LINEAGE POWER

Galaxy Power System 2424 (GPS 2424) H569-437

User's Guide
Select Code 167-792-159
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Issue 8
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Notice:
The information, specifications, and procedures in this manual are subject to change without notice. Lineage Power assumes no responsibility for any errors that may appear in this document.

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1 Introduction

GPS 2424

Overview

Lineage Power developed the Galaxy Power System (GPS) 2424 to support +24-volt telecommunications powering solutions in worldwide markets. The GPS 2424 combines 100-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 2400-ampere maximum capacity, distribution flexibility, and universal ac input capability, the GPS 2424 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 2424 cabinet had a metal door and the Galaxy Vector Controller consisted of a BIC2 board. For information on these systems, see Issue 5 of this manual.

Illustrations

Figures 1-1 and 1-2 illustrate the GPS 2424 half height and full height cabinets.

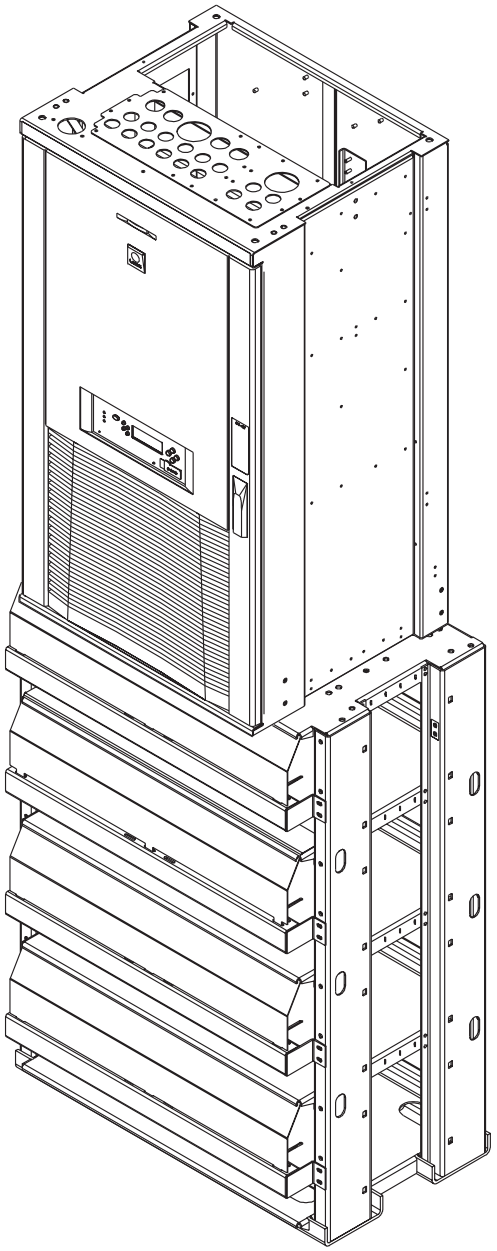


Figure 1-1: GPS 2424 Half Height Cabinet (with Battery Stand)

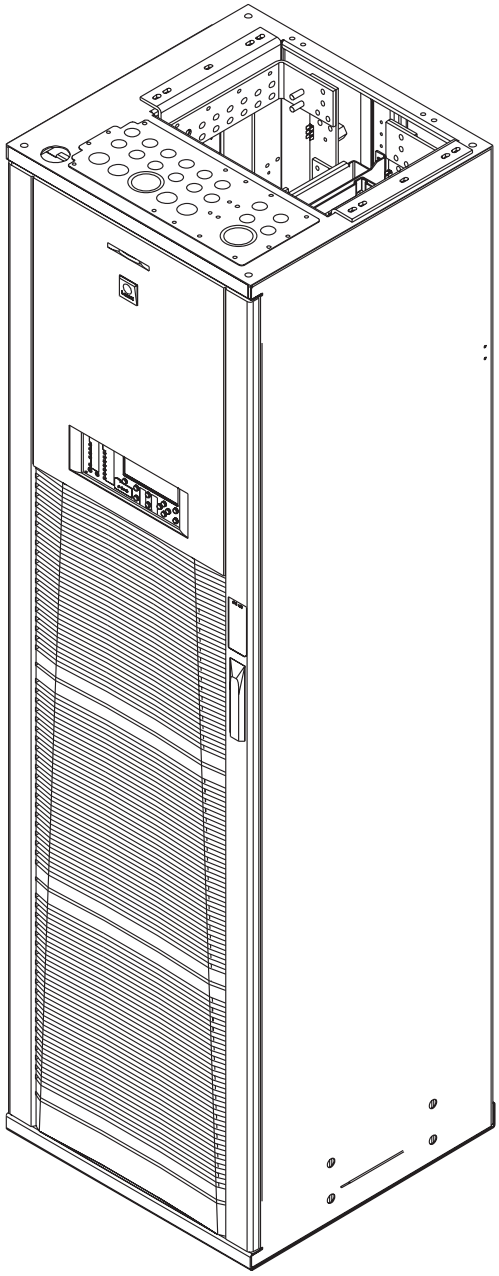


Figure 1-2: GPS 2424 Full Height Cabinet

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 2424 is shown in Figure 2-1. It illustrates the arrangement and interconnections of the system components from the ac input to the dc output.

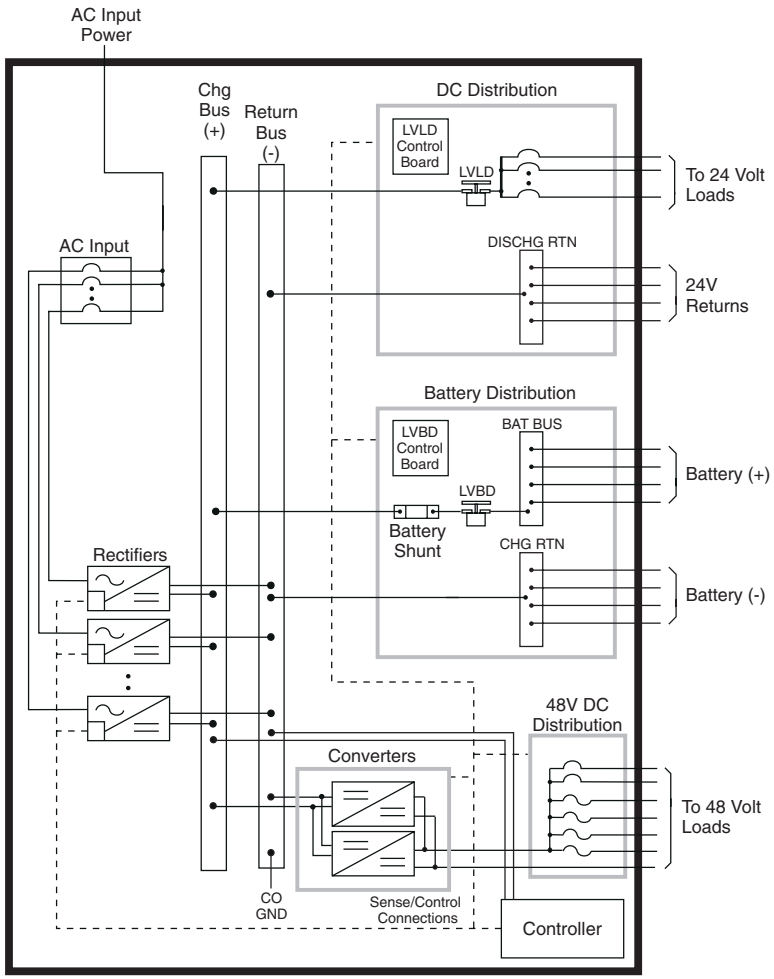


Figure 2-1: Block Diagram of the GPS 2424

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.

Converters transform +24Vdc power to -48Vdc power for 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 2424 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 1200 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 a supplemental full-height cabinet may be added to grow the system to 2400 amperes. The rectifier output buses are interconnected to permit the two cabinets 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.

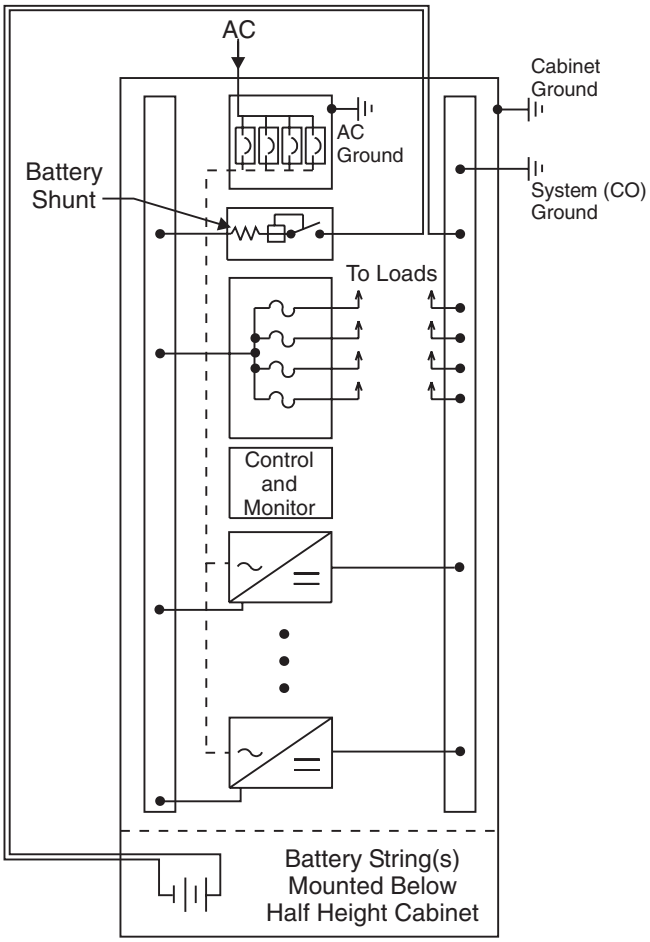


Figure 2-2: Schematic of Half Height Cabinet

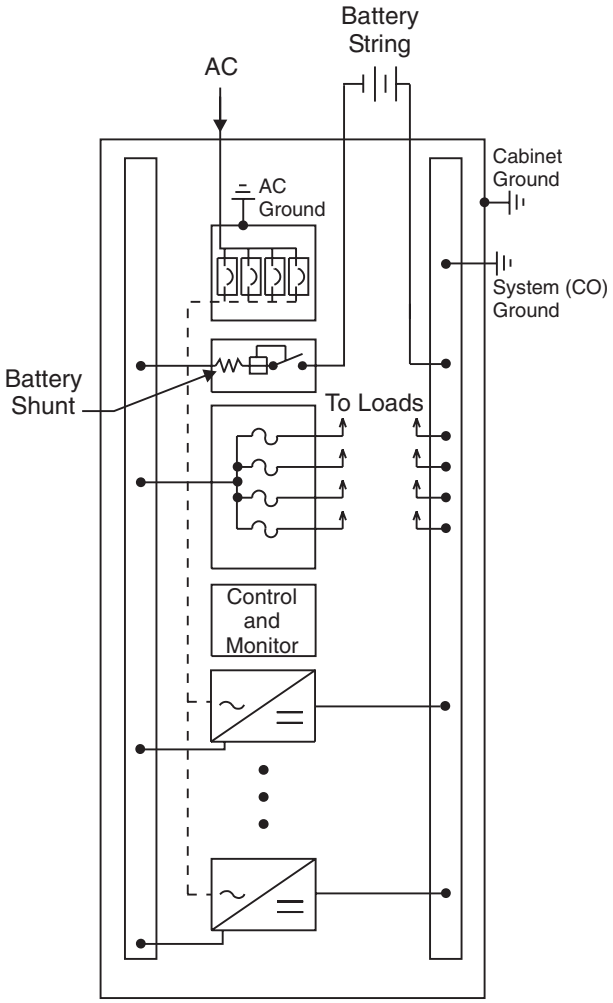


Figure 2-3: Schematic of Full Height Cabinet

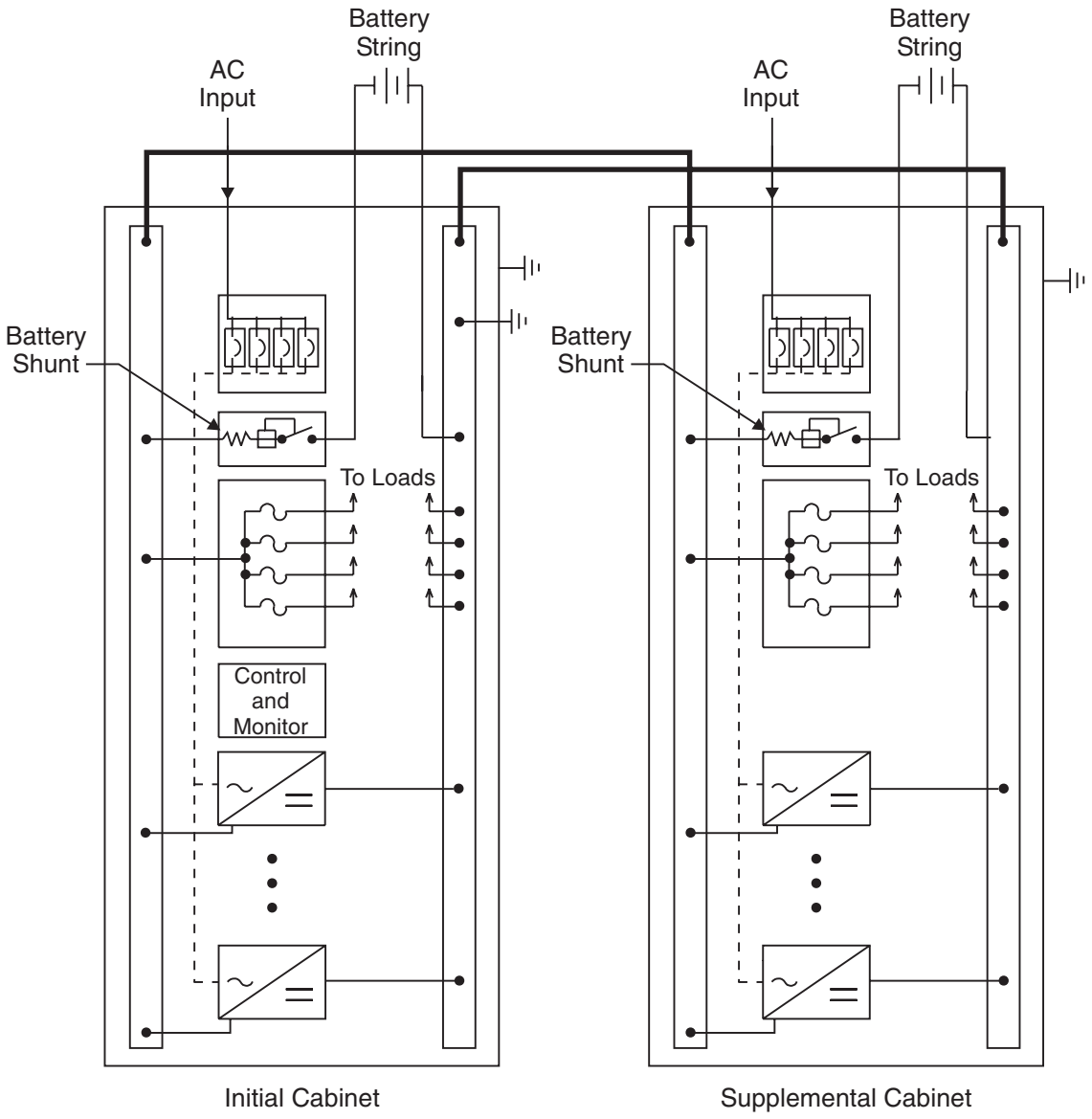


Figure 2-4: Schematic of Two-cabinet System Architecture

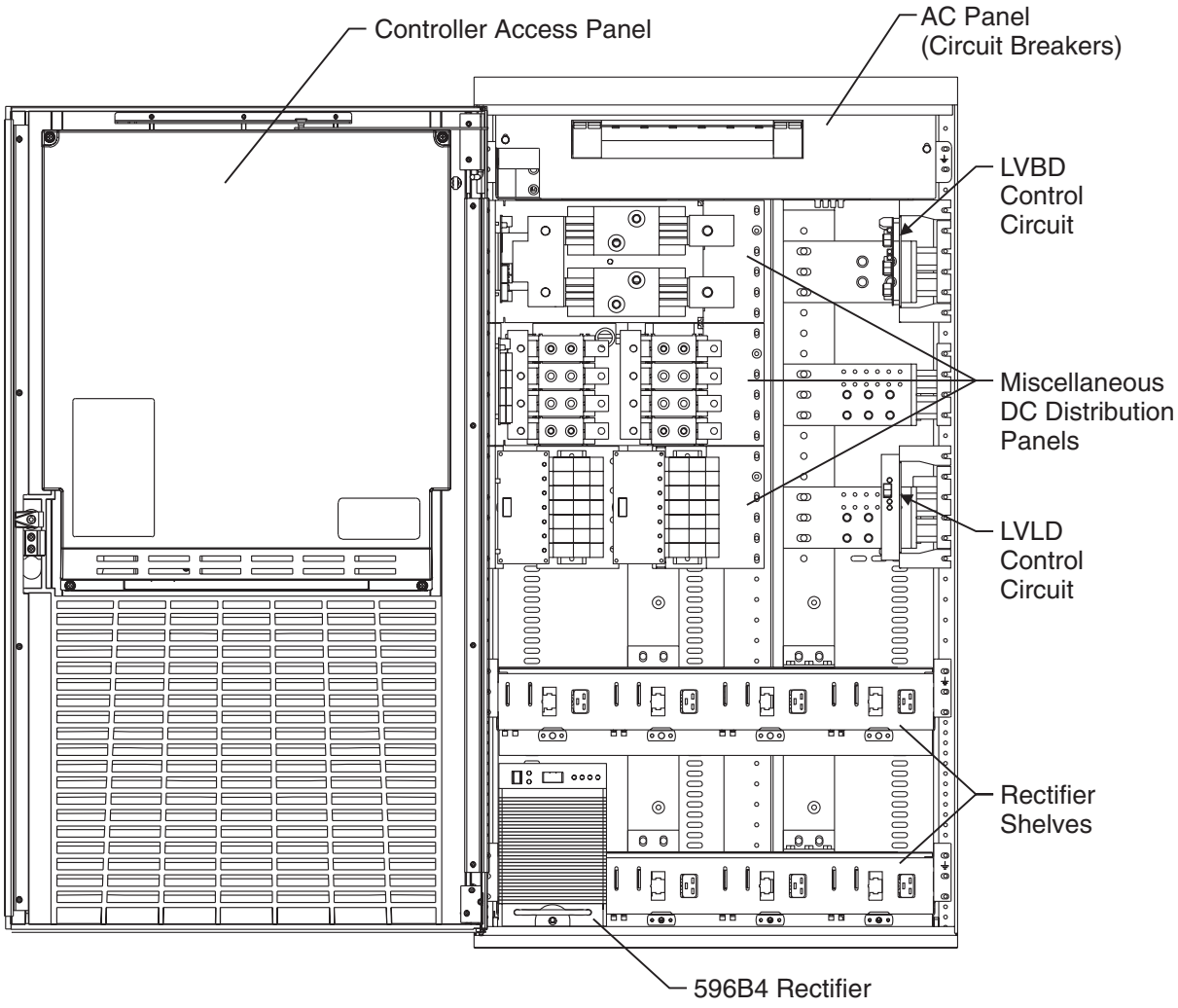


Figure 2-5: Half Height GPS 2424 with Door Open

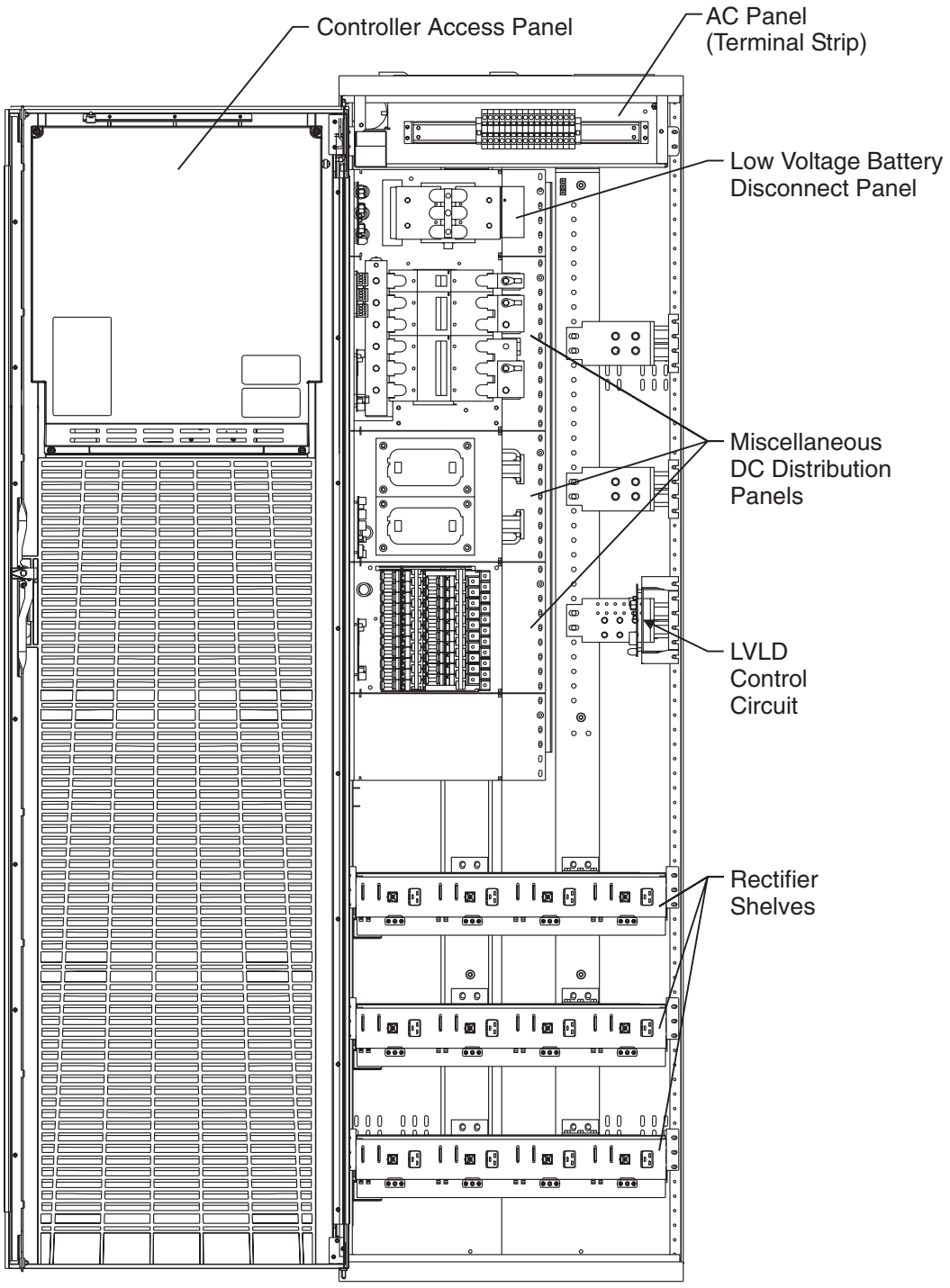


Figure 2-6: Full Height GPS 2424 with Door Open

3 Galaxy Controllers

Overview

Introduction

The GPS 2424 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.

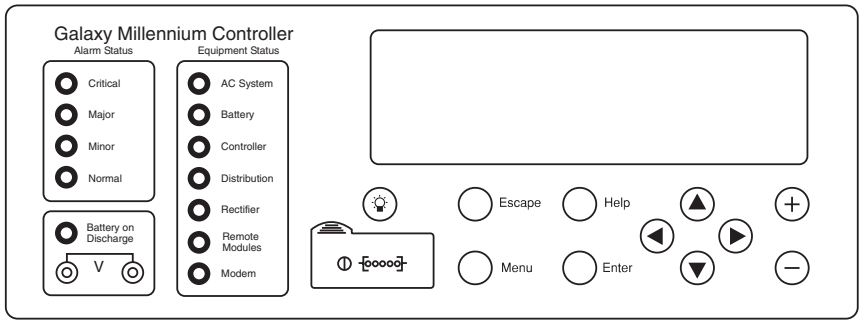


Figure 3-1: Galaxy Millennium Controller Front Panel

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: Test 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.

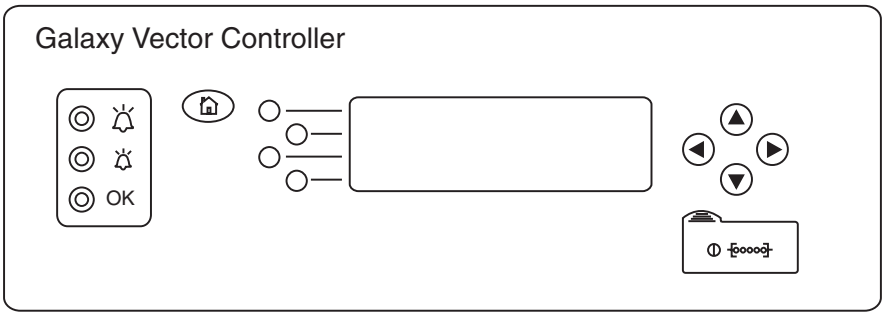


Figure 3-2: Galaxy Vector Controller Front Panel

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 2424. 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

596B4

Overview

The 596B4 100-ampere rectifier operates from 2-wire, 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 596B4 rectifier is **UL Recognized** for both the U. S. and Canada, complies with UL1950 (Information Technology Equipment), and meets 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.

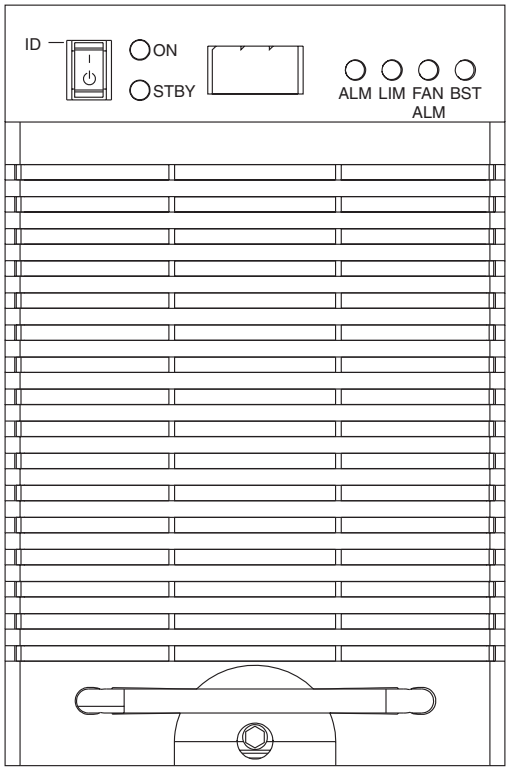


Figure 4-1: Rectifier Front Panel

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

The rectifier is equipped with an internal fuse for system 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.

Features, continued

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.

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 rectifiers are 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 Converters

597A and 597B

Overview

The converter carriers and modules are shipped separately from the cabinets for quick and straightforward installation into rectifier shelves at the site. Interconnections to dc output and control signals occur automatically during insertion. No settings or adjustments to potentiometers are necessary.

The 597A and 597B converter carriers are UL Recognized for both the U. S. and Canada, comply with UL 1950 (Information Technology Equipment), and meet EN60950 requirements.

Output Distribution

- The 597A converter carrier provides four positions for DIN-style circuit breakers and slots for four 24V/48Vdc, 3-ampere 47A converter modules.
- The 597B converter carrier provides six positions for GMT-type fuses and slots for four 24V/48Vdc, 3-ampere 47A converter modules.
- One 128A Converter Interface Card (CIC) is required for each converter carrier.

Displays

Current and Voltage

A switch allows a pair of test jacks on the Converter Interface Card to sense either the current or voltage. In the current setting, the scale is 3.95mV/A.

128A Converter Interface Card LEDs

The main status panel on the 128A Converter Interface Card (CIC) has three LEDS:

- The **ON** LED is green and lights under normal operation.
- The **CFA** LED is red and lights when a converter module is off or a module fan has failed.
- The **FA** LED is red and lights when a distribution fuse or circuit breaker has operated.

47A Converter Module LEDs

Each 47A converter module has its own set of LEDs:

- The green **ON** LED lights under normal operation.
- The yellow **STBY** LED lights when a converter module has been turned off.
- The red **ALM** LED lights when a converter module has failed.

597A and 597B Converter Carrier LEDs

The converter carrier has **NORMAL** (green) and **ALARM** (red) LEDs. When the ALM LED of a converter module lights, the ALARM LED on the carrier also lights.

Displays, continued

Illustration Figure 5-1 illustrates the converter carrier and converter front panels.

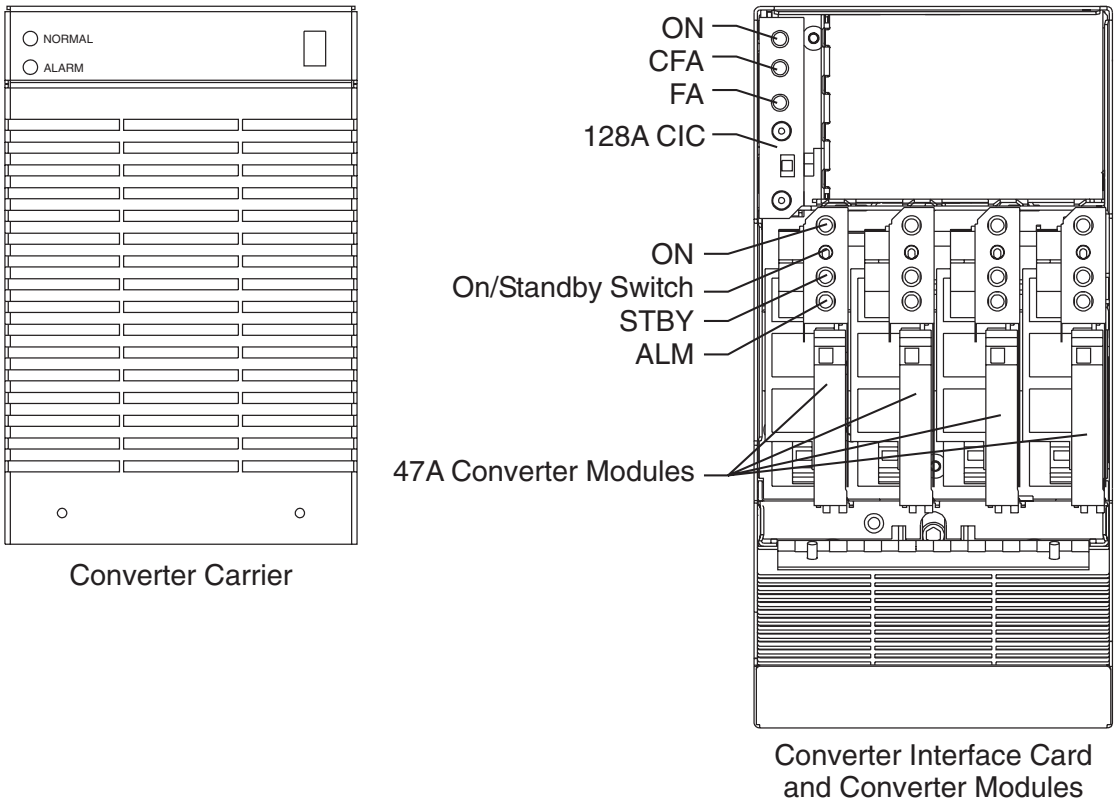


Figure 5-1: Carrier and Converter Front Panels

6 AC Input Panels

Overview

AC Service

The ac input panel provides the facility to terminate 3-phase ac service to the GPS 2424 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.

In some systems circuit breakers are provided to protect the conductor providing ac service to the individual rectifiers. In other systems the system's ac input panel contains 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.

Overview, continued

Cross Reference of Cabinets and Panels

Table 6-A identifies which cabinet uses each of the panels.

Table 6-A: AC Input Panels

Panel	Cabinet	Figure
H569-437 G73F (ED83142-30 G6)	Full-height cabinet with two rectifier shelves that are connected phase to phase	Figure 6-1
H569-437 G71H (ED83142-30 G6)	Half-height cabinet with two rectifier shelves that are connected phase to phase	Figure 6-1
H569-437 G74F (ED83142-30 G6M)	Full-height cabinet with two rectifier shelves that are connected phase to neutral	Figure 6-1
H569-437 G74H (ED83142-30 G6M)	Half-height cabinet with two rectifier shelves that are connected phase to neutral	Figure 6-1
H569-437 G72F (ED83142-30 G7)	Full-height cabinet with three rectifier shelves that are connected phase to phase	Figure 6-2
H569-437 G76H (ED83142-30 G8)	Half-height cabinet with two rectifier shelves that are connected phase to phase or phase to neutral	Figure 6-3
H569-437 G77F (ED83142-30 G9)	Full-height cabinet with three rectifier shelves that are connected phase to phase or phase to neutral	Figure 6-4
H569-437 G78F (ED83142-30 G9)	Full-height cabinet with four rectifier shelves (with each shelf containing three rectifiers and one converter carrier) that are connected phase to phase or phase to neutral	Figure 6-4

Illustrations

Circuit breaker panels are shown in Figures 6-1 and 6-2; terminal strip panels are shown in Figures 6-3 and 6-4.

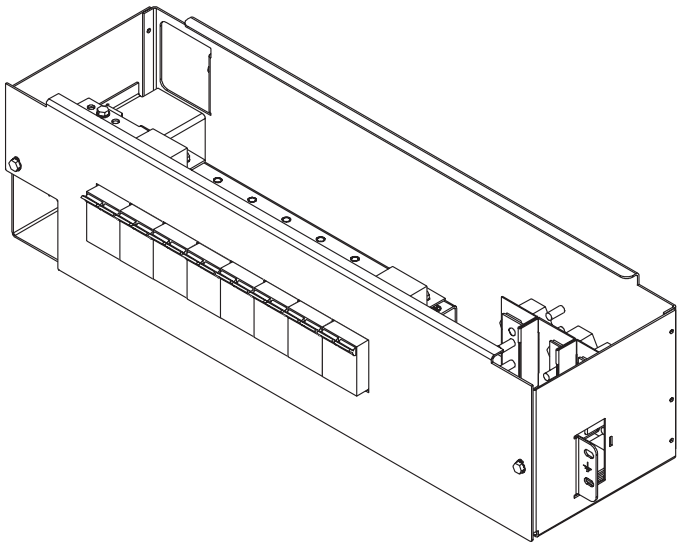


Figure 6-1: H569-437 G73F/71H (ED83142-30 G6)
H569-437 G74F/74H (ED83142-30 G6M)
AC Input Circuit Breaker Panel

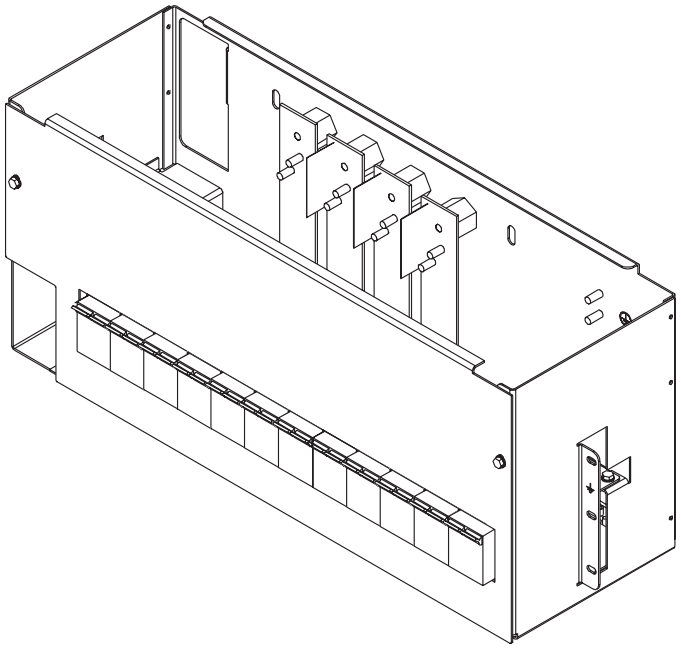


Figure 6-2: H569-437 G72F (ED83142-30 G7)
AC Input Circuit Breaker Panel

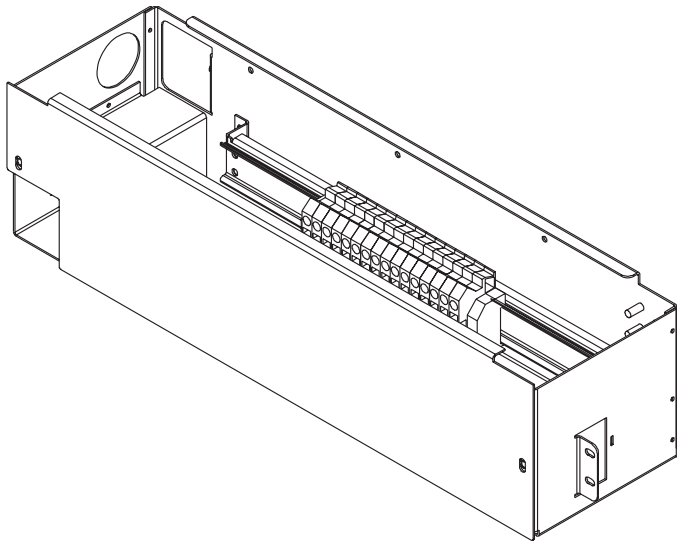


Figure 6-3: H569-437 G76H (ED83142-30 G8)
AC Input Terminal Strip Panel

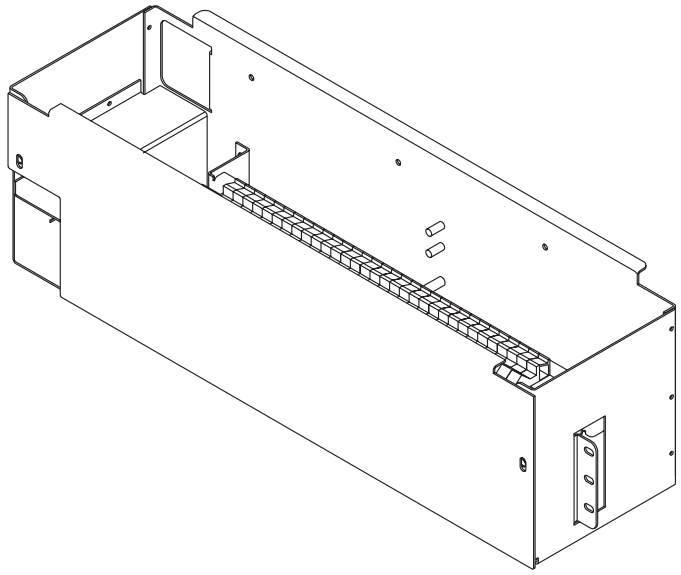


Figure 6-4: H569-437 G77F/78F (ED83142-30 G9)
AC Input Terminal Strip Panel

7 Battery Connection Panels

Overview

Function

Batteries are connected to the GPS 2424 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), H569-437 G33F is selected as a placeholder in the order.

Illustrations

These panels are shown in Figures 7-1 through 7-9.

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

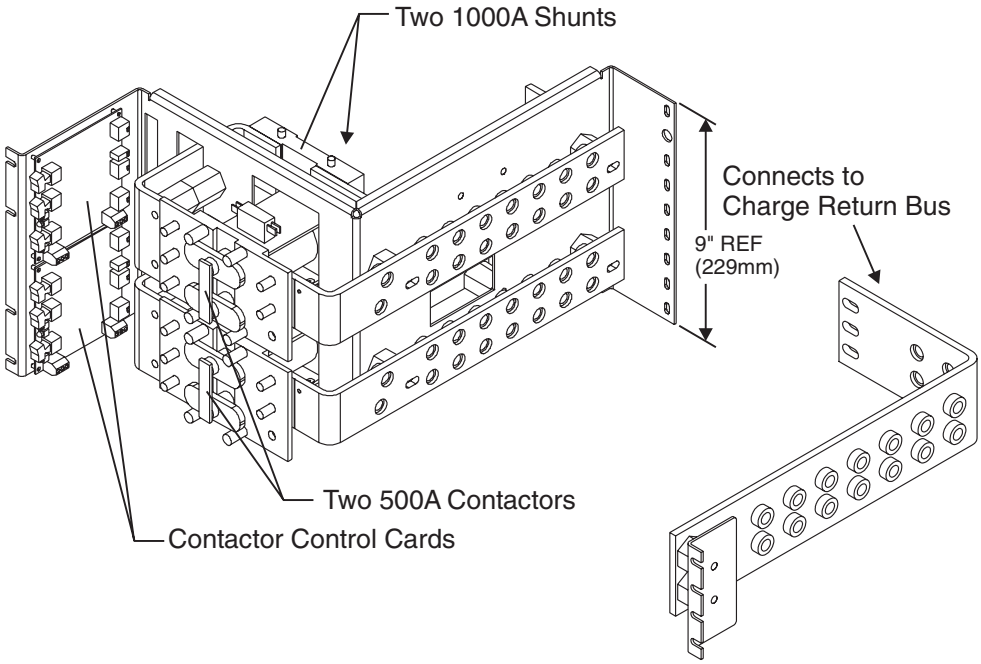


Figure 7-1: H569-437 G30 (ED83143-31 G132)
Battery Connection Panel

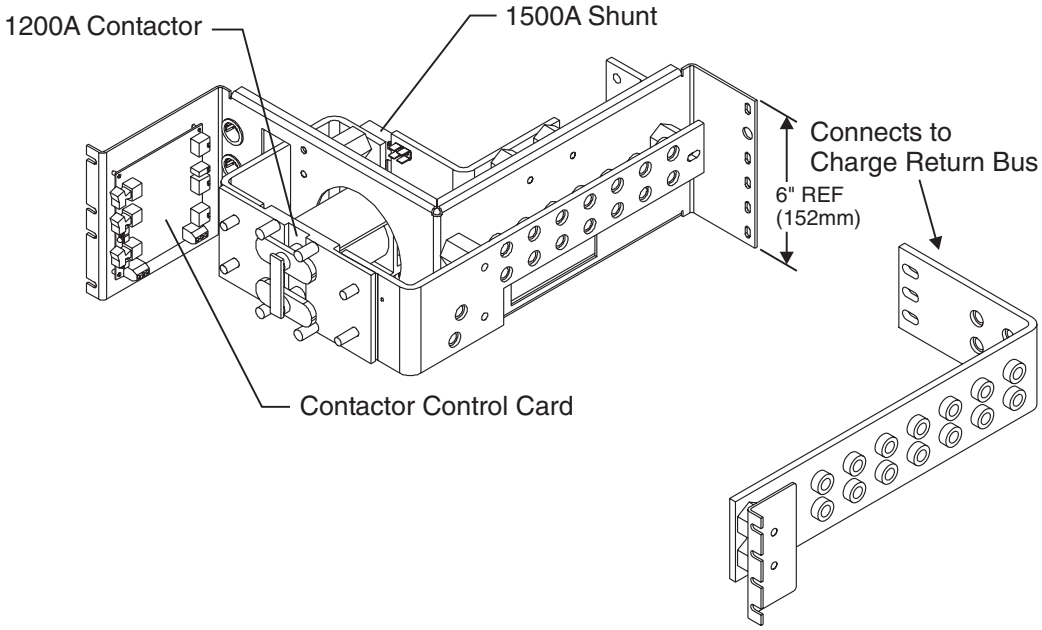


Figure 7-2: H569-437 G31 (ED83143-31 G131)
Battery Connection Panel

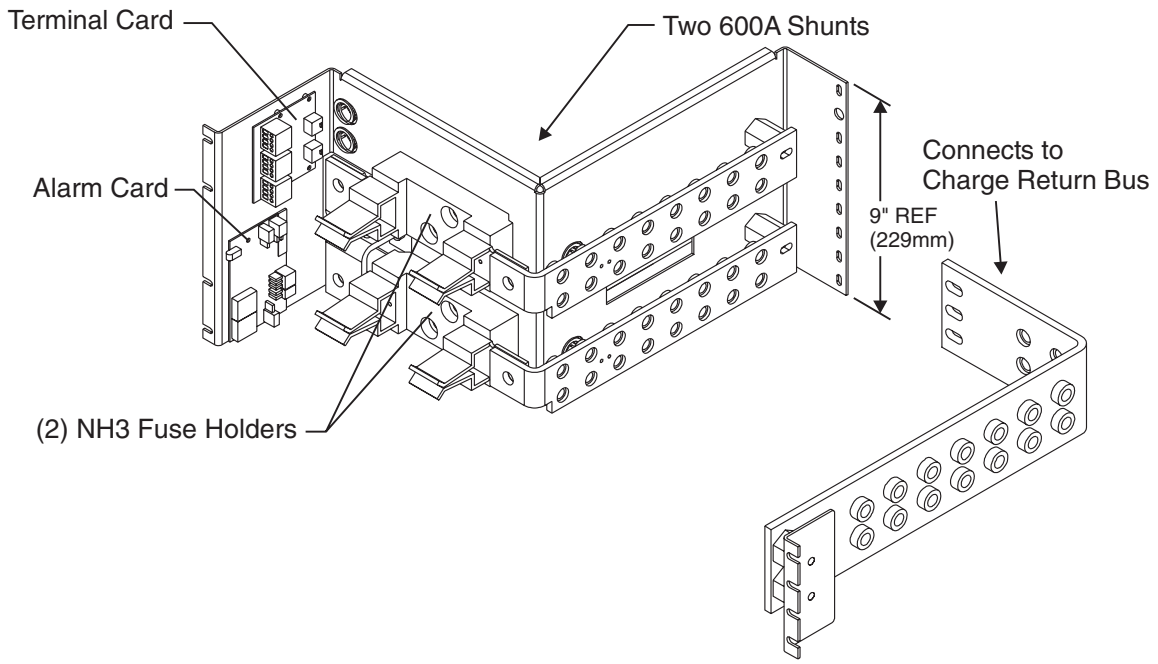


Figure 7-3: H569-437 G34 (ED83143-31 G141)
Battery Connection Panel

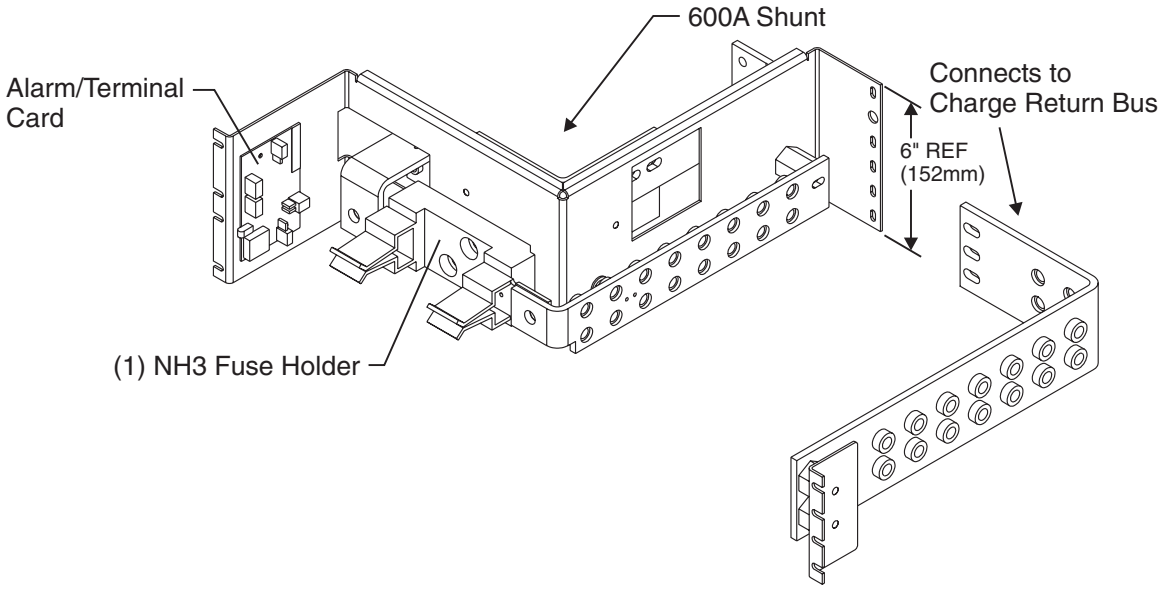


Figure 7-4: H569-437 G35 (ED83143-31 G142)
Battery Connection Panel

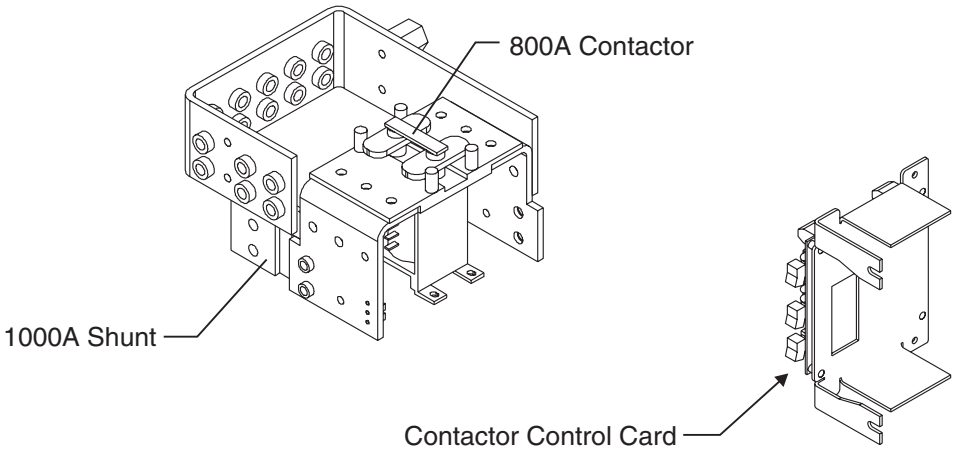
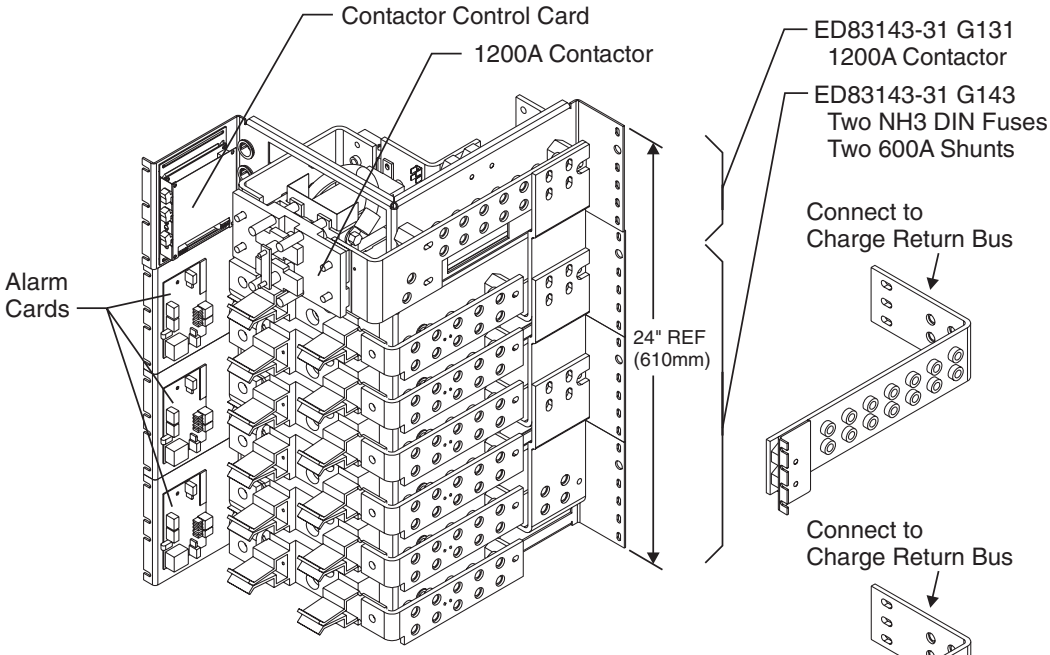


Figure 7-5: H569-437 G36H (ED83143-31 G133) Battery Connection Panel



H569-437	Includes:
G80	1 G131 1 G143
G81	1 G131 2 G143
G82	1 G131 3 G143 (shown)

Figure 7-6: H569-437 G80/81/82 (ED83143-31 G131/143) Battery Connection Panel

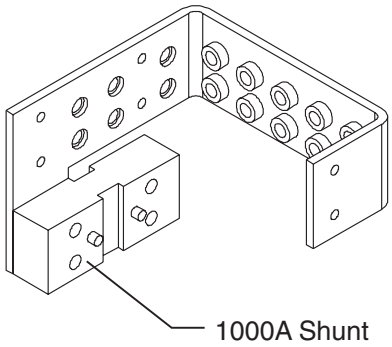


Figure 7-7: H569-437 G84H (ED83143-31 G134)
Battery Connection Panel

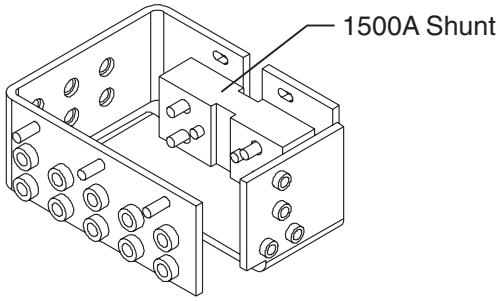


Figure 7-8: H569-437 G85F (ED83143-31 G135)
Battery Connection Panel

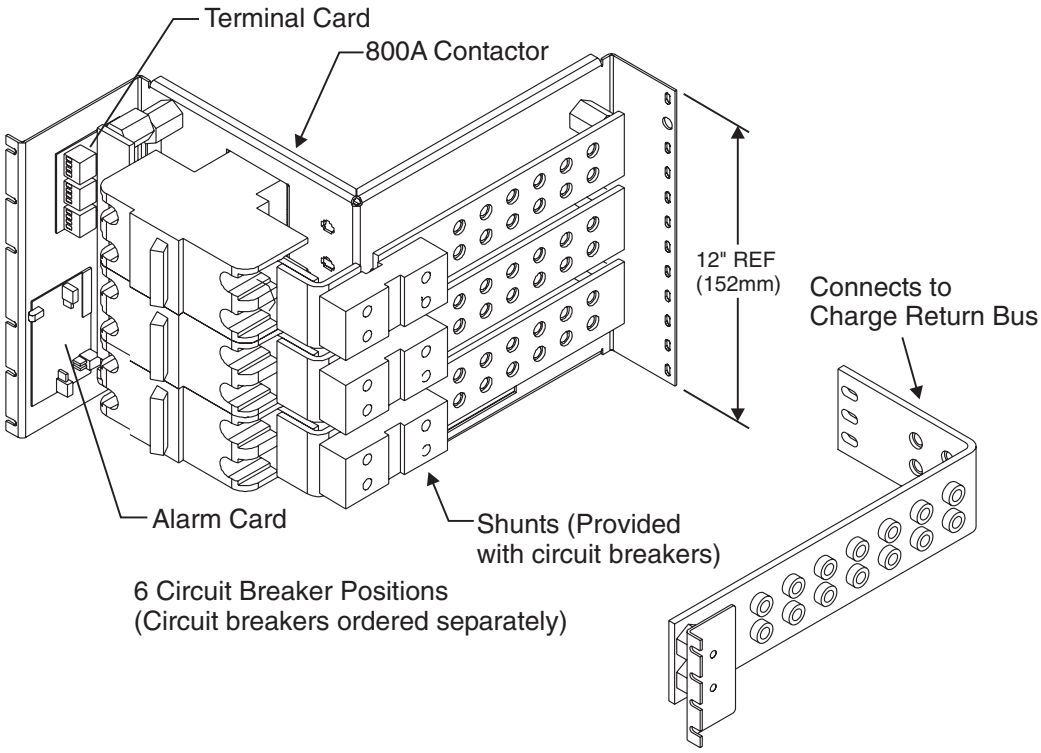


Figure 7-9: H569-437 G86/87 (ED83143-31 G163/164) Battery Connection Panel

8 DC Distribution Panels

Overview

Function

A variety of dc distribution panels is available for the GPS 2424 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 8-1 through 8-11.

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

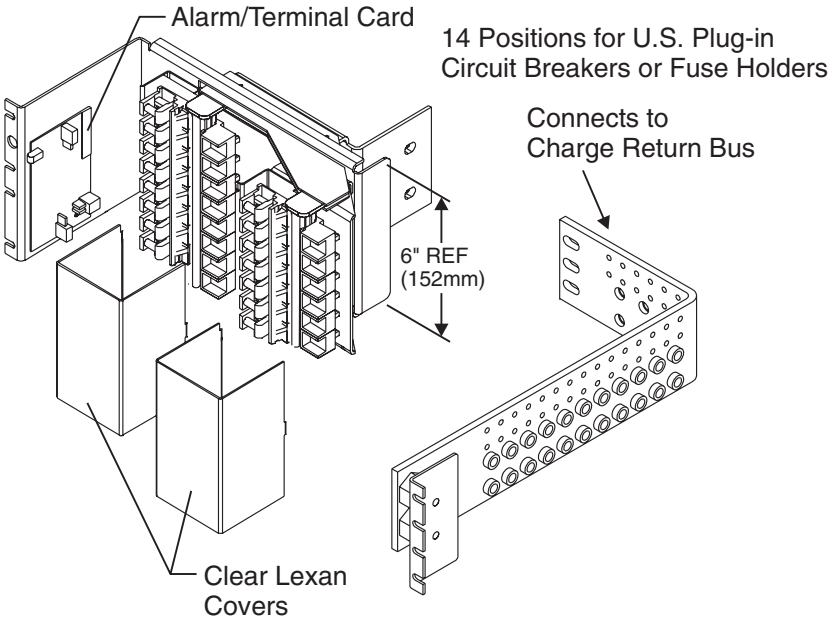


Figure 8-1: H569-437 G40/50 (ED83143-31 G11)
DC Distribution Panel

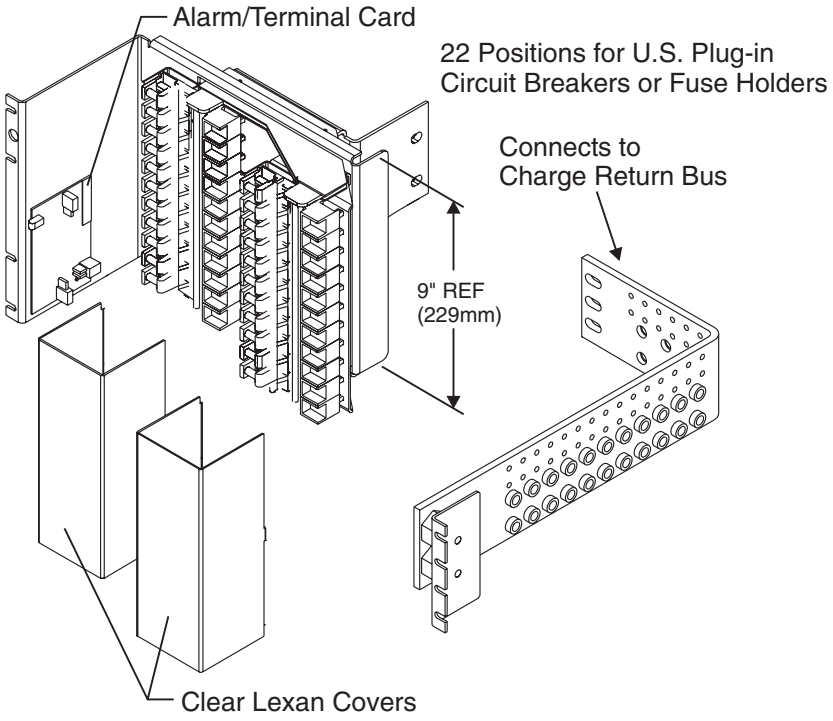


Figure 8-2: H569-437 G41/51 (ED83143-31 G12)
DC Distribution Panel

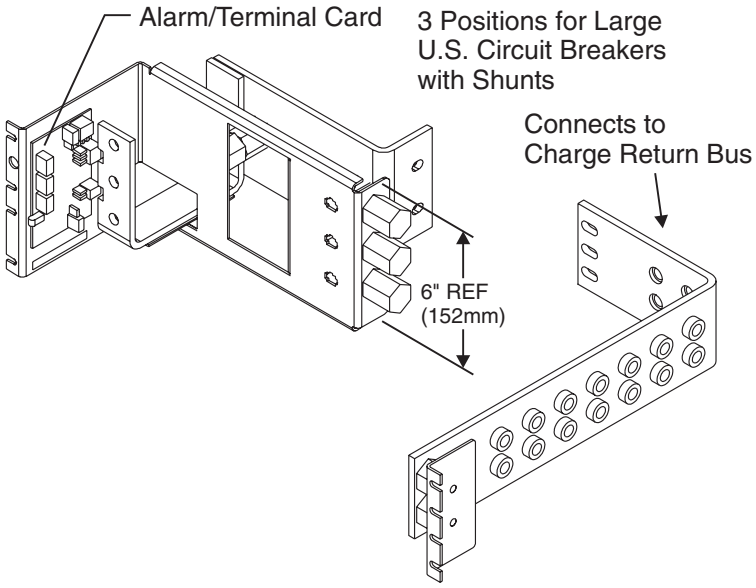


Figure 8-3: H569-437 G42 (ED83143-31 G2)
DC Distribution Panel

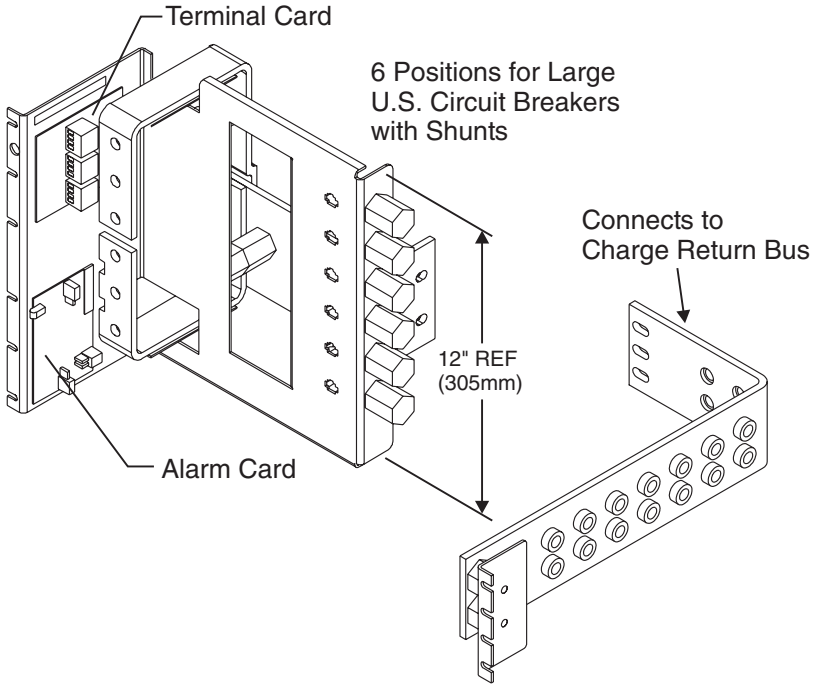


Figure 8-4: H569-437 G43 (ED83143-31 G1)
DC Distribution Panel

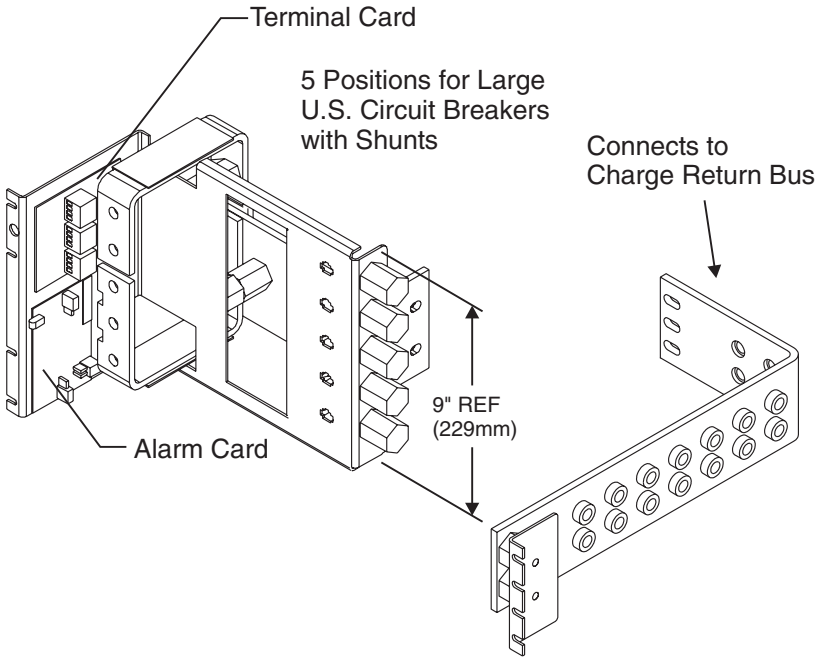


Figure 8-5: H569-437 G44 (ED83143-31 G5)
DC Distribution Panel

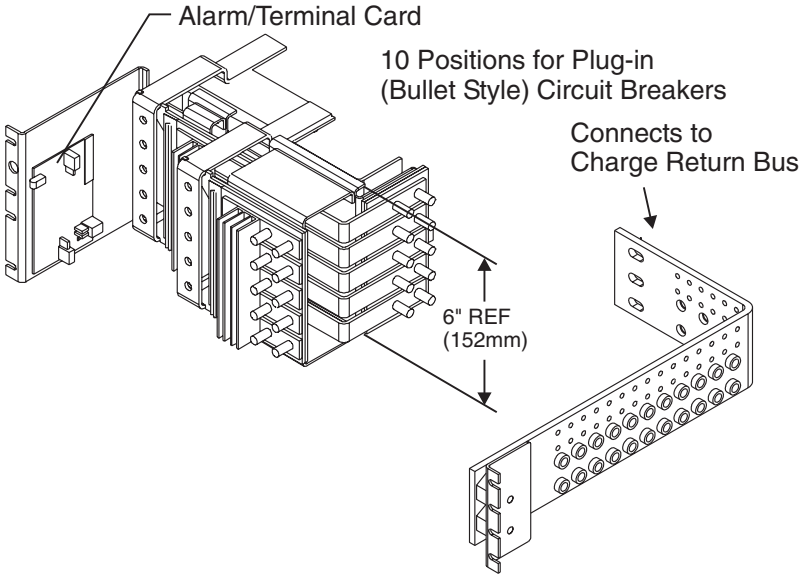


Figure 8-6: H569-437 G46 (ED83143-31 G15)
DC Distribution Panel

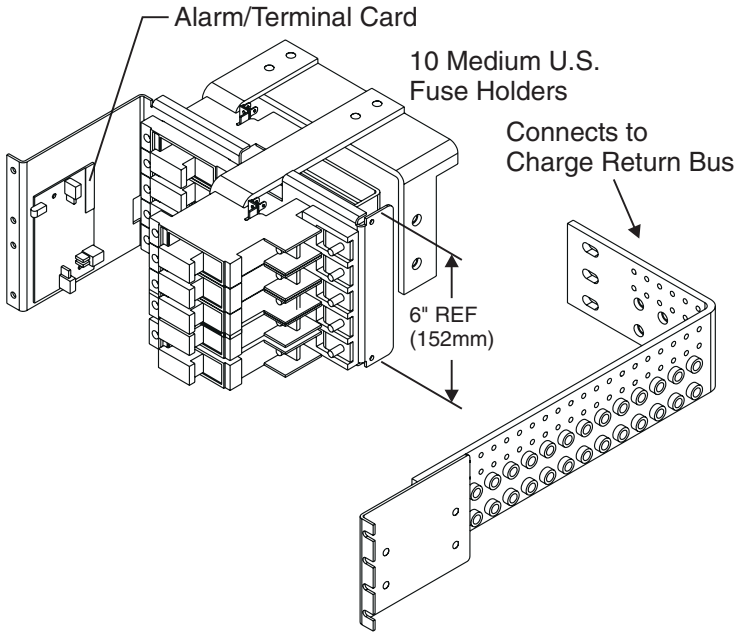


Figure 8-7: H569-437 G52 (ED83143-31 G53)
DC Distribution Panel

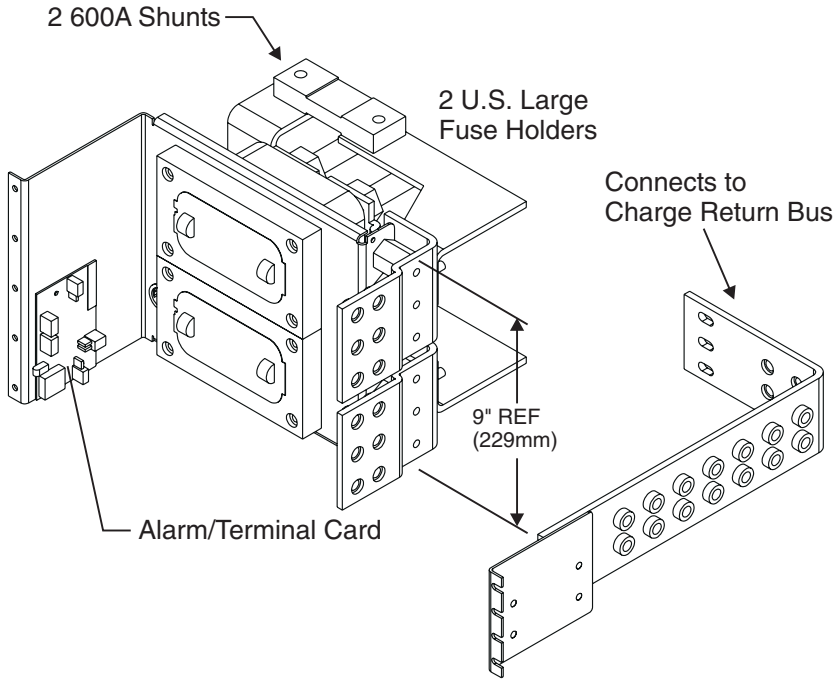


Figure 8-8: H569-437 G53 (ED83143-31 G55)
DC Distribution Panel

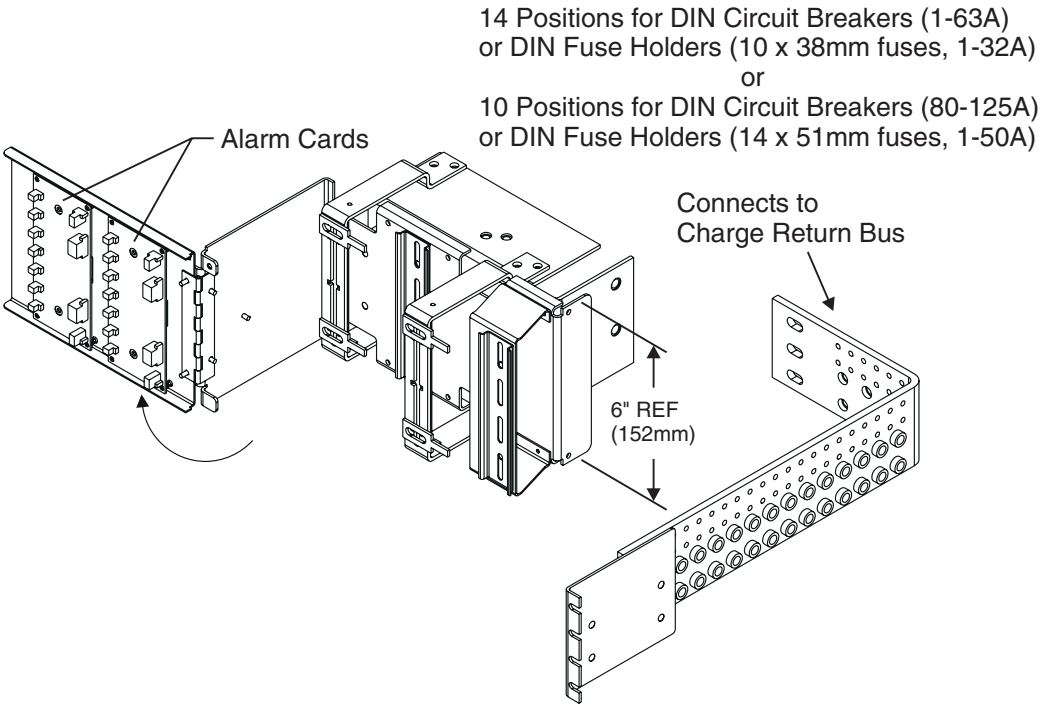


Figure 8-9: H569-437 G60/61/65/66 (ED83143-31 G171)
DC Distribution Panel

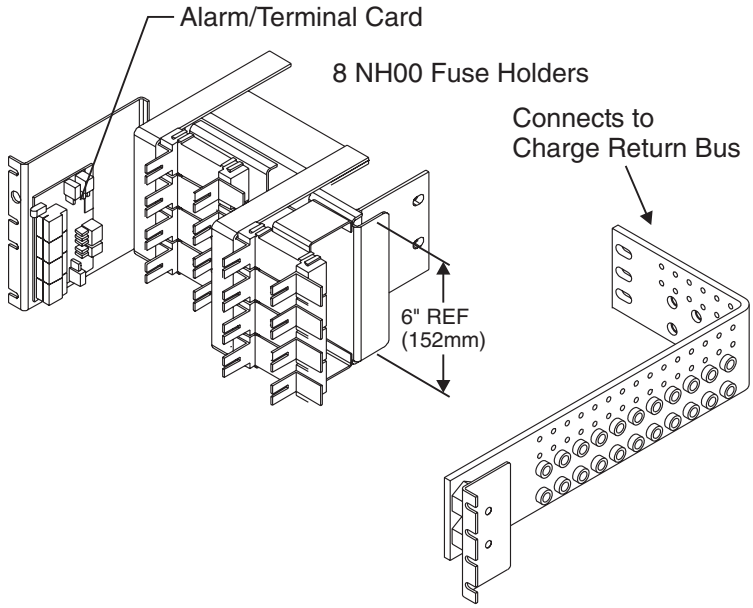


Figure 8-10: H569-437 G67 (ED83143-31 G22)
DC Distribution Panel

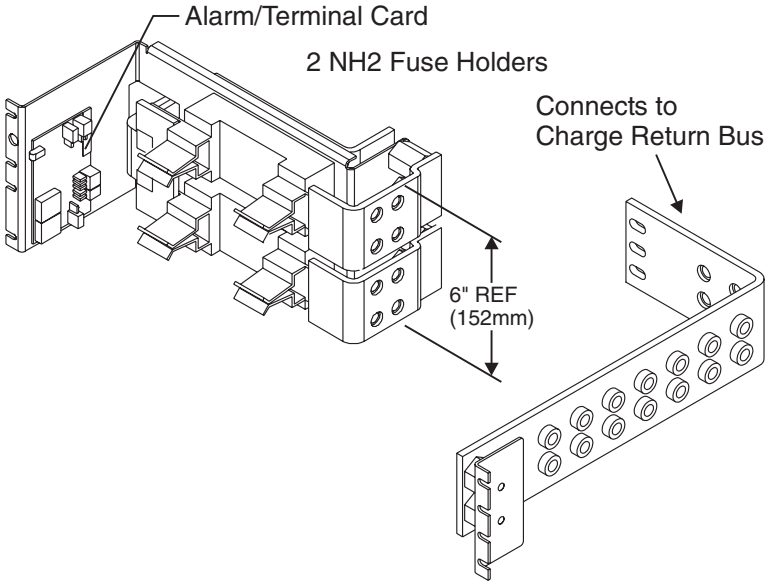


Figure 8-11: H569-437 G68 (ED83143-31 G21)
DC Distribution Panel

9 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 13-3.

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 13-5.

10 Specifications

GPS 2424

Table 10-A: Galaxy Power System 2424 Specifications

Electrical		
AC Input		
Input Distribution	125A circuit breaker (2-shelf system) or 150A circuit breaker (3-shelf system) feed into each cabinet or 25A circuit breaker per rectifier for individual feeds	
Wire Size	Minimum 2 gauge/35 mm^2 (2-shelf system) or 1/0 gauge/50 mm^2 (3-shelf system) cable to each cabinet or 8 gauge/8 mm^2 (2-shelf system) or 8 gauge/8 mm^2 (3-shelf system) for individual feeds	
System Output		
	Full Height	**Half Height**
System Voltage	+24	+24
Output Current	100 - 2400 amperes	100 - 800 amperes
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 19.70 in.)	1080 H x 600 W x 500 D mm (42.5 H x 23.6 W x 19.7 D in)

Table 10-A: Galaxy Power System 2424 Specifications (Continued)

Units Per Initial Cabinet		
	Full Height	**Half Height**
Rectifiers	1 - 12	1 - 8
Converters	1 - 4	1 - 2
Controller	1	
Battery Disconnect Modules	0 - 1	
DC Distribution	1 - 6	1 - 3
Units Per Supplemental Cabinet		
Rectifiers	0 - 12	N/A
Battery Disconnect Modules	0 - 1	N/A
DC Distribution	1 - 6	N/A
Environmental		
Operating Ambient Temperature	-40°C to +85°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 10-B: 596B4 Rectifier Specifications

Electrical				
Input				
Voltage Range	176-264Vac, 2-wire, single phase			
Frequency Range	47 - 63 Hz			
Power Factor	> 0.98 for loads > 50%			
High Voltage Shutdown Internal Selective High Voltage Shutdown (ISHVSD)	596B4	Float	28.75V[1]	Nom.[2]
	596B4	Boost	28.75V[1]	Nom.[2]
Backup High Voltage Shutdown[3] (BUHVSD)	596B4	Boost/Float	29.76Vdc	Nom.
[1]Selectable/programmable through Galaxy Controller *[2]Factory default setting – actual range is 22 - 30Vdc* *[3]Hardwired feature in rectifier – range is 29.275 - 30.265Vdc*				

Rated Service Entrance Surge Protector: It is important that the service entrance surge protector (if provided) be coordinated with the internal surge protection and that it clamps at a lower voltage then the internal protection. The internal protection of the 596B4 has the following voltage and current characteristics:

Phase to Phase Voltage	MOV Conduction Current
320Vac (RMS)	0A
565Vpeak maximum clamping	1mA (DC test current)
850Vpeak	100A peak (8 x 20µs)

Output	
Output Current (Max.)	110 amperes maximum (-40°C to +65°C) Derate 2 amperes per degree C (+65°C to +85°C)
Float/Boost Voltage	22-29Vdc
Total Harmonic Distortion	10% at Nom. Line V
Regulation	±0.5%
Ripple	100 mVrms
Noise	< 1mV psophometric
Permanent Overload	110A
Current Limit Set Point	15A-110A **Note: When using the maximum 12 rectifiers in a cabinet, do not exceed 100 amperes current limit per rectifier at 50°C.**

Table 10-B: 596B4 Rectifier Specifications (Continued)

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	> 86% typical
Heat Release 24Vdc, 100A Output 24Vdc, 80A Output	Per Rectifier: 390 Watts (1331.3 BTU/hr.) 312 Watts (1065 BTU/hr.)
Storage Temperature	-40°C to 85°C
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, TUV, 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.

Converters

Table 10-C: Converter Specifications

Electrical and Thermal	
Nominal Input Voltage	24V
Input Voltage Range	18V - 31V
Nominal Input Current	7.2A per 47A converter; 28.9A (full 597A/B)
Efficiency System (597A/B) 46A	 88% 91%
Regulation	±1.0%
Ripple	10mVrms; 100mVp-p
Output Noise	32 DBrnc
Load Share Accuracy	5% of the total current
Nominal Output Voltage	52V
Output Voltage Range	46.0V - 57.0V
Output Current	0-12A per converter carrier 0-24A two carriers in parallel 0-36A three separate converter carriers (full height GPS 2424) 0-48A four separate converter carriers (full height GPS 2424)
Environmental	
Heat Dissipation 47A 597A/B	 21W with 72BTU/hour typical 84W with 288 BTU/hour typical with four 47A converters
Humidity	5%-95%
Audible Noise	60 dBA
Safety/Standards Compliance	
Safety Agency Approvals	UL, VDE
EMI	CISPR Class B, EMI FCC Level B

AC Input Panels

Table 10-D: AC Input Panels

Description	H569-437 Group No.	ED83142-30 Group No.
AC Input Circuit Breaker Panel Full-height cabinet with two rectifier shelves that are connected phase to phase	G73F	G6
AC Input Circuit Breaker Panel Half-height cabinet with two rectifier shelves that are connected phase to phase	G71H	G6
AC Input Circuit Breaker Panel Full-height cabinet with two rectifier shelves that are connected phase to neutral	G74F	G6M
AC Input Circuit Breaker Panel Half-height cabinet with two rectifier shelves that are connected phase to neutral	G74H	G6M
AC Input Circuit Breaker Panel Full-height cabinet with three rectifier shelves that are connected phase to phase	G72F	G7
AC Input Terminal Strip Panel Half-height cabinet with two rectifier shelves that are connected phase to phase or phase to neutral	G76H	G8
AC Input Terminal Strip Panel Full-height cabinet with three rectifier shelves that are connected phase to phase or phase to neutral	G77F	G9
AC Input Terminal Strip Panel Full-height cabinet with four rectifier shelves (with each shelf containing three rectifiers and one converter carrier) that are connected phase to phase or phase to neutral	G78F	G9

Battery Connection Panels

Table 10-E: Battery Connection Panels

Description	H569-437 Group No.	ED83143-31 Group No.
LVBD: (2) 500A contactors with 1000A shunts	G30	G132
LVBD: 1200A contactor with 1500A shunt	G31	G131
(2) fuse holders for 315-630A NH3 DIN fuses with 600A shunts	G34	G141
(1) fuse holder for 315-630A NH3 DIN fuse with 600A shunt	G35	G142
LVBD: 800A contactor with 1000A shunt	G36H	G133
LVBD: 1200A contactor, (2) NH3 DIN fuses and (2) 600A shunts	G80	G131 (1) G143 (1)
LVBD: 1200A contactor, (4) NH3 DIN fuses and (4) 600A shunts	G81	G131 (1) G143 (2)
LVBD: 1200A contactor, (6) NH3 DIN fuses and (6) 600A shunts	G82	G131 (1) G143 (3)
1000A shunt	G84H	G134
1500A shunt	G85F	G135
(6) positions for battery circuit breakers	G86	G163
LVBD: 800A contactor and (6) positions for battery circuit breakers	G87	G164

DC Distribution Panels

Table 10-F: DC Distribution Panels

Description	H569-437 Group No.	ED83143-31 Group No.
14 positions for 3-100A plug-in fuse holders or circuit breakers	G40, G50	G11
22 positions for 3-100A plug-in fuse holders or circuit breakers	G41, G51	G12
3 positions for 125-600A circuit breakers	G42	G2
6 positions for 125-600A circuit breakers	G43	G1
5 positions for 125-600A circuit breakers	G44	G5
10 positions for 3-100A plug-in (bullet style) circuit breakers	G46	G15
10 fuse holders for 3-70A fuses	G52	G53
2 fuse holders for 100-600A fuses	G53	G55
14 positions for 1-63A DIN circuit breakers	G60	G171
10 positions for 80-125A DIN circuit breakers	G61	G171
14 fuse holders for 1-32A DIN fuses	G65	G171
10 fuse holders for 1-50A DIN fuses	G66	G171
8 fuse holders for 4-160A DIN NH00 fuses	G67	G22
2 fuse holders for 32-400A DIN NH2 fuses	G68	G21

11 Safety

Please read and follow all safety instructions and warnings before servicing the GPS 2424. Reference the GPS Installation Guide and individual module product manuals for safety statements specific to the modules.

12 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 11 of this product manual.

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.

Converters

With the exception of a fan failure, converters are repaired by replacement.The expected life of the converter fans at 25 °C (77°F) is approximately five years. The fans in the converters may be replaced in the field.

Two approaches can be taken to fan maintenance. The first approach is to replace the two fans on a routine basis every four to five years; this ensures that the fans do not fail in the field under normal operating conditions. This approach is appropriate when there are no remote alarm facilities at the site. The second approach, assuming one has remote alarm capability, is to wait until a fan fails. It can then be replaced. Since it is likely that all the converters in that installation are of roughly the same age, all converter 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. The fan replacement procedure is described 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 or converter 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 or converter 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.

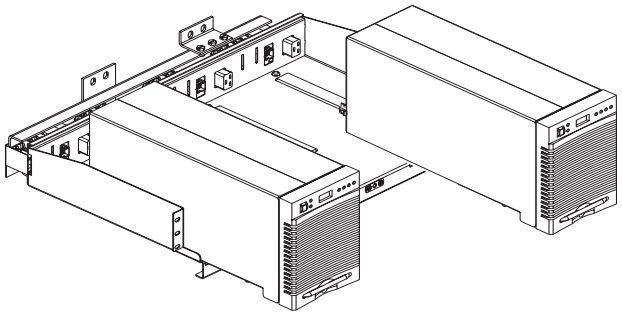



Figure 12-1: Detail of Rectifier Position	
Continued on next page.	

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	Once the rectifier has been installed, set the rectifier ID. 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. 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.
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 a 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 Procedures, continued

⚠Replacing a Converter Carrier

Note: This procedure will disconnect the 48V output from the load even if two carriers are being used.

Replacing a Converter Carrier	
Step	**Action**
1	Open the carrier door.
2	Remove all converter modules from the carrier to be replaced. See "Replacing a Converter Module."
3	Locate the Allen-head retaining screw. See Figure 12-2. Using the Allen wrench provided, rotate the tool counter-clockwise to remove the old converter from the shelf. Note: If two carriers are used, disconnect the shelf-to-shelf cable as you slide out the carrier. See Figure 12-3.
4	Turn off the load protectors in the carrier to be replaced and disconnect the output wiring.
5	To install a converter carrier, slowly slide the carrier into the shelf until it contacts the rear connector. **Remember to reconnect the carrier cable if two carriers are used.** Turning the Allen key insertion tool clockwise will pull the carrier into the shelf. See Figure 12-1.

Replacement Procedures, continued

⚠ Replacing a Converter Module

Replacing a Converter Module	
Step	**Action**
1	Open the converter carrier.
2	Pull the latch forward and remove the old 47A converter module.
3	Switch new 47A converter module to STBY.
4	Insert new converter module.
5	Switch converter module ON.

Replacement Procedures, continued

⚠*Replacing the 128A Converter Interface Card*

Replacing the 128A Converter Interface Card	
Step	**Action**
1	Remove the retaining screw that holds the converter interface card in place.
2	Replace the converter interface card.
3	Replace and tighten the retaining screw.

⚠*Replacing a Converter Fan Assembly*

Replacing a Converter Fan Assembly	
Step	**Action**
1	Remove adjacent rectifier from the shelf by loosening the Allen-head retaining screw.
2	Disconnect the power wire connection.
3	Slide the fan latch to the left.
4	Remove fan assembly.
5	Replace fan assembly.
6	Replace power wire assembly.
7	Slide converter carrier into shelf.
8	Tighten retaining screw.

Replacement Procedures, continued

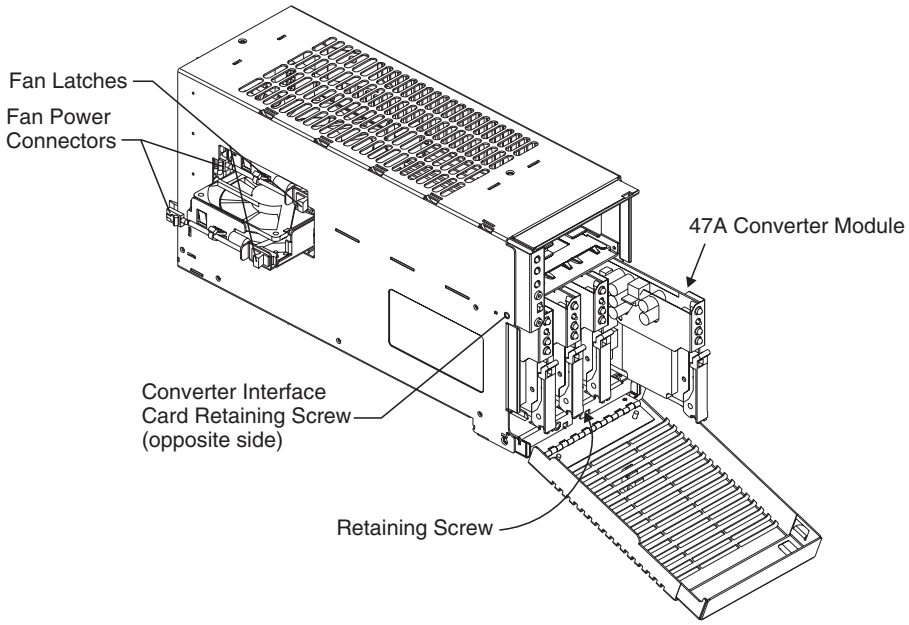


Figure 12-2: Detail of Converter Components

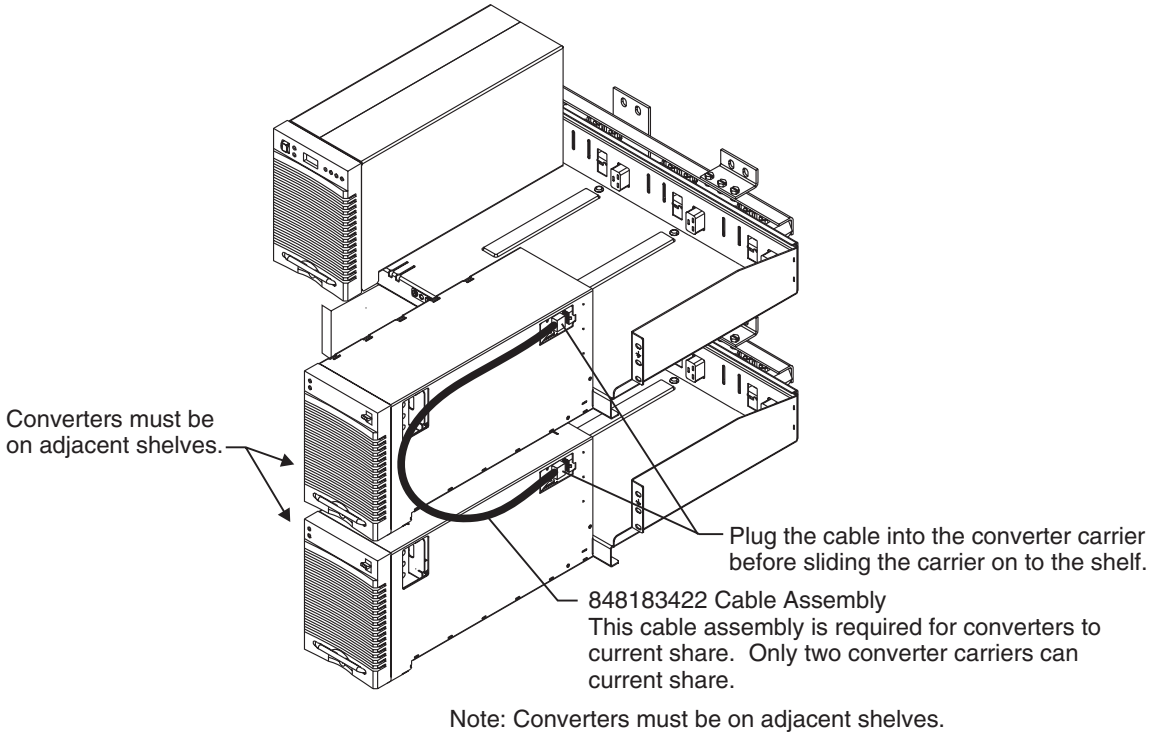


Figure 12-3: Cable Connection Between Two Converter Carriers

Replacement Parts

System

Table 12-A provides a list of replacement parts for the GPS 2424.

Table 12-A: GPS 2424 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
108558625	BIC8 bay interface card (Millennium controller only)
108045485	EBV3 load disconnect board
107782583	BJN2 battery disconnect board
407226836	Cabinet alarm lamp, 24V
Rectifier	
108687765	596B4, 24V/100A rectifier
407840792	Fan assembly
901181834	Insulated Allen-head wrench
Converter	
108171547	597A converter carrier
108271974	597B converter carrier
848190054	Converter fan assembly
108171562	128A converter interface card (CIC)
108171554	47A converter module
Distribution	
405673161	1/2 ampere alarm fuse
Millennium Controller	
406530725	1-1/3 ampere fuse (GMT)
406204230	3 ampere fuse (GMT)
406677880	Battery TL5101 for BSJ circuit board

Replacement Parts, continued

Millennium Controller Circuit Boards

Table 12-B lists the spare parts available for the Galaxy Millennium Controller.

Table 12-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)
108204397	Basic control board (BSH2)
847950912	LCD module assembly display board
108204405	Intelligent control board (BSJ2)
108851338	Modem board (BSM5)
108163601	Data switch board (BSW1)
108340100	Gateway board (EBW1)

Vector Controller Circuit Boards

Table 12-C lists the spare parts available for the Galaxy Vector Controller.

Table 12-C: Galaxy Vector Controller Circuit Boards and Temperature Module

Ordering Code	Description
107789513	Thermal probe multiplexer (210E)
848597563	Display assembly (includes BMW2)
108890088	24V control board (GCM2)
108415647	Modem Board (BSM3)
108340100	Gateway Board (EBW1)

Additional Ordering Information

Documentation Table 12-D lists other documentation associated with the GPS 2424.

Table 12-D: Product Documentation

Document Number	Description
H569-437	GPS 2424 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

13 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 Section 2 of the GPS Installation Guide before troubleshooting the GPS 2424.

⚠ Warnings

- 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 2424:

- 3/16-inch (5 mm) 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 13-1.

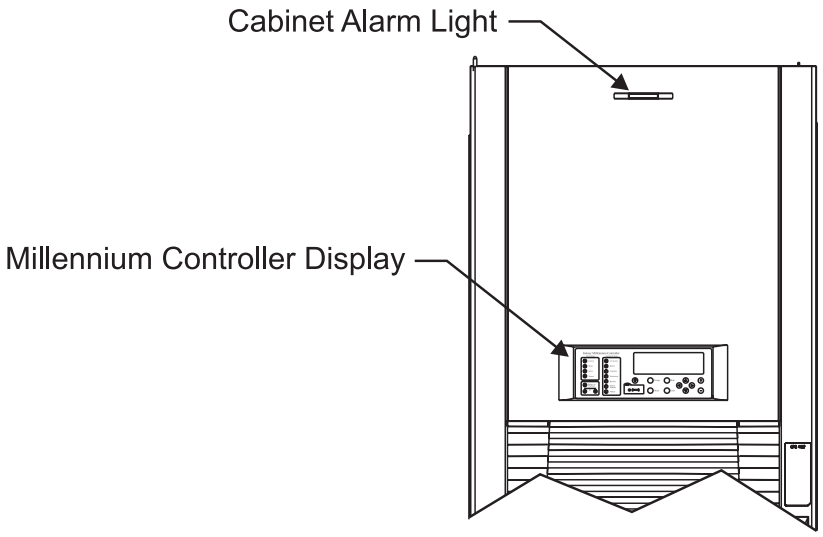


Figure 13-1: Location of Cabinet Alarm

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 13-3 and 13-5. 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 14, *Troubleshooting Millennium Systems*	
Alarm LED	**Table**
AC System	14-A, AC Alarms
Battery	14-B, Battery Alarms
Battery on Discharge	14-F, Miscellaneous Alarms
Controller	14-C, Controller Alarms
Distribution	14-D, Distribution Alarms
Rectifier	14-E, Rectifier and Converter Related Alarms
Remote Module	14-F, Miscellaneous Alarms
No LED*	14-F, Miscellaneous Alarms
*If an alarm condition exists, but no alarm LED is lit, refer to Table 14-F.	

Troubleshooting Procedure, continued

Troubleshooting Tables, continued

Section 15, *Troubleshooting Vector Systems*	
Display Message	**Table**
ac failure	15-A, AC Alarms
MULTIPLE AC FAIL	
phase failure	
VERY LOW VOLTAGE	15-B, Battery Alarms
CONTACTOR1 OPEN	
CONTACTOR1 FAIL	
HIGH BATT TEMP	
(no message)	15-C, Controller Alarms
CONTACTOR2 OPEN	15-D, Distribution Alarms
CONTACTOR2 FAIL	
DISTRIBUTION FUSE	
RECT ID CONFLICT	15-E, Rectifier and Converter Related Alarms
rectifier fail	
MULTI RECT FAIL	
VERY HIGH VOLTGE	
rect manual off	
high float volt	
CONV FAN FAILURE	
CONV DISTRBUTION	
conv id conflict	
converter fail	
MULTI CONV FAIL	
conv fan fail	
temp probe fail	15-F, Miscellaneous Alarms
BATT ON DISCHRGE	
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.	

Identifying Problems

5. 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
13-1	Location of Cabinet Alarm
13-2	Millennium Controller Display
13-3	Location of Millennium Controller Fuses and Boards
13-4	Vector Controller Display
13-5	Location of Vector Controller Fuses and Boards
13-6	Rectifier Display
13-7	Converter Status Panels
13-8	Low Voltage Battery Disconnect Contactor Control Switches
13-9	Detail of AC Input Panel and Rectifier Shelf
13-10	Detail of DC Distribution Panel
13-11	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

Millennium Controller, continued

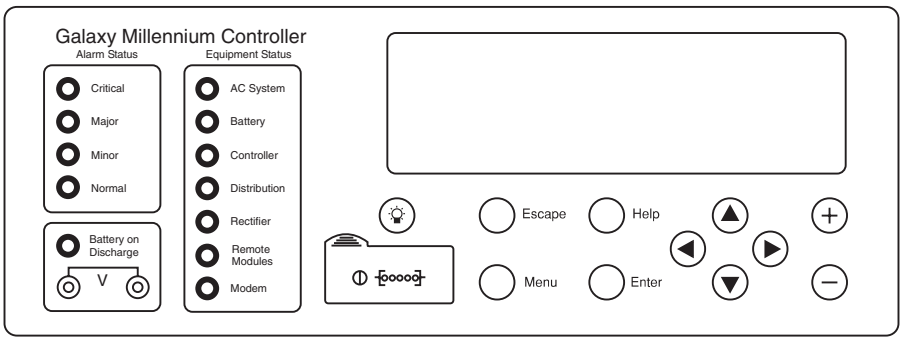


Figure 13-2: Millennium Controller Display

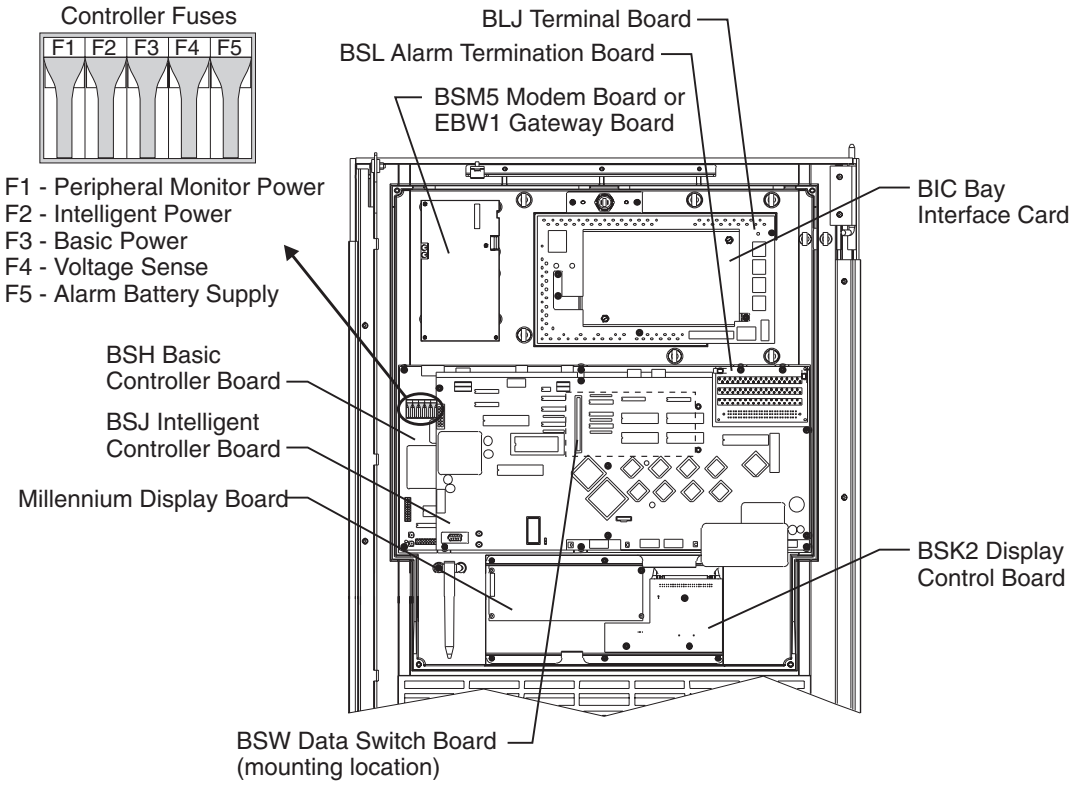


Figure 13-3: Location of Millennium Controller Fuses and Boards

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 13-5. The controller display shows a message for each alarm. These messages are listed in Section 15, *Troubleshooting Vector Systems*.

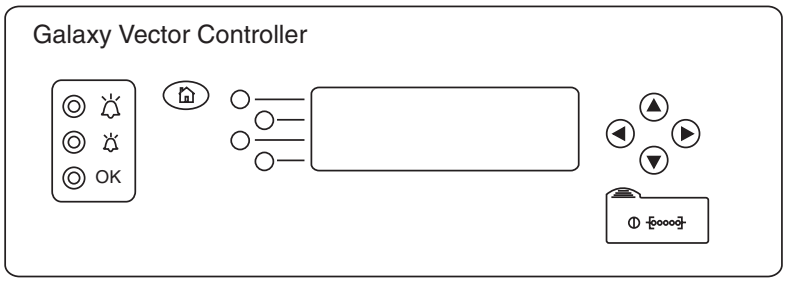


Figure 13-4: Vector Controller Display

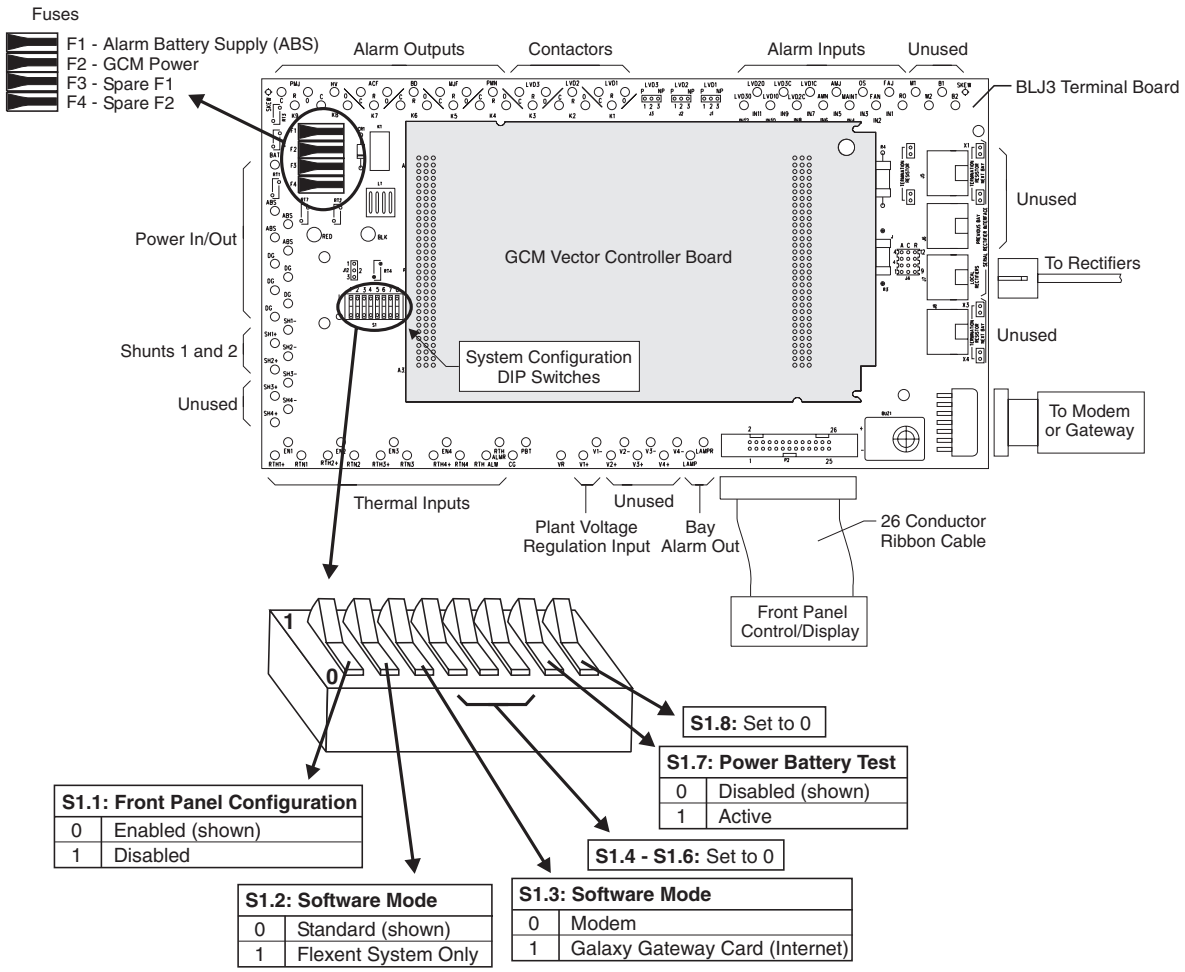


Figure 13-5: Location of Vector Controller Fuses and Boards

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.

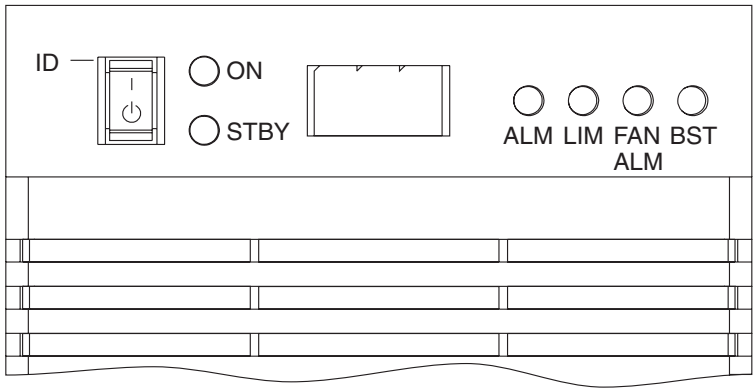


Figure 13-6: Rectifier Display

Reference Figures, continued

Converters

During normal operations, the green NORMAL LED on the converter carrier, the green ON LED on the 128A CIC (Converter Interface Card), and the green ON LED on each 47A converter module will be lit.

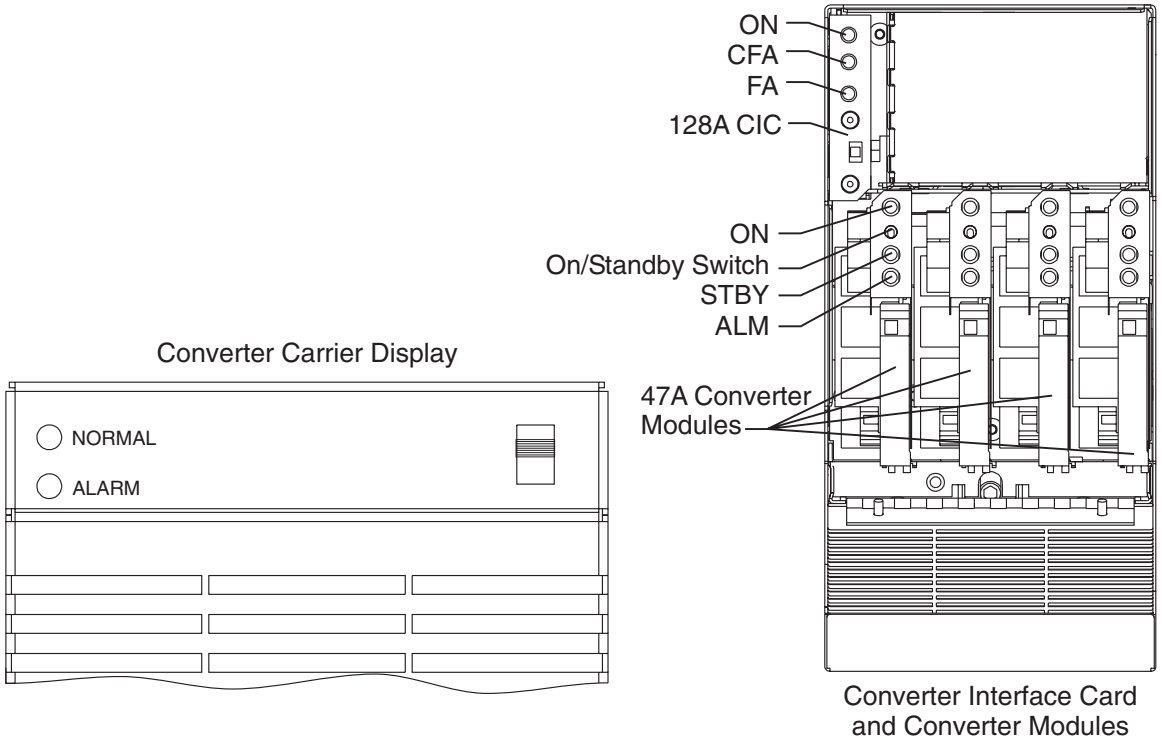


Figure 13-7: Converter Status Panels

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 13-8 shows the location of the contactor control board in the GPS cabinet.

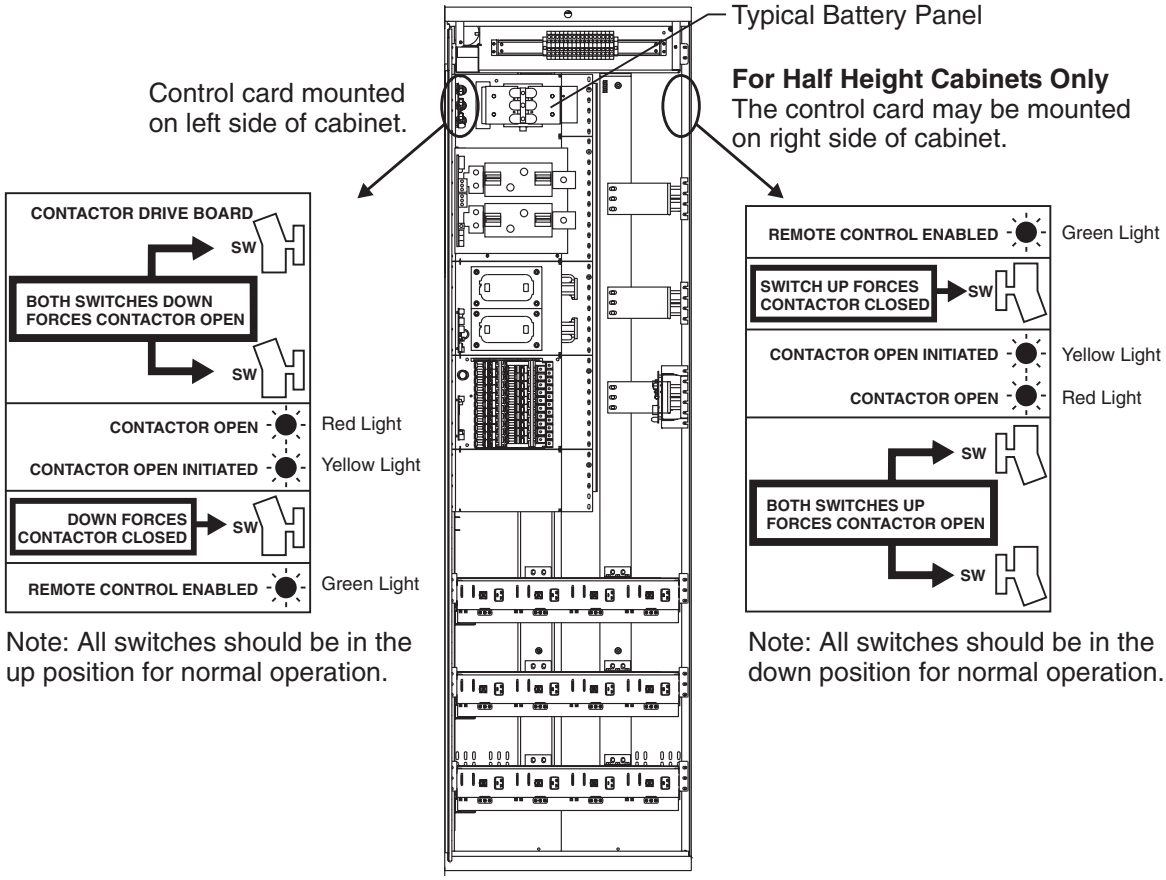
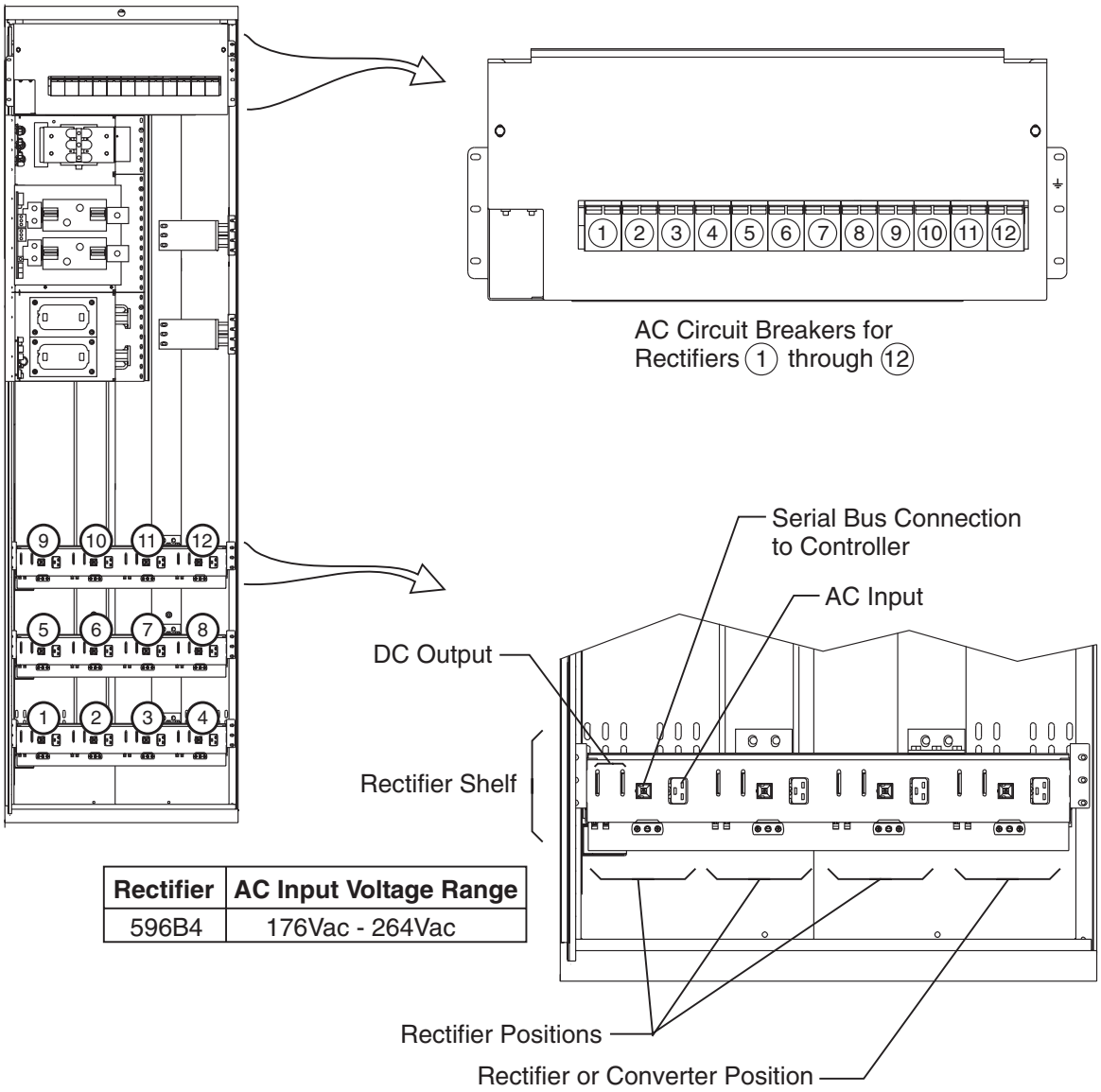


Figure 13-8: Low Voltage Battery Disconnect Contactor Control Switches

Reference Figures, continued

AC Input



Rectifier	AC Input Voltage Range
596B4	176Vac - 264Vac

Figure 13-9: Detail of AC Input Panel and Rectifier Shelf

Reference Figures, continued

DC Distribution

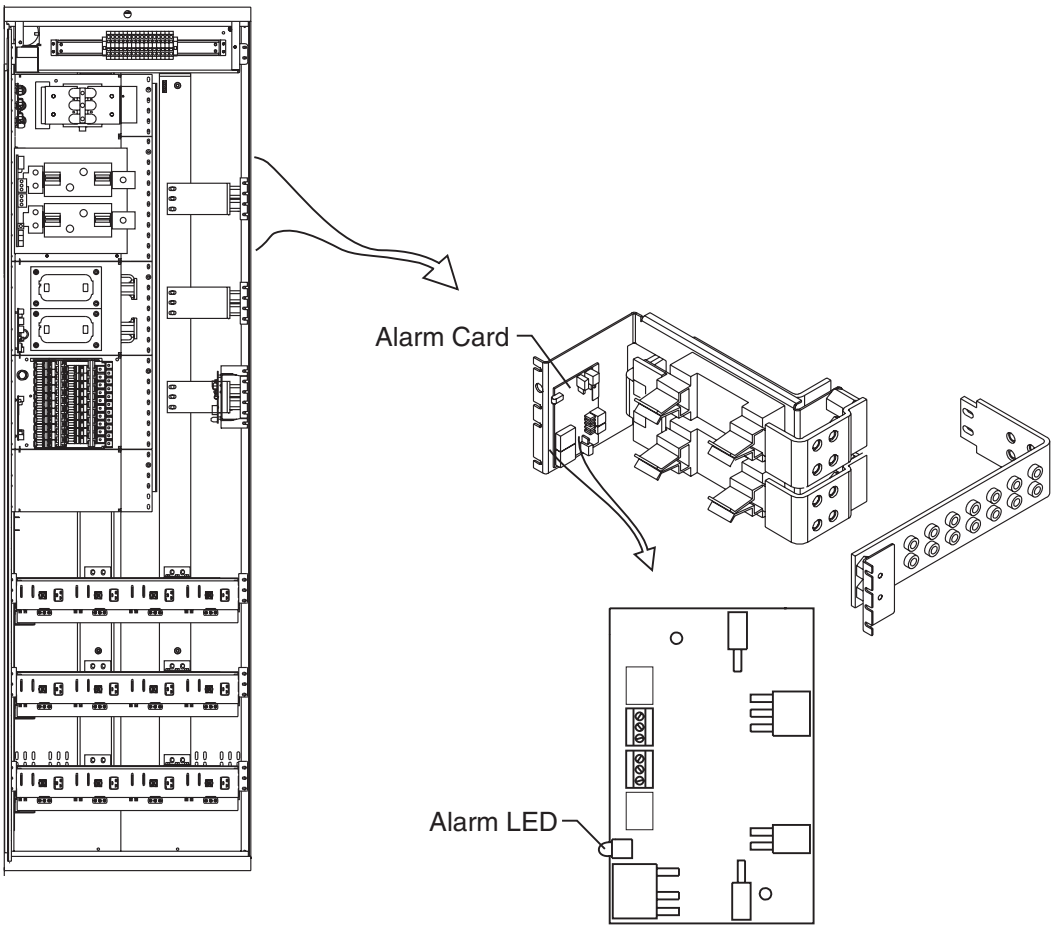


Figure 13-10: Detail of DC Distribution Panel

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 13-11.

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.

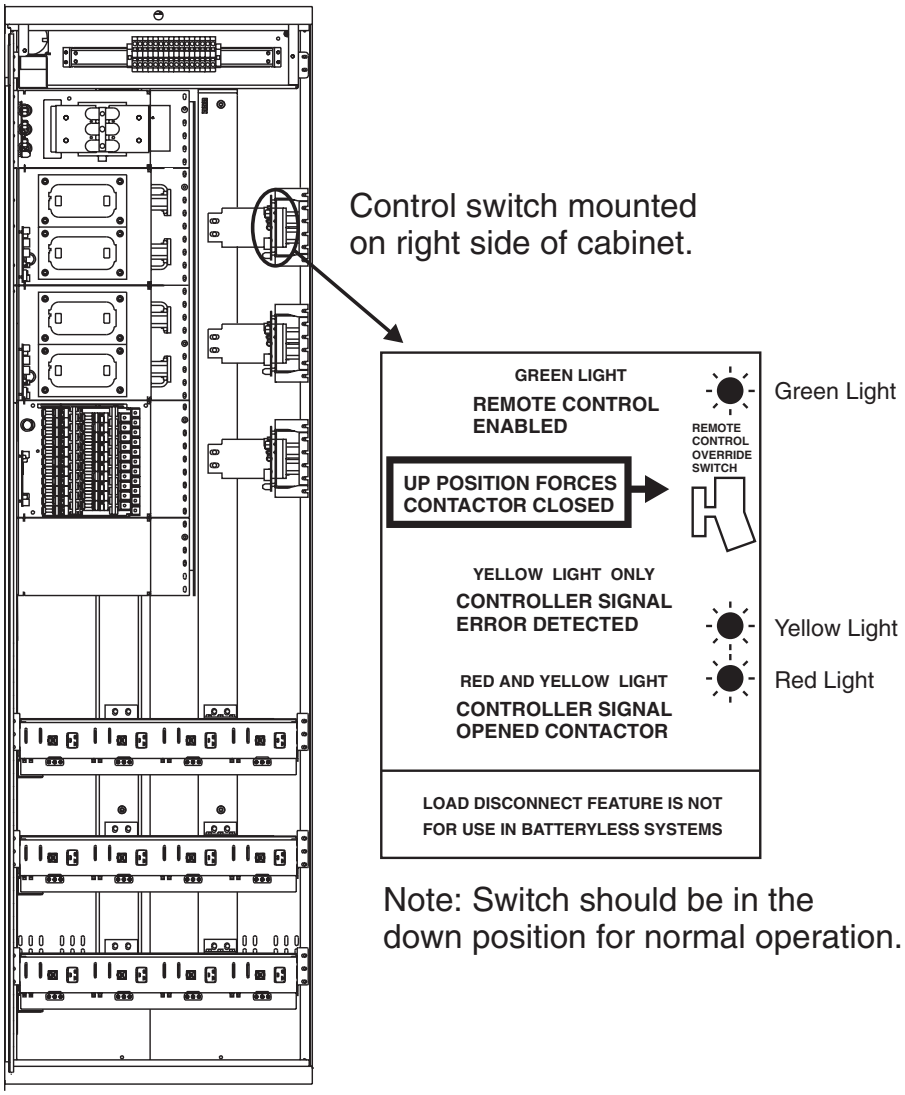


Figure 13-11: Low Voltage Load Disconnect Contactor Control Switches

14 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 13, *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 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.

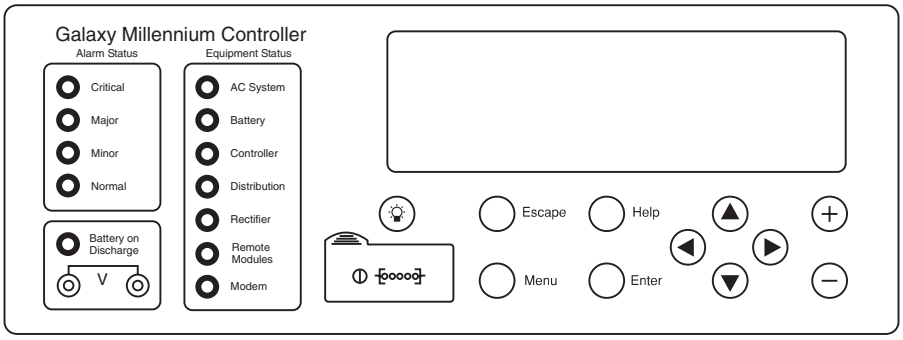
Table Reference

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

Alarm LED	Table
AC System	14-A, AC Alarms
Battery	14-B, Battery Alarms
Battery on Discharge	14-F, Miscellaneous Alarms
Controller	14-C, Controller Alarms
Distribution	14-D, Distribution Alarms
Rectifier	14-E, Rectifier and Converter Related Alarms
Remote Modules	14-F, Miscellaneous Alarms
No LED*	14-F, Miscellaneous Alarms
*If an alarm condition exists, but no alarm LED is lit, refer to Table 14-F.	

Millennium Display Reference

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



AC System Alarm LED

Table 14-A: AC Alarms
(See Figure 13-9)

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: •AC input circuit breaker has operated. •AC input voltage is out of range. •Internal rectifier failure	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: •Rectifier high voltage shutdown •External phase imbalance or failure •Internal rectifier failure	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 14-B: Battery Alarms
(See Figure 13-8)

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.	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	Contactor 1 Open	Red LED on contactor drive board is lit.	Contactor is 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 13-8). 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	Contactor 1 Fail	--	Contactor 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 battery string switch has opened.	Replace the operated fuse.

Table 14-B: Battery Alarms

(See Figure 13-8)

Controller LED	Controller Alarm Status	Millennium Controller Display	Other Indication(s)	Possible Problem(s)	Possible Solution(s)
Battery	Minor	Low Reserve Time	--	Controller has calculated that battery reserve time is below the alarm threshold level.	Call technical support.
Battery	Minor	Battery Thermal Alarm	Alarm on 210E unit, if equipped	Batteries have exceeded temp threshold.	•Check room ambient temperature against battery temperature threshold •Call technical support.

Controller Alarm LED

Table 14-C: Controller Alarms

(See Figures 13-2 and 13-3)

Controller LED	Controller Alarm Status	Millennium Controller Display	Other Indication(s)	Possible Problem(s)	Possible Solution(s)
Controller	Major	Controller Fail	--	**•BSH failure** → •BSJ failure •Option board failure •Display failure •BIC failure	Check the BSH board to see if the green LED is extinguished and the yellow LED is lit. If so, perform the following steps: 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 14-C: Controller Alarms

(See Figures 13-2 and 13-3)

Controller LED	Controller Alarm Status	Millennium Controller Display	Other Indication(s)	Possible Problem(s)	Possible Solution(s)
Controller	Major	Controller Fail	--	•BSH failure •**BSJ failure→** •Option board failure •Display failure •BIC failure	Check the BSJ board to see if the green LED is extinguished and the yellow LED is lit. If so, perform the following steps: 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 14-C: Controller Alarms

(See Figures 13-2 and 13-3)

Controller LED	Controller Alarm Status	Millennium Controller Display	Other Indication(s)	Possible Problem(s)	Possible Solution(s)
Controller	Major	Controller Fail	--	•BSH failure •BSJ failure **•Option board failure→** •Display failure •BIC failure	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: 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	--	•BSH failure •BSJ failure •Option board failure **•Display failure→** •BIC failure	If the front panel LCD module, LEDs, or switches fail, perform the following steps: 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 14-C: Controller Alarms

(See Figures 13-2 and 13-3)

Controller LED	Controller Alarm Status	Millennium Controller Display	Other Indication(s)	Possible Problem(s)	Possible Solution(s)
Controller	Major	Controller Fail	--	•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 blinking CFA LED on converter interface cards or red LED on BIC	Loss of communication with controller: •Defective interface from BIC, multiple rectifiers, or multiple converters to controller •Internal failure of controller, BIC, multiple rectifiers, or multiple converters	1. Verify that the controller is powered and operating correctly. 2. If there are no controller alarms, replace the equipment that has lost communication. 3. If the problem is not corrected, call technical support.

Table 14-C: Controller Alarms

(See Figures 13-2 and 13-3)

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 or blinking CFA LED on converter interface card	Loss of communication with controller: •Defective interface from rectifier or converter to controller •Internal failure of controller, rectifier, or converter	1. Verify that the controller is powered and operating correctly. 2. If there are no controller alarms, replace the equipment that has lost communication. 3. 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 14-D: Distribution Alarms
(See Figures 13-10 and 13-11)

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	Major	Converter Distribution Fuse	FA LED on converter carrier	A fuse or circuit breaker in the converter distribution has operated.	Replace fuse or reset circuit breaker.
Distribution* *Alarm must be configured to turn on the Distribution LED; not a factory default.	Major	Contactor 2 (or 3) Open	Red LED on contactor drive board is lit.	Contactor is 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 13-11). 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	Contactor 2 (or 3) Fail	--	Contactor or drive board has failed.	Call technical support.

Rectifier Alarm LED

Table 14-E: Rectifier and Converter Related Alarms

Rectifier Related Alarms (See Figures 13-6 and 13-9)						
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 12, "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	•Lightning has struck system. •Internal rectifier failure	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: •Rectifier high voltage shutdown •Internal rectifier failure	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 14-E: Rectifier and Converter Related Alarms

Rectifier Related Alarms (See Figures 13-6 and 13-9)						
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	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	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	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 14-E: Rectifier and Converter Related Alarms

Rectifier Related Alarms (See Figures 13-6 and 13-9)						
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: •Excessive output current •Internal rectifier failure	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: •Internal rectifier failure	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 12)
Rectifier	Minor	Manual Off	STBY	Blank	Rectifier has been manually turned off.	Turn rectifier on.

Table 14-E: Rectifier and Converter Related Alarms

Rectifier Related Alarms (See Figures 13-6 and 13-9)						
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.
Converter Related Alarms (See Figure 13-7)						
Controller LED	**Controller Alarm Status**	**Millennium Controller Display**	**Converter LED**		**Possible Problem(s)**	**Possible Solution(s)**
Rectifier	Major	Multiple Converter Fail	CFA		•More than one converter module are turned off (STBY LEDs are lit). •More than one converter module has failed.	1. Turn on modules if off. 2. Replace modules.
Rectifier	Major	Converter Fan Major	CFA		Both fans in a converter carrier have failed.	Replace fans.
Rectifier	Major	Converter ID Conflict	None		Two or more converters have the same ID number.	1. Pull CIC card out of carrier. 2. Move plastic tab. 3. Set DIP switches. 4. Call technical support.

Rectifier	Minor	Converter Fail	CFA	•Converter module manually turned off (STBY LED is lit.) •Converter module failure	1. Turn on module if off. 2. Replace module.
Rectifier	Minor	Converter Fan Minor	CFA	One fan in a converter carrier has failed.	Replace fan.

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

Table 14-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	--	•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	STBY LED on rectifier is lit. TR on rectifier display	Remote transfer: •Rectifier is in STBY.	Remove the remote standby command issued by the controller.
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.

15 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 13, *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

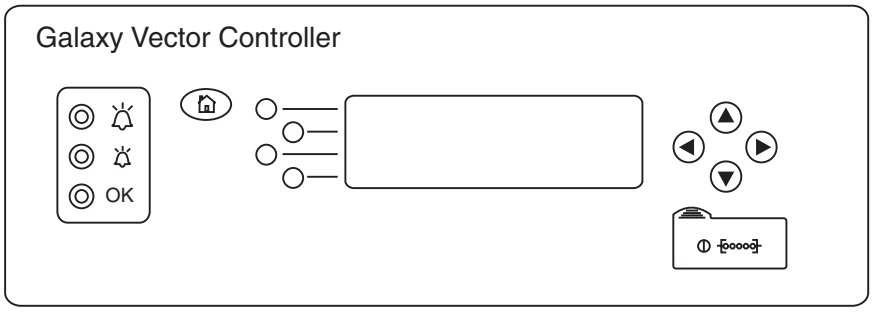
Use the reference below to locate the table corresponding to the message displayed after pressing "← View Alarms."

Display Message	Table
AC failure	15-A, AC Alarms
MULTIPLE AC FAIL	
phase failure	
VERY LOW VOLTAGE	15-B, Battery Alarms
CONTACTOR1 OPEN	
CONTACTOR1 FAIL	
HIGH BATT TEMP	
(no message)	15-C, Controller Alarms
CONTACTOR2 OPEN	15-D, Distribution Alarms
CONTACTOR2 FAIL	
DISTRIBUTION FUSE	
RECT ID CONFLICT	15-E, Rectifier and Converter Related Alarms
rectifier fail	
MULTI RECT FAIL	
VERY HIGH VOLTGE	
rect manual off	
high float volt	
CONV FAN FAILURE	
CONV DISTRBUTION	
conv id conflict	
converter fail	
MULTI CONV FAIL	
conv fan fail	
temp probe fail	15-F, Miscellaneous Alarms
BATT ON DISCHRGE	
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 15-A: AC Alarms
(See Figure 13-9)

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: •AC input circuit breaker has operated. •AC input voltage is out of range. •Internal rectifier failure	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: •AC input circuit breaker has operated. •AC input voltage is out of range. •Internal rectifier failure	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: •Rectifier high voltage shutdown •External phase imbalance or failure •Internal rectifier failure	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 15-B: Battery Alarms
(See Figure 13-8)

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.	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: •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 13-8). 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 15-C: Controller Alarms
(See Figures 13-4 and 13-5)

Controller Alarm Status	Vector Controller Display	Other Indication(s)	Possible Problem(s)	Possible Solution(s)
Major	None	--	•Controller failure	Check controller to see if the green LED is extinguished and the red LED is lit. If so, perform the following steps: 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	--	•Controller failure •Display failure	If the front panel LED module, LEDs, or switches fail, perform the following steps: 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 15-D: Distribution Alarms
(See Figures 13-10 and 13-11)

Controller Alarm Status	Vector Controller Display	Other Indication(s)	Possible Problem(s)	Possible Solution(s)
Major	CONV DISTRBUTION	FA LED on converter is lit.	A fuse or circuit breaker in the converter distribution has operated.	Replace fuse or reset circuit breaker.
Major	CONTACTOR2 OPEN	Red LED on contactor drive board is lit.	Contactor is 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 13-11). 2. If the problem is not corrected, call technical support.
Major	CONTACTOR2 FAIL	--	Contactor or drive board has failed.	Call technical support.
Major	DISTRBUTION FUSE	Alarm LED on dc distribution panel is lit.	DC load fuse or circuit breaker has operated.	Replace fuse or reset circuit breaker.
Major	DISTRBUTION FUSE	--	Fuse has operated.	Replace fuse F1 (alarm battery supply) on the BLJ3 terminal board.

Rectifier and Converter Related Alarms

Table 15-E: Rectifier and Converter Related Alarms

Rectifier Related Alarms (See Figures 13-6 and 13-9)					
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 12, "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: •Defective interface from multiple rectifiers to controller •Internal failure of controller or multiple rectifiers	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	•Lightning has struck system. •Internal rectifier failure	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 ALM LED on rectifier	--	Loss of communication with controller: •Defective interface from rectifier to controller •Internal controller or rectifier failure	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 15-E: Rectifier and Converter Related Alarms

Rectifier Related Alarms (See Figures 13-6 and 13-9)					
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	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	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	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	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 15-E: Rectifier and Converter Related Alarms

Rectifier Related Alarms (See Figures 13-6 and 13-9)					
Controller Alarm Status	**Vector Controller Display**	**Rectifier LED**	**Rectifier Display**	**Possible Problem(s)**	**Possible Solution(s)**
Minor	RECTIFIER FAIL	ALM	ICS IP5 IP6 IP7	Internal rectifier failure	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.
Minor	RECTIFIER FAIL	ALM	SEN	Thermal sensor failure: •Internal rectifier failure	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.

Table 15-E: Rectifier and Converter Related Alarms

Rectifier Related Alarms (See Figures 13-6 and 13-9)					
Controller Alarm Status	**Vector Controller Display**	**Rectifier LED**	**Rectifier Display**	**Possible Problem(s)**	**Possible Solution(s)**
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.

Table 15-E: Rectifier and Converter Related Alarms

Converter Related Alarms (See Figure 13-7)				
Controller Alarm Status	**Vector Controller Display**	**Converter LED**	**Possible Problem(s)**	**Possible Solution(s)**
Major	CONV FAN FAILURE	CFA	Both fans in a converter carrier have failed.	Replace fans.
Major	conv id conflict	None		1. Pull CIC card out of carrier. 2. Move plastic tab. 3. Set DIP switches. 4. Call your technical support.
Major	MULTI CONV FAIL	CFA	•More than one converter modules are turned off. (STBY LEDs are lit.) •More than one converter module have failed.	1. Turn on modules if off. 2. Replace modules.
Major	MULTI CONV FAIL	Blinking CFA LED on converter	•Loss of communication with controller •Defective interface from converters to controller •Internal failure of controller or multiple converters	1. Verify that the controller is powered and operating correctly. 2. If there are no controller alarms, replace the converter CIC. 3. If the problem is not corrected, call technical support.
Minor	converter fail	Blinking CFA LED on converter	•Loss of communication with controller •Defective interface from converter to controller •Internal controller or converter failure	1. Verify that the controller is powered and operating correctly. 2. If there are no controller alarms, replace the converter CIC. 3. If the problem is not corrected, call technical support.
Minor	converter fail	CFA	•Converter module manually turned off (STBY LED is lit.) •Converter module failure	1. Turn on module if off. 2. Replace module.
Minor	conv fan fail	CFA	One fan in a converter carrier has failed.	Replace fan.

Miscellaneous Alarms

Table 15-F: Miscellaneous Alarms

Controller Alarm Status	Vector Controller Display	Other Indication(s)	Possible Problem(s)	Possible Solution(s)
Major	BATT ON DISCHRGE	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; reseat 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 BLJ terminal board.

16 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.