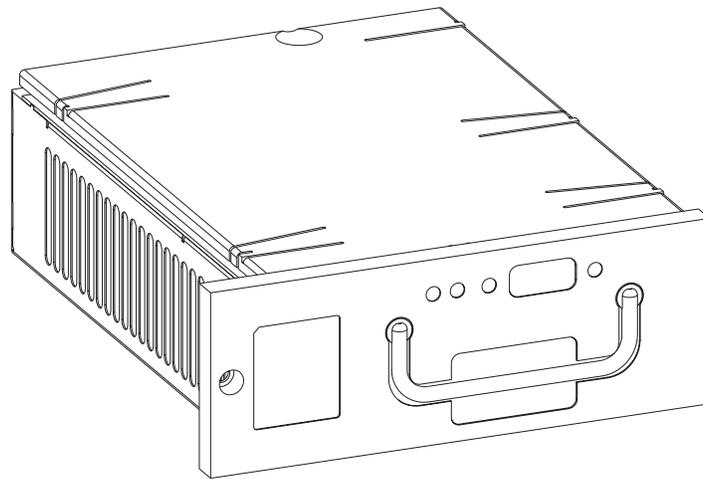


Figure 2-6: ES682H Converter

Features The following paragraphs describe standard features of the ES682H converters. More detailed specifications for these modules are provided in Table 2-D.

Lightweight, easy to install: These connectorized, pluggable units may be installed in the converter shelf in less than one minute.

Simplified plant administration: Converters may be installed in a working plant without adjustment and without interruption of service. System failures are easily corrected by replacing defective converters. Defective fans are easily replaced in the field.

Front access only: Converters may be installed and serviced without the need for rear access.

Status indicators: Front panel LED indicators on the converter indicate system status. In addition to ON and STANDBY LEDs, two additional LEDs indicate alarms for converter failure and thermal alarm. The alarm LED will blink if communication with the controller is interrupted.

Parallel operation: Converters operate in parallel with other converters.

Load share: A load share circuit automatically forces converters to share current. The load share circuit is made

fail-safe by using an isolated load share bus between converters. Upon failure, an inoperative power module is disconnected from the load share bus.

Active inrush current limiting: Upon application of the source voltage, an active circuit limits the peak inrush current, thus eliminating nuisance tripping of input breakers.

Output current limit: Converters provide a constant output voltage up to their rated output current, at which point they begin to provide constant current outputs. The maximum output current is inherently limited to less than 110% of the rated output without user adjustment.

Internal selective high-voltage shutdown: If the plant voltage goes too high, only the defective power module will shut down.

Restart circuit: If a converter has shut down due to high voltage, it will try to restart a maximum of two times automatically. After two unsuccessful tries, the power module shuts down.

Alarms: The converter provides both a local visual indication of low output voltage as well as a signal to the Galaxy Rectifier Controller. In addition, an alarm is generated by an operated internal fuse.

Thermal alarm: The converters are fan cooled to increase their reliability. An excessive internal temperature caused by fan failure or other conditions initiates a thermal alarm.

Power switch: The power switch is a two-position switch located on the converter front panel. This switch, labeled ON/STBY, enables or disables converter dc output.

Status indicators: LEDs on the converter front panel provide visual indication of the converter's condition.

**Converter
Specifications**

Table 2-E: ES682H Converter Specifications

Output voltage range	48-52 volts dc
Output current	0 - 8.5 amperes
Input voltage range	20 -30 volts dc
Input current	19 amperes (Note 1) 26 amperes (Note 2)
Efficiency	82% typical @ 50 volts dc
Regulation	±3.5%
Ripple	150 millivolts peak to peak maximum, over the range 10 Hz to 20 MHz
Output noise	<32 dBrc
Load share accuracy	0.75 amperes maximum
Heat dissipation	93 watts (320 BTU/hr) maximum
High voltage shutdown	60 volts dc
Temperature range	-40 to +65 °C

Note 1: Input current specified at input voltage of 27.25 volts, an output of 50 volts and 8.5 amperes and efficiency of 82%.

Note 2: Input current specified at input voltage of 20 volts, an output of 50 volts and 8.5 amperes and efficiency of 80%.

Note 3: The controller continuously adjusts the converter voltage in the system.

AC Input Panel

The ac input panel provides the facility to terminate the 208/220/240-volt, 3-phase ac service to the GPS 2408 plant. Depending upon the option ordered, the panel will connect 3-wire delta, 4-wire wye, or provide individual connections to the rectifiers.

The input wiring should be sized to accommodate 20 amperes per rectifier or 75 amperes per phase. The rectifier current is based on a maximum output of 3000 watts, a minimum

efficiency of 84 percent, and a minimum input of 175 volts. A wiring diagram of the ac input breaker panel is included in the T-83324-31 drawing, Figures 1, 2, H8, H9, and H12, for connection description.

24-volt DC Distribution Panel

The 24-volt dc distribution panel provides the facility to protect and distribute 42 pairs of conductors to power 24-volt telecommunications loads. Protection for the load conductors is provided by KS-23616 type circuit breakers or AT-type fuses. To mount these circuit breakers or fuses and terminate the load distribution conductors, the panel includes snap-in rails and associated bus bars. Figure 5-5 shows the location of the panel in the plant.

The panel bus bars are sized for a maximum steady state current of 300 amperes for each of the four sections. The current capacities for all circuit breakers or fuses must be distributed so that the maximum current from each section does not exceed 300 amperes.

A wiring diagram of the 24-volt dc distribution panel is included as Figures 5, 6A, H1, and H3 in the T-83324-31 drawing.

48-volt DC Distribution Panel

The 48-volt dc distribution panel provides the facility to protect and distribute six pairs of conductors to power 48-volt telecommunications loads. This panel is located behind the door on the right end of the converter shelf, as shown in Figure 5-5. Protection for the load conductors is provided by two KS-23616 type circuit breakers and four WP-90247 (GMT) fuses. The output of the 48-volt distribution is limited by the converter capacity and not the plant wiring capacity. A wiring diagram of the 48-volt dc distribution panel is included as Figures 10A and H10 in the T-83324-31 drawing.

Battery Connection Panel

The battery connection panel provides the facility to connect battery strings to the Galaxy plant, measure the plant current while the battery is discharging, and the option, depending on the plant ordered, to disconnect the battery from the plant as the plant voltage reaches the lowest usable battery voltage. Figure 5-5 shows the location of this panel in the plant.

Current for the battery is measured by the Galaxy RC using a 50mV battery shunt; the terminal voltage for the battery is measured by the Galaxy RC using the voltage sense input.

***Low Voltage
Battery
Disconnect***

In unattended battery plant locations, especially those without automatic ac backup, batteries could be completely discharged during an ac power outage. The GPS 2408 battery plant is equipped with an optional automatic battery disconnect to prevent costly battery damage due to unforeseen deep discharge. This disconnect is designed to isolate batteries from the load when the plant voltage reaches the lowest usable battery voltage.

The low voltage battery disconnect (LVBD) feature consists of a contactor, circuitry on the BJN2 board, and associated wiring. Control of the contactor is dictated by the BJN2 contactor control board and the controller. Figure 5-5 shows the location of the contactor control board in the plant and Figure 5-6 describes the contact switches.

When the battery voltage drops below a preset level, the Galaxy RC senses the low voltage condition and removes power to the contactor. This opens the connection between the battery bus and the charge bus, thus disconnecting the batteries from the rectifier(s) and the load. The user can configure the disconnect voltage threshold via the Galaxy RC.

When the contactor is open and the rectifiers are not delivering power, the controller is unpowered as well. In this state, the controller displays and LEDs are extinguished and various alarms are issued to the alarm reporting center. (See the Galaxy Rectifier Controller manual for further details.) A wiring diagram of the battery connection is included in the T-83324-31 drawing.

3 *Ordering Information*

Standard Configurations Table 3-A provides standard configuration information for the GPS 2408.

Table 3-A: Standard Configurations for GPS 2408

Model Number	Ordering Code (Comcode)	Equipped with Groups	Type of Battery Stand	Description
M2408-1A	108115312	G1, G11, G20, G30, and G40	IR125	Consists of a 42-inch frame mounted on a battery stand, two rectifier shelves, eight separate ac feed for each rectifier, Galaxy Enhanced RC Controller, and 42-position distribution with Battery Disconnect.
M2408-5B	108115353	G3, G11, G20, G30, and G40	VR375E	
M2408-5C	108115395	G2, G11, G20, G30, and G40	VR250E	
M2408-2A	108115320	G1, G11, G20, G31, and G40	IR125	Consists of a 42-inch frame mounted on a battery stand, two rectifier shelves, eight separate ac feed for each rectifier, Galaxy Enhanced RC Controller, and 42-position distribution with Load Disconnect.
M2408-6B	108115361	G3, G11, G20, G31, and G40	VR375E	
M2408-6C	108115403	G2, G11, G20, G31, and G40	VR250E	
M2408-3A	108115338	G1, G11, G22, G30, and G40	IR125	Consists of a 42-inch frame mounted on a battery stand, two rectifier shelves, one converter shelf, eight separate ac feed for each rectifier, Galaxy Enhanced RC Controller, and 42-position distribution with Battery Disconnect.
M2408-8B	108115379	G3, G11, G22, G30, and G40	VR375E	
M2408-8C	108115411	G2, G11, G22, G30, and G40	VR250E	
M2408-4A	108115346	G1, G11, G23, G30, and G40	IR125	Consists of a 42-inch frame mounted on a battery stand, two rectifier shelves, one converter shelf, one bulk delta ac feed for the plant, Galaxy Enhanced RC Controller, and 42-position distribution with Battery Disconnect.
M2408-9B	108115387	G3, G11, G23, G30, and G40	VR375E	
M2408-9C	108115429	G2, G11, G23, G30, and G40	VR250E	

Table 3-A: Standard Configurations for GPS 2408

M2408-1	107955486	G4, G11, G20, G30, and G40	---	Consists of a 42-inch frame, two rectifier shelves, eight separate ac feed for each rectifier, Galaxy Enhanced RC Controller, and 42-position distribution with Battery Disconnect.
M2408-2	107955494	G4, G11, G20, G31, and G40	---	Consists of a 42-inch frame, two rectifier shelves, eight separate ac feed for each rectifier, Galaxy Enhanced RC Controller, and 42-position distribution with Load Disconnect.
M2408-3	107955502	G4, G11, G22, G30, and G40	---	Consists of a 42-inch frame, two rectifier shelves, one converter shelf, eight separate ac feed for each rectifier, Galaxy Enhanced RC Controller, and 42-position distribution with Battery Disconnect.
M2408-4	107955510	G4, G11, G23, G30, and G40	---	Consists of a 42-inch frame, two rectifier shelves, one converter shelf, one bulk delta ac feed for the plant, Galaxy Enhanced RC Controller, and 42-position distribution with Battery Disconnect.

Notes:

- DC Distribution Panels: There are two dc distribution panels with a total of 42 positions on GPS 2408. Plug-in circuit breakers or fuses ranging from 1-100A can be mounted in these panels.
- AC Input Panels: The GPS 2408 is available in two different ac distribution modules:
 - Bulk feed Delta: GPS 2408 operates from 208/240, three phase Delta commercial power over a frequency range of 47-63 Hz, plus protective earth ground (3W + PE). Each rectifier is bussed through a two-pole ac input circuit breaker in the frame.
 - GPS 2408 operates from eight separate ac feeds to each rectifier via a Wago block in the ac distribution. The ac source can be 208/240 single phase (phase to phase) or 360/416 Vac single phase (phase to neutral). In this case each ac feed must be protected with an external circuit breaker.
- Battery Connection Panel: GPS 2408 can be mounted on an IR, VR, or Unigy type battery stand. Unigy batteries require an adapter kit for mounting. Batteries may be connected to the frame through an 800A contactor.
- DC/DC Converter: GPS 2408 offers a +24 to -48V conversion and distribution in a space-saving shelf designed for maximum flexibility. The output of each converter is 8.5A; up to two converters, along with six distribution positions--each 3-15A--can be placed on a shelf.
- Refer to Tables 3-B through 3-F for descriptions of each group.

Custom Configurations

Refer to Drawing H569-435 for custom configurations of the GPS 2408 battery plant.

Field Mounted Equipment

Refer to Tables 3-G through 3-R for field mounted equipment. These items must be ordered separately.

Table 3-B: Plant Type

Code	Maximum Current	Description
H569-435 (1) G1	800	Equipment with IR125 Battery Stand
H569-435 (1) G2	800	Equipment with VR250 Battery Stand
H569-435 (1) G3	800	Equipment with VR375 Battery Stand
H569-435 (1) G4	800	Equipment with No Battery Stand

Table 3-C: Controller Types

Code	Description
G10	Galaxy RC Controller
G11	Galaxy Enhanced RC Controller

Table 3-D: AC Input Selections

Code	Input Voltage	Bay AC Feeds	AC CB Quantity	Rectifier Shelves	Converter Shelves
AC Input Delta					
G20	208/240	8	0	2	0
G21	208/240	1	8	2	0
G22	208/240	8	0	2	1
G23	208/240	1	8	2	1
AC Input Wye					
G20	380	8	0	2	0
G21	380	1	8	2	0
G22	380	8	0	2	1
G23	380	1	8	2	1

Table 3-E: Battery/Load Disconnect Options

Code	Description
G30	LVBD, Low Voltage Battery Disconnect, 800A
G31	LVLVD, Low Voltage Load Disconnect (two 400A contactors, one per load panel)
G32	No disconnect.

Table 3-F: DC Distribution Panel for Field Mounted Protectors

Code	Protector Sizes	Protector Positions		Field Mounted Other Equipment
G40	1-100A	42	800A	See Tables 3-G and 3-H

Table 3-G: Plug-in Circuit Breakers for 24V and 48V Distributions

Comcode	Amperage	Protector Positions	Minimum Wire Gauge
407098417	3	1	10
407098425	5	1	10
407098433	10	1	10
407098458	15	1	10
407098474	20	1	10
407098482	25	1	10
407098490	30	1	10
407245448	40	1	8
407098516	45	1	8
407098524	50	1	8
407098532	60	2	6
407098540	70	2	6
407098557	80	2	4
407098565	90	2	4
407098573	100	2	2

Table 3-H: AT Type Plug-in Fuses for 24V Distribution

Comcode	Amperage	Protector Positions	Minimum Wire Gauge
406980797	Holder	---	---
407006329	5	1	10
407006337	10	1	10
407006345	15	1	10
407006352	20	1	10
407006360	25	1	10
407006378	30	1	10

Table 3-I: Lugs and Hardware Kits for 24V Distribution

847301660			
<u>10-14 AWG Termination Lug Kit</u>			
This kit contains the following items:			
Description	Qty.	Die	Used With
WP91412 L73 Double Hole Term	1	R-5473-5	Single Position Circuit Breaker or Fuse Holder
WP91412 L93 Single Hole Term	1	R-5473-5	
10-32 x 7/16 SCR	2	--	
WP91767 L3 1/4 Tubing 2IN	2	--	
847301678			
<u>8 AWG Termination Lug Kit</u>			
This kit contains the following items:			
Description	Qty.	Die	Used With
WP91412 L52 Double Hole Term	1	Red	Single Position Circuit Breaker or Fuse Holder
WP91412 L1 Single Hole Term	1	Red	
10-32 x 7/16 SCR	2	--	
WP91767 L4 3/8 Tubing 2IN	2	--	
847301686			
<u>6 AWG Termination Lug Kit</u>			
This kit contains the following items:			
Description	Qty.	Die	Used With
WP91412 L108 Double Hole Term	1	Blue	Single Position Circuit Breaker or Fuse Holder
WP91412 L2 Single Hole Term	1	Blue	
10-32 x 7/16 SCR	2	--	
WP91767 L5 1/2 Tubing 2IN	2	--	

Table 3-I: Lugs and Hardware Kits for 24V Distribution

847301694			
<u>4 AWG Termination Lug Kit</u>			
This kit contains the following items:			
Description	Qty.	Die	Used With
WP91412 L5 Double Hole Term	1	Grey	Single Position Circuit Breaker or Fuse Holder
WP91412 L4 Single Hole Term	1	Grey	
10-32 x 7/16 SCR	2	--	
WP91767 L5 1/2 Tubing 2IN	2	--	
847782430			
<u>6 AWG Termination Lug Kit with Two Position Adapter Bus Bar</u>			
This kit contains the following items:			
Description	Qty.	Die	Used With
Two Position Adapter Bus Bar	1	--	Two Position Circuit Breaker
WP91412 L3 Double Hole Term	1	Blue	
WP91412 L111 Double Hole Term	1	Blue	
10-32 x 7/16 SCR	2	--	
.375-16 Nut	2	--	
.375 Flat Washer	2	--	
.375 Lock Washer	2	--	
WP91767 L5 1/2 Tubing 2IN	2	--	

Table 3-I: Lugs and Hardware Kits for 24V Distribution

847782422			
<u>2 AWG Termination Lug Kit with Two Position Adapter Bus Bar</u>			
This kit contains the following items:			
Description	Qty.	Die	Used With
Two Position Adapter Bus Bar	1	--	Two Position Circuit Breaker
WP91412 L54 Double Hole Term	1	Brown	
WP91412 L121 Double Hole Term	1	Brown	
10-32 x 7/16 SCR	2	--	
.375-16 Nut	2	--	
.375 Flat Washer	2	--	
.375 Lock Washer	2	--	
WP91767 L5 1/2 Tubing 2IN	2	--	

Table 3-J: GMT Type Fuses for Converter Output (48V) Distribution

Comcode	Capacity (Amperes)
405006222	1/4
406976894	1/2
405673146	1-1/3
405181983	2
406976985	3
406159061	5
405725433	7-1/2
406159236	10

Table 3-K: Lugs for Converter Output Distribution

Comcode	Wire Gauge
847572716	10-12 AWG
847572724	14-18 AWG

**Field Mounted
Equipment**

Table 3-L: Type of Battery and Battery Disconnect

Comcode	Description
407155399	12IR125 Battery (Order 2 for a single string.)
407435825	2VR375E Battery (Order 12 for a single string.)
407435841	2VR250E Battery (Order 12 for a single string.)
601837354 ED83123-30 GR14	12IR125 Battery String Disconnect (Order 1 for two 24V battery strings.)
601861420 ED83123-30 GR15	2VR375E and 2VR250E Battery String Disconnect
601371628 ED83123-30 GR10	Remote Power Off Switch Assembly

Table 3-M: Unigy Battery Adapter Kit

Comcode	Description
847913001	Frame Adapter Kit for 75AH Unigy Batteries
847913019	Frame Adapter Kit for 85AH Unigy Batteries

Table 3-N: Battery Temperature Modules

Comcode	Description
847618139	Battery Thermal Management Unit (Maximum 8 temperature probes/unit, maximum 5 units; 2 paddle probes provided)
847050010	Additional Paddle Type Probe
847494606	Ring Terminal Type Probe

Table 3-O: Type and Quantity of Rectifiers and Converters

Comcode	Description
108036476	100A Rectifier, 596B3
107985582	24Vdc to -48Vdc Converter, ES682H

Table 3-P: AC Input Recommendations

For Code	External Breaker		Conduit	Wire Size
	Size	Quantity		
G20	30A	8	1-1/2"	(24) 10 gauge
G21	125A	3	1-1/2"	(3) 4 gauge + (1) 6 gauge Ground
G22	30A	8	1-1/2"	(24) 10 gauge
G23	125A	3	1-1/2"	(3) 4 gauge + (1) 6 gauge Ground
G24	125A	3	1-1/2"	(4) 4 gauge + (1) 6 gauge Ground
G25	125A	3	1-1/2"	(4) 4 gauge + (1) 6 gauge Ground

Table 3-Q: Terminal Lugs for AC Service

Lug Comcode	WP-91412 List	Wire Gauge			Centers
		Standard	Flex	Metric	
Double Hole Lugs					
406338426	109	6	6	16	1.00
406332940	116	4	4	25	1.00
406338665	121	2	—	35	1.00
Single Hole Terminal Lug for AC Ground (1/4-inch stud size)					
406847774	15	6	6	16	1.00

Table 3-R: Lugs and Hardware (3/8-inch Stud Size) for Battery Connection

Lug Comcode	WP-91412 List	Wire Gauge			Centers
		Standard	Flex	Metric	
406332841	111	6	6	--	1.00
406332940	116	4	4	25	1.00
406338665	121	2	—	35	1.00
405348228	56	1/0	—	--	1.00
405348236	57	2/0	1/0	70	1.00
406021725	77	--	2/0	--	1.00
405348251	59	4/0	--	--	1.00
405347923	27	--	4/0	--	1.00

Spare Parts

Table 3-S lists spare parts for the GPS 2408 plants that may be installed in the field.

Table 3-S: Spare Parts

Description	Ordering Code
BMY1, Control Board	107792459
BMU1, Enhanced Relay Board	107792434
BMW1, Display Board	107792442
BNA1, Fuse Board	107832677
BJN2, Contactor Control Board	107782583
Converter Fan Cradle Assembly	847244100
Rectifier Fan Assembly	407840792

Documentation

Table 3-T lists documentation associated with the GPS 2408.

Table 3-T: Product Documentation

Document Number	Description
H569-435	GPS 2408 Ordering Guide
J85500E-4	GPS 2408 Plant Assembly Drawing
T-83324-31	GPS 2408 Plant Wiring Diagram
167-792-158	GPS 2408 Product Manual
167-792-170	Galaxy Rectifier Controller Product Manual
157-622-025	12IR125 Battery Product Manual
157-622-011	Enhanced VR Battery Product Manual
157-622-030	Unigy II Battery Product Manual

4 *Safety*

Safety Statements

Please read and follow all safety instructions and warnings before installing, maintaining, or repairing the power system. Reference the individual module product manuals for additional safety statements specific to the modules.

This Galaxy Power System is Underwriters Laboratories (UL) Listed per Subject Letter 1801, DC Power Distribution Centers for Telecommunications Equipment. Rectifiers are individually UL Recognized and/or CSA Certified to UL1950 and CSA C22.2 No 234/950. Rectifiers are also approved to IEC-950/EN60950 by an EC Notified Body and have outputs classified as SELV.

Install only in restricted access areas (dedicated equipment rooms, equipment closets, or the like) in accordance with articles 110-16, 110-17, and 110-18 of the U.S. National Electric Code (NEC), ANSI/NFPA No. 70, and pursuant to applicable local codes.

This equipment is to be used in controlled environments (an area where the humidity is maintained at levels that cannot cause condensation on the equipment, the contaminating dust is controlled, and the steady-state ambient temperature is within the range specified).

This equipment has been evaluated for use in a continuous ambient temperature of up to 40°C. Short-term excursions to 50°C are acceptable.

This equipment must not be installed over combustible surfaces.

For installations in the U.S. and Canada, Listed/Certified compression connectors are to be used to terminate

Listed/Certified field-wired conductors where required. For all installations, the appropriate connector is to be applied only to the correct size conductor as specified by the connector manufacturer using only the connector manufacturer's recommended tooling or tooling approved for that connector.

If the proper connector for the country of installation is not provided, obtain appropriate connectors and follow manufacturer's and all local requirements for proper connections. All national and local rules and regulations are to be followed when making field connections.

NOTE The ac input distribution has been evaluated for connection of minimum 90°C conductors sized per the US National Electrical Code using the 90°C ampacity tables.

Torque electrical connections to the values specified on labels or in the product documentation.

Battery input cables must be dressed to avoid damage to the conductors (caused by routing around sharp edges or routed in areas where wires could get pinched) and undue stress on the connectors.

The short circuit current capability of the battery input to the distribution panel should not exceed 10,000A.

Fuses and/or circuit breakers may not be provided with the equipment. Refer to the product documentation for the proper hardware. Use only the parts specified in the equipment documentation. Installing fuses or circuit breakers not specified for use in this equipment may result in injury to service personnel or equipment damage.

External loading must not exceed 80% of its fuse or circuit breaker current rating.

AC branch circuits to this equipment must be protected with either fuses or circuit breakers sized as required by the National Electric Code (NEC) and/or local codes. Refer to the equipment ratings to assure rating of equipment will not exceed 80% of the value of the protector chosen. Reference drawing T-83324-31 for recommended circuit protection for the different options.

When utilizing the single-feed ac option (List 11), the maximum size branch-circuit protector required is 30A for each input.

An accessible ac disconnect/protection device to remove ac power from the equipment in the event of an emergency must be provided. This device must open all poles and be connected together.

When connecting to 3-wire plus neutral supply systems, the neutral is to be reliably earthed at the supply, i.e., this equipment is not intended to be connected to IT supply systems.

***Warning
Statements And
Safety Symbols***



This symbol identifies the need to refer to the equipment instructions for important information.



This symbol (or equivalent) is used to identify the presence of hazardous ac mains voltage.



This symbol (or equivalent) is used to identify the presence of hazardous ac mains voltage.



This symbol is used to identify the presence of hazardous ac or dc voltages. It may also be used to warn of hazardous energy levels.



One of the above two symbols (or equivalent) may be used to identify the presence of rectifier and battery voltages. The symbol may sometimes be accompanied by some type of statement - for example: "Battery voltage present. Risk of injury due to high current. Avoid contacting conductors with uninsulated metal objects. Follow safety precautions."



This symbol is used to identify the need for safety glasses and may sometimes be accompanied by some type of statement, for example: "Fuses can cause arcing and sparks. Risk of eye injury. Always wear safety glasses."



These symbols are used to identify the safety earth ground or bonding point for the equipment.

The symbols may sometimes be accompanied by some type of statement - for example: "Battery voltage present. Risk of injury due to high current. This unit must be accessed only by qualified personnel. Avoid contacting conductors with uninsulated metal objects. Follow safety precautions."

Precautions

When working on or using this type of equipment, the following precautions should be noted:

- This unit must be installed, serviced, and operated only by skilled and qualified personnel who have the necessary knowledge and practical experience with electrical equipment and who understand the hazards that can arise when working on this type of equipment.
- The Galaxy Power System can be powered by multiple ac inputs. Ensure that the appropriate circuit protection device for each ac input being serviced is disconnected before servicing the equipment.
- For equipment connected to batteries, disconnecting the ac alone will not necessarily remove power to the equipment. Make sure the equipment is not also powered by the batteries or the batteries are not connected to the output of the equipment.
- High leakage currents may be possible on this type of equipment. Make sure the equipment is properly safety earth grounded before connecting power.
- Hazardous energy and voltages that can shock or cause serious injury are present in the unit and on the interface cables. Follow all safety warnings and practices when servicing this equipment. Exercise care when servicing this area.
- Batteries may be connected in parallel with the output of the rectifiers. Turning off the rectifiers will not necessarily remove power from the bus. Make sure the battery power is also disconnected and/or follow safety procedures while working on any equipment that contains hazardous energy/voltage.

In addition to proper job training and safety procedures, the following are some basic precautions that should always be used:

- Use **only** properly insulated tools.
- Remove all metallic objects (key chains, glasses, rings, watches, or any other jewelry).
- Wear safety glasses.
- Test circuits before touching.
- Lock out and tag any circuit breakers/fuses when possible to prevent accidental turn on.
- Be aware of potential hazards before servicing equipment.

- Identify exposed hazardous electrical potentials on connectors, wiring, etc. (note the condition of these circuits, especially any wiring).
- Use care when removing or replacing any covers - avoid contacting any circuits.

5 *Installation*

General

This section outlines a sequence for installing a Lucent Technologies Galaxy Power System (GPS) 2408, as well as a test sequence for checking the integrity of the installation.

Installation Tools and Hardware

You will need the following tools and hardware to install the GPS 2408:

- Material handling equipment to unload the plant at site, remove from shipping container, and set in final position [Minimum lifting capacity: **570 lb (260 Kg)**]
- Drill and drill bits to install floor anchors
- Cable racks and associated hardware
- Battery and load cables
- Terminal lugs for 1/4-inch, 5/16-inch, and 3/8-inch bolts (See Section 3 for terminal lug data.)
- Crimping tools and dies
- 3/16-inch (5 mm) Allen-head wrench
- Insulated hand tools:
 - screw drivers (flat-blade and Phillips)
 - wire cutters and stripper
 - sockets and torque wrenches for metric and English hardware (see Table 5-A for torque requirements)
 - a crowbar
- Calibrated digital voltmeter (DVM) (0.05% accuracy on dc scale)
- ESD wrist strap
- Load box (100 amperes @ 24V)
- Load box (20 amperes @ 48V)

Unpacking and Handling

Before opening the packaging, carefully inspect the outside in the presence of shipping personnel for signs of damage. If damaged, follow the shipping carrier's procedure for filing a damage claim.

Use the equipment weights and dimensions as a guideline for choosing material handling tools. Carefully open the packaging to verify that the contents are complete and undamaged. If the equipment must be returned, it should be be repacked in the original shipping crate.

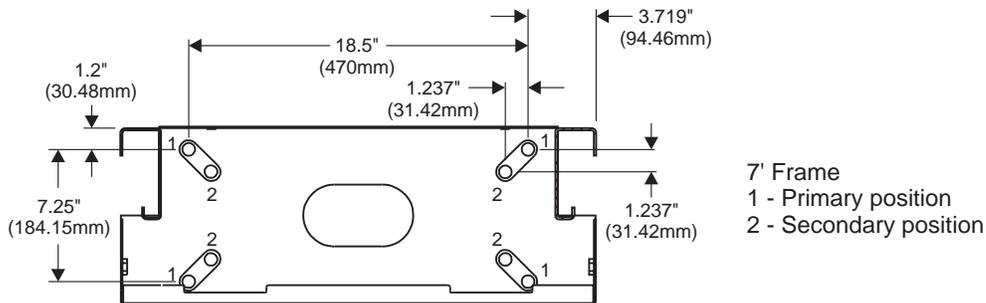


Figure 5-1A: 7-foot Frame Mounting Footprint

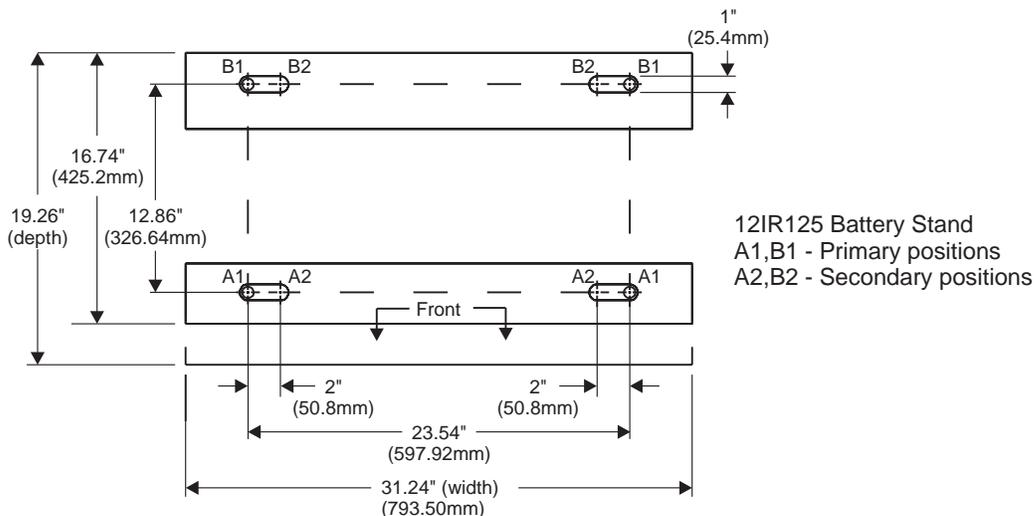


Figure 5-1B: 12IR125 Battery Stand Mounting Footprint

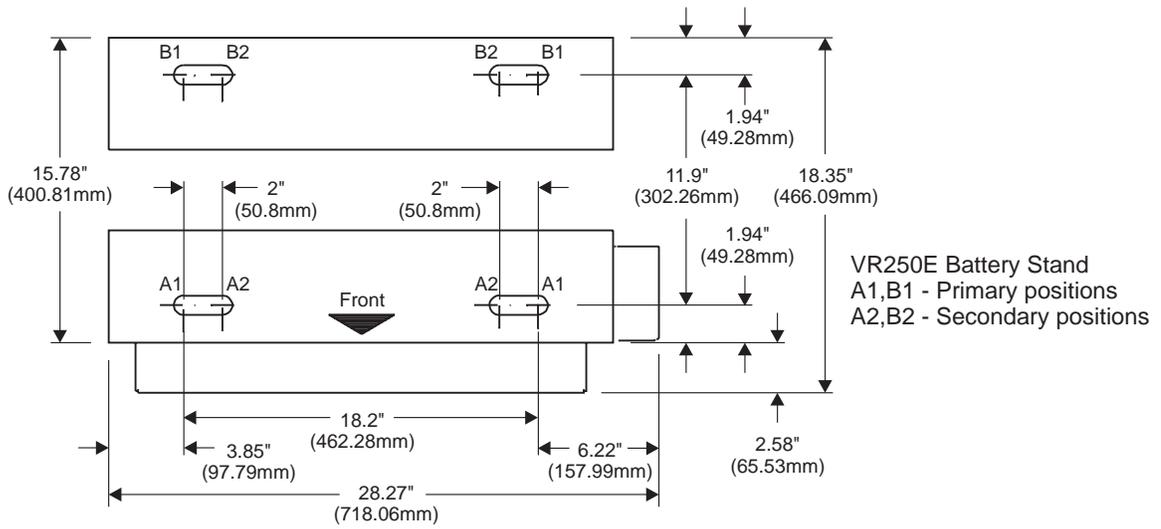


Figure 5-1C: VR250E Battery Stand Mounting Footprint

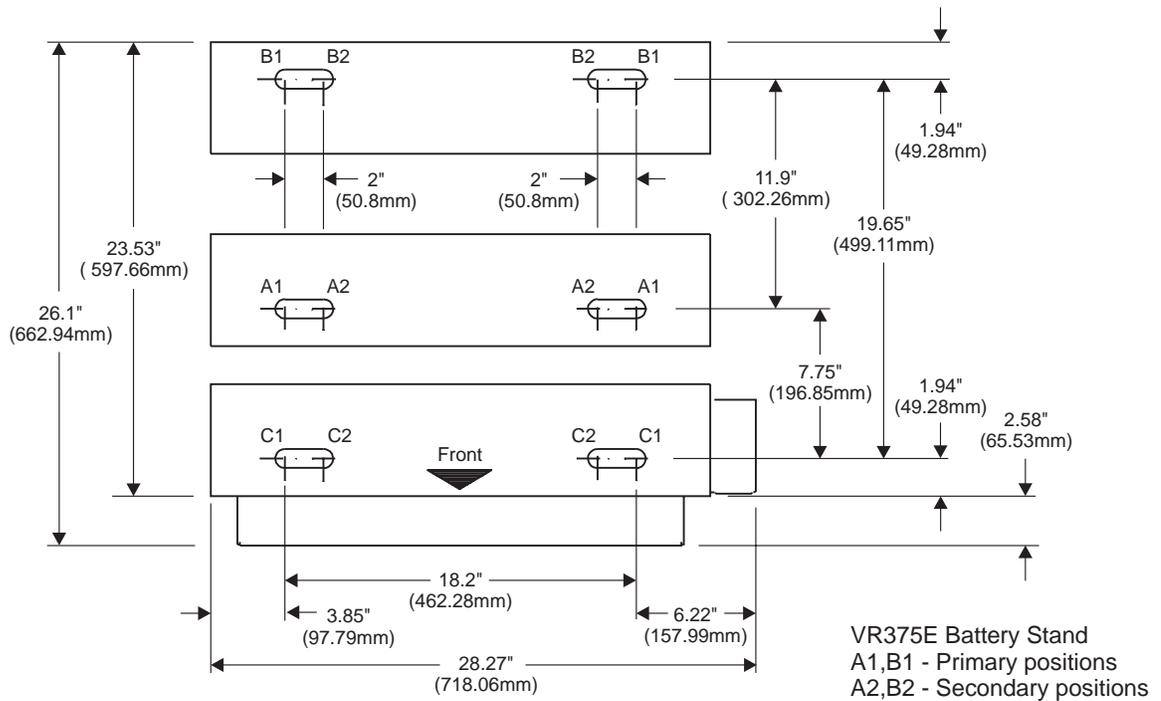


Figure 5-1D: VR375E Battery Stand Mounting Footprint

Figure 5-1 shows the plant footprint. The plant is 2133 mm high, 650 mm wide, and 485 mm deep. It has four holes for anchoring it to the floor. (See Figure 5-2.) The GPS 2408 is shipped with an anchor-bolt kit containing four 12 mm, heavy-duty anchors with torque cap bolts and hold-down washers. Other types of floor construction may require other mounting methods.

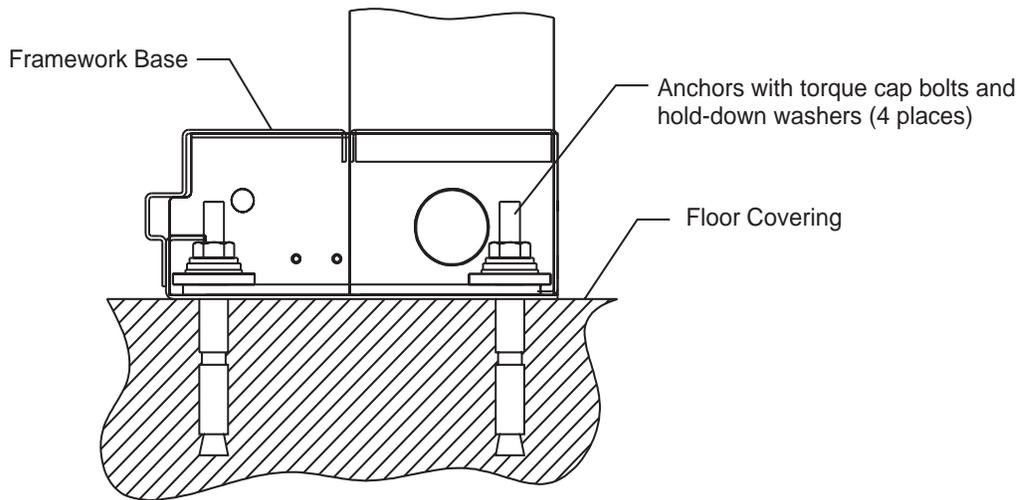


Figure 5-2: Floor Mounting Detail

Frame Installation

1. Using an 18 mm drill bit, drill anchor holes 102 mm deep.
2. Locate the plant in position using four anchor bolts and hold-down washers.
3. Using a 19 mm wrench or socket, torque anchors to a maximum of 86.4 Nm.

Cable Routing Strategy

As with any battery plant, plant positioning with respect to cable racks, batteries, and the ac service is very important in order to ensure not only easy installation but also proper maintenance and graceful growth of the system in the future.

Each plant is arranged in a manner that separates ac from dc leads. These leads should be separated wherever possible to minimize electrical noise transmitted back to the ac source or to the load.

It is recommended that ac cable be run either on a cable rack above the front of the plant or in an ac duct mounted above the front of the plant. AC cable may then be dropped from the cable rack to the plant or routed through the ac duct to the plant. DC leads should be routed along a cable rack above the back of the plant.

Frame Ground

The next step is to ground the plant framework. Local grounding practices will determine the grounding method and the size of cable connected to the plant. Use a #12-24 bolt and a double-hole terminal lug for this connection. See Figure 5-4 to locate the connection.

Central Office Ground

The plant Central Office Ground (CO Ground) should be connected to the building's principal ground point. The conductor size must conform to local standards. Connection to the plant is through the 3/8-inch studs located on the 24-volt distribution return bus. See Figure 5-4 to locate the stud and Table 3-Q for terminal lug information.

Getting Started

The following items may be addressed before or after the ac service and dc loads are connected to the plant, but they should be completed **before** power is applied to the plant.

- Install the load circuit breakers or fuses on the 24-volt and 48-volt dc distribution panels. See Figure 5-5 and the section "Connecting Loads" for additional information.
- Set the Low Voltage Battery Disconnect control status using switches SW100, SW200, and SW300 on the contactor control board. See Figure 5-5 to locate the contactor control board and Figure 5-6 or the label on the inside-left of the plant to set the switches.

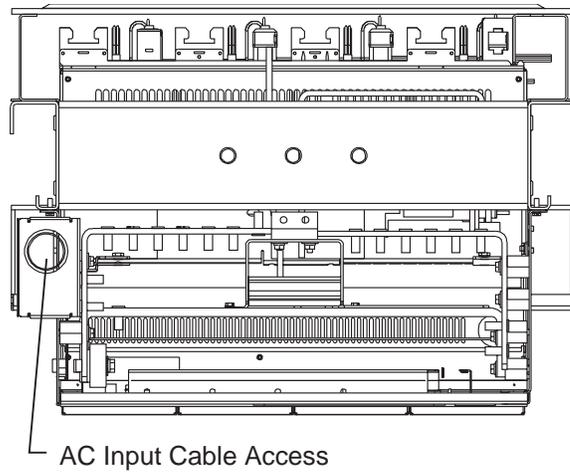


Figure 5-3: Top View of the GPS 2408 Plant

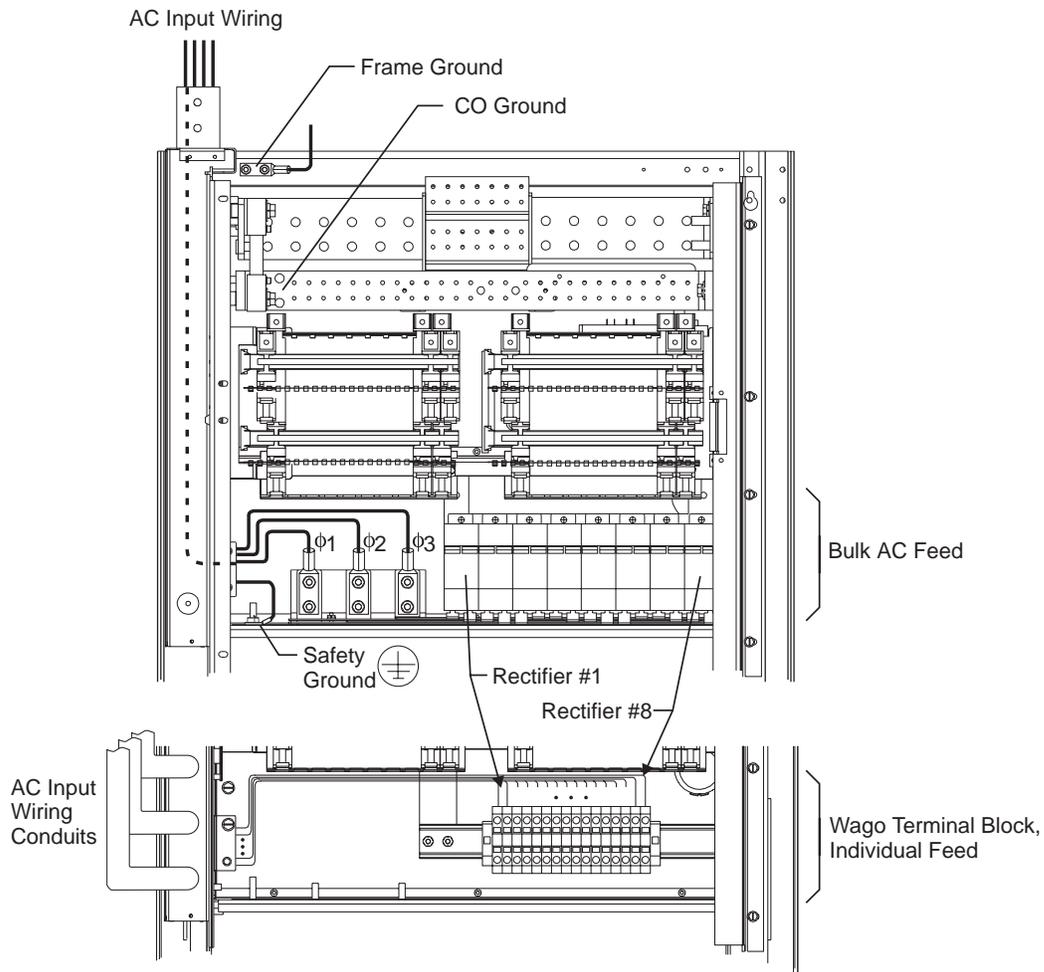


Figure 5-4: AC Cable Routing

Connecting AC

AC service for these plants must be provided via a 208/220/240-volt, 3-phase, 3-wire plus protective earth ground service (3W+PE) for the bulk feed option, or via a 208/220/240-volt or 380-volt phase to neutral single feed to each rectifier.

AC wiring must conform to local standards. Using the American National Electric Code and Wire Gauge Standards as guidelines, input wiring should be sized to accommodate 20 amperes per rectifier or 75 amperes per phase. Refer to Table 5-A for torque requirements, to Table 3-Q for terminal lug information, and to Table 3-P for conduit recommendations. Figures 1 and H9 in drawing T-83324-31 provide additional information.

Follow these steps to connect ac to the GPS 2408:

Warning

Hazardous AC voltage. Use extreme caution when performing this procedure.

Note

Review all safety statements before installing, maintaining, or troubleshooting the system.

1. Clearly label the main ac circuit breaker panel, stating that installers are working in the ac cabling.
2. Check that all dc and ac circuit breakers are turned off.
3. Route the ac cables to the plant in a duct mounted along the top of the plant; or, if the building code requires conduit, route the ac cables in conduit to the plant.
4. At the plant, route the ac cables through the access hole in the top-left side or side of the plant. See Figures 5-3 and 5-4.
5. Pass the three phase conductors and the safety ground down the ac housing and to the studs as illustrated in Figure 5-4 or Figure H1 of drawing T-83324-31; **or**

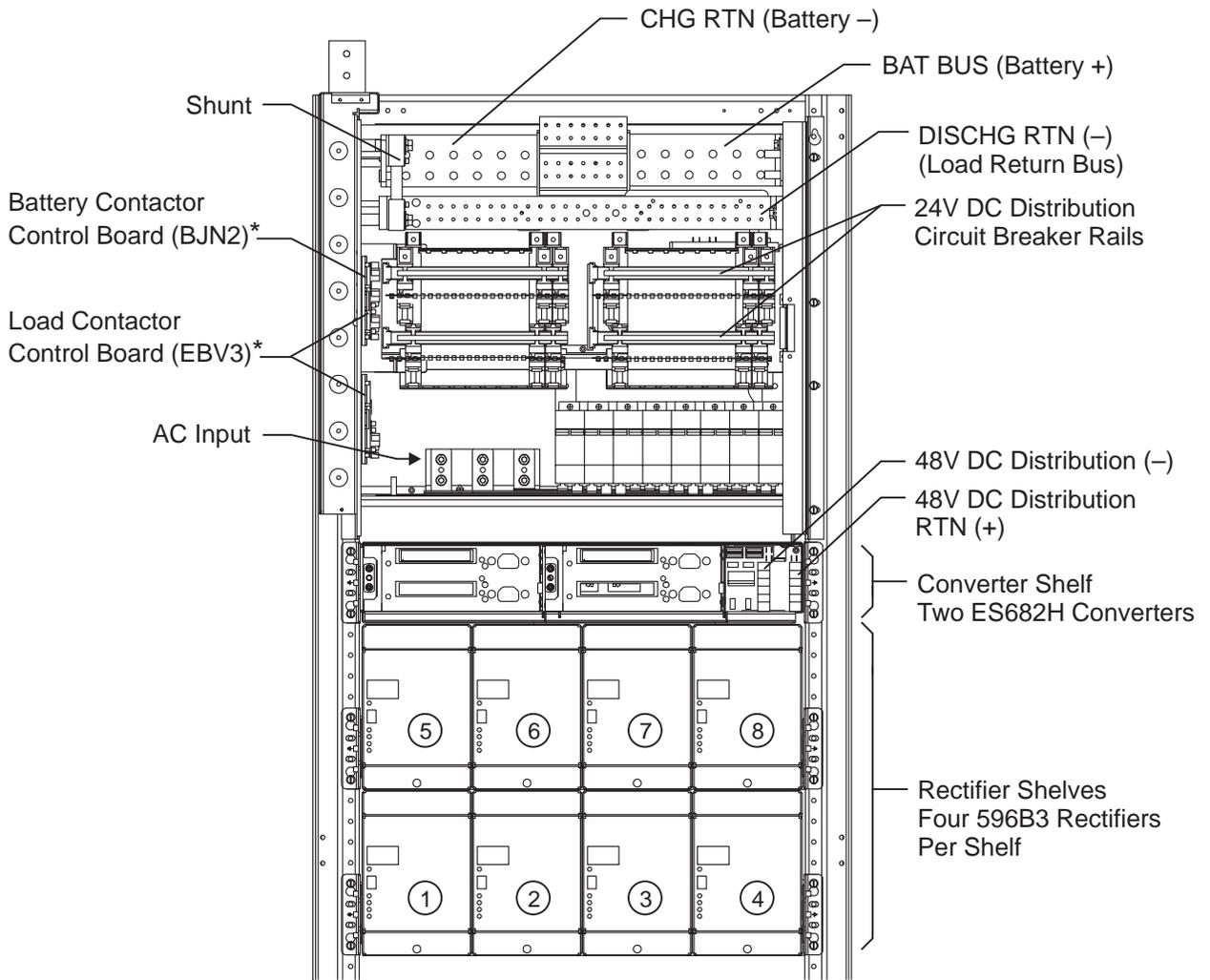
Connect eight conduit to the side for eight feed to rectifiers. See Figure 5-4. Terminate safety (earth) ground

to the appropriate termination points inside the ac box on the side. Terminate lines 1, 2, and 3 to the appropriate termination points on the Wago block. Rectifiers are numbered as shown in Figure 5-5.

6. Verify that there are no shorts or bad contacts in the service cables.
7. Turn the main ac circuit breaker on.
8. Use an ac voltmeter to check that the proper ac voltage is present.
9. Do not turn the rectifier circuit breakers on.

Table 5-A: Torque Settings

Screw Size (Metric)	Torque (Nm)	Screw Size (Inches)	Torque (in-lb)
M2	0.24	--	2
M2.5	0.48	--	4
M3	0.9	--	8
M3.5	1.4	9/64	12
M4	2	5/32	18
M5	4	10/32	35
M6	7	1/4	62
M8	18	5/16	160
M10	34	3/8	300
M12	58	1/2	513
M18	86	11/16	761



*BJN2 Contactor Control Board supplied in plants equipped with a low-voltage battery disconnect contactor.
EBV3 Contactor Control Boards supplied in plants equipped with low-voltage load disconnect contactors.

Figure 5-5: Galaxy Power System Distribution Components

Signal LEDs

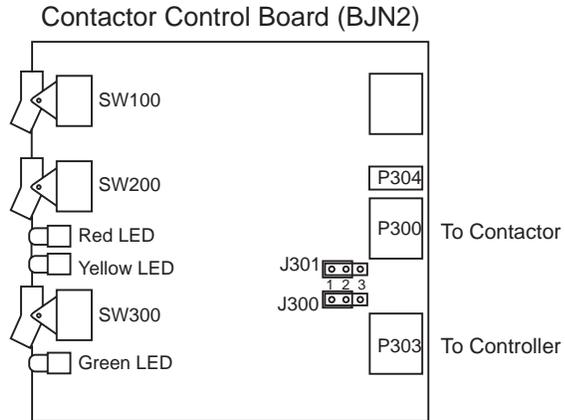
Green	Normal. SW100 - SW300 in normal position.
Yellow	Alarm condition. Controller is signalling to open the contactor.
Red	Contactor open.

Contactor Control

Contactor	SW100*	SW200*	SW300
Auto (Normal)	Up	Up	Up
Closed	x	x	Down
Open	Down	Down	Up

x - Switch position doesn't matter

*SW100 and SW200 are redundant switches. If either switch is up, the contactor will be operating in auto (normal) mode. If both switches are not in the up position however, the green LED will not be lit.



Note: Jumpers on J300 and J301 must be set on pins 1 and 2.

Signal LEDs

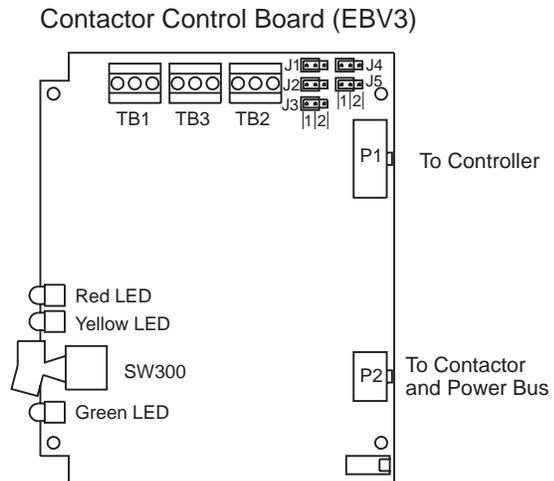
Green	Normal. SW300 in normal position.
Yellow	Alarm condition. Controller is signalling to open the contactor, or the P1 cable assembly is disconnected.
Green	Contactor open.

Contactor Control

Contactor	SW300
Auto (Normal)	Up
Closed	Down

Note 1: This switch is not meant to be used to permanently override the LVD function. It is only to be used temporarily while servicing or testing the equipment.

Note 2: When powering up the unit from an ac failure, SW300 must be in the NORMAL or up position.



Note: Jumpers on J1 through J5 must be set in position 1.

Figure 5-6: Contactor Control Board

Connecting Loads

See Figure 5-5 to locate the circuit breaker rails and the load return bus. See Figures 6, 10, H1, and H3 in the T-83324-31 drawing for additional information. Table 3-I provides terminal lug data and Table 5-A provides torque requirements. When choosing the circuit breaker size and load cables, the maximum load current, the conductor size, and circuit breaker capacity must be coordinated.

To connect the loads:

1. Verify that the ac and dc circuit breakers are off.
2. Terminate the appropriate conductors with terminal lugs as required. Use insulating sleeves.
3. Route cable as suggested in "Cable Routing Strategy."

Installing Rectifiers and Converters

The same basic procedure is used to install both rectifiers and converters in new or operational plants. In the following procedures, the term *power unit* refers to either rectifiers or converters.

1. Verify that the control switch on the front of the power unit is in the standby (STBY) position.
2. Place the power unit in the appropriate shelf assembly. Rectifiers are installed vertically. Converters are installed horizontally with the rear connector on the left. Verify the converter position by looking in the shelf before installing.
3. Using the handle, carefully slide the power unit toward the rear of the shelf assembly. Push until the unit is seated.
4. Use a 5mm (3/16-inch) Allen-head wrench to turn the recessed locking screw (located in the lower center of the power unit) clockwise until the unit is firmly seated.

Removing Rectifiers and Converters

1. Verify that the ON/STBY switch is in the standby position.
2. Use a 3/16" (5 mm) Allen-head wrench to turn the recessed locking screw counterclockwise until it turns freely.

3. Grasp the front handle and slide/pull the power unit from the plant shelf assembly. Support the rear of the unit as it slides from the shelf.

Note

Due to energy storage in the power unit, the front LEDs may remain lit after removal of dc voltage. No hazardous voltages exist on the power unit terminals during this time.

Important Note

The user must configure the Galaxy RC Controller per product manual 167-792-170.

Turning Up the Plant

To turn up the plant while using the factory default firmware and software loaded in the Galaxy Rectifier Controller, process as follows:

1. Verify that the ac source circuit breakers are turned off.
2. Verify that the plant ac and dc circuit breakers are off.
3. Install a rectifier in slot #1 (lower left side).
4. Verify that the control switch on the rectifier is in the standby (STBY) position.
5. Install all converters.
6. Using the circular switches located on the inside-right of the converter shelf door, set the converter ID numbers. Set the left switch to position 1 and the right switch to position 2.
7. Verify that the control switch on the converters is in the ON position.
8. Turn the circuit breakers that protect the 24-volt and 48-volt load boxes to ON. Set the 24-volt load to 30 amperes; set the 48-volt load to 5 amperes.
9. Turn the rectifier power switch to ON. Turn the ac source circuit breaker and the ac circuit breaker for the rectifier to ON.

10. Verify that the rectifier and converters turn on.
11. Verify the following:
 - Green normal LED is illuminated on the rectifier, converters, and contactor control boards.
 - Plant voltage is 27.24 volts.
 - Plant current is approximately 30 amperes.
 - Controller-major alarm LED is illuminated. This alarm will retire after the rectifier ID is set. (See “Setting Rectifier Slot ID.”)

***Setting Rectifier
Slot ID***

12. Set the Rectifier Slot ID numbers by using the following procedure:
 - a. Depress the top of the rectifier power switch to display the rectifier ID number on the meter. A display of 0 indicates an unconfigured status.
 - b. To establish an ID number, depress and hold the switch for approximately five seconds. The number displayed will begin to blink, indicating that a new ID can be set.
 - c. To set the ID number, depress and release the switch until the desired ID number is reached. Once reached, continue to hold the switch depressed until the display stops blinking. The new ID number is now set. **Note: Abandoning this process before the display stops blinking will default the ID to the last number set.**
13. Repeat above procedure for remaining rectifiers.

Lamp Test

1. Depress **LAMP TEST** on the controller display. Verify that the LEDs on the rectifier, converters, and controller illuminate. The LEDs extinguish after approximately 10 seconds.
2. The green normal LEDs remain illuminated on the rectifier, converters, controller, and contactor control boards.

Installing Batteries

In this section the batteries are connected to the plant. Battery (+) conductors are connected to the **battery bus**. Battery (-) conductors are connected to the **charge return bus**. See Figure 5-5 to locate the battery bus and charge return bus. See Figure H1 in the T-83324-31 drawing for additional information.

Table 3-R provides terminal lug data and Table 5-A provides torque requirements.

To install the batteries:

1. **Turn the system off.** Open the rectifier ac circuit breakers and load circuit breakers.
2. Terminate the appropriate conductors with terminal lugs as required. Use insulating sleeves.
3. Connect the bay end of the cables to the BAT bus (+) and CHG RTN (-). Next, connect the battery end of the cables. Tape the terminal lugs as required for safety during installation.
4. Use a dc voltmeter to check the voltages at the fuse holders and return bus. **Verify the polarity.**
5. **Turn the system on.** Close the rectifier ac circuit breakers and load circuit breakers protecting the rectifier and converter load boxes.
6. Monitor the charge current into the battery on the controller screen. Verify that the charge current does not exceed 100 amperes. When the battery current stabilizes (about one ampere or less) proceed to the next section.

Setting the Plant Configuration

The default plant configuration settings are based on the following criteria:

- A twelve-cell plant battery made of Unigy[®] II valve-regulated batteries with a float voltage of 2.27 volts/cell
- A low battery voltage disconnect-reconnect feature
- Battery thermal compensation feature

The default configuration settings are shown in Figure 5-9. To set these parameters for other configurations, use the procedure outlined below:

1. Press **CONFIGURE**.
2. Use the **UP** arrow to page to the desired mnemonic.
3. Press **ENTER**.
4. Set the desired parameter using the <+> and <-> keys.
5. Press **ENTER**.
6. Press **ESCAPE**.

The plant voltage should indicate 27.24 volts. All illuminated LEDs should be green.

Voltage Calibration

The plant voltages (+24 and -48) are calibrated using the following procedure:

1. Measure the plant voltage from the front panel voltage test jacks using a calibrated digital voltmeter (DVM).
2. Press **CONFIGURE**; the mnemonic **StYP** appears.
3. Using the **UP** arrow, page until the Front Panel Voltage Calibration mnemonic **FPC** appears.
4. Press **ENTER**; 27.24 volts is displayed.
5. Using the <+> and <-> arrows, set the display voltage to the voltage indicated on the DVM.
6. Press **ENTER**; the mnemonic **FSP** appears.
7. Press **ESCAPE**; the plant voltage appears on the controller display and is indicated on the DVM.

Repeat this procedure to calibrate the converter shelf output voltage using the Converter Front Panel Voltage Calibration mnemonic **CFPC**. To display the converter shelf output, press the plus <+> key. To return to the plant output, again press the plus <+> key.

Testing Plant Thresholds

The plant functions related to plant voltage are verified in the steps below. In each of these steps the plant voltage is adjusted to a new value and a plant metric is verified; e.g., an alarm occurs or a contactor operates. The plant voltage is set by pressing **CONFIGURE**, paging to **FSP**, pressing **ENTER**, setting the new voltage, again pressing **ENTER**, and pressing **ESCAPE**. The alarms appear on the controller display and as front panel LEDs. To view the alarms, press the **VIEW ACTIVE ALARMS** key. When multiple active alarms have occurred, press the **UP** or **DOWN** arrow to page through the alarm mnemonic display. The alarm screen must be refreshed to reflect all changes in alarm status. To refresh the screen, push the **VIEW ACTIVE ALARMS** key twice. Figure 5-7 shows the front panel of the Galaxy Rectifier Controller, Figure 5-8 shows the controller alarm information, and Figures 5-9.1 and 5.9.2 show the configuration information.

1. Using the procedure outlined in “Setting the Plant Configuration,” set the Contactor 1 low voltage disconnect threshold C1Ld to 22.50 volts and the Contactor 1 low voltage reconnect threshold C1Lr to 24.00 volts. Set the high voltage float threshold (FHO) to 27.90.
2. Verify that the plant voltage is set to 27.24 volts.
3. Reduce the plant load to less than 10 amperes. The load circuit breakers may be turned off during these tests.
4. Increase the plant voltage to 27.75 volts. Verify that the **REC** and **MIN** alarm LEDs illuminate and the controller alarms screen indicates **HFO** (high float voltage).
5. Increase the plant voltage (**FSP**) to 28.00. Verify that the **REC** and **MAJ** alarm LEDs illuminate and the controller alarms screen indicates **HO** (high voltage). Note that the rectifier does not shut down because its output current does not meet the 10-ampere criteria. High voltage shutdown is verified using the procedure in “High Voltage Shutdown.”
6. Reduce the plant voltage to 27.24 volts. Verify that all alarms retire and the green normal LEDs illuminate.
7. Reduce the plant voltage to 25.53 volts. Verify that the **BD** and **MAJ** alarm LEDs illuminate and the controller alarms screen indicates **bod** (battery on discharge).

8. Reduce the plant voltage to 22.75 volts. Verify that the **BD**, **BATT**, and **MAJ** alarm LEDs are illuminated and that the controller alarms screen indicates **LLO** (very low voltage).
9. Carefully reduce the plant voltage to 22.00 volts. Verify that the battery disconnect contactor operates, the **BD**, **BATT**, and **MAJ** alarm LEDs are illuminated, and the controller alarms screen indicates **CIO** (contactor #1 open).
10. Increase the plant voltage to 23.50 volts. Verify that the **LLO** alarm retires.
11. Increase the plant voltage to 24.50 volts. Verify that the battery disconnect contactor closes and the **BATT** alarm retires.
12. Increase the plant voltage to 26.80 volts. Verify that the **BD** alarm retires.
13. Return the plant voltage to 27.24 volts.
14. The Contactor 1 Low Voltage Disconnect Threshold is set to 22.50 volts and the Low Voltage Reconnect Threshold is set to 24.00 volts. **Reset these settings** to the default requirements. See Items 17 and 18 in Figure 5-9.1.

***Testing Rectifiers
and Load Share***

1. Verify that the plant load is less than 100 amperes.
2. Turn all but one of the rectifiers to STBY.
3. Increase the plant load until the rectifier current is 100 amperes.
4. Turn a second rectifier on; after approximately 10 seconds, verify that the two rectifiers share the load.
5. Turn the first rectifier to STBY; verify that the second rectifier supports the 100-ampere load.
6. Repeat the procedure until all rectifiers have been tested.

7. Turn all rectifiers on. Verify that the rectifiers load share so that the maximum difference in the rectifier output currents is less than or equal to 10 amperes.
8. Reduce the plant load. Verify that the rectifiers continue to share the load.

**Testing
Temperature
Compensation**

1. If thermal probes are installed, heat one of the probes to simulate a battery operating at high temperature.
2. Verify that the plant voltage is reduced from the nominal float voltage value as the thermal probe is heated. Verify that the Temperature Compensation LED illuminates.
3. Allow the thermal probe to cool and verify that the plant voltage returns to the nominal value. Verify that the Temperature Compensation LED extinguishes.

**Testing
Additional
Alarms**

Operation of the following alarms may be verified while the plant operates at float voltage.

1. Turn off the ac circuit breaker for rectifier #1. Verify that the **AC** and **MIN** alarm LEDs illuminate, the rectifier displays **ACF**, and the controller alarms screen indicates **ACF** (ac fail). Turn the circuit breaker on. Verify that the rectifier starts and the alarms retire.
2. Repeat Step 1 for the remaining rectifiers.
3. Turn off the ac circuit breakers for rectifiers #1 and #2. Verify that the **AC** and **MAJ** alarm LEDs illuminate, the rectifiers display **ACF**, and the controller alarms screen indicates **nACF** (multiple ac fails). Turn the circuit breakers on. Verify that the rectifiers start and the alarms retire.
4. Repeat Step 3 for all other combinations of rectifiers.
5. Repeat Steps 1 through 4. Instead of turning the rectifiers off using circuit breakers, use the rectifier ON/STBY switch to remove the rectifiers from service. Verify that the **RECT** and **MIN** alarm LEDs illuminate, but **ACF** does not appear on the rectifiers. The controller alarm screen indicates **rOFF** (rectifier manual off).

6. Turn converter #1 from ON to STBY. Verify that the **RECT** and **MIN** alarm LEDs illuminate and the controller alarms screen indicates **CFA** (converter failure). Also, verify the Converter Fail LED is illuminated on the converter shelf door. Turn the converter on and verify that the converter starts and the alarm retires.
7. Repeat Step 6 for all installed converters.
8. Turn two converters from ON to STBY. Verify that the **RECT** and **MAJ** alarm LEDs illuminate and the controller alarms screen indicates **nCFA** (multiple converter failures). The **Fail** alarm LED illuminates on the converter shelf. Turn the converters on and verify that the converters start and the alarms retire.
9. Repeat Step 8 for all installed converters.
10. Simulate a load circuit breaker alarm by shorting the alarm contacts on the +24V circuit breaker bus. Verify that the **DIST** and **MAJ** alarm LEDs illuminate and the controller alarms screen indicates **FAJ** (fuse failure major) for the 24-volt distribution.
11. Simulate a load circuit breaker alarm by placing a blown GMT fuse into the -48V distribution panel of the converter shelf assembly. Verify that the **DIST** LED on the converter shelf is illuminated, the **MAJ** and **DIST** alarm LEDs are illuminated on the controller, and **cdSt** (converter distribution fuse failure - major) for the 48-volt distribution is displayed on the controller screen.
12. Use the battery contactor control switches to force the battery disconnect contactor open. Verify that the **MIN** alarm LED illuminates and the controller alarms screen indicates **CIF** (contactor 1 failure). Verify that the red and yellow LEDs illuminate on the contactor control board. Return the control switches to normal.
13. **Reset** switches SW100 and SW200 to the default position.

**Testing High
Voltage
Shutdown**

Exhaustive testing of the plant high voltage shutdown and restart features was completed during system integration testing in the factory. The following procedure tests the operation status of

this system. For additional information consult the Galaxy Rectifier Controller product manual.

1. Set the plant load to 20 amperes.
2. Turn all but one rectifier to STBY.
3. Increase the plant voltage to 27.75 volts. Verify that the MIN and RECT LEDs illuminate and the controller alarms screen indicates HFO (high float output).
4. Increase the plant voltage to 28.00 volts. Verify that the rectifier shuts down. Immediately after the rectifier shuts down, return the plant to the float voltage. Verify that the rectifier restarts. Return the high voltage float threshold (HFO) to 28.24 (default value) through the Configuration menu.

Discharge Test

To verify the reserve time expected from the batteries, a simple discharge test may be conducted before the telecommunication loads are applied to the plant. For this, turn the plant off at the main ac circuit breaker panel. Allow the plant to discharge until the battery disconnect contactor opens. At this point the plant may be turned on and batteries allowed to charge until the battery current is reduced to one ampere or less. The plant is now ready to be placed in service.

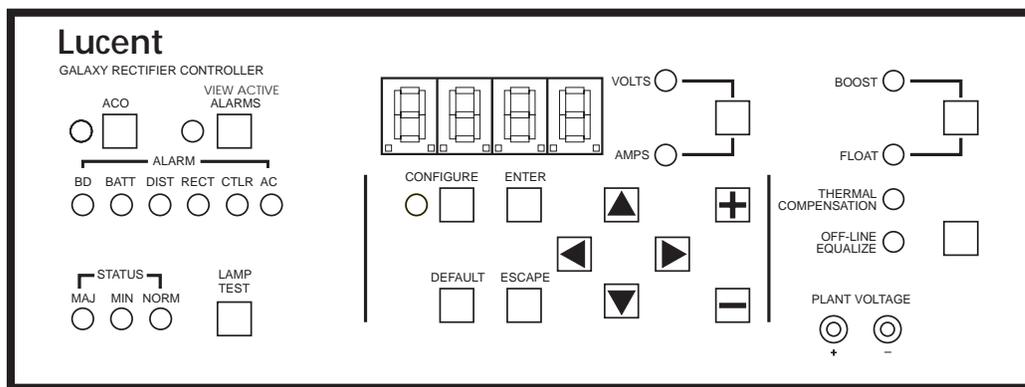


Figure 5-7: Front Panel of Galaxy Rectifier Controller

NUM	ID	MNEM	Description	Alarm Status	BMW LED	BMU Relay
0	nonE	nonE	No Active Alarms Present	Norm	NORM	None
1	LLO	LLO	Very Low Voltage	Major	BATT	VLV
2	bod	bod	Battery on Discharge	Major	BD	BD
3	HFO	HFO	High Float Voltage	Minor	RECT	HFV
4	HO	HO	High Voltage	Major	RECT	HV
5	SEnS	SEnS	Voltage Sense Fuse Alarm	Major	CTLR	CTLR
6	ACF	ACF	AC Fail	Minor	AC	ACF
7	nACF	nACF	Multiple AC Fail	Major	AC	ACF
8	rFA	rFA	Rectifier Fail	Minor	RECT	RFA
9	nRFA	nRFA	Multiple Rectifier Fail	Major	RECT	MRFA / RFA
10	rid	rid	Invalid Rectifier ID	Major	RECT	None
11	rOFF	rOFF	Rectifier Manual Off Alarm	Minor	RECT	None
12	rHPA	rHPA	Rectifier Half Power Alarm	Minor	RECT	None
13	rPHA	rPHA	Rectifier Phase Alarm	Minor	AC	None
14	rOS	rOS	Rectifier On Standby Due To Engine Transfer	Minor	RECT	None
15	EtO	EtO	Engine Time Out	Minor	AC	None
16	CFA	CFA	Converter Fail	Minor	RECT	AUX
17	nCFA	nCFA	Multiple Converter Fail	Major	RECT	AUX
18	Cid	Cid	Invalid Converter ID	Major	RECT	None
19	CdSt	CdSt	Converter Distribution Alarm	Major	DIST	MJF
20	FAJ	FAJ	Major Fuse	Major	DIST	MJF
21	FAn	FAn	Minor Fuse	Minor	DIST	MNF
22	AUJ	AUJ	Auxiliary Major	Major	None	None
23	AUn	AUn	Auxiliary Minor	Minor	None	None
24	Abs	Abs	Alarm Battery Source Fuse Alarm	Major	CTLR	CTLR
25	OS	OS	Open String	Minor	BATT	None
26	C1O	C1O	Contactor 1 Open	Minor	None	None
27	C1F	C1F	Contactor 1 Failed	Minor	None	LVDF
28	C2O	C2O	Contactor 2 Open	Minor	None	None
29	C2F	C2F	Contactor 2 Failed	Minor	None	LVDF
30	btA	btA	Battery Thermal Alarm	Major	BATT	None
31	tPA	tPA	Temperature Probe Failure	Minor	CTLR	CTLR
32	Erc	Erc	Enhanced RC Failure	Major	CTLR	CTLR

Figure 5-8: Galaxy Rectifier Controller Alarm Identification

NUM	ID	MNEM	Description	Range	Default
1	StYP	StYP	Shunt Type	0 to 2 (0=none, 1=plant, 2=battery)	2
2	SH1A	SH1A	Shunt 1 Size	0 to 9999A (0=disable, other=shunt rated amps)	800
3	SH2A	SH2A	Shunt 2 Size	0 to 9999A (0=disable, other=shunt rated amps)	0
4	FSP	FSP	Plant Float Set Point	22 to 28V, 44 to 56V	27.24, 54
5	FCL	FCL	Rectifier Float Current Limit	30 to 110%	100
6	FHO	FHO	High Voltage Float Threshold	25 to 30V, 50 to 60V	28.24, 57
7	FHFO	FHFO	High Float Voltage Float Threshold	25 to 30V, 50 to 60V	27.74, 56
8	Fbd	Fbd	Battery on Discharge Threshold	23 to 27.5V, 46 to 55V	25.54, 51.1
9	LLO	LLO	Very Low Voltage Threshold	20 to 25.5V, 40 to 51V	23, 46
10	btAt	btAt	Battery Thermal Alarm Threshold	30 to 85 Deg C	55
11	btSt	btSt	Battery Thermal Step Temperature	45 to 85 Deg C	75
12	btut	btut	Battery Thermal Slope Upper Temperature	30 to 55 Deg C	45
13	btnt	btnt	Battery Thermal Slope Nominal Temperature	15 to 30 Deg C	25
14	btLt	btLt	Battery Thermal Slope Lower Temperature	-5 to 20 Deg C	0
15	btLE	btLE	Battery Thermal Slope Lower Enable	0 to 1 (0=disable, 1=enable)	0
16	btEn	btEn	Battery Thermal Compensation Enable	0 to 1 (0=disable, 1=enable)	0
17	C1Ld	C1Ld	Contactactor 1 Low Voltage Disconnect Threshold	20 to 26V, 40 to 52V	21, 43.2
18	C1Lr	C1Lr	Contactactor 1 Low Voltage Reconnect Threshold	20 to 26V, 40 to 52V	22.2, 44.4
19	C1Hd	C1Hd	Contactactor 1 High Voltage Disconnect Threshold	25-30V, 52 to 60V	29, 56.4
20	C1Hr	C1Hr	Contactactor 1 High Voltage Reconnect Threshold	25-30V, 52 to 60V	28.5, 55.6
21	C1HE	C1HE	Contactactor 1 High Voltage Disconnect Enable	0 to 1 (0=disable, 1=enable)	0
22	C1tY	C1tY	Contactactor 1 Type	0 to 2 (0=none, 1=load, 2=battery)	0
23	C2Ld	C2Ld	Contactactor 2 Low Voltage Disconnect Threshold	20 to 26V, 40 to 52V	21, 43.2
24	C2Lr	C2Lr	Contactactor 2 Low Voltage Reconnect Threshold	20 to 26V, 40 to 52V	22.2, 44.4
25	C2Hd	C2Hd	Contactactor 2 High Voltage Disconnect Threshold	25-30V, 52 to 60V	29, 56.4
26	C2Hr	C2Hr	Contactactor 2 High Voltage Reconnect Threshold	25-30V, 52 to 60V	28.5, 55.6
27	C2HE	C2HE	Contactactor 2 High Voltage Disconnect Enable	0 to 1 (0=disable, 1=enable)	0
28	C2tY	C2tY	Contactactor 2 Type	0 to 2 (0=none, 1=load, 2=battery)	0
29	bSP	bSP	Plant Boost Set-Point	24 to 30V, 48 to 60V	27.24, 55.2
30	bCL	bCL	Rectifier Boost Current Limit	30 to 110%	100
31	bHO	bHO	High Voltage Boost Threshold	26 to 30V, 52 to 60V	28.24, 57
32	bHFO	bHFO	High Float Voltage Boost Threshold	25 to 30V, 50 to 60V	27.74, 56.2
33	bbd	bbd	Battery on Discharge Threshold	23 to 27.5V, 46 to 55V	25.54, 52

Figure 5-9.1: Galaxy Rectifier Controller Configuration Parameters (1 of 2)

NUM	ID	MNEM	Description	Range	Default
34	bAF	bAF	Boost Auto Mode Factor	0 to 9 (0=disable or 1-9 times BD duration)	0
35	bEn	bEn	Boost Enable	0 to 1 (0=disable, 1=enable)	0
36	CSP	CSP	Converter Voltage Set-Point	48 to 54V	50
37	CLd	CLd	Converter Low Voltage Disconnect Threshold	20 to 25V	21
38	CLr	CLr	Converter Low Voltage Reconnect Threshold	20 to 25V	23
39	CLdE	CLdE	Converter Low Voltage Disconnect Enable	0 to 1 (0=disable, 1=enable)	0
40	CFPC	CFPC	Converter Front Panel Voltage Calibration	48 to 54V	Converter V
41	FPC	FPC	Front Panel Voltage Calibration	22-28V, 44 to 56V	Plant V
42	SH1C	SH1C	Front Panel Shunt 1 Calibration	0 to 9999A	Shunt 1 A
43	SH2C	SH2C	Front Panel Shunt 2 Calibration	0 to 9999A	Shunt 2 A
44	USL	USL	Update Serial Link and Clear Alarms	0 to 1 (0=do nothing, 1=update)	0
45	id	id	Identifiers Enable	0 to 1 (0=numeric, 1=alphanumeric)	1
46	rEL	rEL	Display Software Release		

Figure 5-9.2: Galaxy Rectifier Controller Configuration Parameters (2 of 2)

6 *Maintenance*

Safety Warnings

Review all safety instructions and warnings before maintaining or troubleshooting the GPS 2408.

Warnings

The modules intended for use in the GPS plant are not suitable as disconnect means and the spacings of the shelf backplane do not provide adequate spacing to act as a disconnect means.

Hazardous voltage exists throughout this equipment and extreme care should be taken when working on any output circuit.

AC input voltages are provided to the GPS via multiple input cables. Ensure that the circuit protector for each ac input is disconnected while installing or servicing this equipment.

Power Unit Fans

The expected life of the rectifier and converter fans at 25° C (77° F) is seven years. The fans in the power modules may be replaced in the field without opening the power unit. When a fan fails, the power unit shuts down and issues a power unit alarm and a thermal alarm.

Maintenance Two approaches can be taken to fan maintenance.

1. The first approach is to replace the fans on a routine basis every five years; this ensures that the fans do not fail in the field under normal operating conditions. This approach is appropriate when there are no remote alarm facilities at the site.

2. The second approach, if there is remote alarm capability, is to wait until a fan fails. The power unit will safely shut down and issue both a fail alarm and a thermal alarm. The fan assembly can then be replaced. Since it is likely that all the power units in that installation are approximately the same age, all power unit fans at that site should be replaced at that time. The approach used depends on the convenience of the site and the monitoring of alarms used at the site.

***Converter Fan
Replacement
Procedure***

1. Using the Allen wrench provided, remove the power unit from the system.
2. Remove the screw holding the fan cradle assembly onto the bottom of the chassis.
3. Separate the fan cradle assembly from the chassis.
4. Unplug the connectors on the old fans from the power unit.
5. Plug in fan connectors on the new fan cradle.
6. Reattach fan cradle assembly to chassis bottom panel using one screw.
7. Replace and restore ac service according to the procedures outlined in Section 5.

***Rectifier Fan
Replacement
Procedure***

1. Using the Allen wrench provided, remove the power unit from the system.
2. Remove the six screws holding the front cover onto the rectifier.
3. Separate the fan cradle assembly from the chassis.
4. Unplug the connectors to the rectifier.
5. Remove the screws securing the fan to the front cover.
6. Attach the new fan onto the front cover using the screws.
7. Reconnect the connectors to the front cover.
8. Reposition the front cover on the rectifier.
9. Replace the six screws.

7 *Troubleshooting*

Safety Warnings

Review all safety instructions and warnings before troubleshooting the GPS 2408.

Warning

The modules intended for use in the GPS plant are not suitable as disconnect means and the spacings of the shelf backplane do not provide adequate spacing to act as a disconnect means.

Note: Before working on any output circuit, turn off ac service circuit breakers to the rectifier shelves and turn off load circuit breakers. Disconnect batteries.

Warning

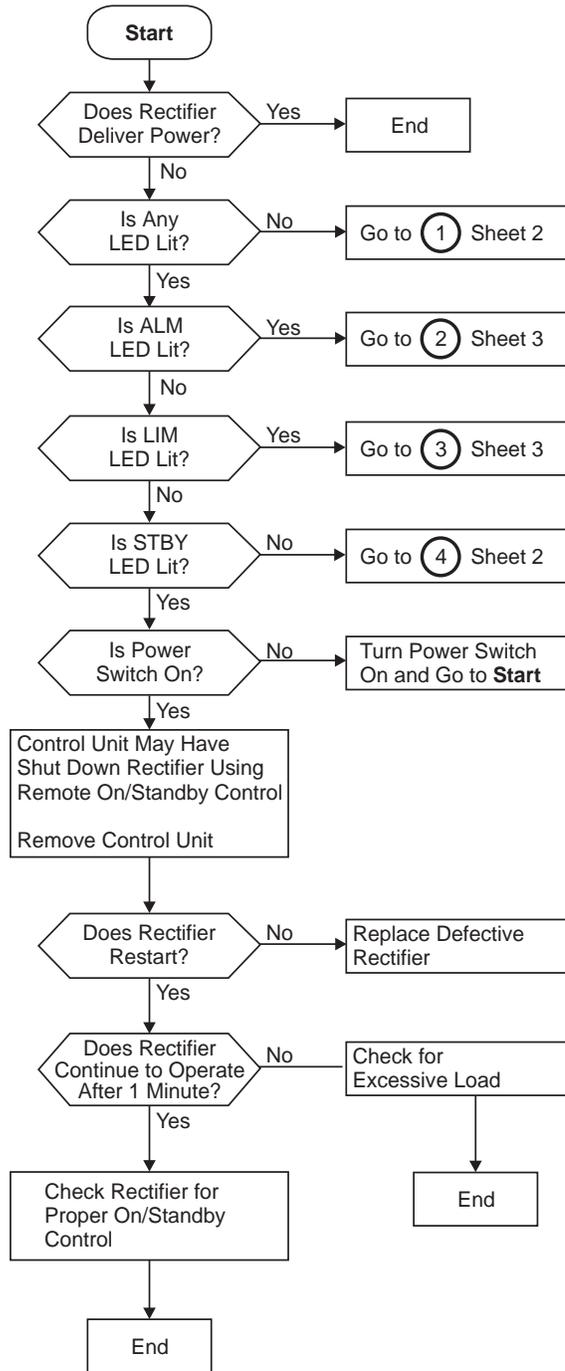
AC input voltages are provided to the GPS via multiple input cables. Ensure that the circuit protector for each ac input is disconnected while installing or servicing this equipment.

The following flowcharts list indications and the corrective action(s) to take when a rectifier or converter does not deliver power. Match specific site conditions to those listed in the chart. If none of these corrective actions remedies the problem, call your local RTAC representative at 1-800-CAL-RTAC (1-800-225-7822).

Troubleshooting Flowcharts

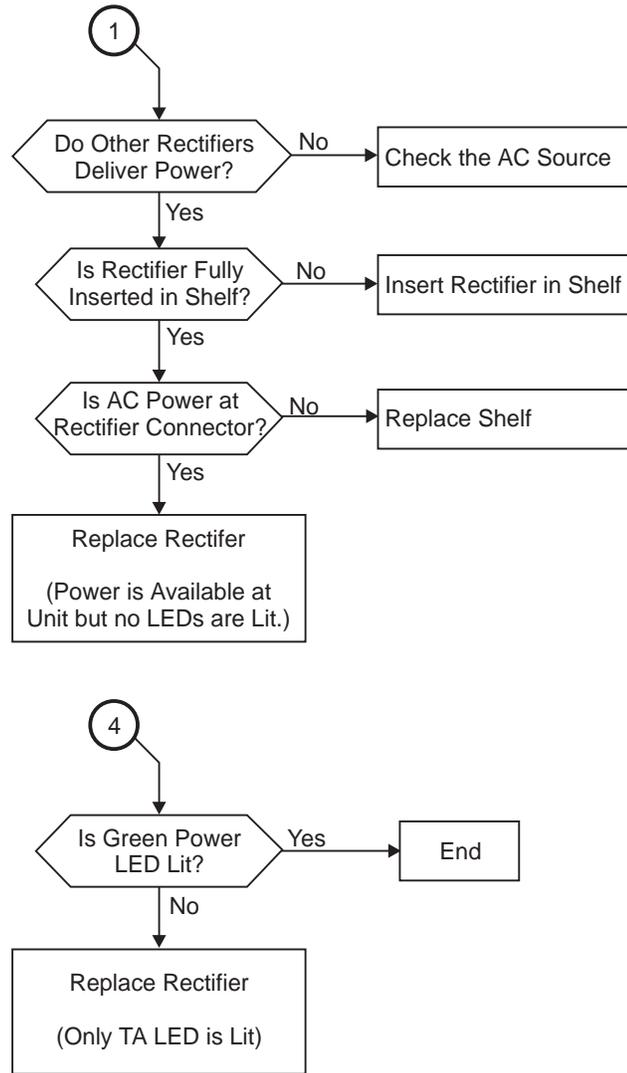
Figures 7-1.1 through 7-1.3 are troubleshooting flowcharts for the 596B3 rectifier. Figures 7-2.1 through 7-2.3 are troubleshooting flowcharts for the ES682H converter.

Rectifier



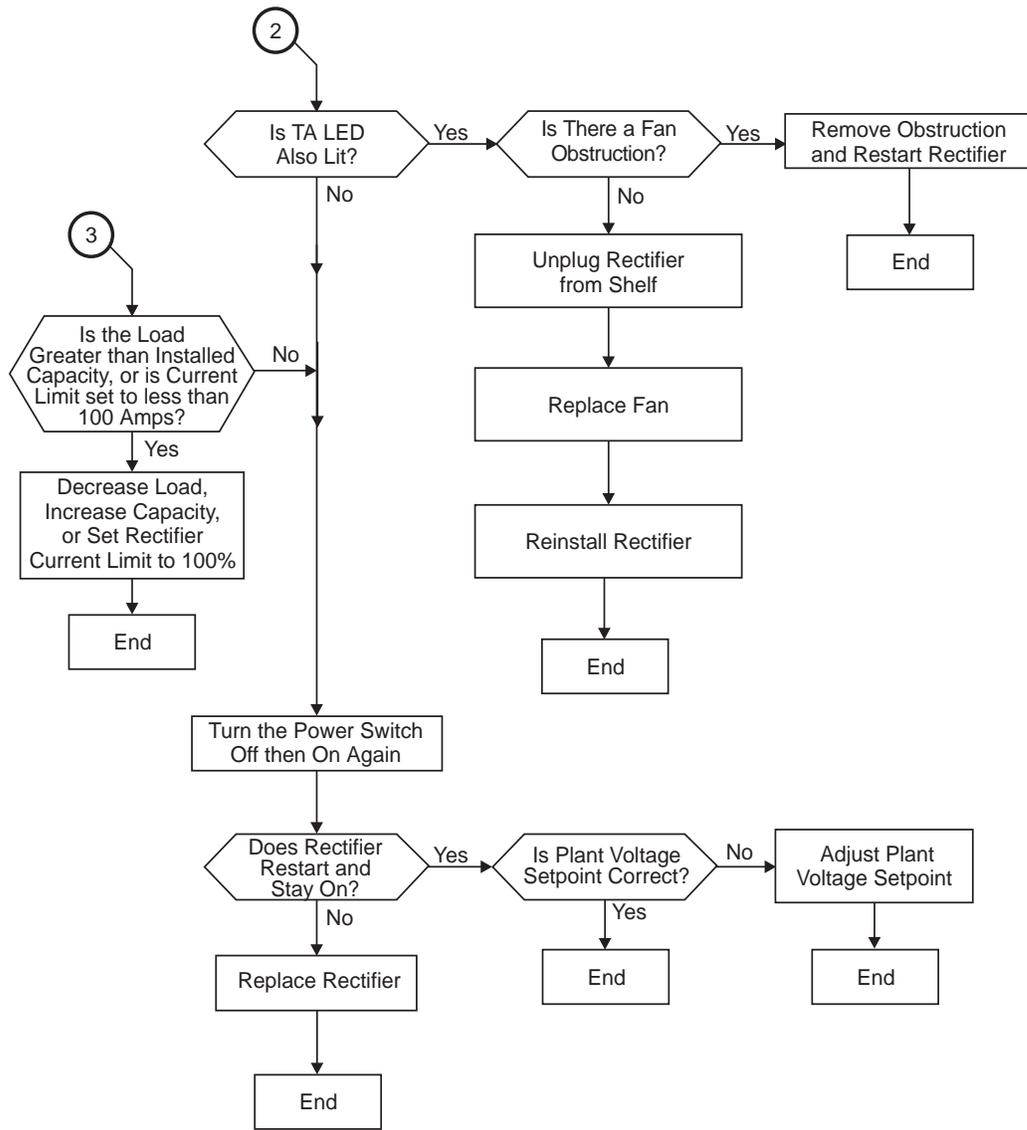
Sheet 1

Figure 7-1.1: Rectifier Troubleshooting Flowchart (Sheet 1 of 3)



Sheet 2

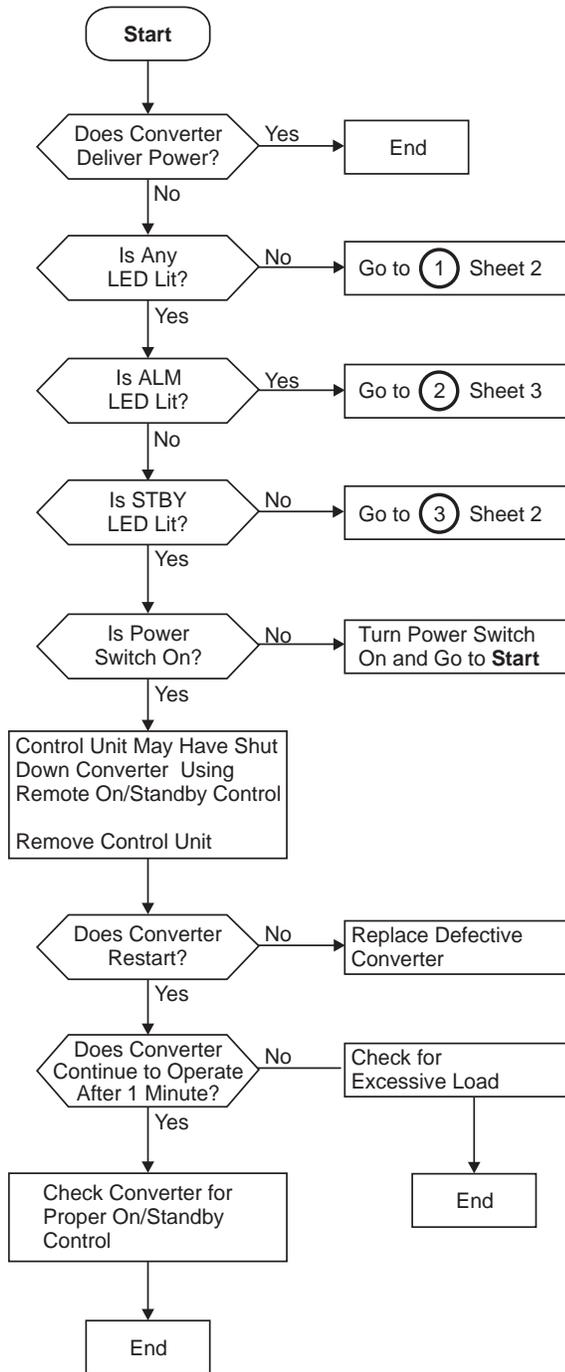
Figure 7-1.2: Rectifier Troubleshooting Flowchart (Sheet 2 of 3)



Sheet 3

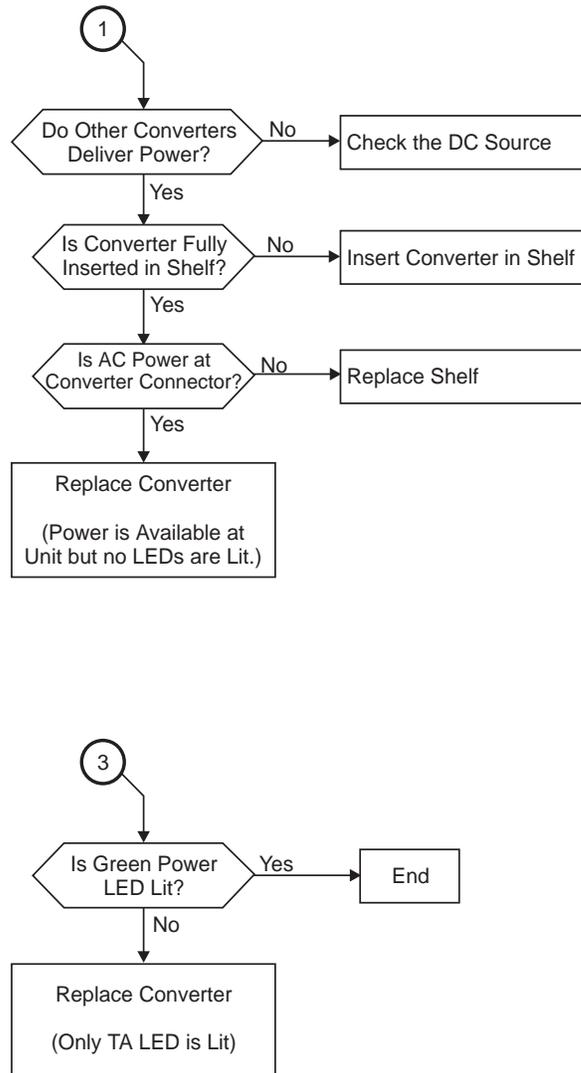
Figure 7-1.3: Rectifier Troubleshooting Flowchart (Sheet 3 of 3)

Converter



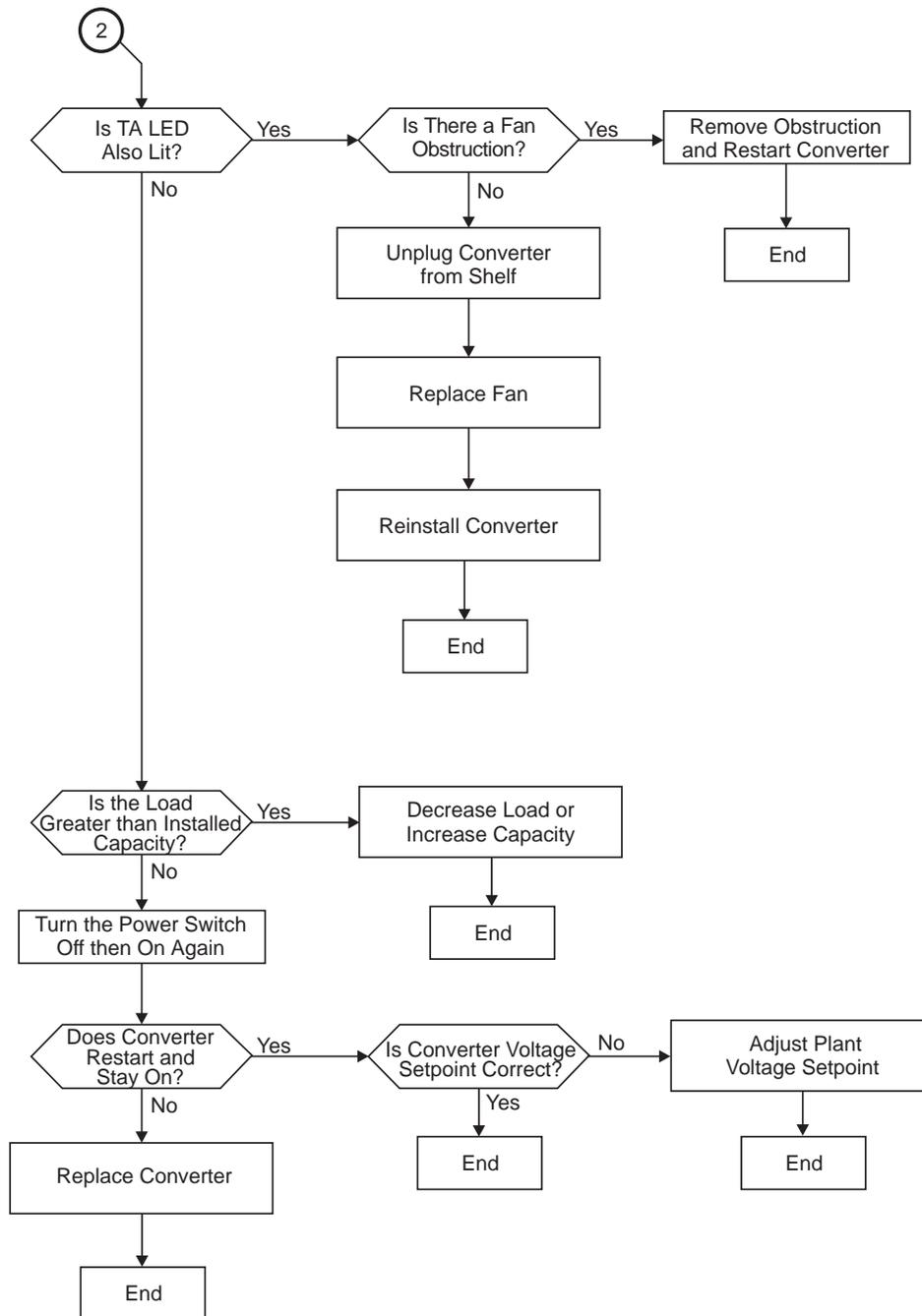
Sheet 1

Figure 7-2.1: Converter Troubleshooting Flowchart (Sheet 1 of 3)



Sheet 2

Figure 7-2.2: Converter Troubleshooting Flowchart (Sheet 2 of 3)



Sheet 3

Figure 7-2.3: Converter Troubleshooting Flowchart (Sheet 3 of 3)

8 *Product Warranty*

A. Seller warrants to Customer only, that:

1. As of the date title to Products passes, Seller will have the right to sell, transfer, and assign such Products and the title conveyed by Seller shall be good.
2. Upon shipment, Seller's Manufactured Products will be free from defects in material and workmanship, and will conform to Seller's specifications or any other agreed-upon specification referenced in the order for such Product.
3. With respect to Vendor items, Seller, to the extent permitted, does hereby assign to Customer the warranties given to Seller by its Vendor of such Vendor Items, such assignment to be effective upon Customer's acceptance of such Vendor Items. With respect to Vendor items recommended by Seller in its specifications for which the Vendor's warranty cannot be assigned to Customer, or if assigned, less than Sixty (60) days remain of the Vendor's warranty or warranty period when the Vendor's items are shipped to Customer or when Seller submits its notice of completion of installation if installed by Seller, Seller warrants that such Vendor's items will be free from defects in material and workmanship on the date of shipment to Customer. In such an event, the applicable Warranty Period will be sixty (60) days.

B. The Warranty Period listed below is applicable to Seller's Manufactured Products furnished pursuant to this Agreement, unless otherwise stated:

Warranty Period

Product Type	New Product	Repaired Product or Part*
Central Office Power Equipment**	24 Months	6 Months

*The Warranty Period for a repaired Product or part thereof is as listed or, in the case of Products under Warranty, is the period listed or the unexpired term of the new Product Warranty Period, whichever is longer.

**The Warranty Period for Products ordered for Use in Systems or equipment Manufactured by and furnished by Seller is that of the initial Systems or equipment.

C. If, under normal and proper use during the applicable Warranty Period, a defect or nonconformity is identified in a Product and Customer notifies Seller in writing of such defect or nonconformity promptly after Customer discovers such defect or nonconformity and follows Seller's instructions regarding return of defective or nonconforming Products, Seller shall, at its option, attempt first to repair or replace such Product without charge at its facility or, if not feasible, provide a refund or credit based on the original purchase price and installation charges if installed by Seller. Where Seller has elected to repair a Seller's Manufactured Product (other than Cable and Wire Products) that has been installed by Seller and Seller ascertains that the Product is not readily returnable for repair, Seller will repair the Product at Customer's site.

With respect to Cable and Wire Products manufactured by Seller which Seller elects to repair but which are not readily returnable for repair, whether or not installed by Seller, Seller at its option, may repair the cable and Wire Products at Customer's site.

D. If Seller has elected to repair or replace a defective Product, Customer shall have the option of removing and reinstalling or having Seller remove and reinstall the defective or nonconforming Product. The cost of the removal and the reinstallation shall be borne by Customer. With respect to Cable and Wire Products, Customer has the further responsibility, at its expense, to make the Cable and Wire Products accessible for repair or replacement and to restore the site. Products returned for repair or replacement will be

accepted by Seller only in accordance with its instructions and procedures for such returns. The transportation expense associated with returning such Product to Seller shall be borne by Customer. Seller shall pay the cost of transportation of the repair or replacing Product to the destination designated by Customer within the Territory.

- E. The defective or nonconforming Products or parts which are replaced shall become Seller's property.
- F. If Seller determines that a Product for which warranty service is claimed is not defective or nonconforming, Customer shall pay Seller all costs of handling, inspecting, testing, and transportation and, if applicable, traveling and related expenses.
- G. Seller makes no warranty with respect to defective conditions or nonconformities resulting from actions of anyone other than Seller or its subcontractors, caused by any of the following: modifications, misuse, neglect, accident, or abuse; improper wiring, repairing, splicing, alteration, installation, storage, or maintenance; use in a manner not in accordance with Seller's or Vendor's specifications or operating instructions, or failure of Customer to apply previously applicable Seller modifications and corrections. In addition, Seller makes no warranty with respect to Products which have had their serial numbers or month and year of manufacture removed, altered, or with respect to expendable items, including, without limitation, fuses, light bulbs, motor brushes, and the like.

THE FOREGOING WARRANTIES ARE EXCLUSIVE AND ARE IN LIEU OF ALL OTHER EXPRESS AND IMPLIED WARRANTIES, INCLUDING BUT NOT LIMITED TO WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. CUSTOMER'S SOLE AND EXCLUSIVE REMEDY SHALL BE SELLER'S OBLIGATION TO REPAIR, REPLACE, CREDIT, OR REFUND AS SET FORTH ABOVE IN THIS WARRANTY.

© 1998 Lucent Technologies
All Rights Reserved
Printed in U.S.A.