



Galaxy Power System 4812/24
(GPS 4812/24)
H569-436

User's Guide
Select Code 167-792-161
Comcode 108313057
Issue 9
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Notice:

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1 Introduction

GPS 4812/24

Overview

Lineage Power developed the Galaxy Power System (GPS) 4812/24 to support -48 volt telecommunications powering solutions in worldwide markets. The GPS 4812/24 combines 55-ampere and 110-ampere, fan-cooled, switchmode rectifiers, microprocessor control technologies, battery and load disconnect/reconnect options, and a comprehensive line of fuse and circuit breaker dc distribution options in a modular front-access design. This modularity ensures easy access, simplified installation and maintenance, and allows the system to expand in capacity and features as power needs grow.

With 7,040-ampere maximum capacity, distribution flexibility, and universal ac input capability, the GPS 4812/24 supports switching, transmission, and wireless applications in central office locations and environmentally controlled remote sites (huts or vaults).

The main emphasis of this manual is to provide a general product description that will familiarize the user with the main components of the system and to provide guidelines for the basic maintenance of this Galaxy Power System.

Note

Prior to Issue 6 of this manual, the GPS 4812/24 cabinet had a metal door and the Galaxy Vector Controller consisted of a BIC3 board. For information on these systems, see Issue 5 of this manual.

Illustrations

Figures 1-1 and 1-2 illustrate the GPS 4812/24 half height and full height cabinets.

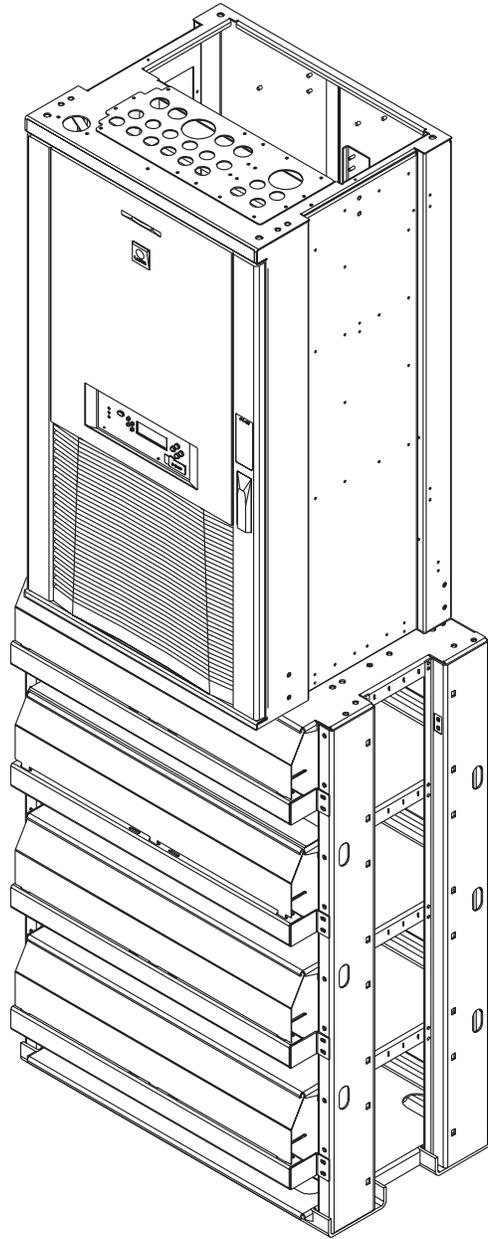


Figure 1-1: GPS 4812/24 Half Height Initial Cabinet (with Battery Stand)

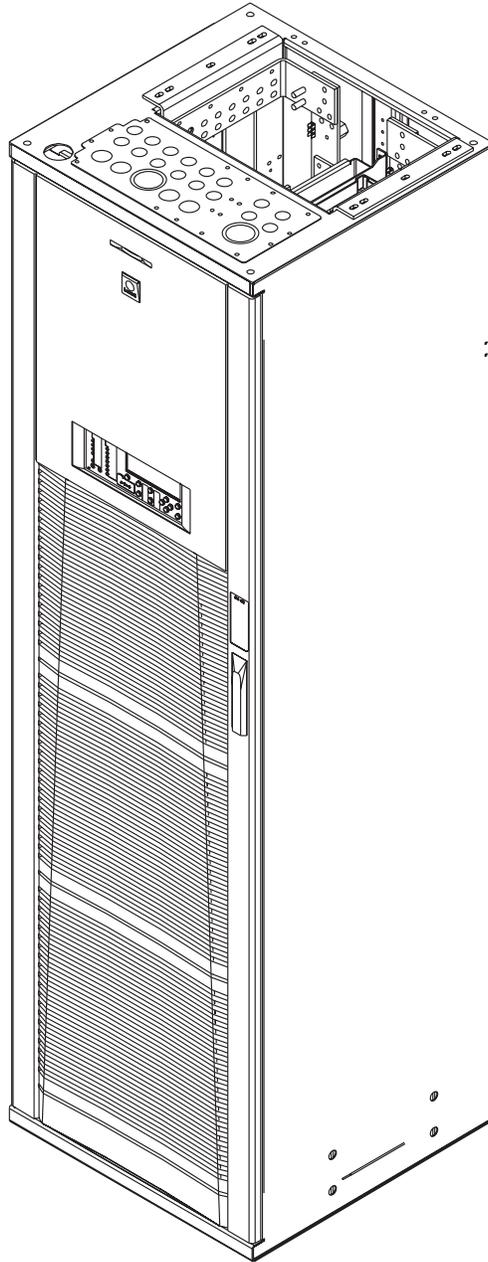


Figure 1-2: GPS 4812/24 Full Height Initial Cabinet

Customer Service Contacts

Customer Service, Technical Support, Product Repair and Return, and Warranty Service

For customers in the United States, Canada, Puerto Rico, and the US Virgin Islands, call 1-800-THE-1PWR (1-800-843-1797). This number is staffed from 7:00 am to 5:00 pm Central Time (zone 6), Monday through Friday, on normal business days. At other times this number is still available, but for emergencies only. Services provided through this contact include initiating the spare parts procurement process, ordering documents, product warranty administration, and providing other product and service information.

For other customers worldwide the 800 number may be accessed after first dialing the AT&T Direct country code for the country where the call is originating, or you may contact your local field support center or your sales representative to discuss your specific needs.

Customer Training

Lineage Power 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.

Downloads and Software

To download the latest product information, product software and software upgrades, visit our web site at <http://www.lineagepower.com>

2 System Description

Overview

Block Diagram

A basic block diagram of the Galaxy Power System 4812/24 is shown in Figure 2-1. It illustrates the arrangement and interconnections of the system components from the ac input to the dc output.

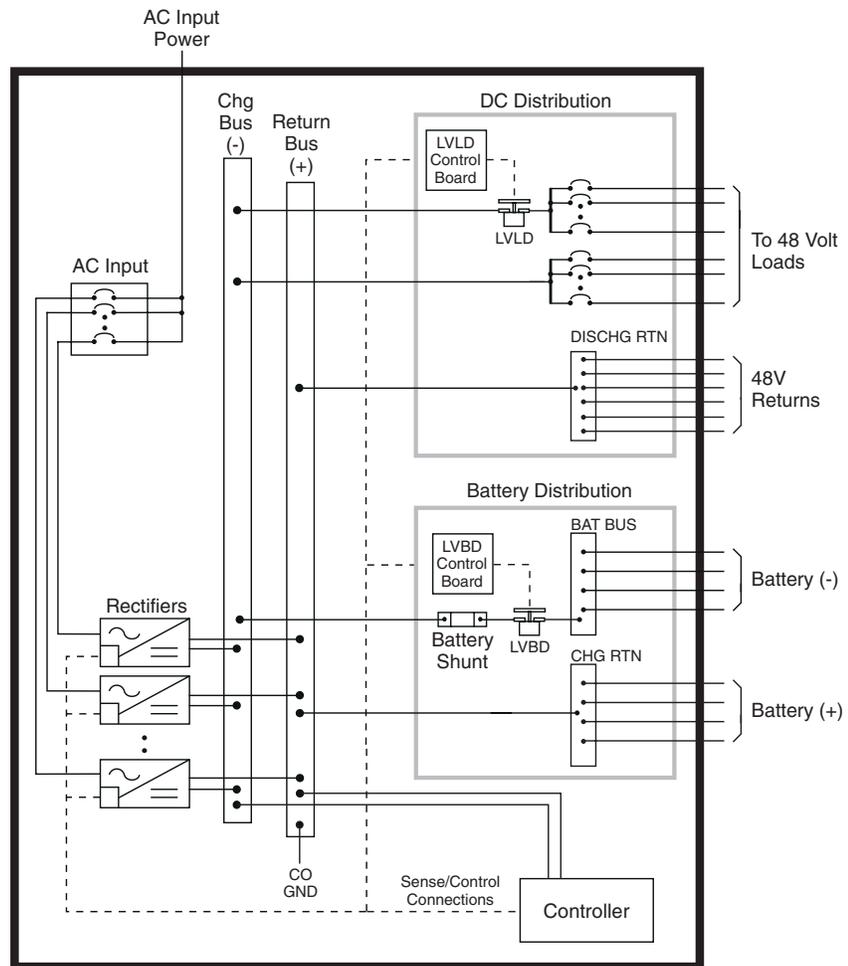


Figure 2-1: Block Diagram of the GPS 4812/24

Overview, continued

System Components

The power system accepts alternating current from the 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. In some applications the ac service is wired directly to the rectifiers and overcurrent protection is provided at the service panel.

Rectifiers convert an ac source voltage into the dc voltage level required to charge and float the batteries and 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 Panel provides overcurrent protection, connection points for the using equipment, and bus bars used to interconnect the rectifiers, batteries, and dc distribution.

Battery Connection Panel provides connection points for the battery strings through battery disconnect fuses or contactors and current monitoring shunts.

Architecture

Configurations

The GPS 4812/24 is available in two configurations:

- The half height cabinet, shown in Figures 1-1 and 2-2, mounts on top of a battery stand and can provide up to 800 amperes of dc power.
- The full height (7-foot) cabinet, shown in Figures 1-2 and 2-3, can provide up to 1,600 amperes of dc power.

Each cabinet contains ac distribution, dc distribution panels, a battery connection panel, rectifiers, termination points for load circuits, and a system controller.

Illustrations

Figure 2-4 shows how supplemental full-height cabinets may be added to grow the system to 7,040 amperes. The rectifier output buses are interconnected to permit the cabinet to share current and ensure common voltage references for all system rectifiers.

Figures 2-5 and 2-6 show open-door views of the half height and full height cabinets.

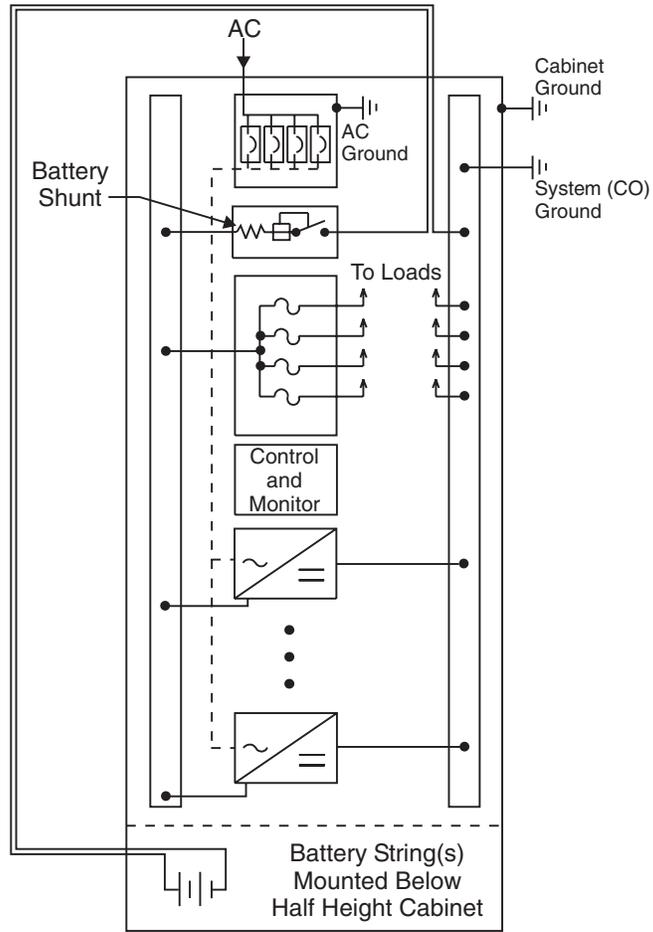


Figure 2-2: Schematic of Half Height Cabinet

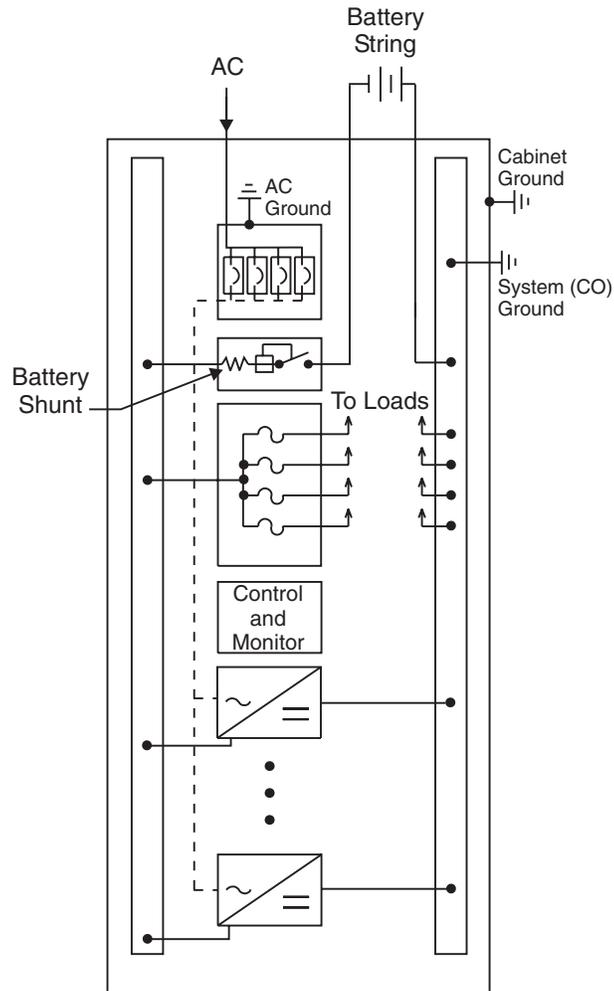


Figure 2-3: Schematic of Full Height Cabinet

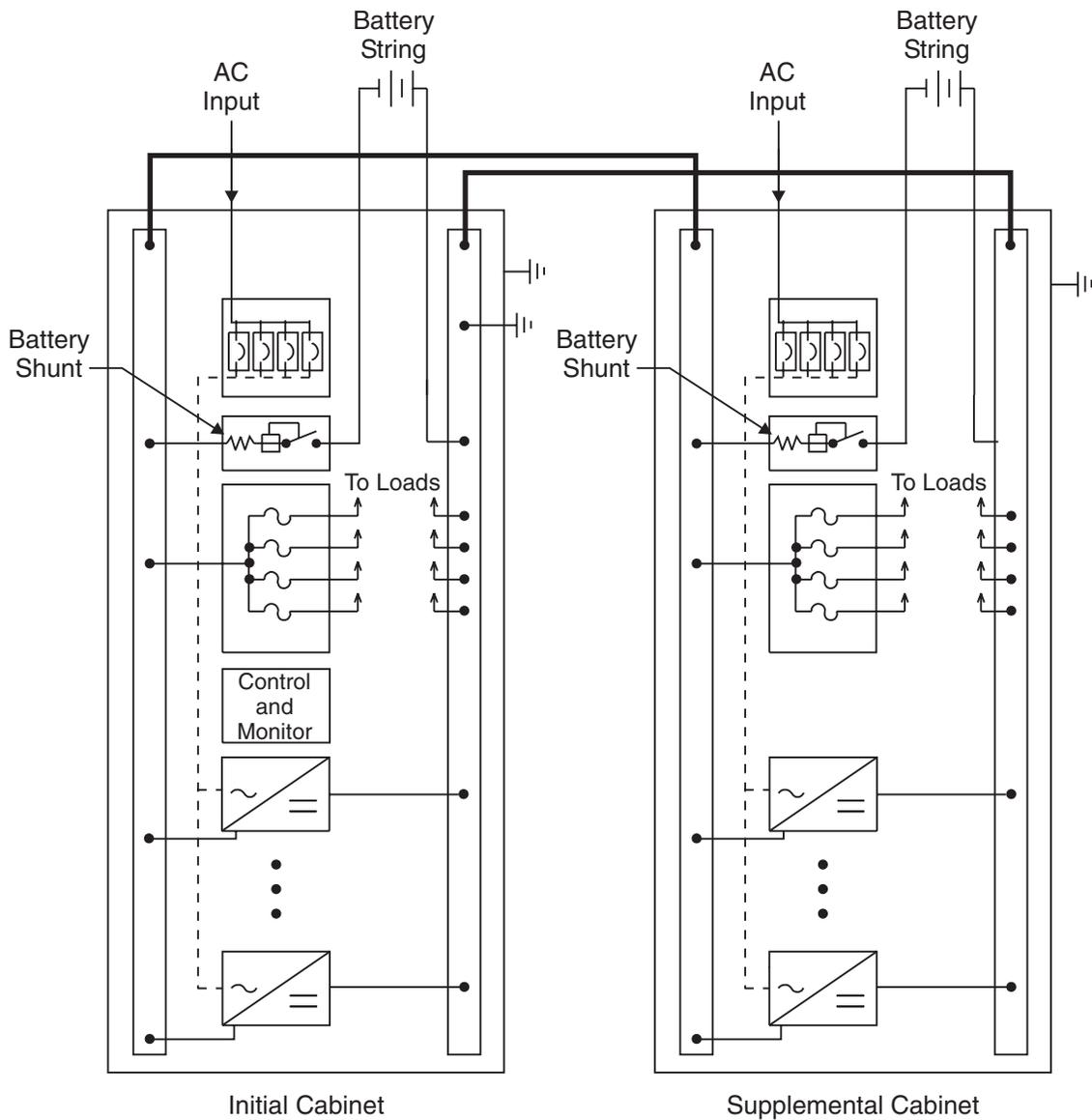


Figure 2-4: Schematic of Two-cabinet System Architecture

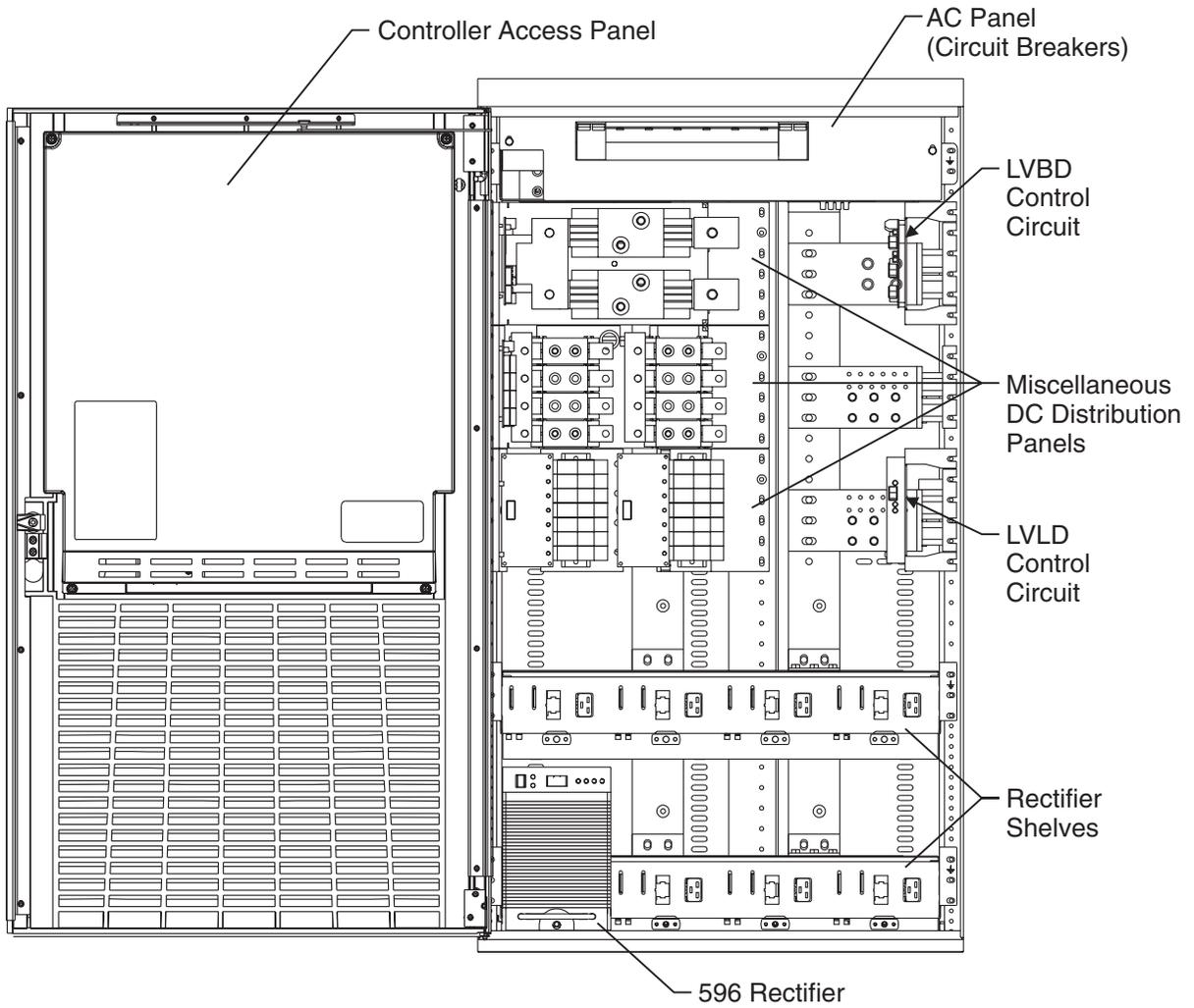


Figure 2-5: Half Height GPS 4812/24 with Door Open

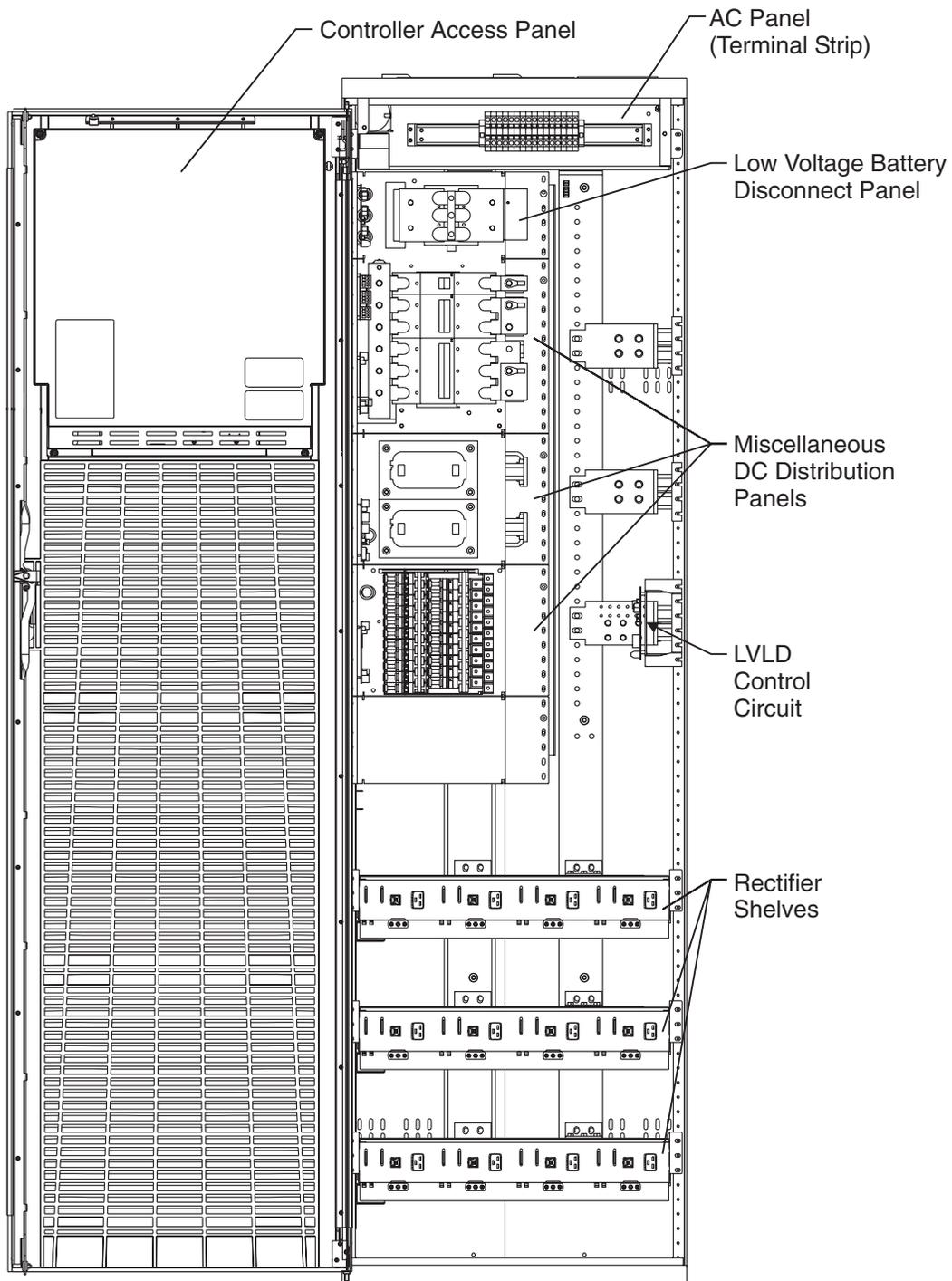


Figure 2-6: Full Height GPS 4812/24 with Door Open

3 ***Galaxy Controllers***

Overview

Introduction

The GPS 4812/24 is available with either the Galaxy Millennium Controller or the Galaxy Vector Controller.

This section describes the operation of each controller. It also provides detailed information about the features of their front panel keys, LEDs, and displays.

Note

If your cabinet has a metal door and a Galaxy Millennium Controller, some components of the controller will look different than in this manual, but operation is the same.

If your cabinet has a metal door and a Galaxy Vector Controller, your controller differs substantially from the version shown in this manual. Refer to Issue 6 of this manual for information pertaining to your controller.

Galaxy Millennium Controller

Design

The Galaxy Millennium Controller is equipped with a **Basic** control board (BSH) for basic operations and an optional **Intelligent** control board (BSJ) that provides advanced local and remote monitoring and data acquisition features. These CPU control boards monitor each other's status and issue appropriate alarms in the event a failure occurs.

Each cabinet used with the Galaxy Millennium Controller requires a bay interface card (BIC). The BIC acts as an interface to the cabinet control and alarm signals.

User Interface and Display

The Millennium's primary user interface is a panel that includes a backlit LCD front panel display that can be viewed in English or Spanish, two rows of LEDs, an array of pushbutton keys, and a pair of test jacks. Figure 3-1 illustrates the Millennium's front panel.

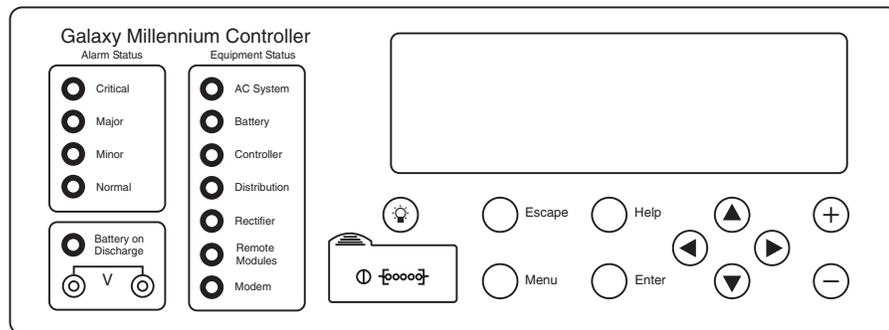


Figure 3-1: Galaxy Millennium Controller Front Panel

Default Display

The default display shows basic system status. The controller returns to this display approximately three minutes after the last time a key is pressed. The information on the screen is updated automatically approximately every two seconds.

The default screen display is similar to the following: The first line shows the number of alarms (0) and warnings (0) present in the system, the date, and the time. The next two lines show the system voltage and the system load. The last line shows the system mode, which can be one of the following:

- FLOAT
- BOOST
- STC (Slope Thermal Compensation)
- BATT TEST

Galaxy Millennium Controller, continued

LEDs

Two rows of LEDs show the source and severity of various alarms. An alarm lights one status LED and one or more alarm LEDs. If more than one alarm LED lights, the status LED that lights will indicate the most severe active alarm.

- The first row includes four LEDs, labeled Alarm Status. They indicate the *severity* of the reported alarm:

Critical
Major
Minor
Normal

The Battery on Discharge LED is also in this row.

- The second row has seven LEDs, labeled Equipment Status. They indicate the *source* of the alarm:

AC System
Battery
Controller
Distribution
Rectifier
Remote Modules

The Modem LED illuminates when the internal modem is in use.

Test Jacks

A pair of test jacks allows direct measurement of the dc bus sense voltage being monitored by the controller.

Galaxy Millennium Controller, continued

Pushbutton Keys

A group of pushbutton keys below the backlit LCD display provides the primary user interface with the controller. These keys are used singly or in combination to navigate through the controller's menus.

The following is a general description of the pushbutton keys:

- ESCAPE: Return to the immediate higher level menu.
- HELP: Displays limited on-line help information.
- MENU: View the MAIN menu.
- ENTER: Select a menu item.
- Up arrow: Moves the cursor up one line.
- Down arrow: Moves the cursor down one line.
- Left arrow: Moves the cursor left one field.
- Right arrow: Moves the cursor right one field.
- + and -: Increase or decrease parameter values.
- Lamp test: Tests the controller's circuit board LEDs and front panel LEDs. It will also test the indicators of serially connected rectifiers.

Access Panel

A rubber flap can be opened to access the local port connector and the display brightness potentiometer. The DB-9 local port connector supports standard RS232 serial communication. Refer to the Galaxy Millennium Controller product manual for additional details concerning port configuration and isolation.

Galaxy Vector Controller

Design

The Galaxy Vector Controller consists of an electronics board and a terminal connection board. The Vector provides a wide range of control and monitoring features and issues appropriate alarms in the event a failure occurs.

User Interface and Display

The Vector's primary user interface is a panel that includes an LCD display, three LEDs, and an array of pushbutton keys. Figure 3-2 illustrates the Vector's front panel.

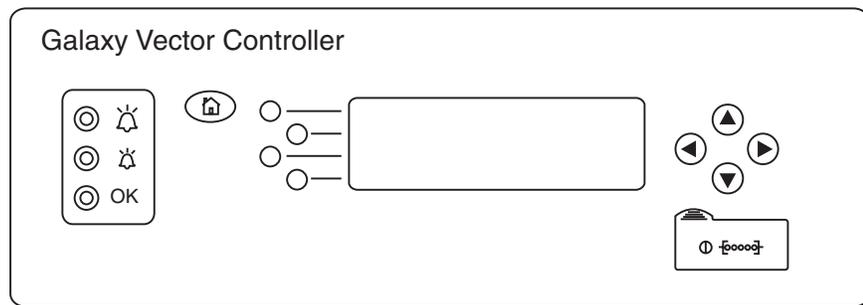


Figure 3-2: Galaxy Vector Controller Front Panel

Default Display

The default display shows the system voltage, load current, and plant state. When active alarms are present, the last line of the display will read “← View Alarms.” Press the corresponding button to view the active alarms.

LEDs

LEDs indicate the alarm state of the system.

-  Major - red
-  Minor - yellow
- OK Normal - green

Galaxy Vector Controller, continued

Pushbutton Keys

Pushbutton keys around the backlit LCD display provide the primary user interface with the controller. These keys are used singly or in combination to navigate through the controller's menus.

The four keys to the left of the LCD display are soft keys. When a soft key is active, its label begins with ← and is displayed on the corresponding line to the right of the key.

-  This key is the Home key
 - If viewing the default screen, Home sends you to the main menu.
 - If viewing the main menu, Home returns you to the default screen.
 - If viewing a menu screen other than the main menu, Home returns you to the main menu.
 - If viewing alarms, Home returns you to the default screen.
- Up arrow: Scrolls up or increments a value.
- Down arrow: Scrolls down or decrements a value.
- Left arrow: Moves the cursor left one character when editing a value.
- Right arrow: Moves the cursor right one character when editing a value.

Access Panel

A rubber flap can be opened to access the local port connector and the display brightness potentiometer. The DB-9 local port connector supports standard RS232 serial communication. Refer to the Galaxy Vector Controller product manual for additional details concerning port configuration and isolation.

Reference Material

Controller Product Manuals

Either a Galaxy Millennium Controller product manual (Select Code 167-792-180) or Galaxy Vector Controller product manual (Select Code 167-792-112) is furnished with every GPS 4812/24. Refer to this manual for information regarding configuration and operation.

RPM System Product Manual

Refer to the Galaxy Remote Peripheral Monitoring System product manual (Select Code 167-790-063) for additional information regarding module operation.

4 *Rectifiers*

596 Series A and D

Overview

The 596 Series A rectifier (55A) and 596D rectifier (110A) operate from single-phase ac service with a phase-to-phase voltage within the range of 176-264Vac.

The rectifiers are shipped separately from the cabinets for quick and straightforward installation into rectifier shelves at the site. Interconnections to ac input, dc output, and control signals occur automatically during insertion. The rectifier is keyed to prevent installation of the wrong rectifier. No settings or adjustments to potentiometers are necessary. The installer must set the rectifier's ID using the ON/STBY switch to allow the controller to learn the rectifier's physical location.

The 596A and D rectifiers are **UL Recognized** for both the U. S. and Canada, comply with UL1950 (Information Technology Equipment), and meet EN60950 requirements.

Front Panel Display

Power Switch

This three-position switch has two active states:

- It controls the on/standby state of the rectifier.
- It is used to set the rectifier ID.

Status Indicators

In addition to the ON and STBY LEDs, four other LEDs on the rectifier's faceplate indicate the rectifier's condition.

- The **ALM** LED is red and lights whenever the rectifier fails.

Front Panel Display, continued

- The **LIM** LED is yellow and lights when the unit is in current limit.
- The **FAN ALM** LED is red and lights when the fan inside the rectifier is not functioning properly.
- The **BST** LED is yellow and lights when the rectifier is in boost mode.

Current Display

This display indicates the current of the rectifier. Upon specific no-power conditions, the 3-digit display will show informative messages.

Lamp Test

To test the LEDs on the rectifier front panel, press the Lamp Test button on the controller.

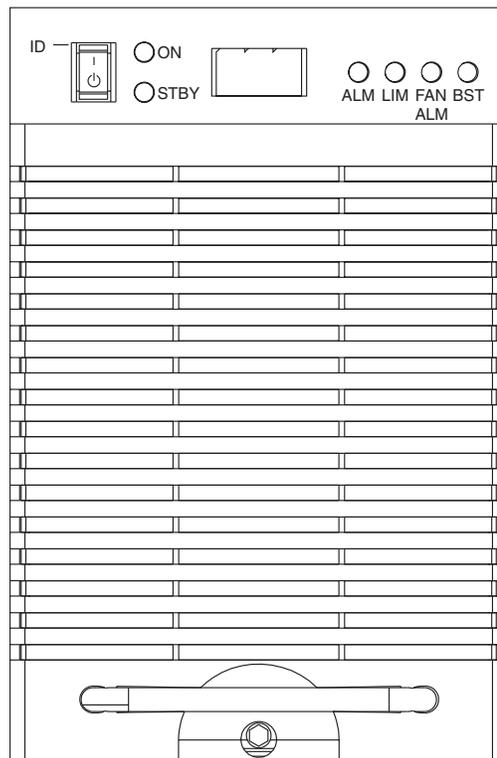


Figure 4-1: Rectifier Front Panel

Features

Output Current “Walk-in”

This circuit controls the time (up to eight seconds) required for the rectifier to reach normal operating conditions after it is turned on. This feature minimizes the starting surge on the customer's power source.

Output Protection

Rectifier is equipped with an internal fuse for plant protection if a fault occurs in a rectifier.

Electronic Current Limit

When the output current tends to increase above the current limit set point, the current limit circuit overrides the voltage regulating signal and safely limits the output current of the rectifier, thus preventing damage to itself or the load.

High Voltage Shutdown (HVSD)

The rectifier senses the voltage at its output terminals. If this voltage is too high, the rectifier will shut down to prevent the high voltage from damaging itself or the load.

Restart

Upon shutdown, the rectifier will attempt to restart. The rectifier will also accept a restart command from the controller for a remote restart. The rectifier will attempt to restart three times before issuing a rectifier fail alarm to the controller.

Fan Alarm and Control

The rectifier contains a cooling fan. The fan's speed, which is based on ambient temperature and output power level, is lowered during low-load and low-temperature conditions to minimize audible noise and maximize fan life.

Thermal Alarm

The rectifier senses the internal operating temperature and will issue a thermal alarm if the internal temperature exceeds a safe operating level. Ambient temperatures above the maximum rating will result in a rectifier shutdown and the issuing of a thermal alarm (TA).

Autonomous Operation

Rectifiers will continue to power the load if the controller fails or if communication is lost.

Controller Communications Alarm

When communications between the rectifier and controller are interrupted, the rectifier continues to operate and the red **ALM** LED on the rectifier blinks.

Features, continued

Connectorized

The rectifiers provide the controller with a full complement of status and alarm signals. The rectifier status and alarm signals, ac input, and dc output are all connectorized for easy installation and maintenance. System connections are made when the rectifier is plugged into the shelf. No additional connections are required.

“Forced” Load Sharing

Internal rectifier circuitry will allow multiple rectifiers to share load in the event communication to the controller is lost or the controller malfunctions.

5 ***AC Input Panels***

Overview

AC Service

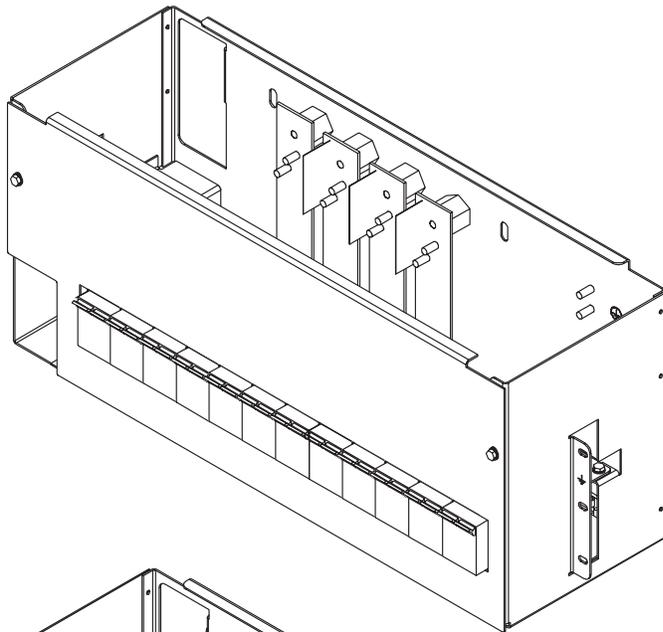
The ac input panel provides the facility to terminate 3-phase ac service to the GPS 4812/24 system or to distribute individual 1-phase ac supplies to each of the system rectifier positions. Depending upon the option ordered, the panel will connect 3-wire (three phases), 4-wire (three phases + neutral), or individual 2-wire (single phase, either 2 hot leads or 1 hot lead and neutral) input ac service.

Some systems provide circuit breakers to protect the conductors providing ac service to the individual rectifiers. Other systems contain a terminal strip and the conductors are protected by circuit breakers located in the building's ac service panel.

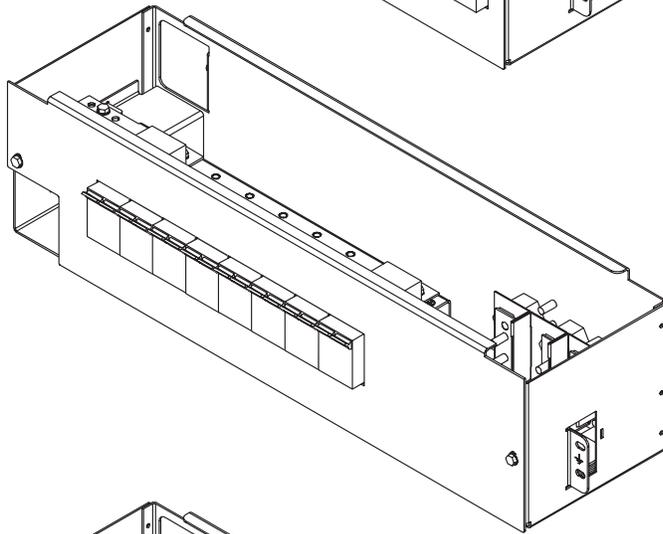
Note: All wire sizes were based on the US National Electric Code.

Illustrations

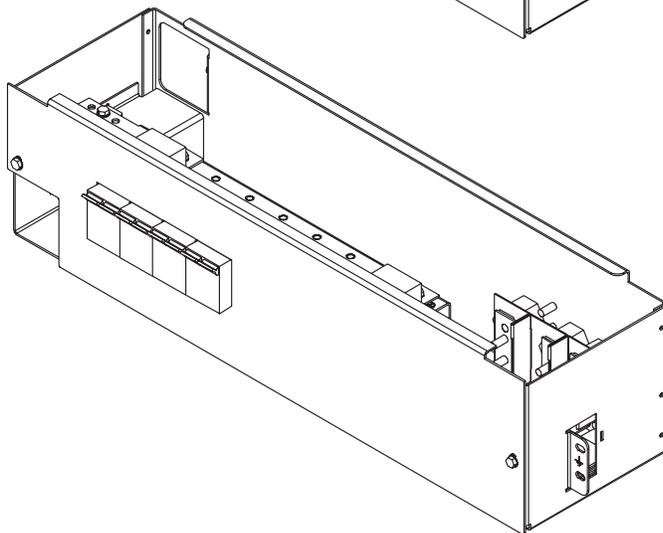
Circuit breaker panels are shown in Figures 5-1, and Figure 5-2 shows terminal strip panels.



ED83142-30 G7, G19
H569-436 G72F, G172F

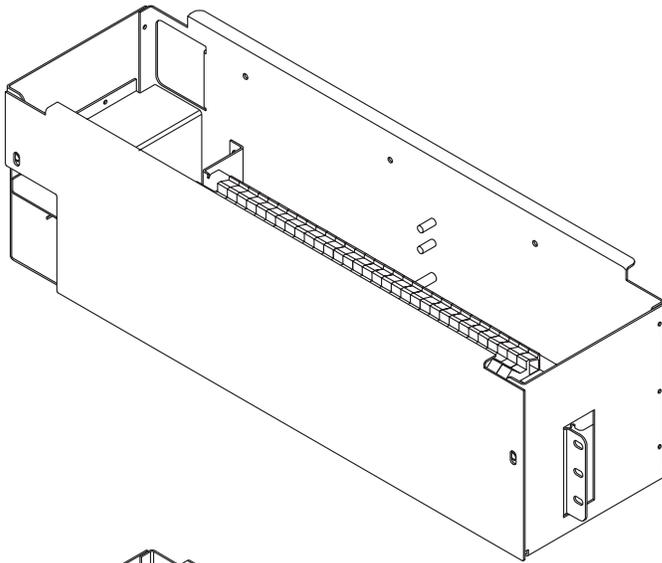


ED83142-30 G6, G6M, G23
H569-436 G71H, G73F, G74F, G74H, G173F

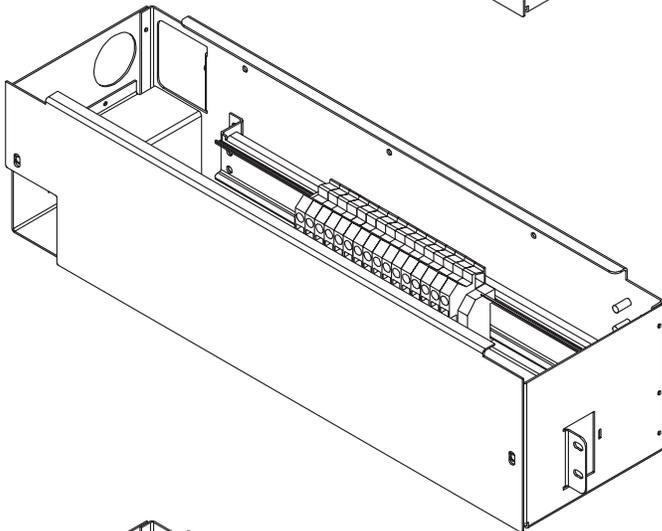


ED83142-30 G21
H569-436 G171H

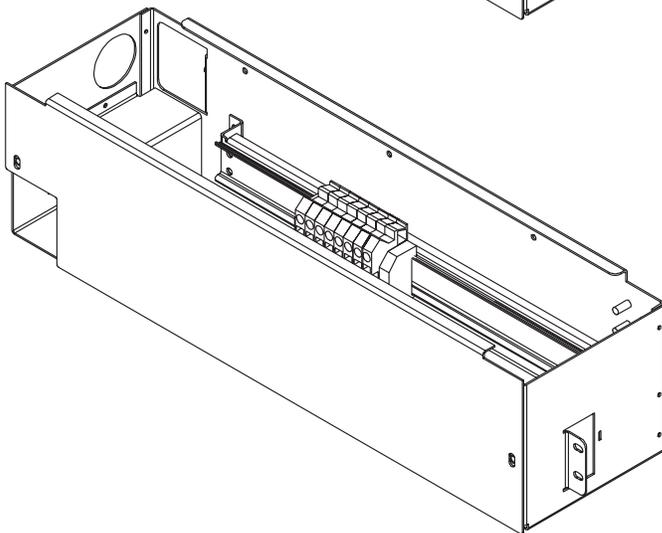
Figure 5-1: AC Input Circuit Breaker Panels



ED83142-30 G9, G20
H569-436 G77F, G78F, G177F, G178F



ED83142-30 G8, G22
H569-436 G76H, G79F, G176H, G179F



ED83142-30 G22
H569-436 G175H

Figure 5-1: AC Input Terminal Strip Panels

6 ***Battery Connection Panels***

Overview

Function

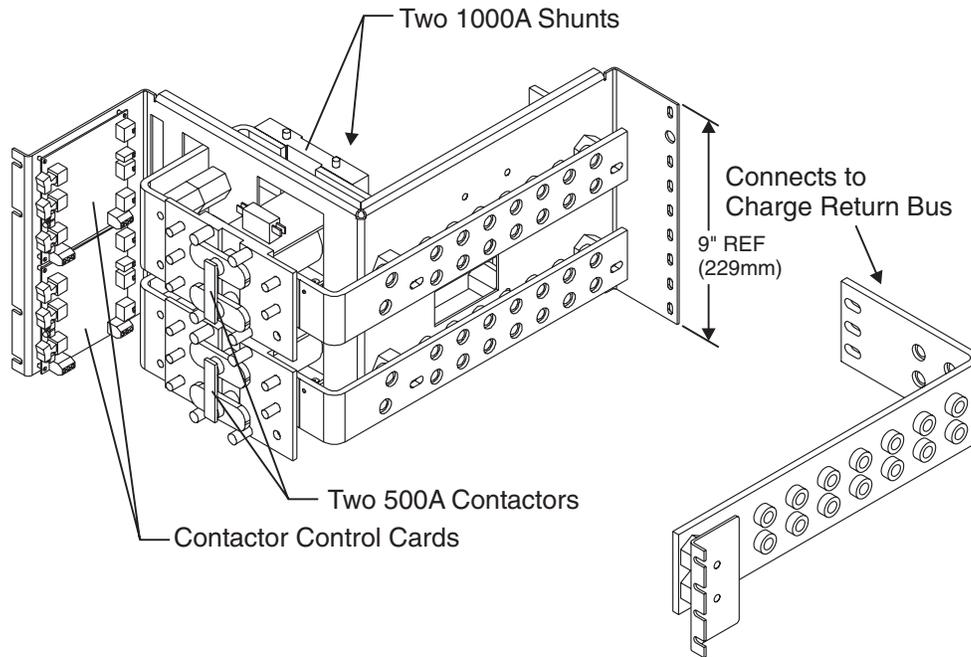
Batteries are connected to the GPS 4812/24 cabinets on battery connection panels located in the cabinet directly below or behind the ac input panel. All panels include the battery shunts and an alarm card that communicates with the controller to provide battery current and status information. As options, the panels may include fuses or low voltage battery disconnect/reconnect (LVBD/R) contactors. When equipped with contactors, a contactor control card provides local/manual control of the contactors.

Note: If no battery panel is needed (for full height supplemental cabinets only), H569-436 G33F is selected as a placeholder in the order.

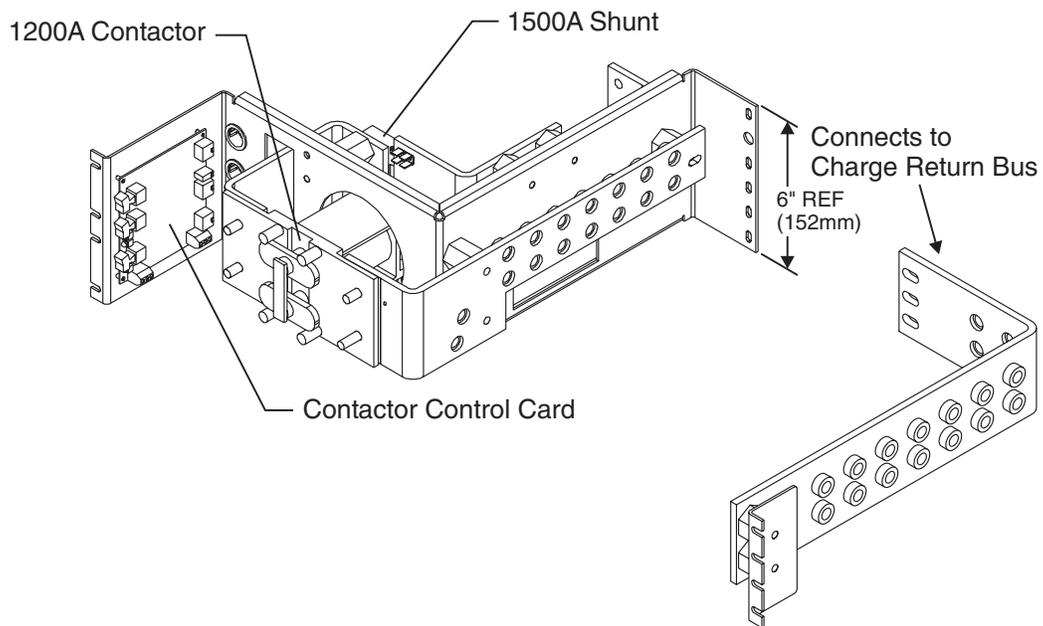
Illustrations

The battery connection panels are shown in Figures 6-1 through 6-10.

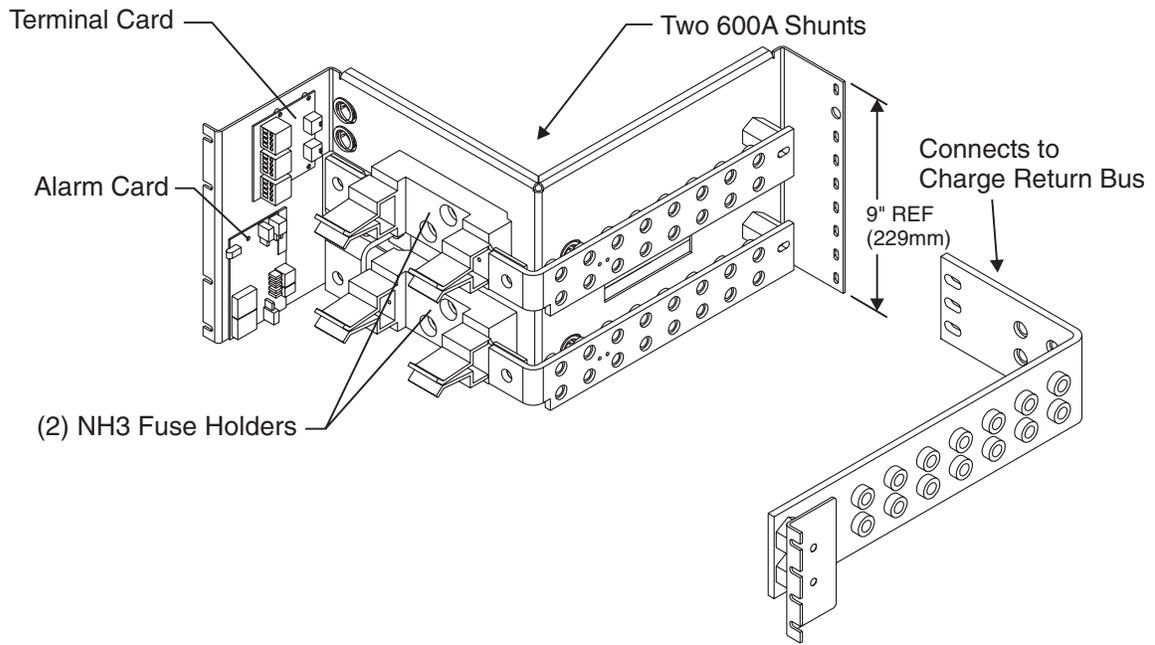
Note: Battery connection panels are blue; dc distribution panels are white.



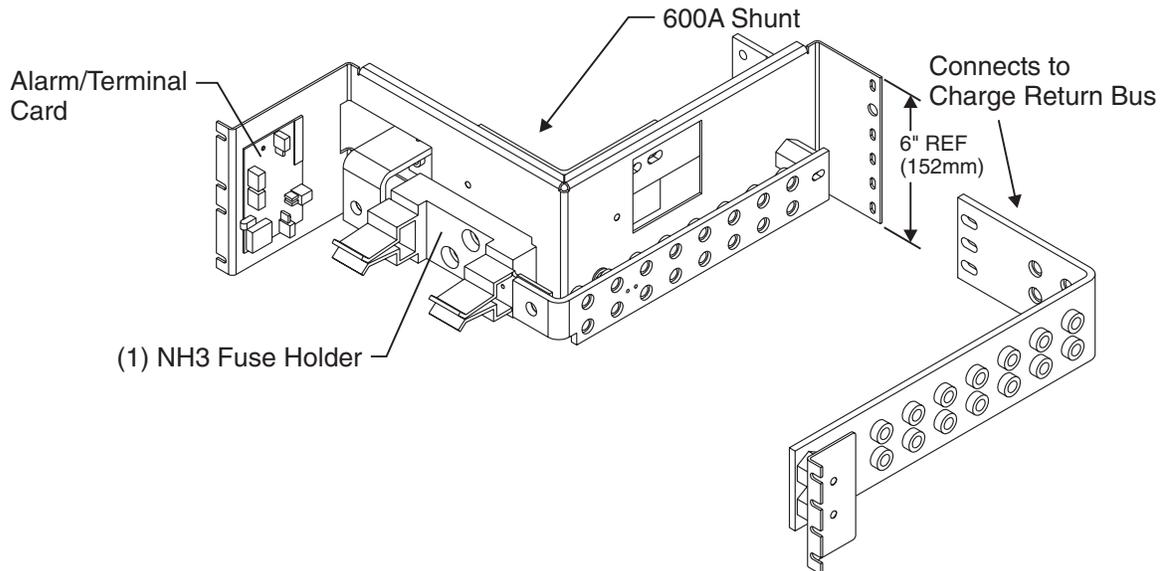
**Figure 6-1: H569-436 G30 (ED83143-31 G32)
Battery Connection Panel**



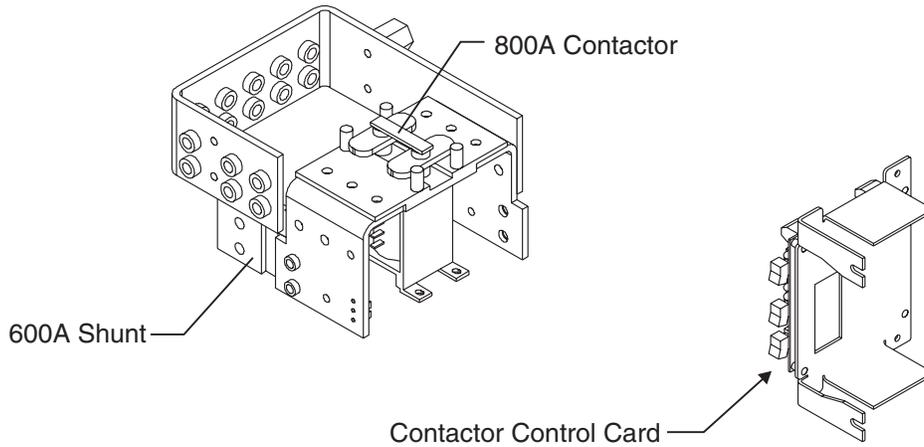
**Figure 6-2: H569-436 G31 (ED83143-31 G31)
Battery Connection Panel**



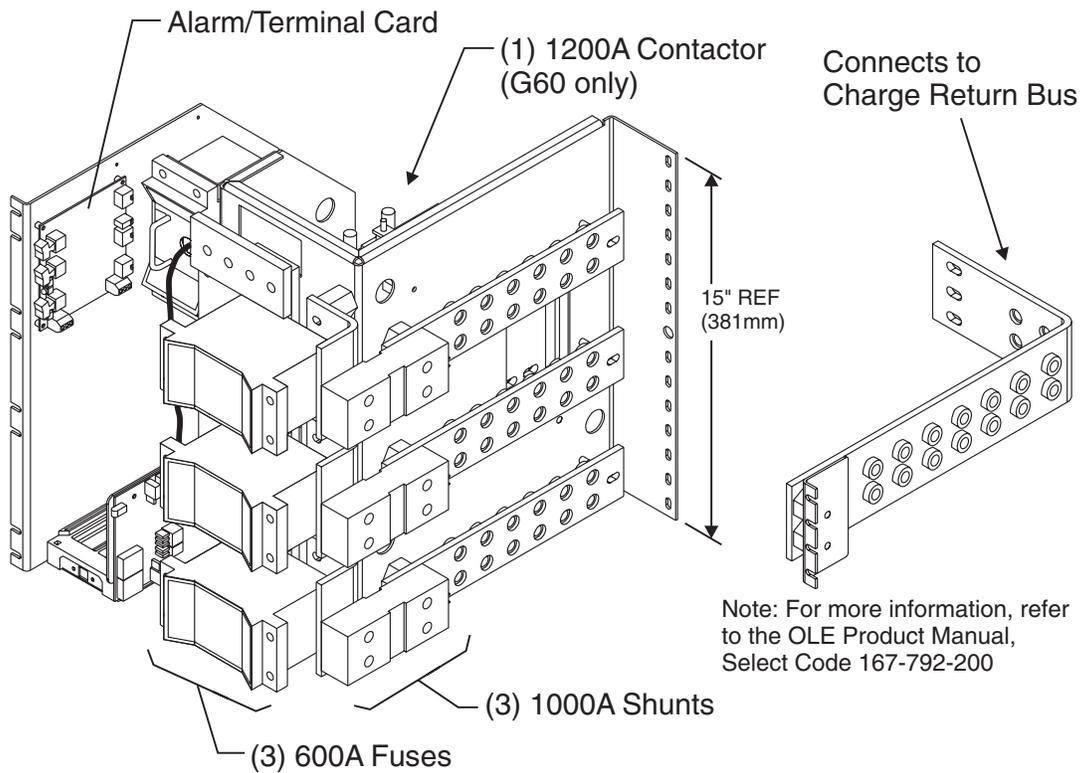
**Figure 6-3: H569-436 G34 (ED83143-31 G41)
Battery Connection Panel**



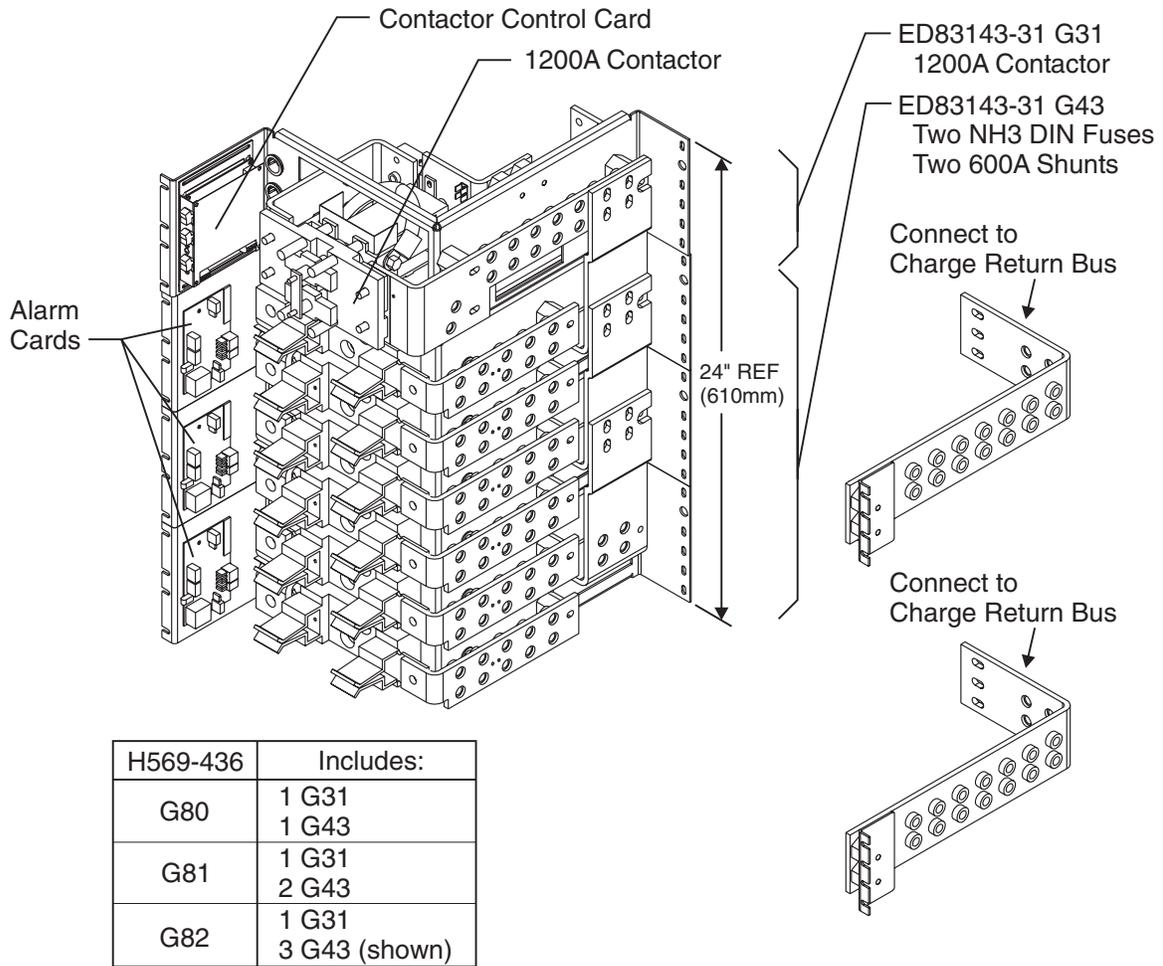
**Figure 6-4: H569-435 G35 (ED83143-31 G42)
Battery Connection Panel**



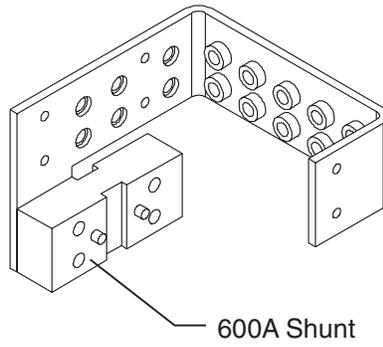
**Figure 6-5: H569-436 G36H (ED83143-31 G33)
Battery Connection Panel**



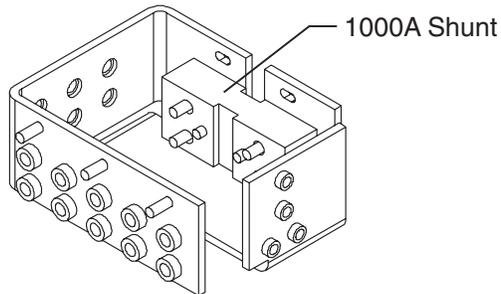
**Figure 6-6: H569-436 G37F/38F (ED83143-31 G60/61)
Battery (OLE) Connection Panel**



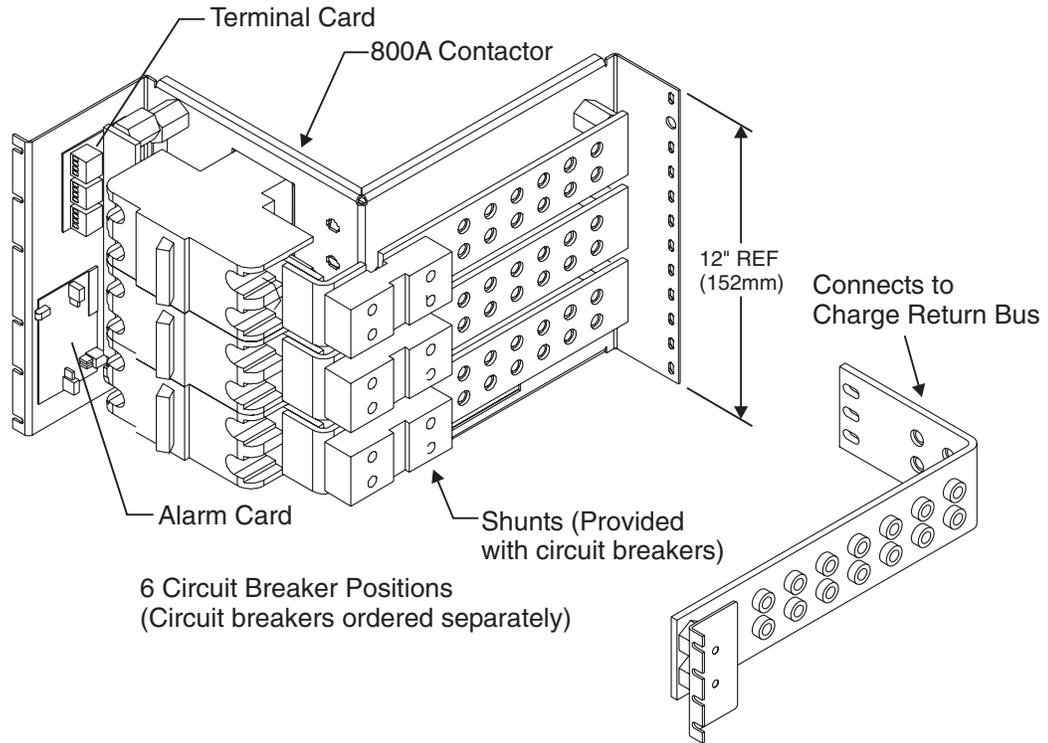
**Figure 6-7: H569-436 G80/81/82 (ED83143-31 G31/43)
Battery Connection Panel**



**Figure 6-8: H569-436 G84H (ED83143-31 G34)
Battery Connection Panel**



**Figure 6-9: H569-436 G85F (ED83143-31 G35)
Battery Connection Panel**



**Figure 6-10: H569-436 G86/87 (ED83143-31 G63/64)
Battery Connection Panel**

7 ***DC Distribution Panels***

Overview

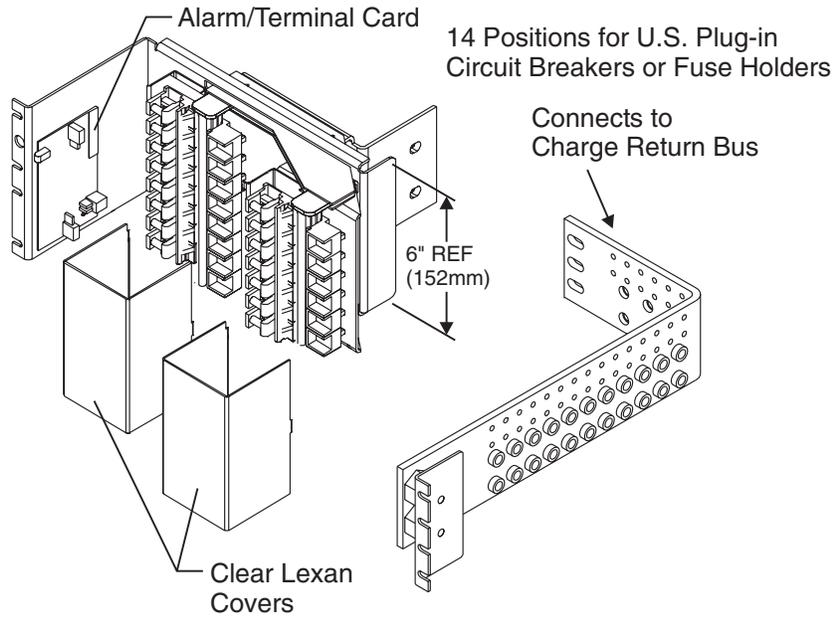
Function

A variety of dc distribution panels is available for the GPS 4812/24 system, including DIN standard fuse holders and circuit breakers and U. S. standard fuse holders and circuit breakers. All panels are equipped with an alarm card. When a fuse operates or a circuit breaker trips, a red LED on the alarm card lights, the cabinet alarm lights, and the alarm is transmitted to the controller. Most panels are also available with contactors to provide low voltage load disconnect.

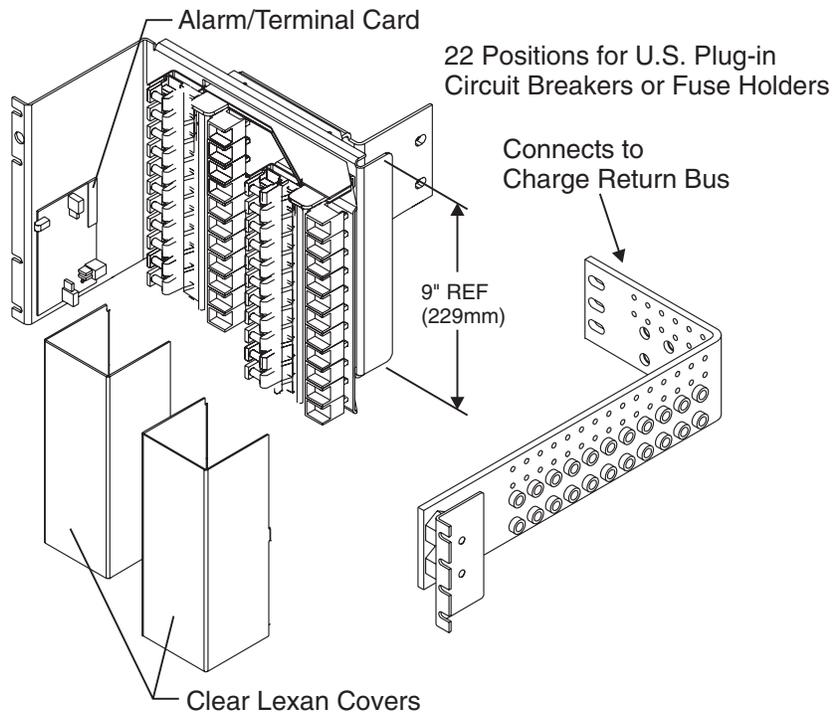
Illustrations

The dc distribution panels are illustrated in Figures 7-1 through 7-11.

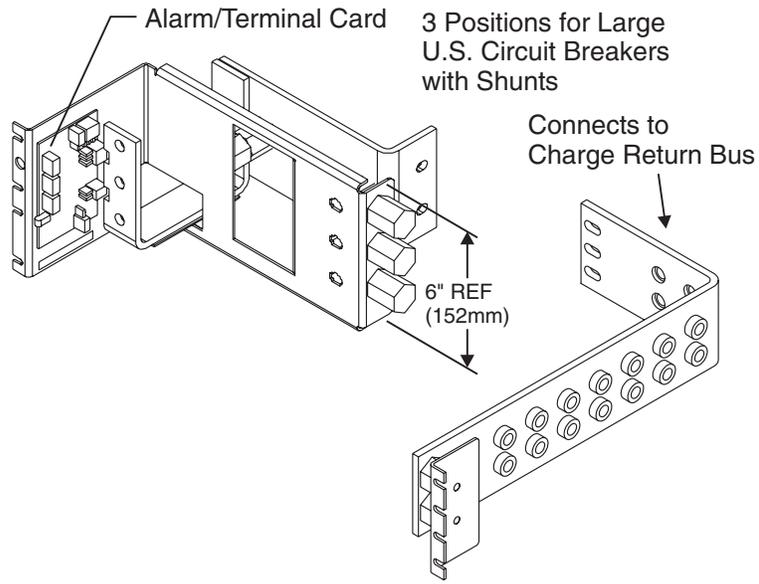
Note: DC distribution panels are white; battery connection panels are blue.



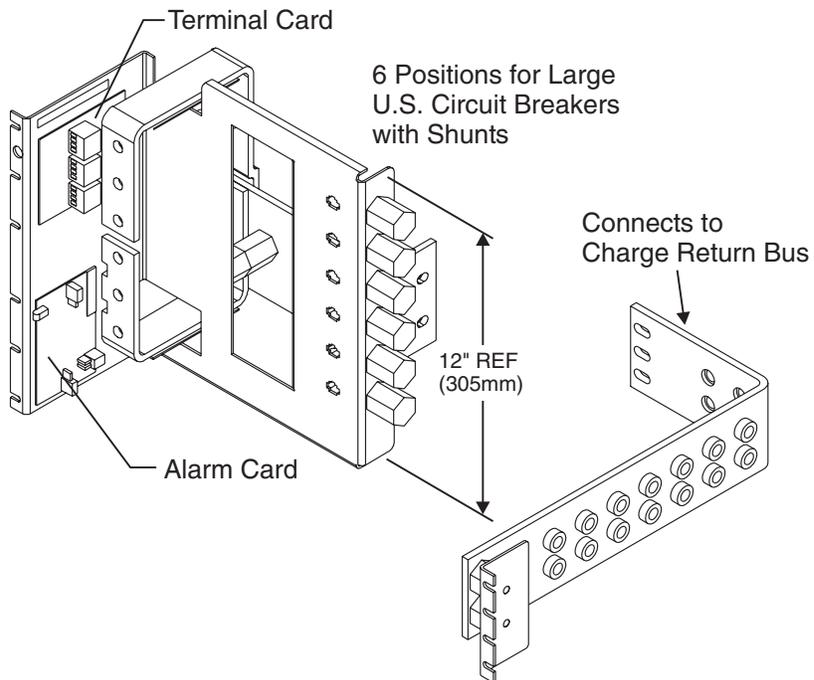
**Figure 7-1: H569-436 G40/50 (ED83143-31 G11)
DC Distribution Panel**



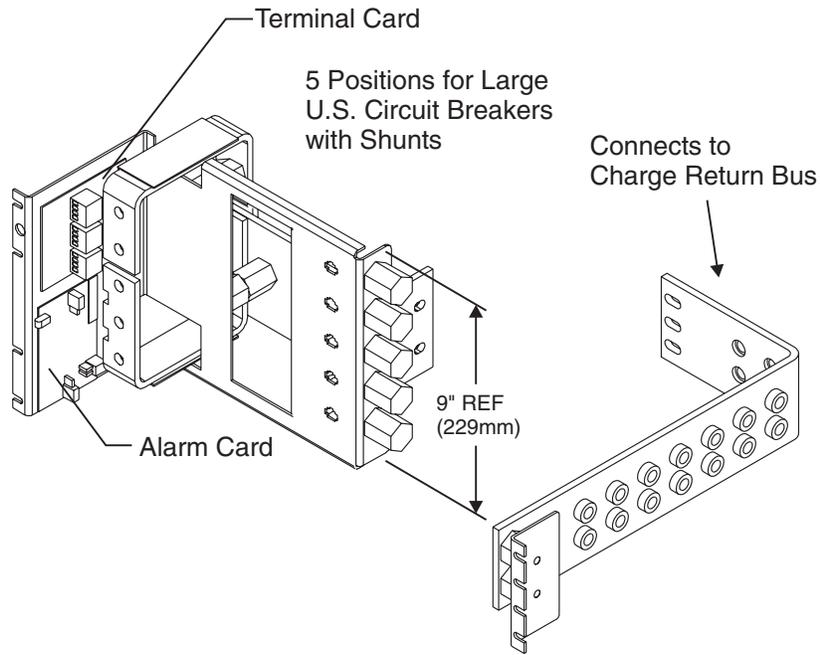
**Figure 7-2: H569-436 G41/51 (ED83143-31 G12)
DC Distribution Panel**



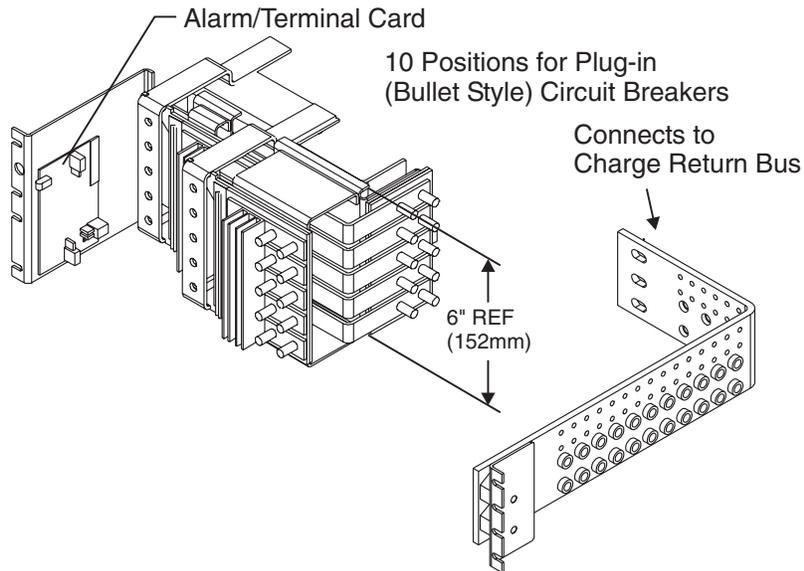
**Figure 7-3: H569-436 G42 (ED83143-31 G2)
DC Distribution Panel**



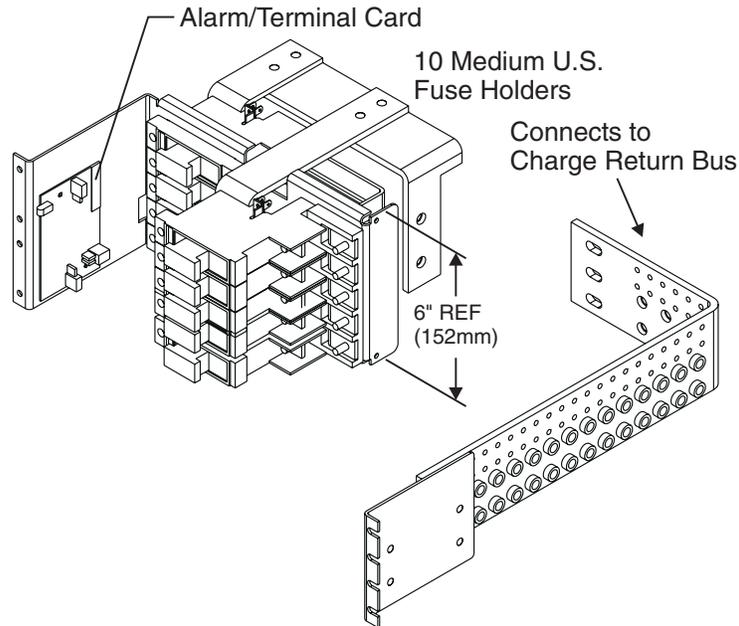
**Figure 7-4: H569-436 G43 (ED83143-31 G1)
DC Distribution Panel**



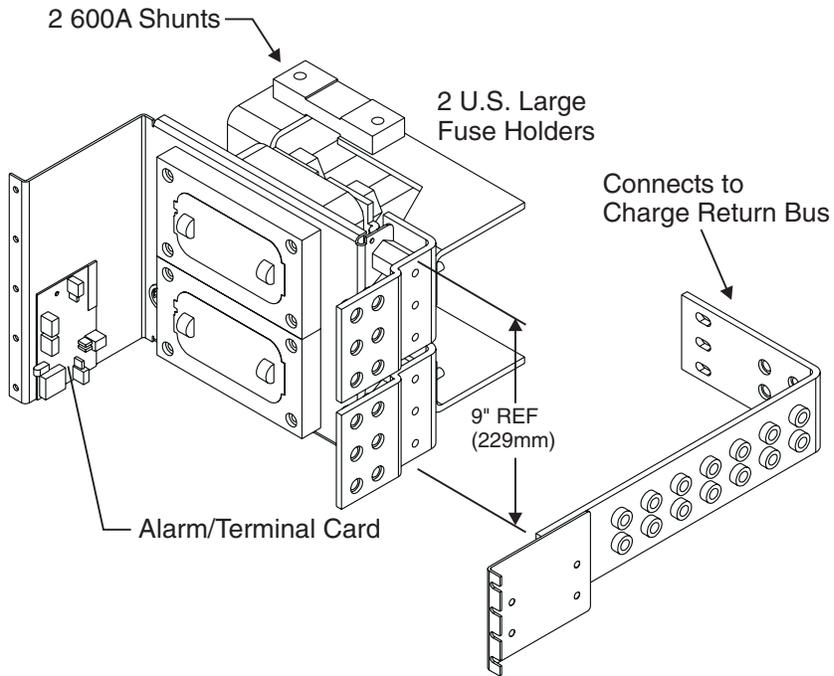
**Figure 7-5: H569-436 G44 (ED83143-31 G5)
DC Distribution Panel**



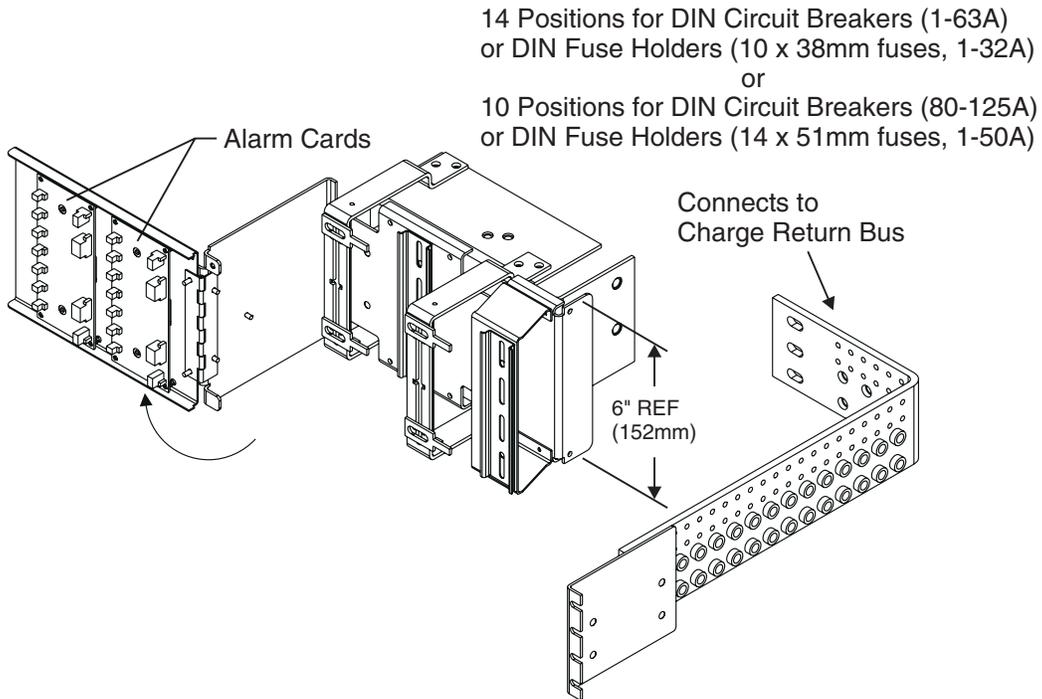
**Figure 7-6: H569-436 G46 (ED83143-31 G15)
DC Distribution Panel**



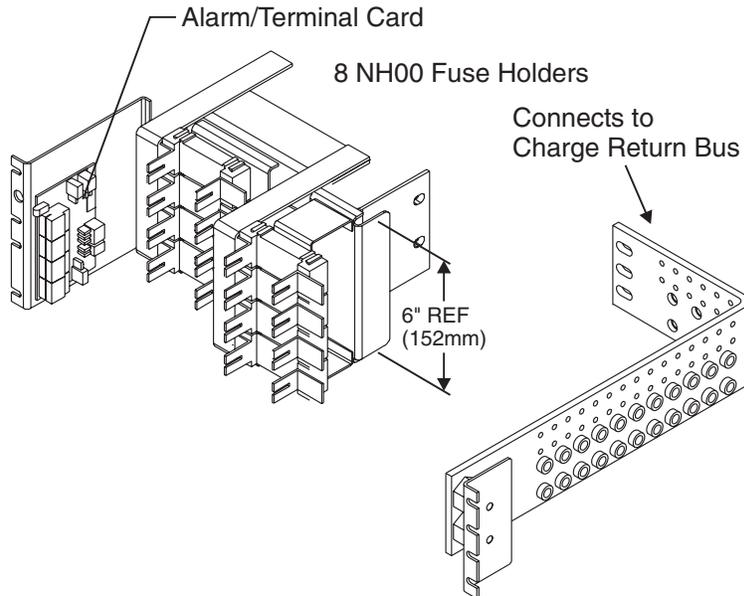
**Figure 7-7: H569-436 G52 (ED83143-31 G53)
DC Distribution Panel**



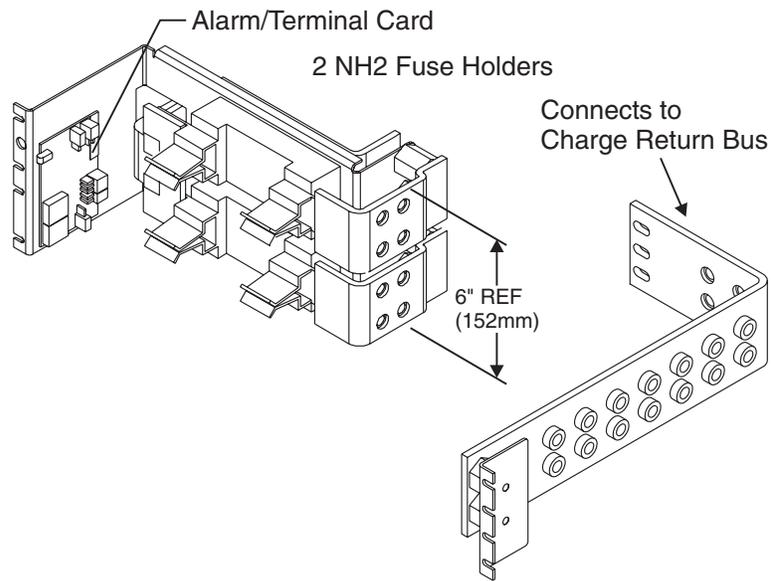
**Figure 7-8: H569-436 G53 (ED83143-31 G55)
DC Distribution Panel**



**Figure 7-9: H569-436 G60/61/65/66 (ED83143-31 G71)
DC Distribution Panel**



**Figure 7-10: H569-436 G67 (ED83143-31 G22)
DC Distribution Panel**



**Figure 7-11: H569-436 G68 (ED83143-31 G21)
DC Distribution Panel**

8 *Circuit Boards*

Overview

Function Circuit boards (sometimes referred to as “cards”) are included in the battery connection and dc distribution panels to provide data required by the controller.

Terminal Boards Terminal boards are used to provide shunt voltage data to the controller, where it is used to calculate current. Terminal boards located on the battery connection panels provide data that is used to calculate battery current; data from terminal boards located on the dc distribution panels is used to calculate load current.

Alarm Boards Alarm boards perform two functions:

- monitor panel functions and activate local indicators when faults occur on the panel
- provide alarm data to the controller

Alarm/Terminal Boards Alarm/terminal boards combine the functions of alarm boards and terminal boards.

BLJ Terminal Board The BLJ terminal board is located inside the cabinet door. The BLJ is the termination point for all signal cables in each cabinet and between cabinets.

Overview, continued

Contactor Control Board

Contactor control boards provide four functions:

- Monitor and report shunt voltage to the controller
- Monitor and report contactor status to the controller
- Operate the contactor based on controller commands
- Operate or block the contactor based on maintenance switch settings

Millennium Systems

Each initial and supplemental cabinet in a Millennium system has a Bay Interface Card (BIC) that attaches to the cabinet's terminal board (BLJ). The BIC provides controller access to alarm monitoring, battery voltages, battery currents, and temperature probes in the cabinet through the serial rectifier bus. See Figure 12-3.

Vector Systems

The initial cabinet contains the Vector controller, which consists of a GCM3 control board mounted on the BLJ terminal connection board. Supplemental cabinets do not require a GCM3 control board or BIC. See Figure 12-5.

9 Specifications

GPS 4812/24

Table 9-A: Galaxy Power System 4812/24 Specifications

Electrical				
AC Input				
Input Distribution	592A2	<ul style="list-style-type: none"> • 125A circuit breaker per 2-shelf cabinet • 150A circuit breaker per 3-shelf cabinet • 25A circuit breaker per rectifier for individual feeds 		
	596D	<ul style="list-style-type: none"> • 110 / 125A circuit breaker per 1-shelf cabinet • 2 x 110 / 125A circuit breaker per 2-shelf cabinet • 2 x 150A circuit breaker per 3-shelf cabinet • 50A circuit breaker per rectifier for individual feeds 		
Minimum Wire Size	596A2	<ul style="list-style-type: none"> • 2 gauge/35 mm² - 1 and 2-shelf cabinet • 1/0 gauge/50 mm² - 3-shelf cabinet • 10 gauge/6 mm² - per rectifier for individual feeds 		
	596D	<ul style="list-style-type: none"> • 2 gauge/35 mm² - 1-shelf cabinet • 2 x 2 gauge/35 mm² - 2-shelf cabinet • 2 x 1/0 gauge/50 mm² - 3-shelf cabinet • 8 gauge/10 mm² - per rectifier for individual feeds 		
Cabinet Output -48V				
		Full Height	Half Height	
Output Current	596A2	55 - 800A	50 - 400A	
	596D	110 - 1,600A	110 - 800A	
System Output -48V				
		2 x Full Height	1 Half Height + 1 Full Height	Maximum System
Output Current	596A2	55 - 1,200A	55 - 1,200A	3,520A ¹
	596D	110 - 3,200A	110 - 2,400A	7,040A ¹

1. With Galaxy Millennium Controller

Table 9-A: Galaxy Power System 4812/24 Specifications (continued)

Mechanical		
Cabinet		
	Full Height	Half Height
Nominal Cabinet Dimensions (H x W x D)	2100 H x 600 W x 500 D mm (82.6 H x 23.6 W x 19.7 in.)	1080 H x 600 W x 500 D mm (42.5 H x 23.6 W x 19.7 D in)
Units Per Initial Cabinet		
	Full Height	Half Height
Rectifiers	1 - 12 or 1 - 16	1 - 8
Controller	1	
Battery Disconnect Modules	0 - 1	
DC Distribution	1 - 6	1 - 3
Units Per Supplemental Cabinet		
Rectifiers	1 - 12 or 1 - 8	N/A
Battery Disconnect Modules	0 - 1	
DC Distribution	1 - 6	N/A
Environmental		
Operating Ambient Temperature		
596A2	-40°C to +85°C	
596D	-40°C to +75°C	
Altitude	-50 to 4000 meters Note: For altitudes between 1500 and 4000 meters, derate the maximum temperature by 0.656°C per 100 meters.	
Humidity	5% to 90% non-condensing	
Radiated and Conducted Emissions	EN50082-1, EN50082-2, EN50081, EN61000	
Electromagnetic Immunity	Level B	
Earthquake Rating	Zone 4, upper floors	
Standards Compliance		
Agency Approvals	CE Marked, UL Underwriters Laboratories (UL) Listed per Subject Letter 1801, DC Power Distribution Centers for Telecommunications Equipment	

Rectifier

Table 9-B: Rectifier Specifications

Electrical	
Input	
Voltage Range	176-264Vac, 2-wire, single phase
Frequency Range	47 - 63 Hz
Power Factor	> 0.98 for loads > 50%
<p>AC Surge Protection: It is important that ac surges reaching rectifiers do not exceed the capacity of the rectifier internal surge protection. Protection must be provided external to the GPS system, if necessary, to limit surge energy reaching the rectifiers. Site surge protection must be coordinated with rectifier internal surge protection and must clamp at a lower voltage than the rectifier internal protection. The internal protection voltage and current characteristics of the rectifiers are as follows:</p>	
<u>Phase to Phase Voltage</u>	<u>MOV Conduction Current</u>
320Vac (RMS)	0A
620V maximum clamping	1mA (DC test current)
810Vpeak	100A peak (8 x 20 μ s)
Output All	
High Voltage Shutdown	
Internal Selective High Voltage Shutdown (ISHVSD)	Float: 56.0Vdc Nom. ^{1, 2} Boost: 56.0Vdc Nom. ^{1, 2} Equalize: 59.52 \pm 1Vdc Nom. ^{1, 2}
Backup High Voltage Shutdown (BUHVSD)	Float/Boost: 59.52Vdc ³ Equalize: 66.0Vdc ³
<p>1. Selectable/programmable through Galaxy Controller 2. Factory default settings – actual range is 44 - 60Vdc 3. Factory default settings – Float/Boost range is 58.51 - 60.53Vdc, Equalize range is 65.2 - 67.0Vdc</p>	
Output 596A2	
Output Power ¹	3,000W maximum
Output Current ¹	55A dc maximum from -40°C to +65°C 42.5A dc at +75°C 30A dc at +85°C Rectifier self-derates at approximately 1 ampere per degree C (+65°C to +85°C)
Float/Boost Voltage	44-58Vdc
Total Harmonic Distortion	<5% at Nominal Vac and >25A dc
Regulation	\pm 0.5%
Ripple	100 mVrms
Noise	< 2mV psophometric
Current Limit Set Point	15A-55A Note: When using the maximum 16 rectifiers in a cabinet, do not exceed 50 amperes current limit per rectifier at 65°C.

1. See Figure 9-1: Output Current vs. Temperature.

Table 9-B: Rectifier Specifications (Continued)

		Output 596D
Output Power ^{1, 2}		6,000W maximum
Output Current ^{1, 2}		110A dc maximum from -40°C to +45°C 85A dc at +60°C 60A dc at +70°C 47.5A dc at +75°C Rectifier self-derates at approximately 1.5 amperes per degree C (+45°C to +60°C) 2.5 amperes per degree C (+60°C to +75°C)
Float/Boost Voltage		42-58Vdc
Total Harmonic Distortion		<5% at Nominal Vac and >50A dc
Regulation		±0.5%
Ripple		100 mVrms
Noise		< 2mV psophometric
Current Limit Set Point		30A-110A
		Mechanical
Width		5.25 in. (133.35 mm)
Height		8 in. (203.2 mm)
Depth		19.75 in. (501.65 mm)
Weight		20 lbs. (9 kg)
		Environmental
Efficiency		> 90% typical
Heat Release		Per rectifier:
596A	52Vdc, 40A	231W [788.9 BTU/hr]
	52Vdc, 50A	288W [983 BTU/hr]
	54.5Vdc, 40A	242W [827 BTU/hr]
	54.5Vdc, 50A	302W [1,030 BTU/hr]
	55Vdc, 55A	332W [1,133 BTU/hr]
596D	52Vdc, 80A	463W [1,578 BTU/hr]
	52Vdc, 100A	577W [1,966 BTU/hr]
	54.5Vdc, 80A	485W [1,654 BTU/hr]
	54.5Vdc, 100A	605W [2,060 BTU/hr]
	54.5Vdc, 110A	666W [2,266 BTU/hr]
Storage Relative Humidity		5% to 90%
Audible Noise		< 52dBA
EMC		EN 50022, level B, conducted and radiated (CISPR 22)
		Standards Compliance
Safety Standard		EN 60950 (IEC950)
Certification Marks		UL, VDE, CE 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.

1. See Figure 9-1: Output Current vs. Temperature.

2. Output is limited to 3,000W when installed in rectifier shelves designated for 596A only to protect the ac input conductors.

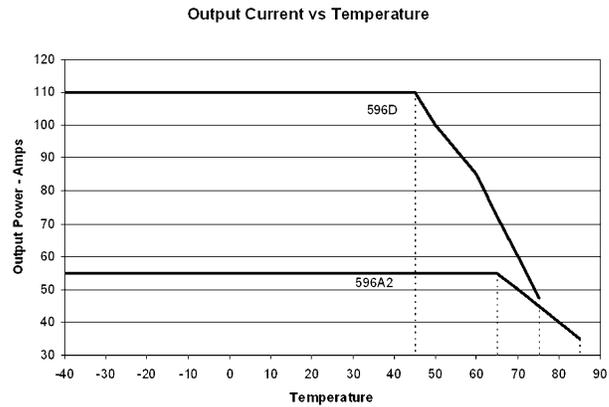


Figure 9-1: Output Current vs. Temperature

AC Input Panels

Applications and Cross Reference

Table 9-C identifies panel applications and reference documents.

Table 9-C: AC Input Panels

Cabinet				Panel				Reference Document		
Half-Height	Full-Height	Shelves	Max Rectifiers	Terminal Block	Circuit Breakers	Phase to Phase	Phase to Neutral	H569-436	ED83142-30	Product Manual
596A2 Rectifier										
X		2	8		X	X		G71H	G6	Figure 5-2
	X	2	8		X	X		G73F	G6	Figure 5-2
	X	3	12		X	X		G72F	G7	Figure 5-1
	X	2	8		X		X	G74F	G6M	Figure 5-2
X		2	8		X		X	G74H	G6M	Figure 5-2
X		2	8	X		X	X	G76H	G8	Figure 5-5
	X	2	8	X		X	X	G79F	G8	Figure 5-5
	X	3	12	X		X	X	G77F	G9	Figure 5-4
	X	4	16	X		X	X	G78F	G9	Figure 5-4
596D Rectifier										
X		1	4		X	X		G171H	G21	Figure 5-3
	X	2	8		X	X		G173F	G23	Figure 5-2
	X	3	12		X	X		G172F	G19	Figure 5-1
X		1	4	X		X	X	G175H	G22	Figure 5-6
X		2	8	X		X	X	G176H	G22	Figure 5-5
	X	2	8	X		X	X	G179F	G22	Figure 5-5
	X	3	12	X		X	X	G177F	G20	Figure 5-4
	X	4	16	X		X	X	G178F	G20	Figure 5-4

Battery Connection Panels

Table 9-D: Battery Connection Panels

LVBD Contactors	Shunt	Off-Line Equalize ⁴	Fuse Holder	Panel		Figure
				H569-436	ED83141-31	
2 x 500A	1000A			G30	G32	6-1
1,200A	1,500A			G31	G31	6-2
			2 x NH3 ¹	G34	G41	6-3
			NH3 ¹	G35	G42	6-4
800A	600A			G36H	G33	6-5
1,200A	3 x 1,000A	X	3 x US ²	G37F	G60	6-6
		X	3 x US ²	G38F	G61	6-6
1,200A	2 x 600A		2 x NH3 ¹	G80	G31 + G43	6-7
1,200A	4 x 600A		4 x NH3 ¹	G81	G31 + 2 x G43	6-7
1,200A	6 x 600A		6 x NH3 ¹	G82	G31 + 3 x G43	6-7
	600A			G84H	G34	6-8
	1,000A			G85F	G35	6-9
	6 positions for circuit breakers ³			G86	G63	6-10
800A	6 positions for circuit breakers ³			G87	G64	6-10

1. NH3 Fuse Holders accept DIN Fuses 315 to 630A

2. US Fuse Holders accept TPL-CZ fuses $\leq 600A$

3. 400A Circuit Breaker uses 2 positions

4. Off-Line Equalize panels use ES671 Off-line Equalize Converter to provide battery equalize voltage

DC Distribution Panels

Table 9-E: Battery Connection Panels

Protector Type ¹	Positions ²	Panel ³		Figure
		H569-436	ED83141-31	
3-100A plug-in fuse holders or CB	14	G40, G50	G11	7-1
3-100A plug-in fuse holders or CB	22	G41, G51	G12	7-2
125-600A CB	3	G42	G2	7-3
125-600A CB	6	G43	G1	7-4
125-600A CB	5	G44	G5	7-5
3-150A plug-in bullet CB	10	G46	G15	7-6
3-70A TPS fuse	10	G52	G53	7-7
100-600A TPL-C fuse	2	G53	G55	7-8
1-63A DIN CB	14	G60	G71	7-9
80-125A DIN CB	10	G61	G71	7-9
1-32A DIN fuse	14	G65	G71	7-9
1-50A DIN fuse	10	G66	G71	7-9
4-160A DIN NH00 fuse	8	G67	G22	7-10
32-400A DIN NH2 fuse	2	G68	G21	7-11

1. NH3 Fuse Holders accept DIN Fuses 315 to 630A

2. US Fuse Holders accept TPL-CZ fuses $\leq 600A$

3. 400A Circuit Breaker uses 2 positions

4. Off-Line Equalize panels use ES671 Off-line Equalize Converter to provide battery equalize voltage

10

Safety

Please read and follow all safety instructions and warnings before servicing the GPS 4812/24. Reference the GPS Installation Guide and individual module product manuals for safety statements specific to the modules.

11 Maintenance and Replacement

Requirements

System

With the exception of the batteries, periodic maintenance specific to the power system is not required. The ac service for the building must be maintained with ANSI specified limits. The temperature and humidity within the power room must be maintained within the limits specified in Section 10 of this product manual.

Refer to Table 11-A for system replacement parts.

Batteries

The batteries must be maintained as directed by the battery manufacturer's requirements.

Rectifiers

With the exception of a fan failure, rectifiers are repaired by replacement. Refer to "Installing or Replacing a Rectifier" in this section.

Requirements, continued

Rectifier Fan Assembly

The expected life of the rectifier fans at 25 °C (77°F) is approximately eight years. The fans in the rectifiers may be replaced in the field.

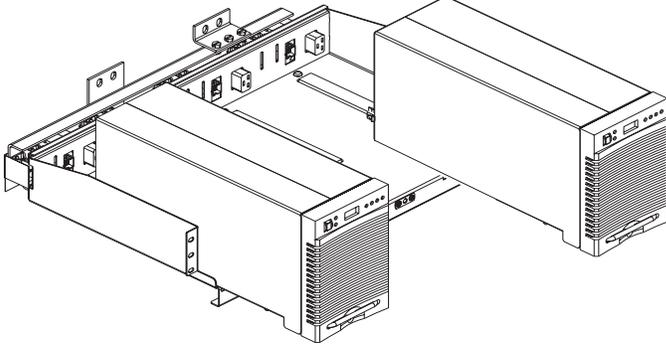
Two approaches can be taken to fan maintenance.

- The first approach is to replace the fan on a routine basis every seven to eight years; this ensures that the fan does not fail in the field under normal operating conditions. This approach is appropriate when there are no remote alarm facilities at the site.
- The second approach, assuming one has remote alarm capability, is to wait until the fan fails. The rectifier will safely shut down and issue both a fail alarm and a thermal alarm. The fan can then be replaced. Since it is likely that all the rectifiers in that installation are of roughly the same age, all rectifier fans at that site should be replaced at that time.

The approach used depends on the location and manning of the site as well as the monitoring of alarms used at the site. Refer to “Replacing a Rectifier Fan Assembly” in this section.

Replacement Procedures

⚠ Installing or Replacing a Rectifier

Installing or Replacing a Rectifier	
Step	Action
1	Locate and turn off the ac service feeding the rectifier. Note: Do not turn off ac service to the entire system, only to the rectifier that has failed.
2	Turn the rectifier's ON/STBY switch to STBY. ⚠ Caution Rear portion of the rectifier that is in operation is HOT to the touch. Use appropriate precautions.
3	(Steps 3 and 4 for replacement only. For a new installation, proceed to Step 5.) Locate the Allen-head bolt in the center of the rectifier front panel. Using the Allen wrench provided, rotate the bolt counterclockwise to release the rectifier for removal.
4	⚠ Caution Handle the rectifier using two hands, one hand supporting the rear of the unit, the other hand on the front handle. Grasp the front handle and slide/pull the rectifier from the shelf assembly. Support the rear of the unit as it slides from the shelf.
	
<p>Figure 11-1: Detail of Rectifier Position</p> <p><i>Continued on next page.</i></p>	

Replacement Procedures, continued.

Installing or Replacing a Rectifier, continued	
Step	Action
5	Slowly slide new rectifier onto the shelf until it contacts the rear connector.
6	Using the Allen wrench, turn the Allen-head bolt clockwise to pull the rectifier into the shelf.
7	<p>Once the rectifier has been installed, set the rectifier ID.</p> <ul style="list-style-type: none">a. Press the ON/STBY switch up and hold for five seconds until display starts blinking “0”.b. Release the switch. The display should continue to blink.c. Depress the switch and release. The display will increment up one number on each release of the switch, and will remain flashing.d. Once the desired ID number appears, depress and hold the switch for five seconds. The display will stop blinking, and revert to the rectifier current. <p>Note: The red LED on the rectifier will blink until the rectifier establishes communication with the controller. After communication is established, the controller will issue a RECT MAJ alarm until the rectifier ID is set.</p>
8	Turn the ac service back on.
9	Turn the rectifier’s ON/STBY switch to ON.

Replacement Procedures, continued

Replacing a Rectifier Fan Assembly

 Stop! Review the “Installing or Replacing a Rectifier” procedure in this section before proceeding.

Replacing a Rectifier Fan Assembly	
Step	Action
1	Remove the rectifier from the system. See the “Installing or Replacing a Rectifier” procedure in this section for the procedure.
2	WAIT five minutes for capacitors to discharge.
3	Loosen the white front cover by removing 14 screws (5 top, 5 bottom, 2 on each side). Before fully removing the cover, disconnect the ribbon cable from the display circuit pack.
4	Remove the screws attaching the old fan to the chassis and carefully unplug the fan connector. The fan connector is keyed and can be loosened by inserting a screwdriver into the slotted side of the connector and gently prying the fan-side connector loose.
5	Replace the old fan with the new fan.
6	Reconnect the ribbon cable removed in Step 3.
7	Attach the front cover.
8	Install the rectifier, following instructions in the “Installing or Replacing a Rectifier” procedure in this section.

Replacement Parts

System

Table 11-A provides a list of replacement parts for GPS 4812/24.

Table 11-A: GPS 4812/24 System Replacement Parts

Ordering Code	Description
Cabinet	
402328926	0.18 ampere alarm fuse
405673161	0.5 ampere alarm fuse
406530725	1-1/3 ampere alarm fuse
406421032	2 ampere alarm fuse
406420273	GMT fuse puller tool
848262622	BLJ3 terminal board
408229318	Wire insertion tool
108588625	BIC8 bay interface card (Millennium controller only)
107900169	EBV2 load disconnect card
107604076	BJN1 battery disconnect card
407227172	Cabinet alarm lamp, 48V
Rectifier	
108796400	596A2 48V/55A rectifier
108962895	596D 48V/110A rectifier
407840792	Fan assembly
901181834	Insulated Allen-head wrench
Distribution	
405673161	1/2A alarm fuse
Millennium Controller	
406530725	1-1/3 ampere fuse (GMT)
406204230	3 ampere fuse (GMT)
406677880	Battery TL5101 for CP BSJ

Replacement Parts, continued

Millennium Controller Circuit Boards

Table 11-B lists the spare parts available for the Galaxy Millennium Controller.

Table 11-B: Galaxy Millennium Controller Circuit Boards

Ordering Code	Description
108895798	Display assembly (includes BSK2)
108029687	Alarm wire wrap board (BSL1)
848194551	Insulation displacement alarm board (BSL2)
108029653	Basic control board (BSH1)
847950912	LCD module assembly display board
108029661	Intelligent control board (BSJ1)
108851338	Modem board (BSM5)
108163601	Data switch board (BSW1)
108340100	Gateway board (EBW1)

Vector Controller Circuit Boards

Table 11-C lists the spare parts available for the Galaxy Vector Controller.

**Table 11-C: Galaxy Vector Controller
Circuit Boards and Temperature Module**

Ordering Code	Description
107789513	Thermal probe multiplexer (210E)
848597563	Display assembly (includes BMW2)
108890096	48V control board (GCM3)
108415647	Modem Board (BSM3)
108340100	Gateway Board (EBW1)

Additional Ordering Information

Documentation Table 11-D lists other documentation associated with the GPS 4812/24.

Table 11-D: Product Documentation

Document Number	Description
H569-436	GPS 4812/24 Ordering Guide
167-792-157	GPS Installation Guide
167-792-180	Galaxy Millennium Controller Product Manual
167-792-112	Galaxy Vector Controller Product Manual
167-790-063	Remote Peripheral Monitoring System Product Manual
193-104-105	EasyView Software Product Manual
193-104-106	Galaxy Gateway Product Manual

Software EasyView software is a Windows-compatible communications package designed specifically for use with Galaxy controllers. Download EasyView software from <http://www.lineagepower.com>

12 *Troubleshooting Preparations*

Preliminary

Introduction

This section provides information needed in preparation for locating and interpreting visual indicators to help identify problems.

When replacing a part does not correct the problem or visual indicators do not identify a defective part, notify Lineage Power Technical Support.

Safety

Review all safety instructions and warnings in the Safety section of the GPS Installation Guide before troubleshooting the GPS 4812/24.

Warnings

- | |
|---|
| <ul style="list-style-type: none">• Hazardous ac and dc voltages and/or energy are present. Caution should be exercised. Tools must be insulated to help prevent accidental contact with live surfaces.• Coordinate all troubleshooting activities with other personnel that may be working on the system. |
|---|

Tools

The following tools are necessary in order to troubleshoot the GPS 4812/24:

- 3/16-inch (5mm) Allen-head wrench
- Insulated hand tools
- Calibrated digital voltmeter (DVM) (0.05% accuracy on dc scale)
- ESD wrist strap

Troubleshooting Procedure

Purpose

The troubleshooting procedure described below is used when a trouble condition has been identified and a technician has been dispatched to the system location as a first and fundamental step in diagnosing and correcting the problem.

For all trouble conditions, proceed as follows:

Cabinet Alarm

1. Locate the system Galaxy controller. The controller is typically located in the cabinet identified as BAY ONE. Because a trouble condition exists, the red alarm on the top of the cabinet will be illuminated. See Figure 12-1.

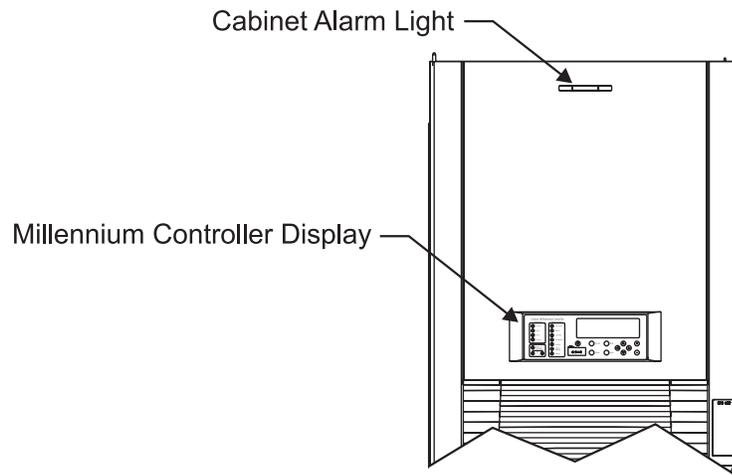


Figure 12-1: Location of Cabinet Alarm

Troubleshooting Procedure, continued

System Status

2. Determine the system status. For most problems, one or more alarm and status LEDs will be illuminated. Depending on the controller type, the following will be displayed:
 - system voltage (all)
 - system current (Millennium)
 - system mode (Millennium)
 - system number of alarm/warnings (Millennium)

If the screen is blank, but alarm and status LEDs are illuminated, call technical support.

If the entire panel is blank, check the controller fuse (F3 basic power for the Millennium; F2 on the BLJ board for the Vector). See Figures 12-3 and 12-5. Verify that the controller is getting power. If not, replace fuse. If the display is still blank, call technical support.

Alarms Menu

3. To view the Alarms Menu:

- **Millennium controller:**

If the default screen appears normal, press the MENU button. The main menu appears with “Alarms” blinking. Press ENTER to obtain the Alarms menu. Additional data appears that will help to identify the problem.

- **Vector controller:**

Press the View Active Alarms button and use the displayed message code to help identify the problem.

Troubleshooting Procedure, continued

Troubleshooting Tables

4. Based on the information presented by the alarm LEDs, select the appropriate table from the lists below:

Section 13, Troubleshooting Millennium Systems	
Alarm LED	Table
AC System	13-A, AC Alarms
Battery	13-B, Battery Alarms
Battery on Discharge	13-F, Miscellaneous Alarms
Controller	13-C, Controller Alarms
Distribution	13-D, Distribution Alarms
Rectifier	13-E, Rectifier and Converter Related Alarms
Remote Modules	13-F, Miscellaneous Alarms
No LED*	13-F, Miscellaneous Alarms
*If an alarm condition exists, but no alarm LED is lit, refer to Table 13-F.	

Troubleshooting Procedure, continued

Troubleshooting Tables, continued

Section 14, Troubleshooting Vector Systems	
AC failure	14-A, AC Alarms
MULTIPLE AC FAIL	
phase failure	
VERY LOW VOLTAGE	14-B, Battery Alarms
CONTACTOR1 OPEN	
CONTACTOR1 FAIL	
HIGH BATT TEMP	
(no message)	14-C, Controller Alarms
CONTACTOR2 OPEN	14-D, Distribution Alarms
CONTACTOR2 FAIL	
DISTRIBUTION FUSE	
RECT ID CONFLICT	14-E, Rectifier Related Alarms
rectifier fail	
MULTI RECT FAIL	
VERY HIGH VOLTGE	
rect manual off	
high float volt	
temp probe fail	14-F, Miscellaneous Alarms
BATT ON DISCHARGE	
AUXILIARY INPUT	
MAINTENANCE OPEN	
SENSE VOLT FAIL	
load imbalance	
Note: If an alarm condition exists, but no alarm LED is lit, refer to Table 14-F. Display messages in lower case are minor alarms. Display messages in upper case are major alarms.	

Identifying Problems

- Once the appropriate table is identified, use the status LEDs and the alarm menu data to identify the specific problem that is causing the alarm.

Reference Figures

Figure Numbers and Titles

The following figures are provided for reference while performing the troubleshooting procedure:

Troubleshooting Reference Figures

Figure No.	Title
12-1	Location of Cabinet Alarm
12-2	Millennium Controller Display
12-3	Location of Millennium Controller Fuses and Boards
12-4	Vector Controller Display
12-5	Location of Vector Controller Fuses and Boards
12-6	Rectifier Display
12-7	Low Voltage Battery Disconnect Contactor Control Switches
12-8	Detail of AC Input Panel and Rectifier Shelf
12-9	Detail of DC Distribution Panel
12-10	Low Voltage Load Disconnect Contactor Control Switches

Reference Figures, continued

Millennium Controller

Basic Controller

BSH (microprocessor board): After power up, or after a reset, the green and yellow LEDs will both be lit while self diagnostics are in progress (which will take about 10 seconds). If all diagnostics pass, the yellow LED will extinguish and the green LED will remain lit. If a failure is detected during diagnostics, the green LED will extinguish and the yellow LED will remain lit.

If a failure occurs during normal operation, the green LED will extinguish and the yellow LED will light.

Intelligent Controller

BSJ (microprocessor board): After power up, or after a reset, the green and yellow LEDs will both be lit while self diagnostics are in progress (which will take about 30 seconds). If all diagnostics pass, the yellow LED will extinguish and the green LED will remain lit. If a failure is detected during diagnostics, the green LED will extinguish and the yellow LED will remain lit. If a terminal is attached to the local port during diagnostics, the diagnostic messages will show which test failed.

If a failure occurs during normal operation, the green LED will extinguish and the yellow LED will light.

Reference Figures, continued

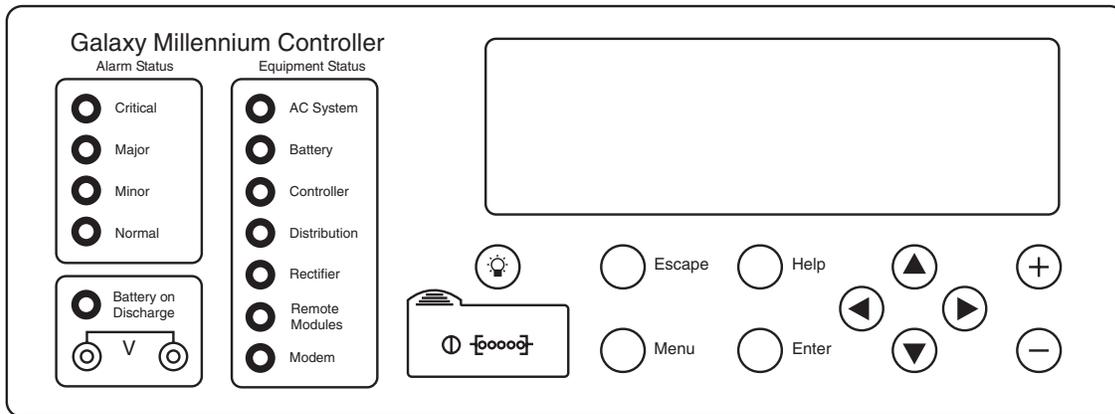


Figure 12-2: Millennium Controller Display

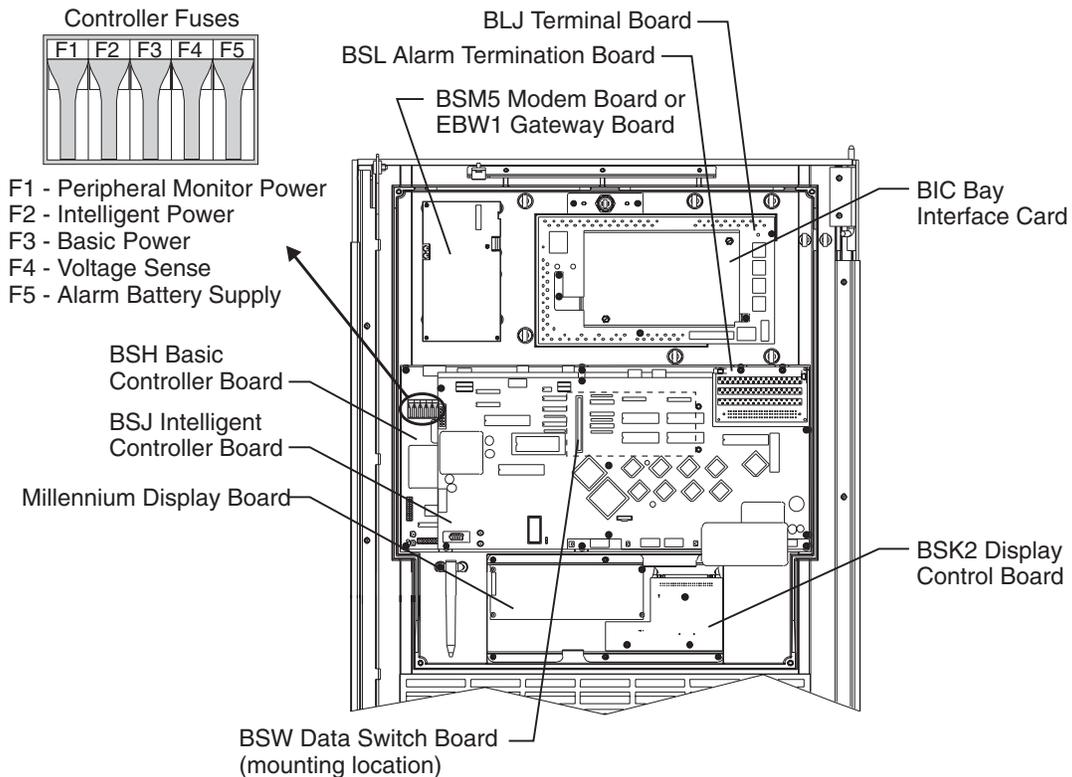


Figure 12-3: Location of Millennium Controller Fuses and Boards

Reference Figures, continued

Vector Controller

The GCM control board is mounted on the BLJ3 terminal connection board. Input/output connections for the BLJ3 are defined in table 12-5. The controller display shows a message for each alarm. These messages are listed in Section 14, *Troubleshooting Vector Systems*.

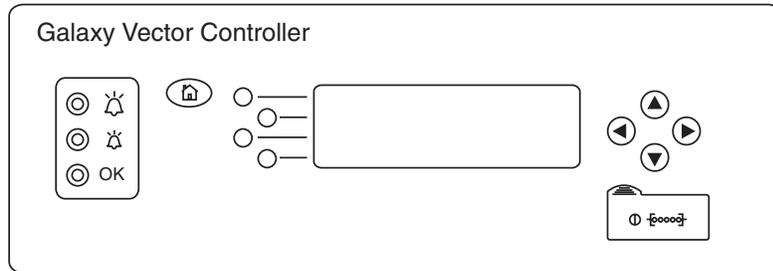


Figure 12-4: Vector Controller Display

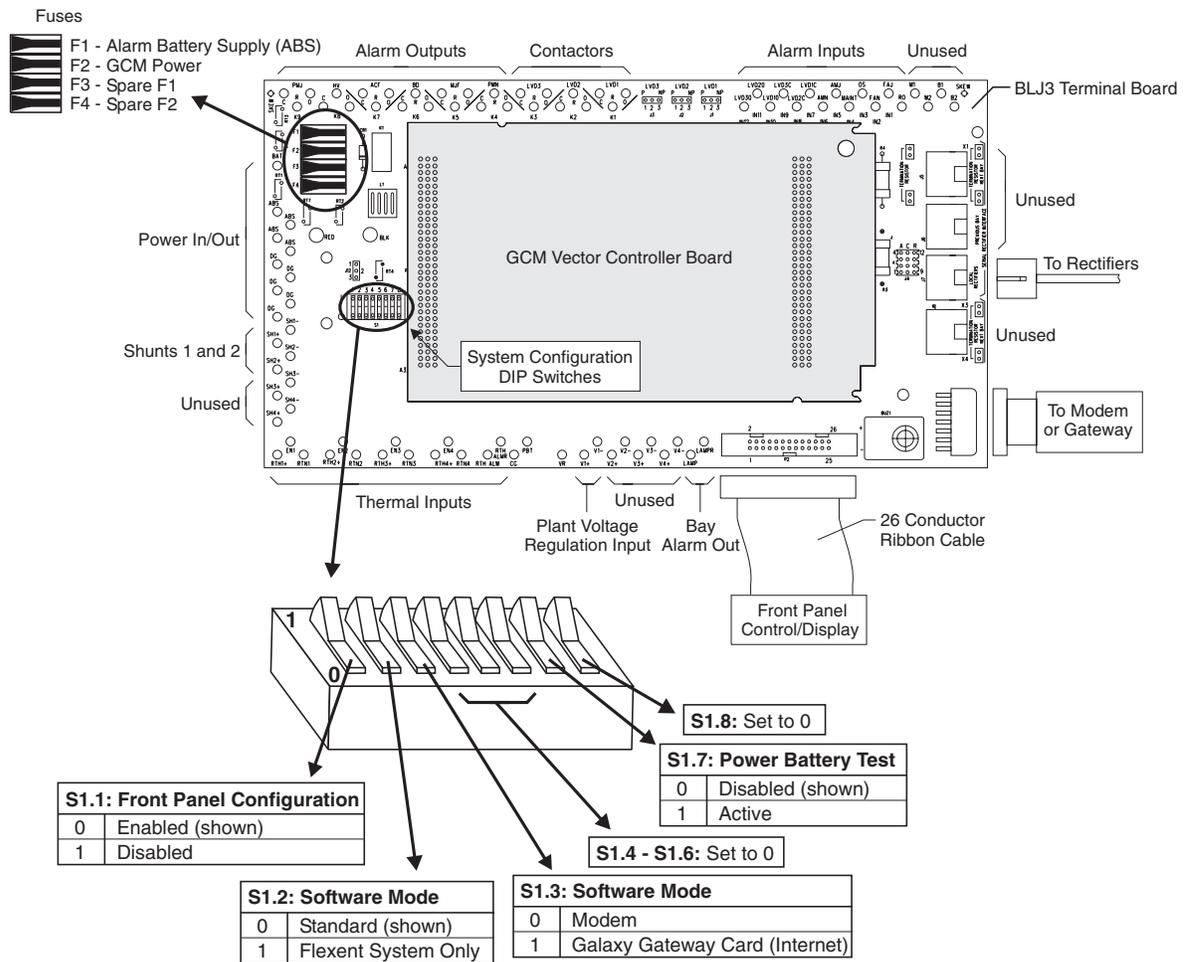


Figure 12-5: Location of Vector Controller Fuses and Boards

Reference Figures, continued

Rectifiers

During normal operation, the rectifier's green ON LED will be lit and the display will show the rectifier's output current.

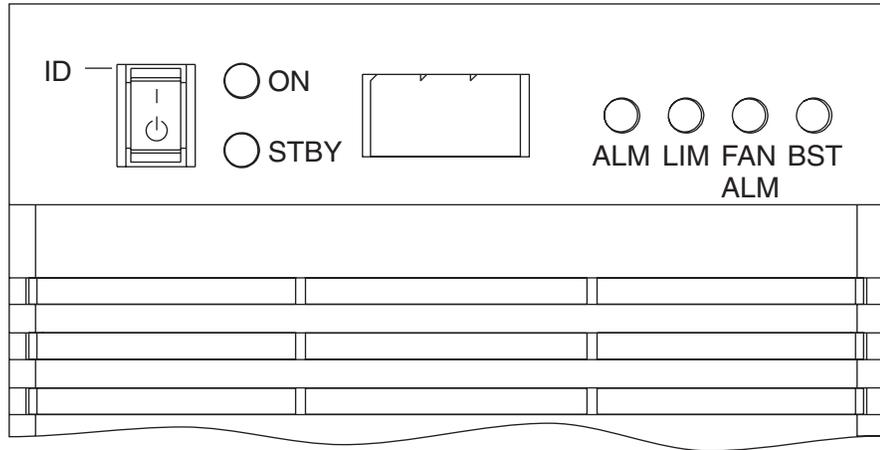


Figure 12-6: Rectifier Display

Reference Figures, continued

Low Voltage Battery Disconnect

The low voltage battery disconnect (LVBD) feature consists of a contactor, circuitry on the BJN board, and associated wiring. Control of the contactor is dictated by the BJN contactor control board and the controller.

Figure 12-7 shows the location of the contactor control board in the GPS cabinet.

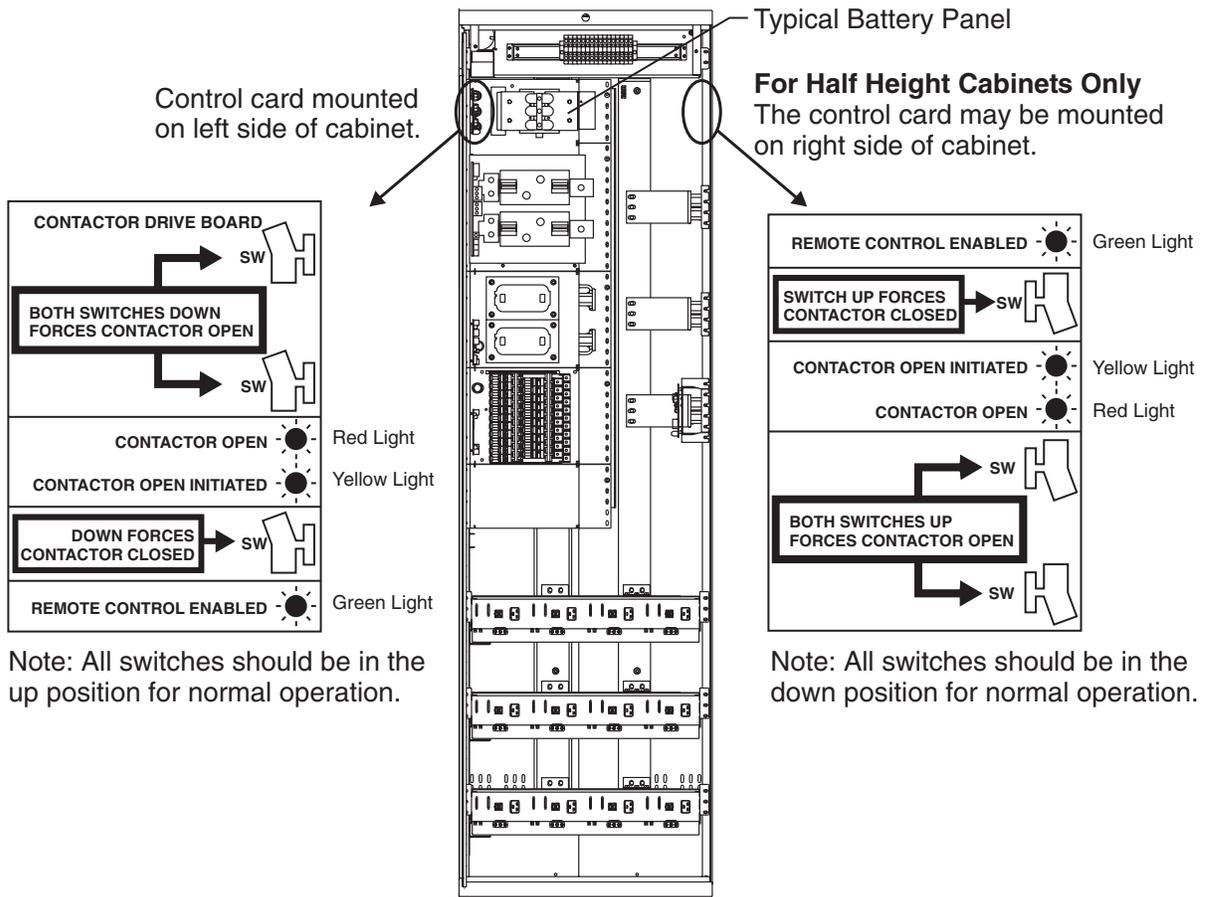


Figure 12-7: Low Voltage Battery Disconnect Contactor Control Switches

Reference Figures, continued

AC Input

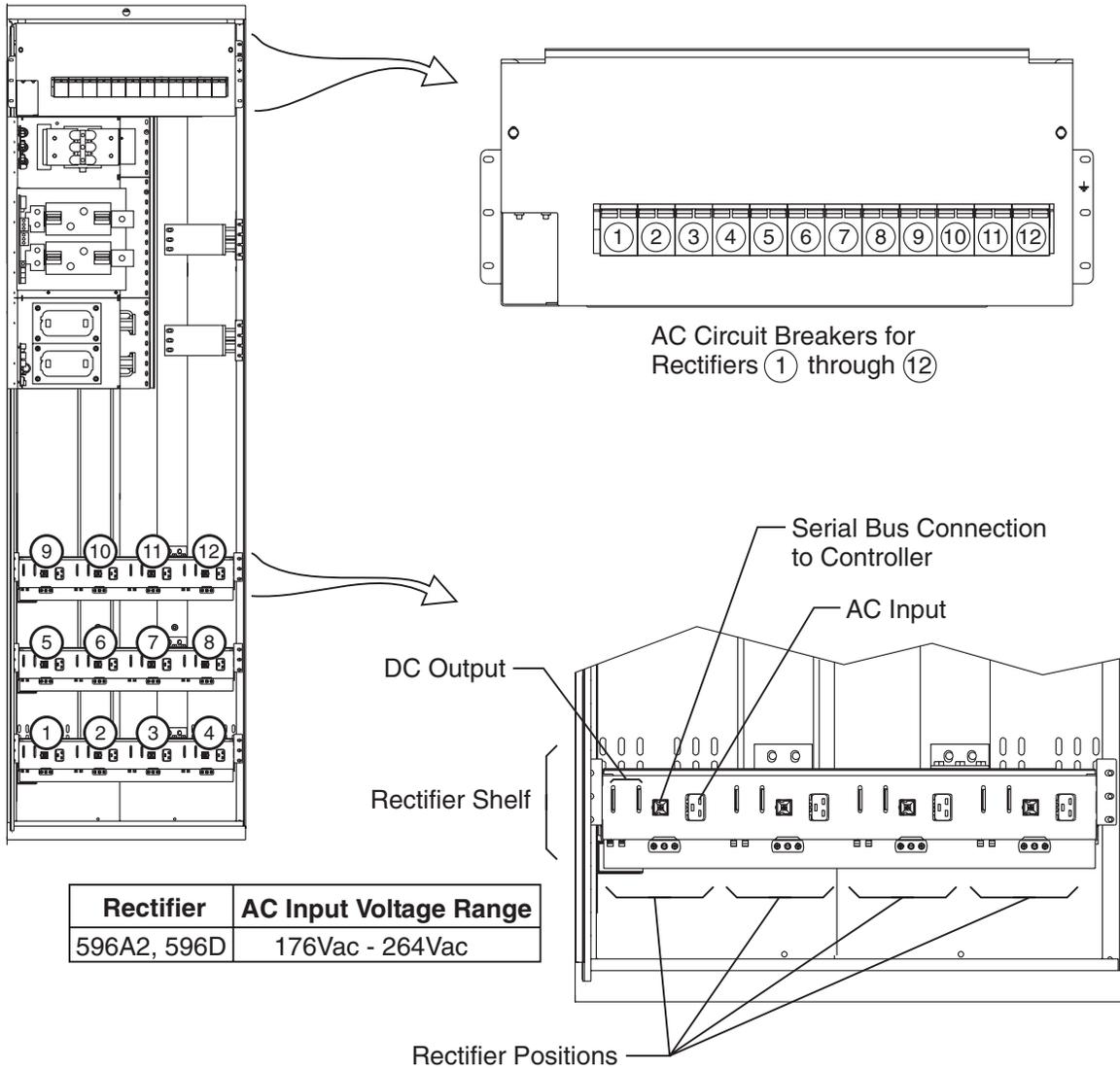


Figure 12-8: Detail of AC Input Panel and Rectifier Shelf

Reference Figures, continued

DC Distribution

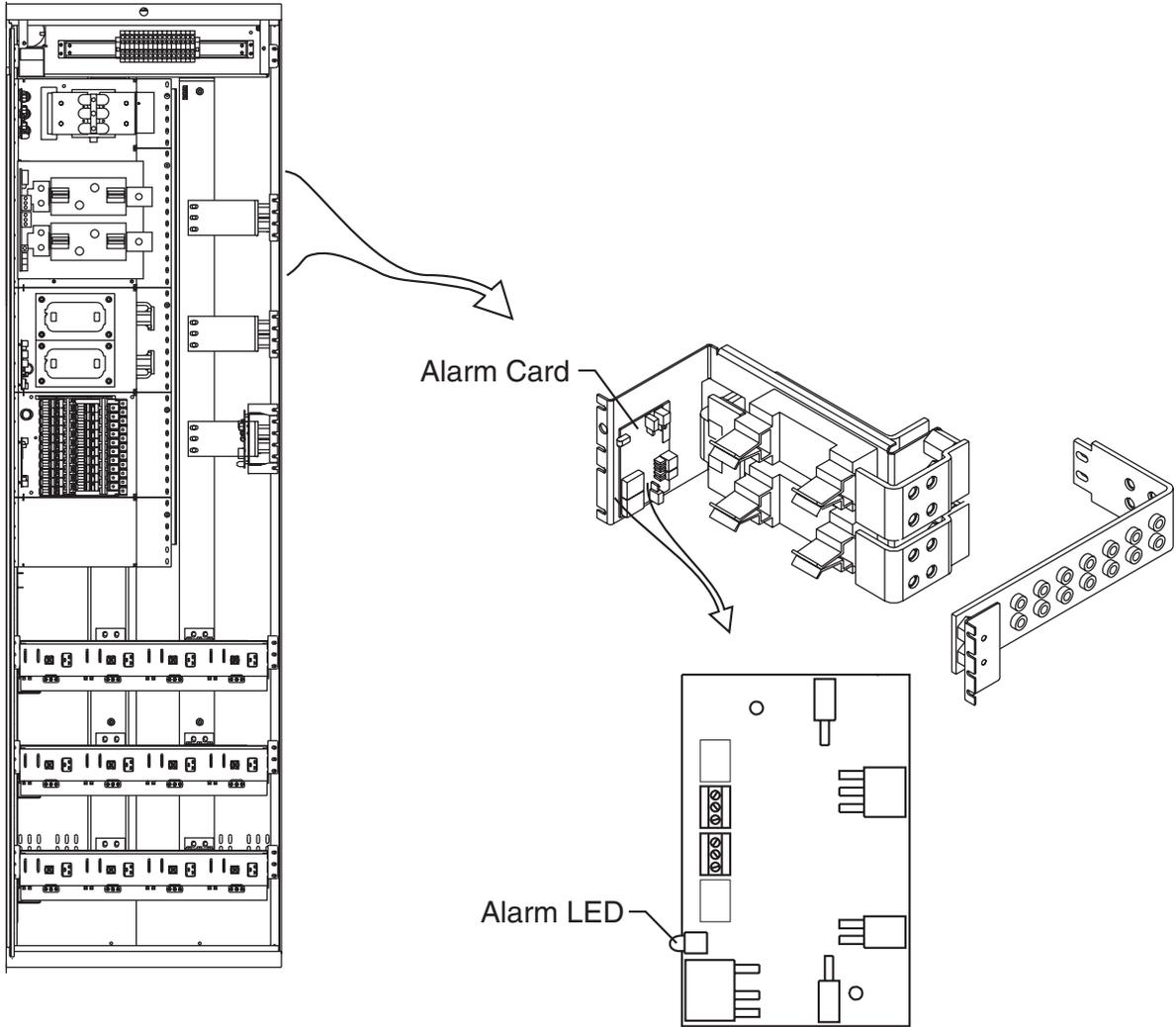


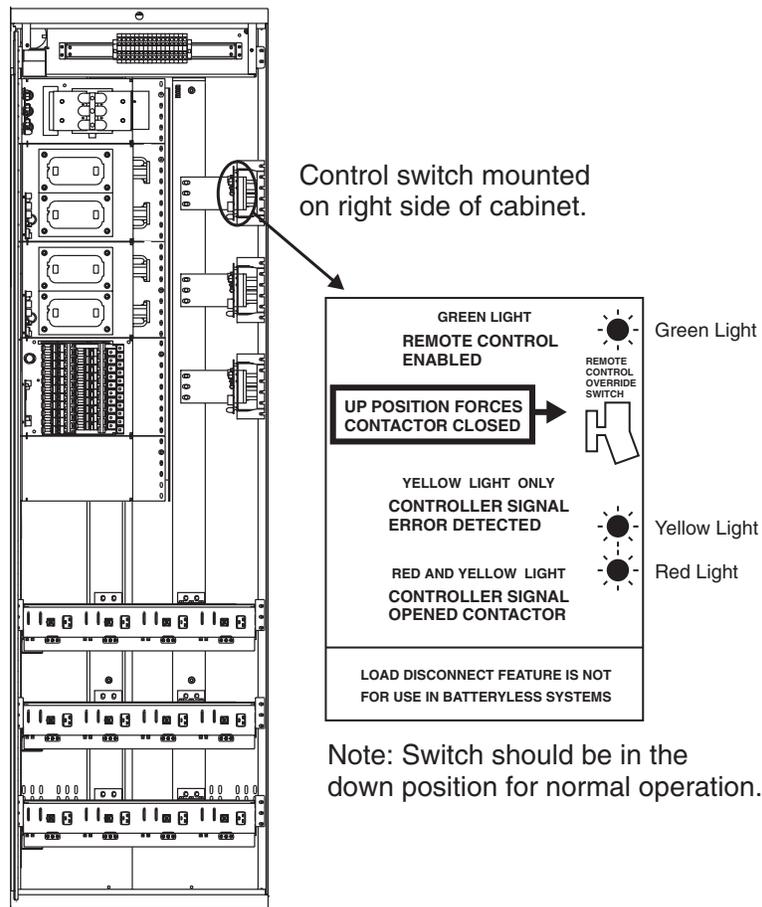
Figure 12-9: Detail of DC Distribution Panel

Reference Figures, continued

Low Voltage Load Disconnect

The EBV low voltage load disconnect (LVLD) contactor control board is mounted on the right side of the cabinet, as shown in Figure 12-10.

The manual contactor control switch (SW300) is not meant to be used to permanently override the LVLD function. It is only to be used temporarily while servicing or testing the equipment.



Note: Switch should be in the down position for normal operation.

Figure 12-10: Low Voltage Load Disconnect Contactor Control Switches

13 ***Troubleshooting Millennium Systems***

Introduction

In This Section This section provides information for locating and interpreting visual indicators to help identify problems in Galaxy Power Systems equipped with the Millennium controller.

Preparation Read Section 12, *Troubleshooting Preparations*, thoroughly before proceeding.

Technical Assistance When visual indicators do not identify a defective part, notify Tcyo Electronics Technical Support.

Note If your cabinet has a metal door and a Galaxy Millennium Controller, some components of the controller will look different than in this manual, but operation is the same.

Troubleshooting Tables

Organization

The tables in this section are organized alphabetically by Alarm LED, then grouped according to the status of the alarm: Critical, Major, or Minor.

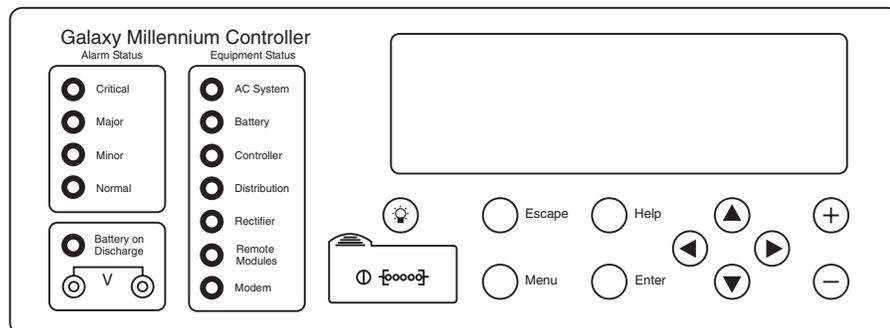
Table Reference

Use the reference below to locate the Alarm LED and corresponding table.

Alarm LED	Table
AC System	13-A, AC Alarms
Battery	13-B, Battery Alarms
Battery on Discharge	13-F, Miscellaneous Alarms
Controller	13-C, Controller Alarms
Distribution	13-D, Distribution Alarms
Rectifier	13-E, Rectifier Related Alarms
Remote Modules	13-F, Miscellaneous Alarms
No LED*	13-F, Miscellaneous Alarms
*If an alarm condition exists, but no alarm LED is lit, refer to Table 13-F.	

Millennium Display Reference

The Millennium display is illustrated below for quick reference while using the troubleshooting tables.



**AC System Alarm
LED**

Table 13-A: AC Alarms
(See Figure 12-8)

Controller LED	Controller Alarm Status	Millennium Controller Display	Other Indication(s)	Possible Problem(s)	Possible Solution(s)
AC System	Minor	AC Fail	ACF on rectifier display	Rectifier is not receiving ac power: <ul style="list-style-type: none"> •AC input circuit breaker has operated. •AC input voltage is out of range. •Internal rectifier failure 	<ol style="list-style-type: none"> 1. Verify that ac circuit breaker is closed; close circuit breaker if operated. 2. If the problem is not corrected, replace the rectifier.
AC System	Minor	Engine Transfer Timeout	Engine may have alarm.	Remote engine or connection to engine has failed.	Call technical support.
AC System	Minor	Phase Alarm	PF on rectifier display	Phase failure: <ul style="list-style-type: none"> •Rectifier high voltage shutdown •External phase imbalance or failure •Internal rectifier failure 	<ol style="list-style-type: none"> 1. Toggle the ON/STBY switch into the STBY position and then back into the ON position. 2. If the problem is not corrected, replace the rectifier.

Battery Alarm LED**Table 13-B: Battery Alarms**
(See Figure 12-7)

Controller LED	Controller Alarm Status	Millennium Controller Display	Other Indication(s)	Possible Problem(s)	Possible Solution(s)
Battery	Critical	Very Low Voltage	--	Occurs in an operating system following an extended commercial ac power outage, during which the batteries are providing power for the system and the system voltage is approaching the user-defined low limit.	<ol style="list-style-type: none"> 1. If commercial ac power is present but the system voltage remains low, call technical support. 2. Investigate other alarms that may be present (rectifier-related alarms and the AC Fail alarm may also occur during the fault condition).
Battery* *Alarm must be configured to turn on the Battery LED; not a factory default.	Major	Contactora 1 Open	Red LED on contactora drive board is lit.	Contactora is open: <ul style="list-style-type: none"> •Open has been initiated by controller. •Open has been initiated manually. 	<ol style="list-style-type: none"> 1. Follow instructions on the label adjacent to the contactora drive board (see Figure 12-7). 2. If the problem is not corrected, call technical support.
Battery* *Alarm must be configured to turn on the Battery LED; not a factory default.	Major	Contactora 1 Fail	--	Contactora or drive board has failed.	Call technical support.
Battery	Minor	Open String	Alarm LED on battery fuse panel is lit.	Battery fuse has operated or bat string switch has opened..	Replace the operated fuse.
Battery	Minor	Low Reserve Time	--	Controller has calculated that battery reserve time is below the alarm threshold level.	Call technical support.

Table 13-B: Battery Alarms
(See Figure 12-7)

Controller LED	Controller Alarm Status	Millennium Controller Display	Other Indication(s)	Possible Problem(s)	Possible Solution(s)
Battery	Minor	Battery Thermal Alarm	Alarm on 210E unit, if equipped	Batteries have exceeded temp threshold	<ul style="list-style-type: none">•Check room ambient temperature against battery temperature threshold•Call technical support.

**Controller Alarm
LED**

Table 13-C: Controller Alarms
(See Figures 12-2 and 12-3)

Controller LED	Controller Alarm Status	Millennium Controller Display	Other Indication(s)	Possible Problem(s)	Possible Solution(s)
Controller	Major	Controller Fail	--	<ul style="list-style-type: none"> •BSH failure→ •BSJ failure •Option board failure •Display failure •BIC failure 	<p>Check the BSH board to see if the green LED is extinguished and the yellow LED is lit. If so, perform the following steps:</p> <ol style="list-style-type: none"> 1. Press the SW200 reset switch on the top of the BSH board. If all diagnostics pass, it is possible that some type of “one time” abnormality occurred to cause the failure. 2. If the diagnostics did not pass, or if the problem recurs, unplug all the optional circuit board cables, then press the reset switch on the top of the BSH board again. If all the diagnostics pass, install optional circuit board cables one at a time, verifying operation after each. 3. If the diagnostics did not pass, Replace the BSH board and verify the failure is resolved. If so, reinstall the optional circuit boards and cables one at a time. 4. If the problem is not corrected, call technical support.

Table 13-C: Controller Alarms
(See Figures 12-2 and 12-3)

Controller LED	Controller Alarm Status	Millennium Controller Display	Other Indication(s)	Possible Problem(s)	Possible Solution(s)
Controller	Major	Controller Fail	--	<ul style="list-style-type: none"> •BSH failure •BSJ failure→ •Option board failure •Display failure •BIC failure 	<p>Check the BSJ board to see if the green LED is extinguished and the yellow LED is lit. If so, perform the following steps:</p> <ol style="list-style-type: none"> 1. Press the SW201 reset switch on the top of the BSJ board. (This circuit has an automatic restart which will try three times to restart the microprocessor.) 2. If the diagnostics did not pass, or if the problem recurs, remove all the optional circuit board cables, then press the reset switch on the top of the BSJ board again. If all the diagnostics pass, install optional circuit board cables one at a time, verifying operation after each. 3. If the diagnostics did not pass, replace the BSJ board and verify the failure is resolved. If so, reinstall the optional circuit boards and cables one at a time. 4. If the problem is not corrected, call technical support.

Table 13-C: Controller Alarms
(See Figures 12-2 and 12-3)

Controller LED	Controller Alarm Status	Millennium Controller Display	Other Indication(s)	Possible Problem(s)	Possible Solution(s)
Controller	Major	Controller Fail	--	<ul style="list-style-type: none"> •BSH failure •BSJ failure •Option board failure→ •Display failure •BIC failure 	<p>Check the option boards (modem and data switch) to see if the green LED is extinguished and the yellow LED is lit. If so, perform the following steps:</p> <ol style="list-style-type: none"> 1. Press the SW201 reset switch on the top of the BSJ board. (This circuit has an automatic restart which will try three times to restart the microprocessor.) If the BSJ is not present, press the reset switch on the top of the BSH board. 2. If the diagnostics did not pass, or if the problem recurs, replace the failed option board.
Controller	Major	Controller Fail	--	<ul style="list-style-type: none"> •BSH failure •BSJ failure •Option board failure •Display failure→ •BIC failure 	<p>If the front panel LCD module, LEDs, or switches fail, perform the following steps:</p> <ol style="list-style-type: none"> 1. Verify that the ribbon cable from the BSH board to the display is not cut, abraded, or otherwise mangled. Replace the cable if damaged. 2. Press SW200 to reset the BSH board. 3. If the LCD module is still not operating, replace the LCD module; if the switches and LEDs are still not operating, replace the BSH board.

Table 13-C: Controller Alarms
(See Figures 12-2 and 12-3)

Controller LED	Controller Alarm Status	Millennium Controller Display	Other Indication(s)	Possible Problem(s)	Possible Solution(s)
Controller	Major	Controller Fail	--	<ul style="list-style-type: none"> •BSH failure •BSJ failure •Option board failure •Display failure •BIC failure→ 	Replace BIC per GPS Installation Guide Section 16, "Replacing Bay Interface Card (BIC)".
Controller	Major	Circuit Pack Fail	--	See "Controller Fail".	See "Controller Fail".
Controller	Major	Controller Fuse	--	Fuse has operated.	Replace the controller fuse labeled F2 (intelligent power).
Controller	Major	Alarm Battery Supply Fuse	--	Fuse has operated.	Replace the controller fuse labeled F5 (alarm battery supply).
Controller	Major	Remote Peripheral Fuse	--	Fuse has operated.	Replace the controller fuse labeled F1 (option power).
Controller	Major	Sense/Control Fuse	--	Fuse has operated.	Replace the controller fuse labeled F4 (voltage sense).
Controller	Major	Bay Interface ID Conflict	--	Two or more bay interface cards (BICs) have the same ID number.	Following instructions printed on the label over the BIC, adjust the DIP switches to change the ID number.
Controller	Major	Major Communication Fail Alarm	Blinking ALM LED on rectifiers or red LED on BIC	Loss of communication with controller: <ul style="list-style-type: none"> •Defective interface from BIC or multiple rectifiers to controller •Internal failure of controller, BIC, or multiple rectifiers 	<ol style="list-style-type: none"> 1. Verify that the controller is powered and operating correctly. 2. If there are no controller alarms, replace the equipment that has lost communication. <ul style="list-style-type: none"> •If the problem is not corrected, call technical support.

Table 13-C: Controller Alarms
(See Figures 12-2 and 12-3)

Controller LED	Controller Alarm Status	Millennium Controller Display	Other Indication(s)	Possible Problem(s)	Possible Solution(s)
Controller	Minor	Minor Communication Fail Alarm	Blinking ALM LED on rectifier	Loss of communication with controller: <ul style="list-style-type: none"> •Defective interface from rectifier to controller •Internal controller or rectifier failure 	<ol style="list-style-type: none"> 1. Verify that the controller is powered and operating correctly. 2. If there are no controller alarms, replace the equipment that has lost communication. <ul style="list-style-type: none"> •If the problem is not corrected, call technical support.
Controller	Minor	Self Fail Test	--	See "Controller Fail".	See "Controller Fail".
Controller	Minor	Thermal Probe Failure	--	Battery thermal probe has failed.	Call technical support.

***Distribution Alarm
LED***

Table 13-D: Distribution Alarms
(See Figures 12-9 and 12-10)

Controller LED	Controller Alarm Status	Millennium Controller Display	Other Indication(s)	Possible Problem(s)	Possible Solution(s)
Distribution	Major	External Fuse Major	Alarm LED on dc distribution panel is lit.	DC load fuse or circuit breaker has operated.	Replace fuse or reset circuit breaker.
Distribution* *Alarm must be configured to turn on the Distribution LED; not a factory default.	Major	Contactors 2 (or 3) Open	Red LED on contactor drive board is lit.	Contactors are open: •Open has been initiated by controller. •Open has been initiated manually.	1. Follow instructions on the label adjacent to the contactor drive board (see Figure 12-10). 2. If the problem is not corrected, call technical support.
Distribution* *Alarm must be configured to turn on the Distribution LED; not a factory default.	Major	Contactors 2 (or 3) Fail	--	Contactors or drive board has failed.	Call technical support.

Rectifier Alarm LED

Table 13-E: Rectifier Related Alarms
(See Figures 12-6 and 12-8)

Controller LED	Controller Alarm Status	Millennium Controller Display	Rectifier LED	Rectifier Display	Possible Problem(s)	Possible Solution(s)
Rectifier	Major	ID Not Configured	None	None	Rectifier ID number has not been set.	Set the rectifier ID using the procedure in Section 11, "Installing or Replacing a Rectifier".
Rectifier	Major	ID Conflict	None	None	Two or more rectifiers have the same ID number.	See above.
Rectifier	Major	Multiple Rectifier Fail	ALM	None	More than one rectifier has an ALM LED lit.	See alarms listed below.
Rectifier	Major	High Voltage Alarm	ALM	HO	<ul style="list-style-type: none"> •Lightning has struck system. •Internal rectifier failure 	<ol style="list-style-type: none"> 1. Toggle the ON/STBY switch into the STBY position and then back into the ON position. 2. If the problem is not corrected, replace the rectifier.
Rectifier	Minor	Rectifier Fail	ALM	HO	High output voltage: <ul style="list-style-type: none"> •Rectifier high voltage shutdown •Internal rectifier failure 	<ol style="list-style-type: none"> 1. Verify the configurable HV thresholds in the controller. 2. Toggle the ON/STBY switch into the STBY position and then back into the ON position. 3. If the problem is not corrected, replace the rectifier.

Table 13-E: Rectifier Related Alarms
(See Figures 12-6 and 12-8)

Controller LED	Controller Alarm Status	Millennium Controller Display	Rectifier LED	Rectifier Display	Possible Problem(s)	Possible Solution(s)
Rectifier	Minor	Rectifier Fail	ALM	TA	Thermal alarm: •Excessive ambient temperature •Internal rectifier failure	<ol style="list-style-type: none"> 1. Verify that there is no obstruction of the fan inlet. 2. Toggle the ON/STBY switch into the STBY position and then back into the ON position. 3. If the problem is not corrected, replace the rectifier.
Rectifier	Minor	Rectifier Fail	ALM	ICS IP5 IP6 IP7	Internal rectifier failure	<ol style="list-style-type: none"> 1. Place the ac circuit breaker for the rectifier in the OFF position. 2. Remove the rectifier from the shelf. 3. Wait for 30 seconds or until all front panel display LEDs have extinguished. 4. Replace the rectifier. 5. Return the ac breaker to the ON position. 6. Place the rectifier ON/STBY switch into the ON position. 7. If the problem is not corrected, replace the rectifier.
Rectifier	Minor	Rectifier Fail	ALM	FSE	Fuse alarm: •DC fuse open •Internal rectifier failure	<ol style="list-style-type: none"> 1. Toggle the ON/STBY switch into the STBY position and then back into the ON position. 2. If the problem is not corrected, replace the rectifier.

Table 13-E: Rectifier Related Alarms
(See Figures 12-6 and 12-8)

Controller LED	Controller Alarm Status	Millennium Controller Display	Rectifier LED	Rectifier Display	Possible Problem(s)	Possible Solution(s)
Rectifier	Minor	Rectifier Fail	ALM	LO	Low output voltage: <ul style="list-style-type: none"> •Excessive output current •Internal rectifier failure 	<ol style="list-style-type: none"> 1. Toggle the ON/STBY switch into the STBY position and then back into the ON position. 2. If the problem is not corrected, replace the rectifier.
Rectifier	Minor	Rectifier Fail	ALM	INF	Input fuse blown.	Replace rectifier.
Rectifier	Minor	Rectifier Fail	ALM	SEN	Thermal sensor failure: <ul style="list-style-type: none"> •Internal rectifier failure 	<ol style="list-style-type: none"> 1. Place the ac circuit breaker for the rectifier in the OFF position. 2. Remove the rectifier from the shelf. 3. Wait for 30 seconds or until all front panel display LEDs have extinguished. 4. Replace the rectifier. 5. Return the ac breaker to the ON position. 6. Place the rectifier ON/STBY switch into the ON position. 7. If the problem is not corrected, replace the rectifier with a new one.
Rectifier	Minor	Rectifier Fail	FAN ALM	None	Fan failure	Replace the fan in the rectifier. (See Section 11)
Rectifier	Minor	Manual Off	STBY	Blank	Rectifier has been manually turned off.	Turn rectifier on.

Table 13-E: Rectifier Related Alarms
(See Figures 12-6 and 12-8)

Controller LED	Controller Alarm Status	Millennium Controller Display	Rectifier LED	Rectifier Display	Possible Problem(s)	Possible Solution(s)
Rectifier	Minor	External Transfer Shutdown	STBY	TR	System is operating on external engine.	No action required.
Rectifier	Minor	High Float Voltage	None	None	Configuration problem	Call technical support.
Rectifier	Minor	Excess Rectifier Drain	None	None	Internal rectifier fault	Replace rectifier.
Rectifier	Minor	Excess System Drain	None	None	System load exceeds shunt rating.	Call technical support.
Rectifier	Minor	Limited Recharge	None	None	Rectifier capacity has been exceeded.	Install more rectifiers.

**Battery on
Discharge and
Remote Modules
Alarm LEDs,
or No LED**

Table 13-F: Miscellaneous Alarms

Controller LED	Controller Alarm Status	Millennium Controller Display	Other Indication(s)	Possible Problem(s)	Possible Solution(s)
Battery on Discharge	Major	Battery on Discharge	Rectifiers may say ACF.	Temporary condition that may be associated with other alarms	Call technical support.
Remote Modules	Minor	Module Failure	Green LED on RPM will not blink.	Remote Peripheral Module has failed.	Call technical support.
Remote Modules	Minor	Measurement Out of Range	--	<ul style="list-style-type: none"> •Data being sensed exceeds remote peripheral module's capability. •Remote peripheral module has failed. 	Call technical support.
None	Major	Auxiliary Major	Auxiliary equipment may have alarm.	Problem with operation of auxiliary equipment	Call technical support.
None	Minor	Auxiliary Minor	Auxiliary equipment may have alarm.	Problem with operation of auxiliary equipment	Call technical support.
None	None	None	<ul style="list-style-type: none"> •STBY LED on rectifier is lit. •TR on rectifier display 	Remote transfer: <ul style="list-style-type: none"> •Rectifier is in STBY. 	Remove the remote standby command issued by the controller.

Table 13-F: Miscellaneous Alarms

Controller LED	Controller Alarm Status	Millennium Controller Display	Other Indication(s)	Possible Problem(s)	Possible Solution(s)
None	None	None	Red LED is lit on some battery contactor drive boards, while green LED is lit on others.	If a green LED is lit despite a contactor open command issued by the controller, the drive card or the contactor has failed.	Call technical support.

14 ***Troubleshooting Vector Systems***

Introduction

In This Section This section provides information for locating and interpreting visual indicators to help identify problems in Galaxy Power Systems equipped with the Vector controller.

Preparation Read Section 12, *Troubleshooting Preparations*, thoroughly before proceeding.

Technical Assistance When visual indicators do not identify a defective part, notify Lineage Power Technical Support.

Note If your cabinet has a metal door and a Galaxy Vector Controller, your controller differs substantially from the version shown in this manual. Refer to Issue 5 of this manual for information pertaining to your controller.

Troubleshooting Tables

Organization

The tables in this section are organized alphabetically by alarm type, then grouped according to the status of the alarm, Major or Minor.

Table Reference

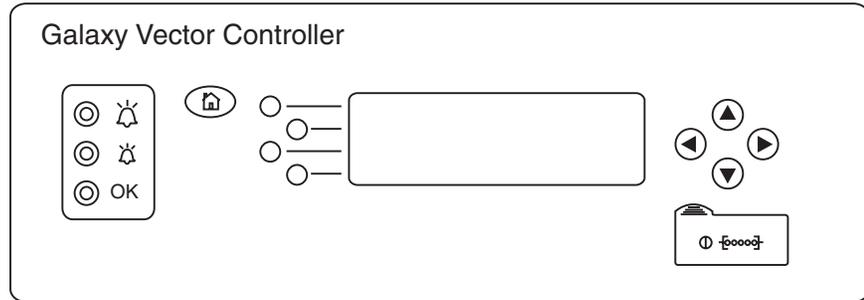
Use the reference below to locate the table corresponding to the message displayed after pressing “← View Alarms.”

Display Message	Table
ac failure	14-A, AC Alarms
MULTIPLE AC FAIL	
phase failure	
VERY LOW VOLTAGE	14-B, Battery Alarms
CONTACTOR1 OPEN	
CONTACTOR1 FAIL	
HIGH BATT TEMP	
(no message)	14-C, Controller Alarms
CONTACTOR2 OPEN	14-D, Distribution Alarms
CONTACTOR2 FAIL	
DISTRIBUTION FUSE	
RECT ID CONFLICT	14-E, Rectifier Related Alarms
rectifier fail	
MULTI RECT FAIL	
VERY HIGH VOLTGE	
rect manual off	
high float volt	
temp probe fail	14-F, Miscellaneous Alarms
BATT ON DISCHARGE	
AUXILIARY INPUT	
MAINTENANCE OPEN	
SENSE VOLT FAIL	
load imbalance	
Note: If an alarm condition exists, but no alarm LED is lit, refer to Table 15-F. Display messages in lower case are minor alarms. Display messages in upper case are major alarms.	

Troubleshooting Tables, continued

Vector Display Reference

The Vector front display is shown below for quick reference while using the troubleshooting tables.



AC Alarms

Table 14-A: AC Alarms
(See Figure 12-8)

Controller Alarm Status	Vector Controller Display	Other Indication(s)	Possible Problem(s)	Possible Solution(s)
Major	MULTIPLE AC FAIL	ACF on rectifier display	Rectifier(s) not receiving ac power: <ul style="list-style-type: none"> •AC input circuit breaker has operated. •AC input voltage is out of range. •Internal rectifier failure 	<ol style="list-style-type: none"> 1. Verify that ac circuit breaker is closed; close circuit breaker if operated. 2. If the problem is not corrected, replace the rectifier(s).
Minor	ac failure	ACF on rectifier display	Rectifier not receiving ac power: <ul style="list-style-type: none"> •AC input circuit breaker has operated. •AC input voltage is out of range. •Internal rectifier failure 	<ol style="list-style-type: none"> 1. Verify that ac circuit breaker is closed; close circuit breaker if operated. 2. If the problem is not corrected, replace the rectifier.
Minor	phase failure	PF on rectifier display	Phase failure: <ul style="list-style-type: none"> •Rectifier high voltage shutdown •External phase imbalance or failure •Internal rectifier failure 	<ol style="list-style-type: none"> 1. Toggle the ON/STBY switch into the STBY position and then back into the ON position. 2. If the problem is not corrected, replace the rectifier.

Battery Alarms**Table 14-B: Battery Alarms**
(See Figure 12-7)

Controller Alarm Status	Vector Controller Display	Other Indication(s)	Possible Problem(s)	Possible Solution(s)
Major	VERY LOW VOLTAGE	--	Occurs in an operating system following an extended commercial ac power outage, during which the batteries are providing power for the system and the system voltage is approaching the user-defined low limit.	<ol style="list-style-type: none"> 1. If commercial ac power is present but the system voltage remains low, call technical support. 2. Investigate other alarms that may be present (rectifier-related alarms and the AC Fail alarm may also occur during the fault condition).
Major	CONTACTOR1 OPEN	Red LED on contactor drive board is lit.	Contactor is open: <ul style="list-style-type: none"> •Open has been initiated by controller. •Open has been initiated manually. 	<ol style="list-style-type: none"> 1. Follow instructions on the label adjacent to the contactor drive board (see Figure 12-7). 2. If the problem is not corrected, call technical support.
Major	CONTACTOR1 FAIL	--	Contactor or drive board has failed.	Call technical support.
Major	HIGH BATT TEMP	Alarm on 210E unit, if equipped	Batteries have exceeded temperature threshold.	Call technical support.

Controller Alarms

Table 14-C: Controller Alarms
(See Figures 12-4 and 12-5)

Controller Alarm Status	Vector Controller Display	Other Indication(s)	Possible Problem(s)	Possible Solution(s)
Major	None	--	•Controller failure	<p>Check controller to see if the green LED is extinguished and the red LED is lit. If so, perform the following steps:</p> <ol style="list-style-type: none"> 1. Remove and reset the controller circuit board. If all diagnostics pass, it is possible that some type of “one time” abnormality occurred to cause the failure. 2. If the diagnostics did not pass, replace the controller circuit board and verify the failure is resolved. 3. If the problem is not corrected, call technical support.
Major	None	--	<ul style="list-style-type: none"> •Controller failure •Display failure 	<p>If the front panel LED module, LEDs, or switches fail, perform the following steps:</p> <ol style="list-style-type: none"> 1. Verify that the ribbon cable from the controller board to the BMW display is not cut, abraded, or otherwise mangled. Replace the cable if damaged. 2. Reset the controller board. 3. If the display is still not operating, replace the display module.
Minor	TEMP PROBE FAIL	--	Battery thermal probe has failed.	Call technical support.

Distribution Alarms

Table 14-D: Distribution Alarms
(See Figures 12-9 and 12-10)

Controller Alarm Status	Vector Controller Display	Other Indication(s)	Possible Problem(s)	Possible Solution(s)
Major	CONTACTOR2 OPEN	Red LED on contactor drive board is lit.	Contactors are open: <ul style="list-style-type: none"> •Open has been initiated by controller. •Open has been initiated manually. 	<ol style="list-style-type: none"> 1. Follow instructions on the label adjacent to the contactor drive board (see Figure 12-10). 2. If the problem is not corrected, call technical support.
Major	CONTACTOR2 FAIL	--	Contactors or drive board has failed.	Call technical support.
Major	DISTRIBUTION FUSE	Alarm LED on dc distribution panel is lit.	DC load fuse or circuit breaker has operated.	Replace fuse or reset circuit breaker.
Major	DISTRIBUTION FUSE	--	Fuse has operated.	Replace fuse F2 (alarm battery supply) on the BLJ3 terminal board.

Rectifier Related Alarms

Table 14-E: Rectifier Related Alarms

(See Figures 12-6 and 12-8)

Controller Alarm Status	Vector Controller Display	Rectifier LED	Rectifier Display	Possible Problem(s)	Possible Solution(s)
Major	RECT ID CONFLICT	None	None	Rectifier ID number has not been set.	Set the rectifier ID using the procedure in Section 11, "Installing or Replacing a Rectifier".
Major	RECT ID CONFLICT	None	None	Two or more rectifiers have the same ID number.	See above.
Major	MULTI RECT FAIL	ALM	None	More than one rectifier has an ALM LED lit.	See rectifier alarms listed below.
Major	MULTI RECT FAIL	--	--	Loss of communication with controller: <ul style="list-style-type: none"> •Defective interface from multiple rectifiers to controller •Internal failure of controller or multiple rectifiers 	<ol style="list-style-type: none"> 1. Verify that the controller is powered and operating correctly. 2. If there are no controller alarms, replace rectifiers that have lost communication. 3. If the problem is not solved, call technical support.
Major	VERY HIGH VOLTGE	ALM	HO	<ul style="list-style-type: none"> •Lightning has struck system. •Internal rectifier failure 	<ol style="list-style-type: none"> 1. Toggle the ON/STBY switch into the STBY position and then back into the ON position. 2. If the problem is not corrected, replace the rectifier.
Minor	RECTIFIER FAIL	Blinking ALMLED on rectifier	--	Loss of communication with controller: <ul style="list-style-type: none"> •Defective interface from rectifier to controller •Internal controller or rectifier failure 	<ol style="list-style-type: none"> 1. Verify that the controller is powered and operating correctly. 2. If there are no controller alarms, replace the rectifier. 3. If the problem is not corrected, call technical support.

Table 14-E: Rectifier Related Alarms
(See Figures 12-6 and 12-8)

Controller Alarm Status	Vector Controller Display	Rectifier LED	Rectifier Display	Possible Problem(s)	Possible Solution(s)
Minor	RECTIFIER FAIL	ALM	HO	High output voltage: •Rectifier high voltage shutdown •Internal rectifier failure	<ol style="list-style-type: none"> 1. Verify the configurable HV thresholds in the controller. 2. Toggle the ON/STBY switch into the STBY position and then back into the ON position. 3. If the problem is not corrected, replace the rectifier.
Minor	RECTIFIER FAIL	ALM	TA	Thermal alarm: •Excessive ambient temperature •Internal rectifier failure	<ol style="list-style-type: none"> 1. Verify that there is no obstruction of the fan inlet. 2. Toggle the ON/STBY switch into the STBY position and then back into the ON position. 3. If the problem is not corrected, replace the rectifier.
Minor	RECTIFIER FAIL	ALM	FSE	Fuse alarm: •DC fuse open •Internal rectifier failure	<ol style="list-style-type: none"> 1. Toggle the ON/STBY switch into the STBY position and then back into the ON position. 2. If the problem is not corrected, replace the rectifier.
Minor	RECTIFIER FAIL	ALM	LO	Low output voltage: •Excessive output current •Internal rectifier failure	<ol style="list-style-type: none"> 1. Toggle the ON/STBY switch into the STBY position and then back into the ON position. 2. If the problem is not corrected, replace the rectifier.
Minor	RECTIFIER FAIL	ALM	ICS IP5 IP6 IP7	Internal rectifier failure	<ol style="list-style-type: none"> 1. Place the ac circuit breaker for the rectifier in the OFF position. 2. Remove the rectifier from the shelf. 3. Wait for 30 seconds or until all front panel display LEDs have extinguished. 4. Replace the rectifier. 5. Return the ac breaker to the ON position. 6. Place the rectifier ON/STBY switch into the ON position. 7. If the problem is not corrected, replace the rectifier.

Table 14-E: Rectifier Related Alarms
(See Figures 12-6 and 12-8)

Controller Alarm Status	Vector Controller Display	Rectifier LED	Rectifier Display	Possible Problem(s)	Possible Solution(s)
Minor	RECTIFIER FAIL	ALM	SEN	Thermal sensor failure: •Internal rectifier failure	<ol style="list-style-type: none"> 1. Place the ac circuit breaker for the rectifier in the OFF position. 2. Remove the rectifier from the shelf. 3. Wait for 30 seconds or until all front panel display LEDs have extinguished. 4. Replace the rectifier. 5. Return the ac breaker to the ON position. 6. Place the rectifier ON/STBY switch into the ON position. 7. If the problem is not corrected, replace the rectifier with a new one.
Minor	RECTIFIER FAIL	FAN ALM	None	Fan failure	Replace the fan in the rectifier.
Minor	rect manual off	STBY	Blank	Rectifier has been manually turned off.	Turn rectifier on.
Minor	high float volt	None	None	Configuration problem	Call technical support.

Miscellaneous Alarms

Table 14-F: Miscellaneous Alarms

Controller Alarm Status	Vector Controller Display	Other Indication(s)	Possible Problem(s)	Possible Solution(s)
Major	BATT ON DISCHARGE	Rectifiers may say ACF.	Temporary condition that may be associated with other alarms	Call technical support.
Major	AUXILIARY INPUT	Auxiliary equipment may have alarm.	Problem with operation of auxiliary equipment	Call technical support.
Major	MAINTENANCE OPEN	Red LED is lit on control panel.	Input Number 4 (MAINT) of the BLJ3 terminal connection board is interrupted.	Re-establish connection.
Major	SENSE VOLT FAIL	Red LED is lit on control panel.	Broken connection or blown fuse.	Re-establish connection or replace blown fuse.
Minor	load imbalance	Yellow LED is lit on control panel.	A rectifier is unable to load share properly.	Identify rectifier that is not functioning properly; reseal and retest. If rectifier still does not load share, replace rectifier.
None	None	Red LED is lit on some battery contactor drive boards, while green LED is lit on others.	If a green LED is lit despite a contactor open command issued by the controller, the drive card or the contactor has failed.	Call technical support.
None	None	--	Fuse has operated.	Replace fuse F2 (power) on the BLJ3 terminal board.

15

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. During the warranty period stated in Sub-Article B below, Seller's Manufactured Products (products manufactured by Seller), which have been paid for by Customer, will conform to industry standards and Seller's specifications and shall be free from material defects;
 3. With respect to Vendor items (items not manufactured by Seller), Seller warrants that such Vendor items, which have been paid for by Customer, will be free from material defects for a period of sixty (60) days commencing from the date of shipment from Seller's facility.
- B. The Warranty Period listed below is applicable to Seller's Manufactured Products furnished pursuant to this Agreement, commencing from date of shipment from Seller's facility, unless otherwise agreed to in writing:

Warranty Period

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

**The Warranty Period for a repaired Product or part thereof is six (6) months or, the remainder of the unexpired term of the new Product Warranty Period, whichever is longer.*

- 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) which 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 repaired or replacing Product to the destination designated by Customer.
- E. Except for batteries, the defective or nonconforming Products or parts which are replaced shall become Seller's property. Customer shall be solely responsible for the disposition of any batteries.
- 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 experimental products or prototypes or with respect to expendable items, including, without limitation, fuses, light bulbs, motor brushes, and the like. Seller's warranty does not extend to any system into which the Product is incorporated. This warranty applies to Customer only and may not be assigned or extended by Customer to any of its customers or other users of the Product.

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.