Lucent Technologies
Bell Labs Innovations

Galaxy Power System 2424 (GPS 2424) H569-437

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

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1 Introduction

GPS 2424

Overview

Lucent Technologies 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.

Illustrations

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

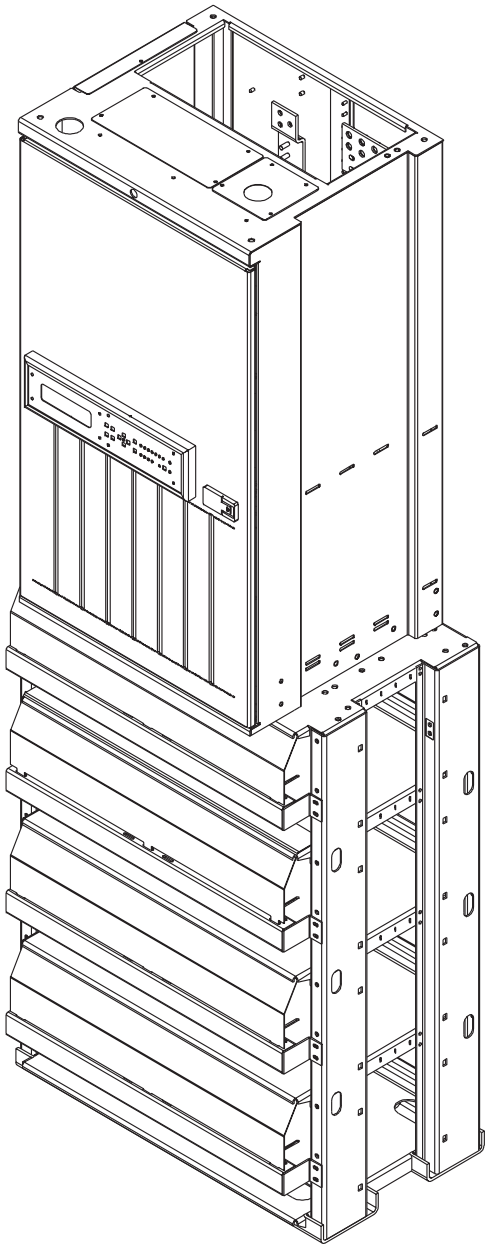


Figure 1-1: GPS 2424 Half Height Cabinet (with Battery Stand)

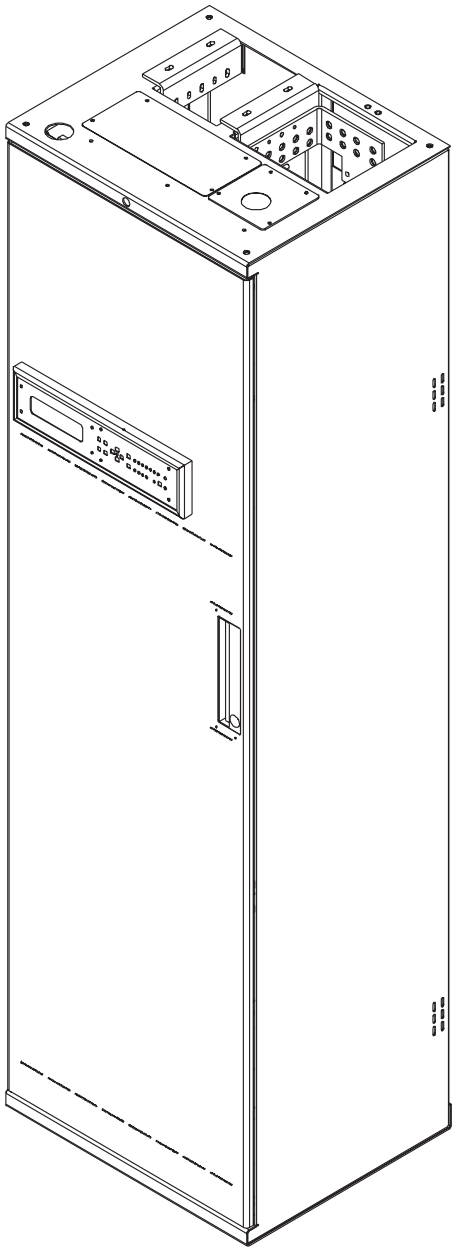


Figure 1-2: GPS 2424 Full Height Cabinet

Customer Assistance Contacts

Customer Training

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

Customer Service

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

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

Technical Support

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

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

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

Product Repair and Return

Repair and return service is provided for Lucent Technologies customers around the world.

For customers in the United States, Canada, Puerto Rico, and the US Virgin Islands, call 1-800-255-1402 for information on returning of products for repair.

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

Customer Assistance Contacts, continued

Warranty Service

For domestic warranty service, contact your Warranty Service Manager (WSM). For international warranty service, contact your sales representative.

On-Line Power Systems Product Manuals

For Lucent Technologies users logging in from inside the corporate firewall, the address of the "Power Systems On-Line Product Manuals" page is *http://www.cic.lucent.com/lineage.html*.

For customers logging in from outside the firewall, the address is *http://www.lucent8.com/lineage.html*. The annual subscription fee for access to this site is $25. To obtain a password, follow the instructions on-line or call 1-888-Lucent8 (1-888-582-3688). When prompted for an order number, enter or say "167-790-010."

On-Line Power Systems Software Upgrades

EasyView software upgrades are on-line at *http://www.lucent.com/networks/power/software.html*.

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.

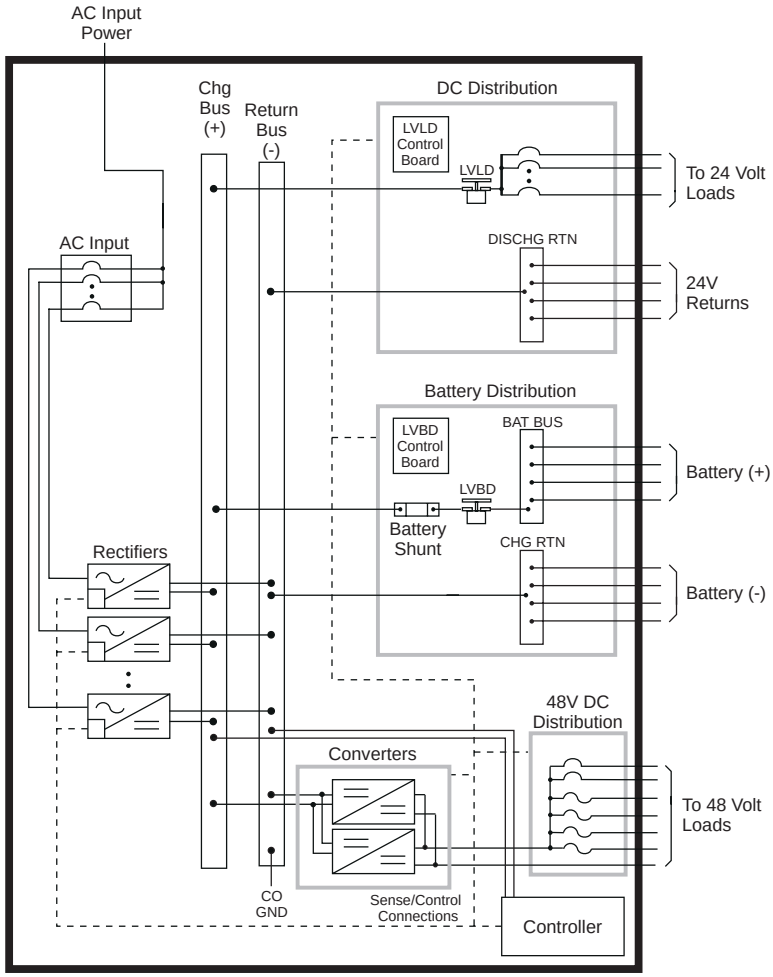


Figure 2-1: Block Diagram of the GPS 2424

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.

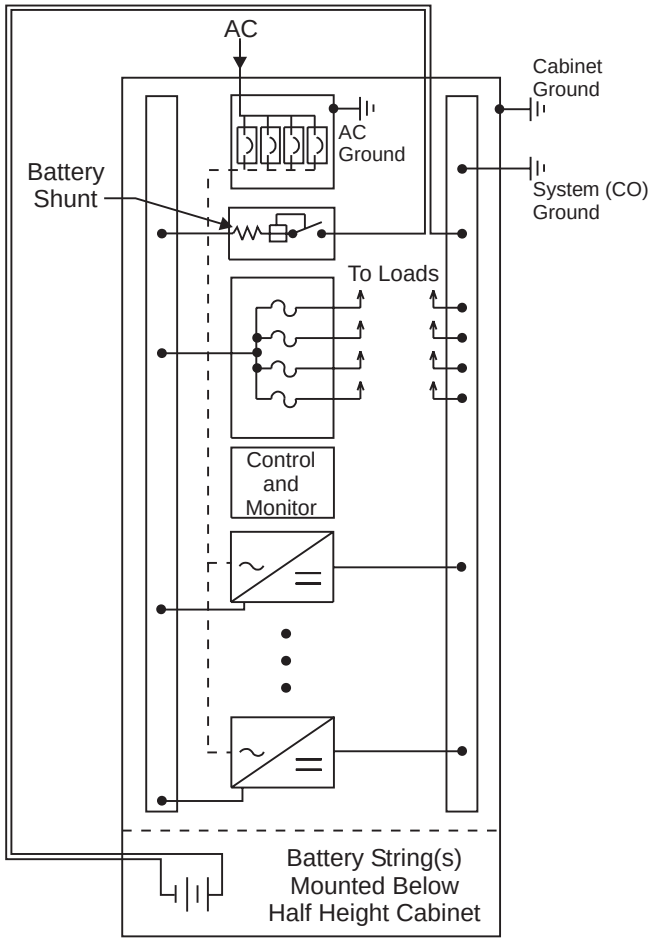


Figure 2-2: Schematic of Half Height Cabinet

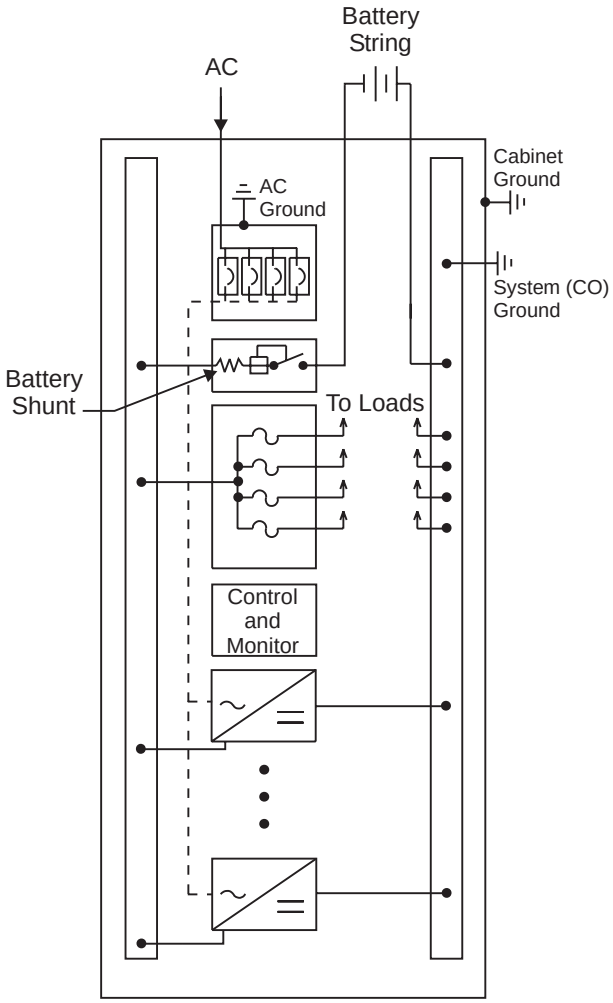


Figure 2-3: Schematic of Full Height Cabinet

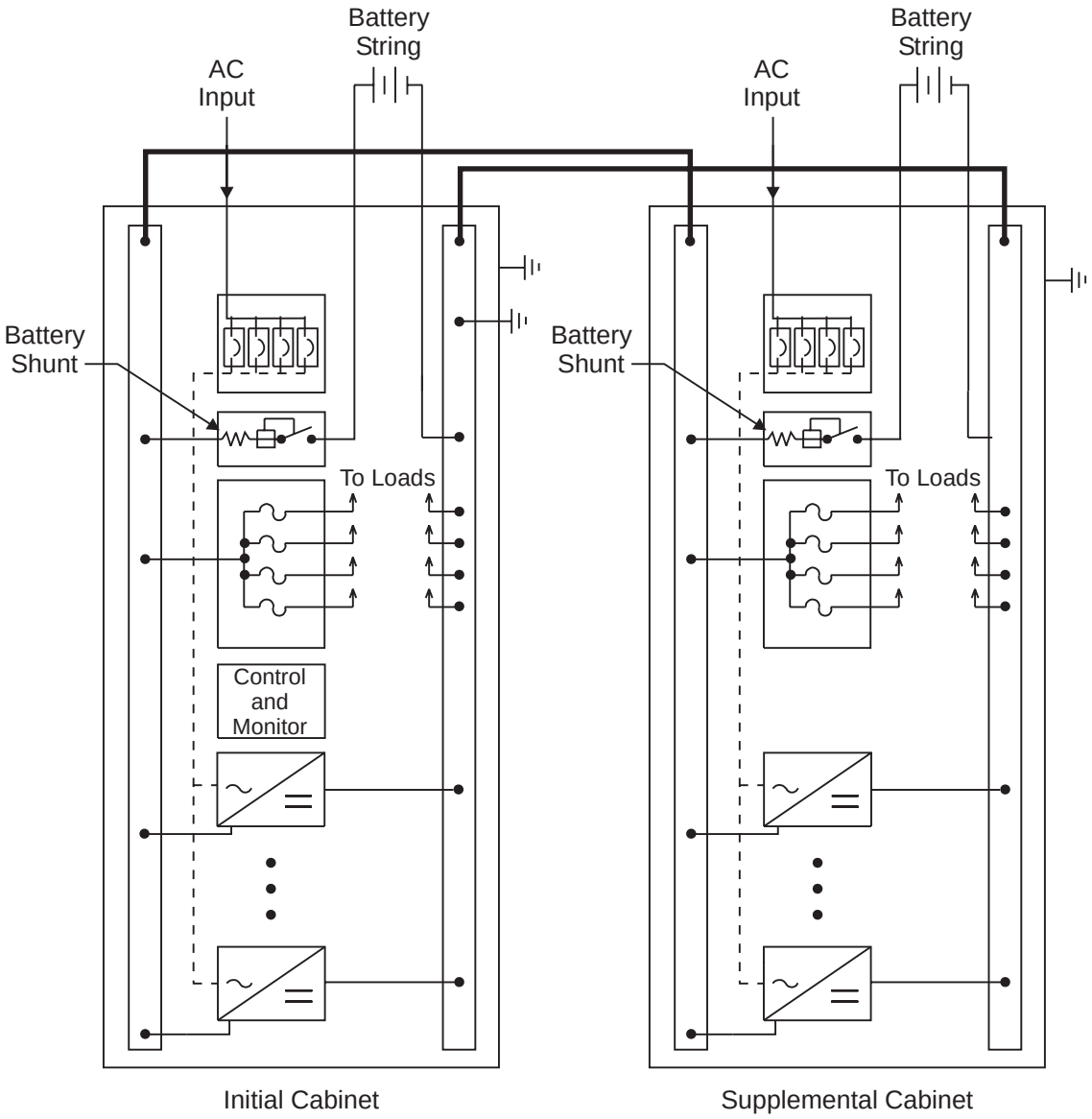


Figure 2-4: Schematic of Two-cabinet System Architecture

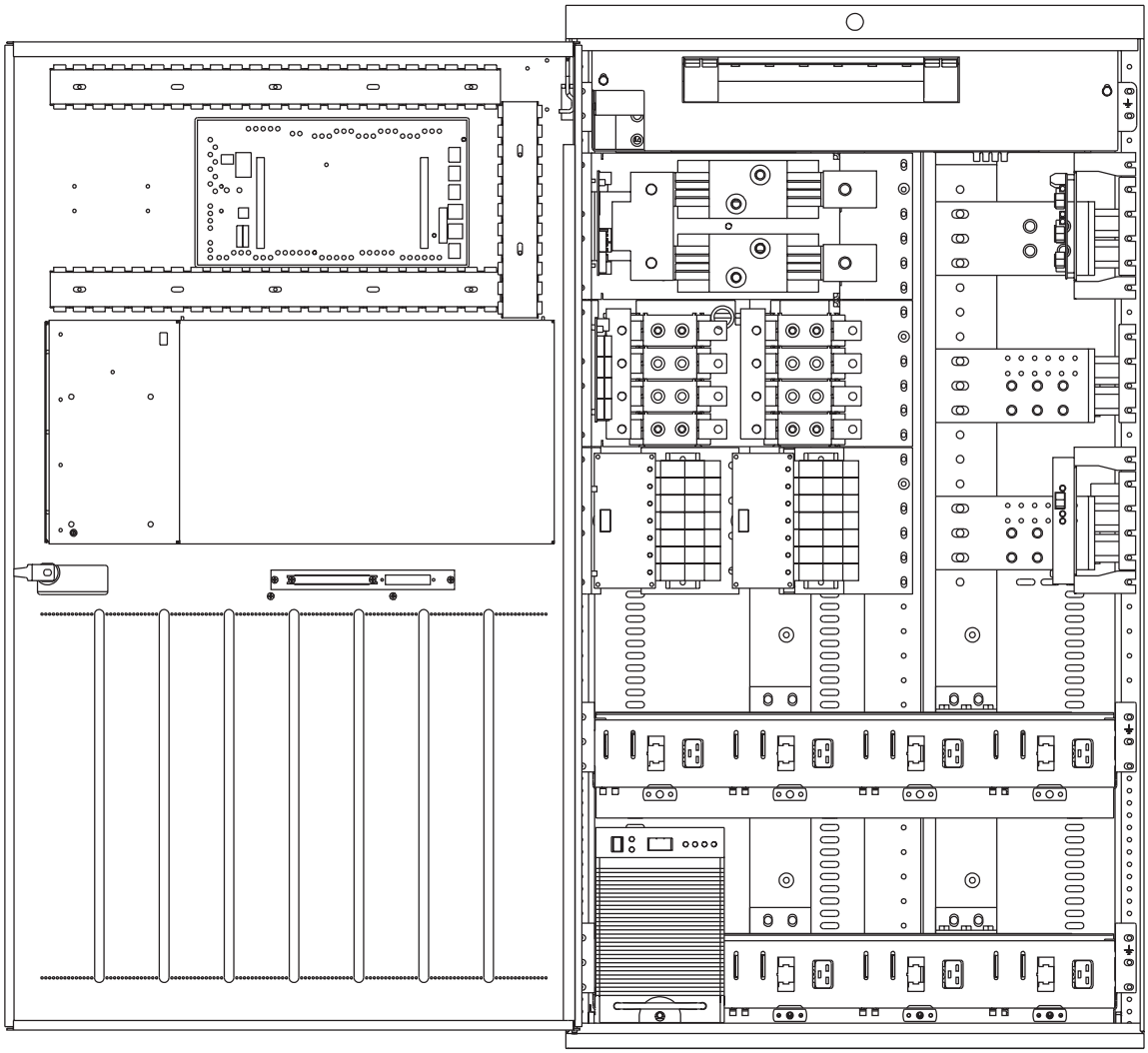


Figure 2-5: Half Height GPS 2424 with Door Open

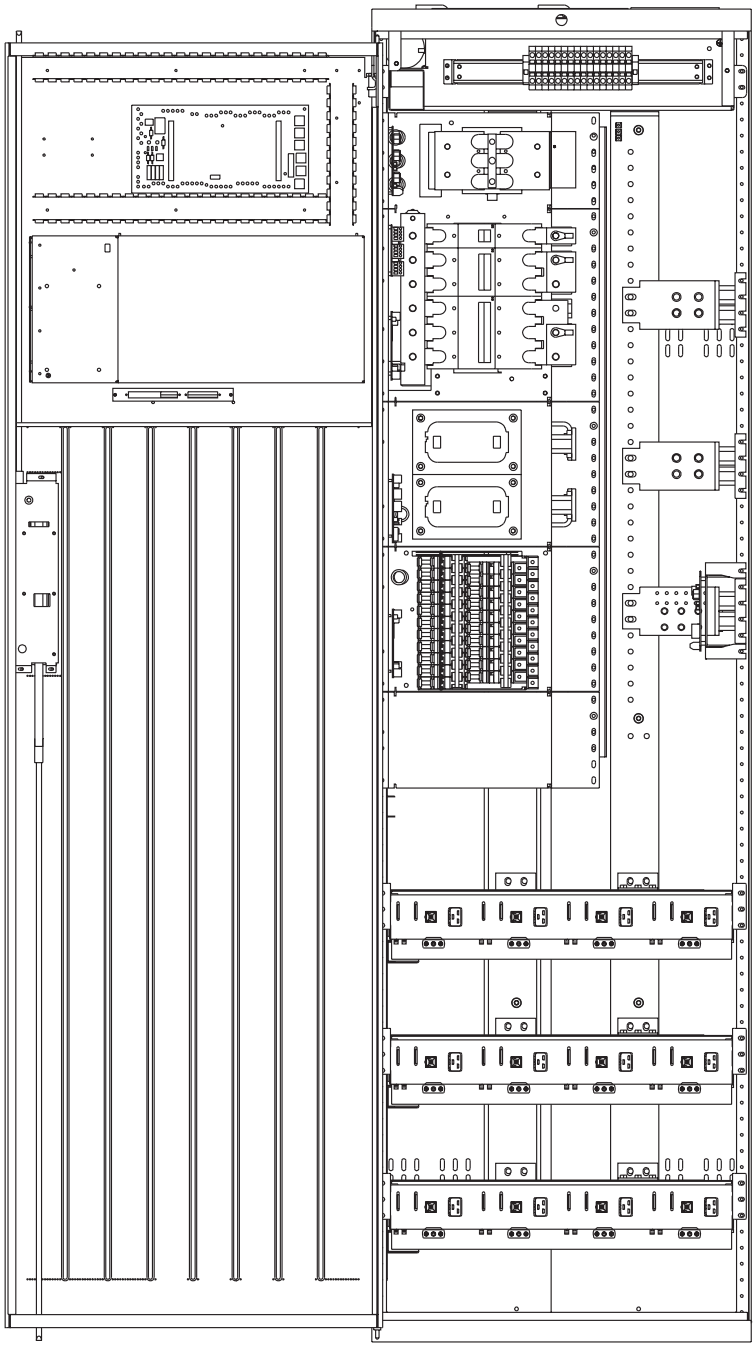


Figure 2-6: Full Height GPS 2424 with Door Open

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.

Galaxy Millennium Controller

Design

The Galaxy Millennium Controller is equipped with a **Basic** control board for basic operations and an optional **Intelligent** control board 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.

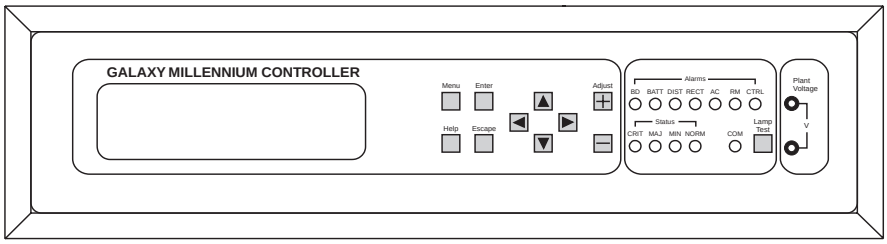


Figure 3-1: Galaxy Millennium Controller Front Panel

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 of seven LEDs, labeled ALARMS, indicates the *source* of the alarm:

  BD - battery on discharge
  BATT - battery
  DIST - distribution
  RECT - rectifier
  AC - ac power supply
  RM - remote monitoring
  CTRL - controller

- The second row includes four LEDs, labeled STATUS. They indicate the *severity* of the reported alarm:

  CRIT - critical
  MAJ - major
  MIN - minor
  NORM - normal

- The COM 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 to the right of 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:

- MENU: View the MAIN menu.
- ENTER: Select a menu item.
- HELP: Display limited on-line help information.
- ESCAPE: Return to the immediate higher level menu.
- Up arrow: Move the cursor up one line.
- Down arrow: Move the cursor down one line.
- Left arrow: Move the cursor left one field.
- Right arrow: Move the cursor right one field.
- ADJUST + 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.

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 alpha-numeric LED display, rows of LEDs, an array of pushbutton keys, and a pair of test jacks. Figure 3-2 illustrates the Vector's front panel.

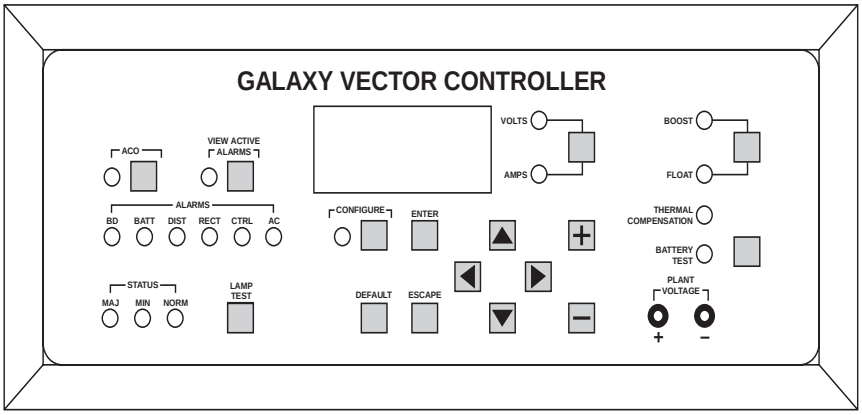


Figure 3-2: Galaxy Vector Controller Front Panel

Default Display

The default display shows the system voltage. Toggle the VOLTS/ AMPS switch to view system voltage or current. Press the VIEW ACTIVE ALARMS button to view the code for any active alarm. The controller returns to the default display approximately 30 seconds after the last time a key is pressed.

Galaxy Vector Controller, continued

LEDs

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 ALARMS row of six LEDs indicates the *source* of the alarm:
  - BD - battery on discharge
  - BATT - battery
  - DIST - distribution
  - RECT - rectifier
  - CTRL - controller
  - AC - ac input power
- The STATUS row of three LEDs indicates the *severity* of the reported alarm:
  - MAJ - major
  - MIN - minor
  - NORM - normal
- THERMAL COMPENSATION: Lights when the system voltage has been adjusted by the Thermal Compensation feature.

Test Jacks

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

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 following is a general description of the pushbutton keys:

- VOLTS or AMPS: Select either volts or amps for viewing.
- BOOST or FLOAT: Select one of these system modes.
- BATTERY TEST: Start/stop discharge test.
- ACO: Switch between Alarm Cut Off and On. The LED lights when audible Alarm Cutoff is active.
- VIEW ACTIVE ALARMS: Display active alarms. Use the arrow keys to page through multiple alarms. The LED lights when this option is selected. **Note: View Active Alarms and Configure cannot be active simultaneously.**
- CONFIGURE: Enter Configuration Mode. The LED lights when this option is selected. **Note: Configure and View Active Alarms cannot be active simultaneously.**
- ENTER: Select a menu item.
- DEFAULT: In Configure mode, change a parameter to default value.
- ESCAPE: Return to the immediate higher level menu.
- Up arrow: Move the cursor up one line.
- Down arrow: Move the cursor down one line.
- Left arrow: Move the cursor left one field.
- Right arrow: Move the cursor right one field.
- ADJUST + 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.

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.
- 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.

Front Panel Display, continued

Illustration Figure 4-1 shows the rectifier's front panel.

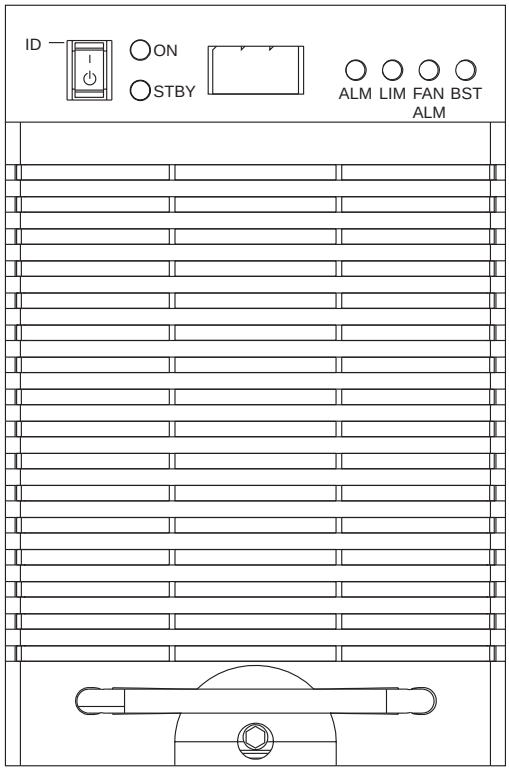


Figure 4-1: Rectifier Front Panel

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.

Controller Communications Alarm

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

Features, continued

Connectorized

The rectifiers provide the controller with a full complement of status and alarm signals. The rectifier status and alarm signals, ac input, and dc output are all connectorized for easy installation and maintenance. System connections are made when the 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.

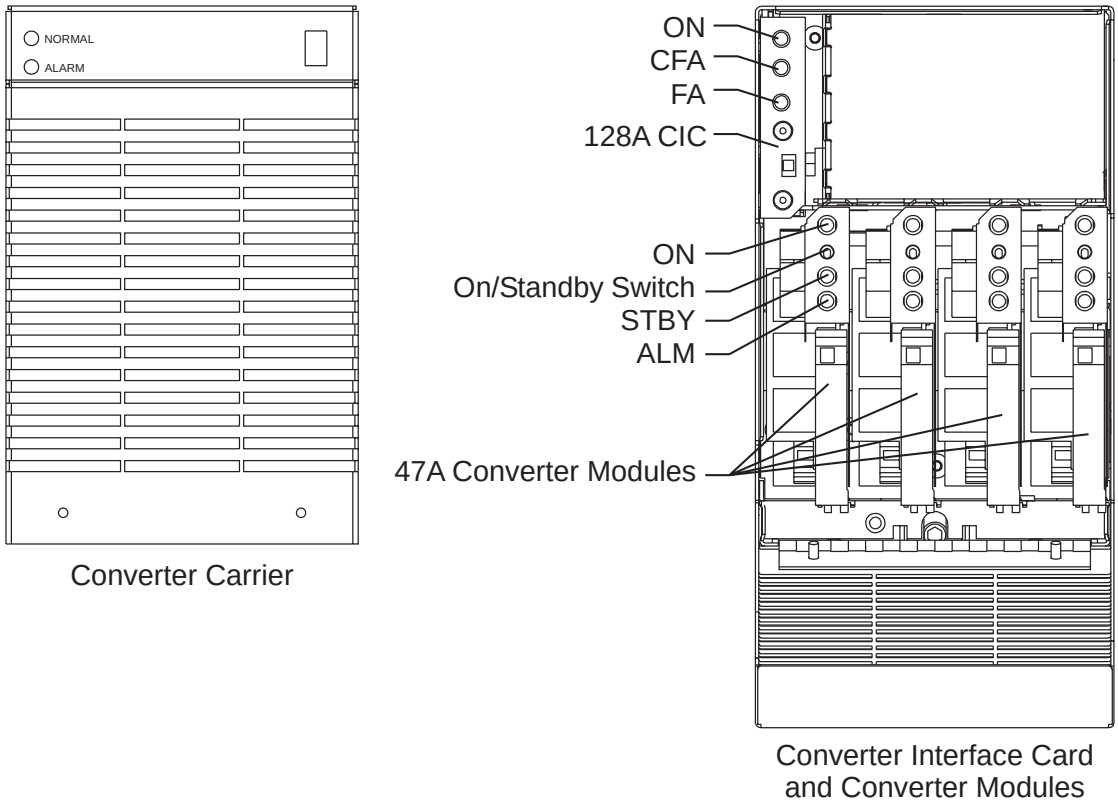


Figure 5-1: Carrier and Converter Front Panels

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 shelves of rectifiers that are connected phase to phase	Figure 6-1
H569-437 G71H (ED83142-30 G6)	Half-height cabinet with two shelves of rectifiers that are connected phase to phase	Figure 6-1
H569-437 G74F (ED83142-30 G6M)	Full-height cabinet with two shelves of rectifiers that are connected phase to neutral	Figure 6-1
H569-437 G74H (ED83142-30 G6M)	Half-height cabinet with two shelves of rectifiers that are connected phase to neutral	Figure 6-1
H569-437 G72F (ED83142-30 G7)	Full-height cabinet with three shelves of rectifiers that are connected phase to phase	Figure 6-2
H569-437 G76H (ED83142-30 G8)	Half-height cabinet with two shelves of rectifiers that are connected phase to phase or phase to neutral	Figure 6-3
H569-437 G77F (ED83142-30 G9)	Full-height cabinet with three shelves of rectifiers 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.

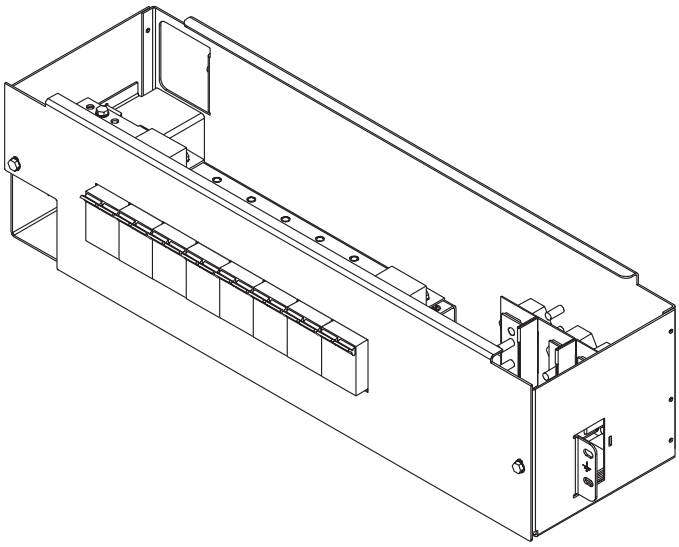


Figure 6-1: H569-437 G73F/71H (ED83142-30 G6)
H569-437 G74F/74H (ED83142-30 G6M)
AC Input Circuit Breaker Panel

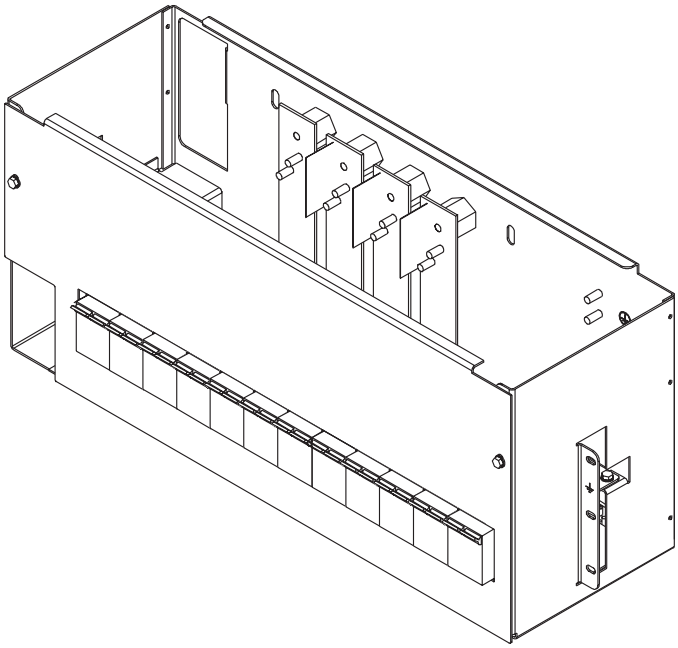


Figure 6-2: H569-437 G72F (ED83142-30 G7)
AC Input Circuit Breaker Panel

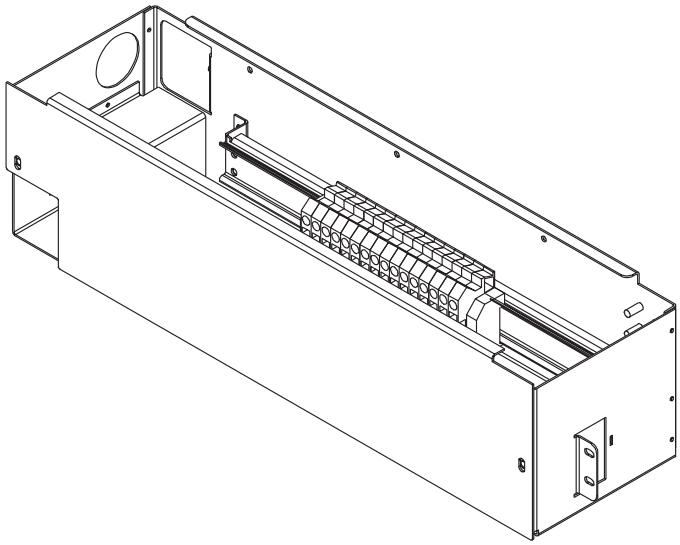


Figure 6-3: H569-437 G76H (ED83142-30 G8)
AC Input Terminal Strip Panel

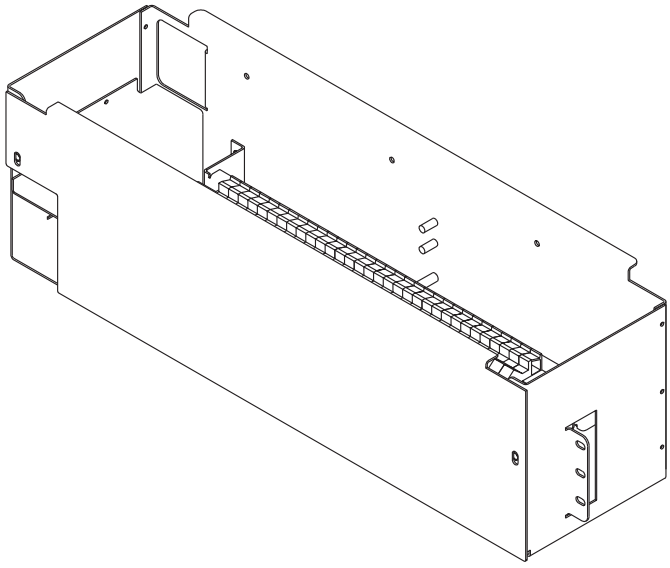


Figure 6-4: H569-437 G77F (ED83142-30 G9)
AC Input Terminal Strip Panel

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 7-8.

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

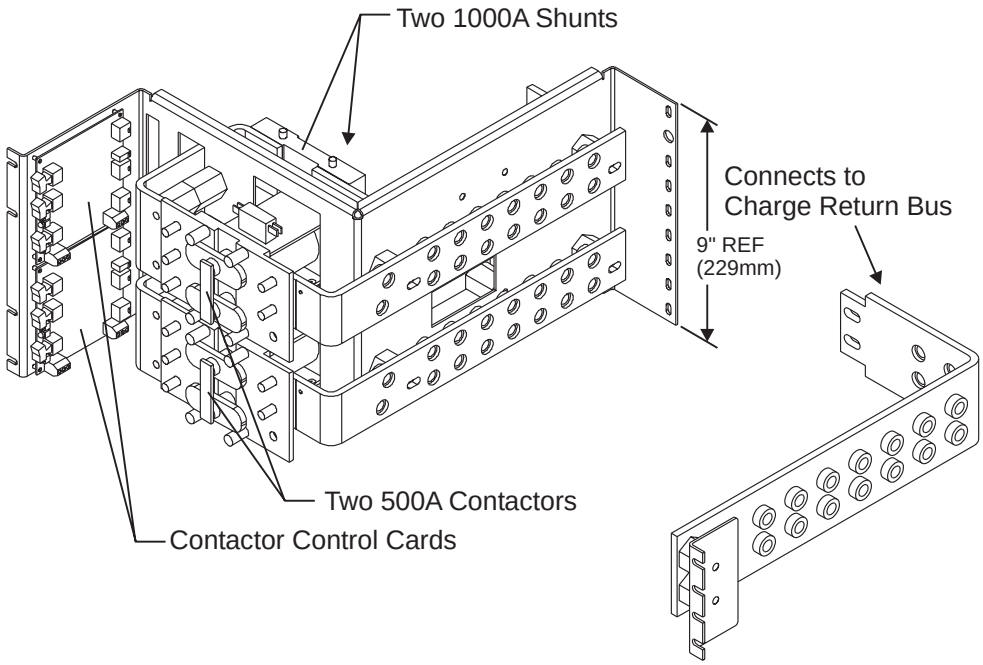


Figure 7-1: H569-437 G30 (ED83143-30 G132)
Battery Connection Panel

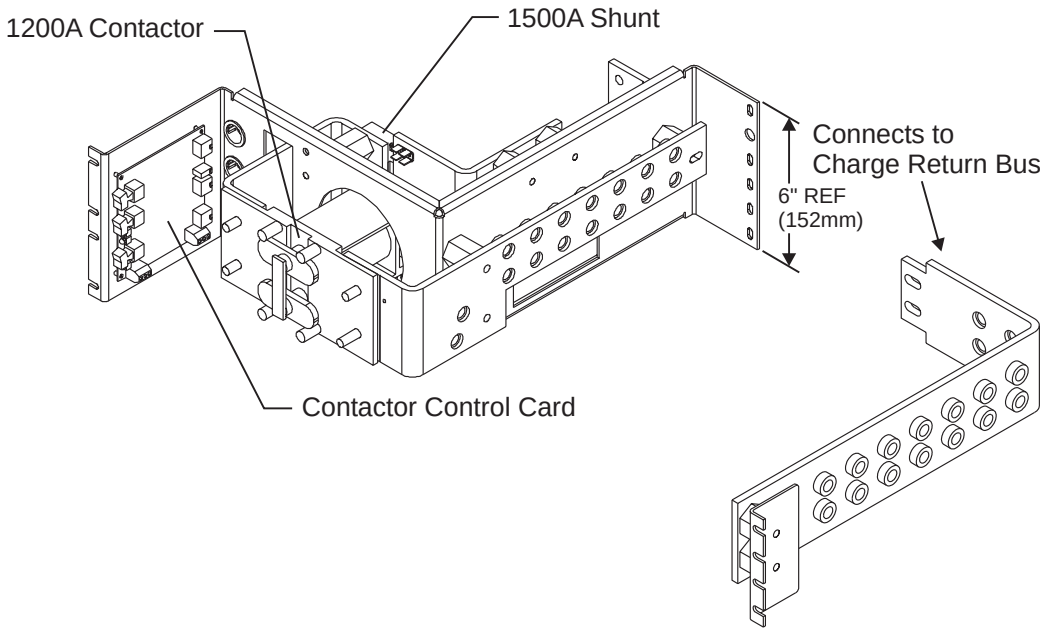


Figure 7-2: H569-437 G31 (ED83143-30 G131)
Battery Connection Panel

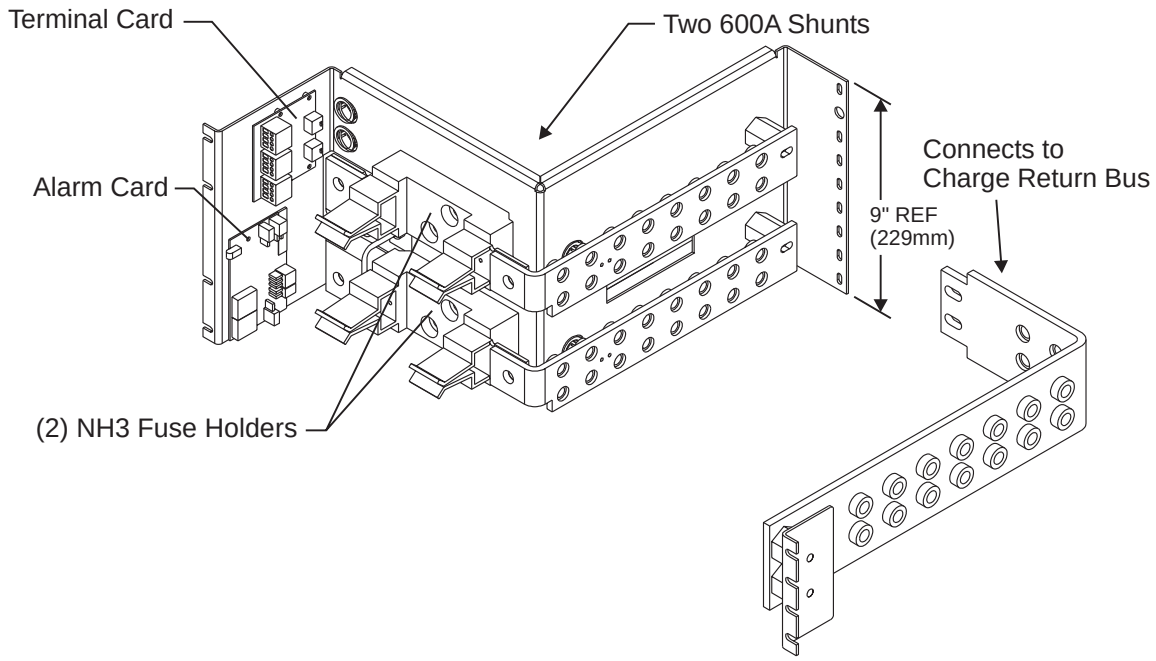


Figure 7-3: H569-437 G34 (ED83143-30 G141)
Battery Connection Panel

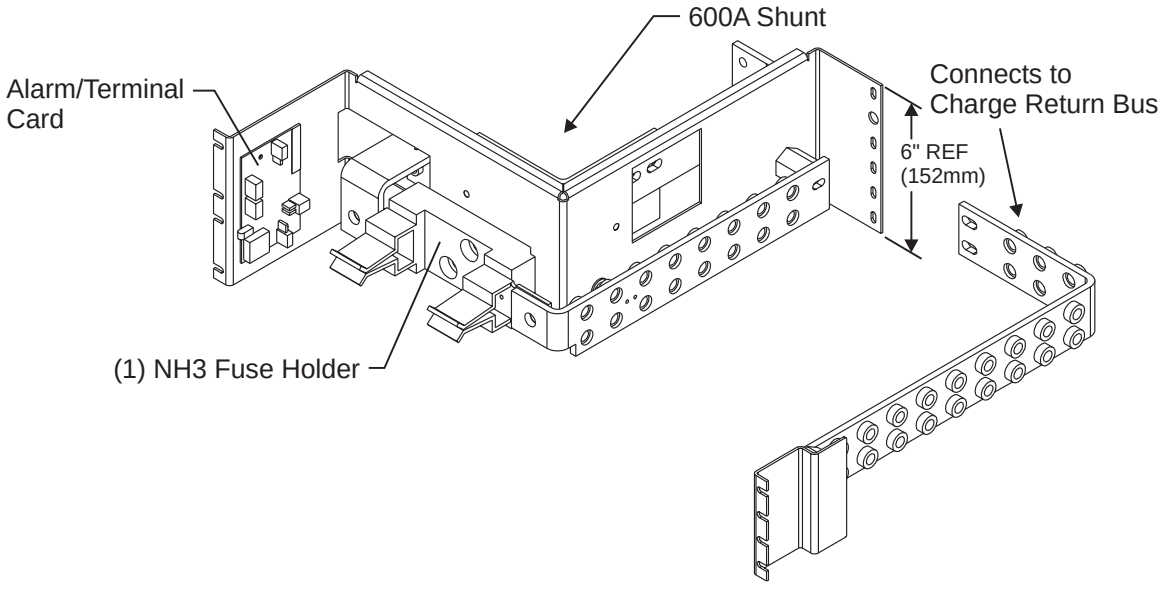


Figure 7-4: H569-437 G35 (ED83143-30 G142)
Battery Connection Panel

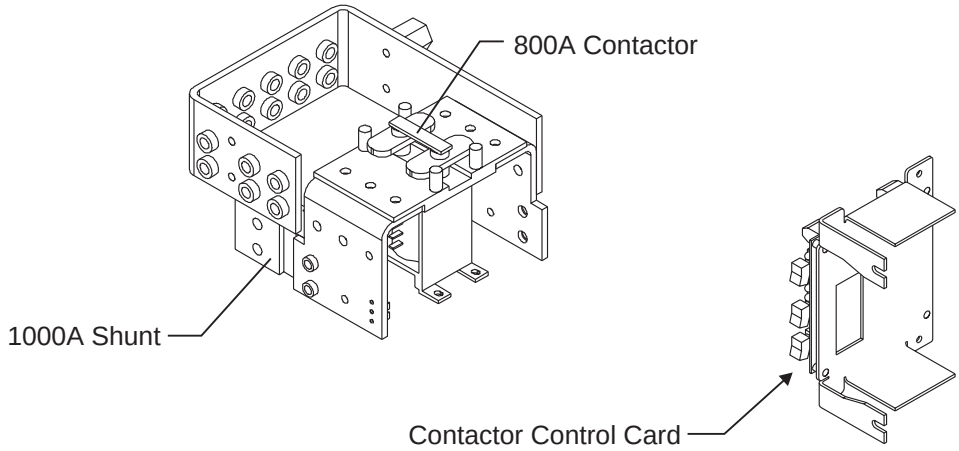
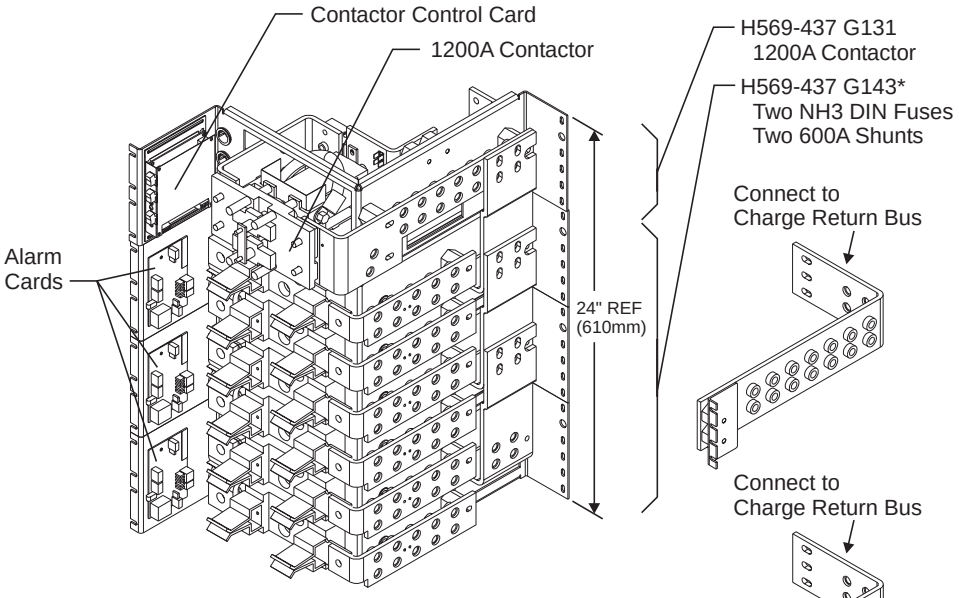


Figure 7-5: H569-437 G36H (ED83143-30 G133)
Battery Connection Panel



*H569-437 Battery Module

Group #	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 (ED83143-30 G131/143)
Battery Connection Panel

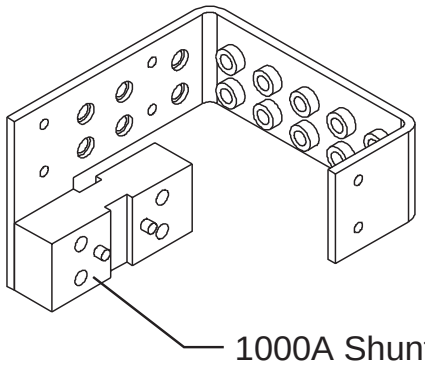


Figure 7-7: H569-437 G84H (ED83143-30 G134)
Battery Connection Panel

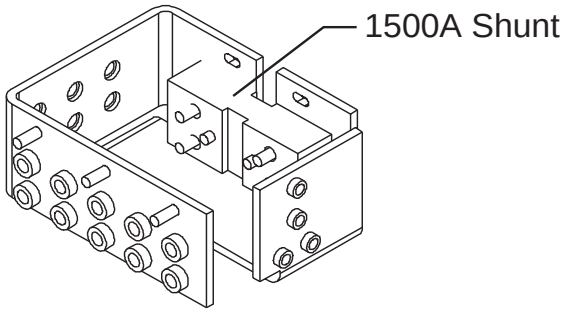


Figure 7-8: H569-437 G85F (ED83143-30 G135)
Battery Connection Panel

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 8-14.

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

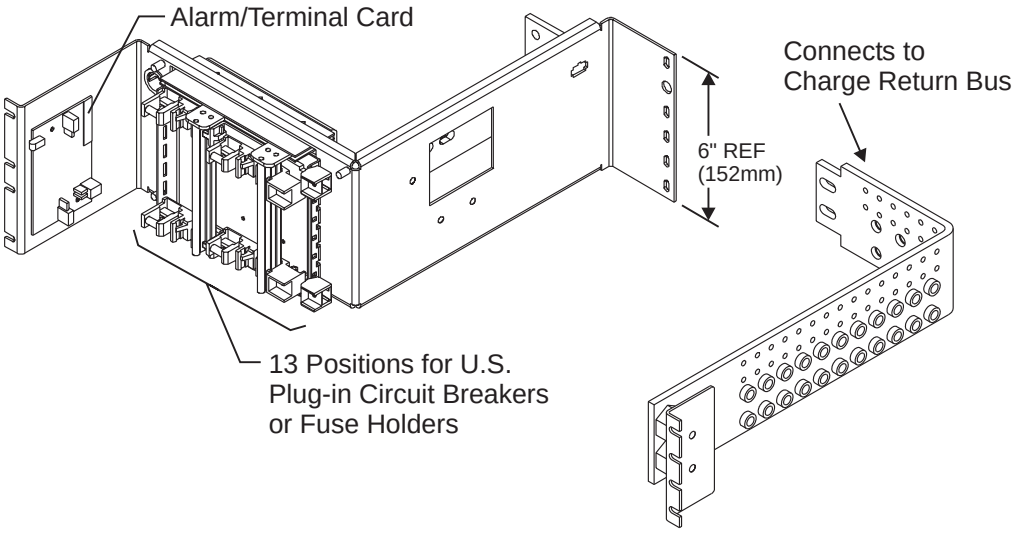


Figure 8-1: H569-437 G40/50 (ED83143-30 G111/113)
DC Distribution Panel

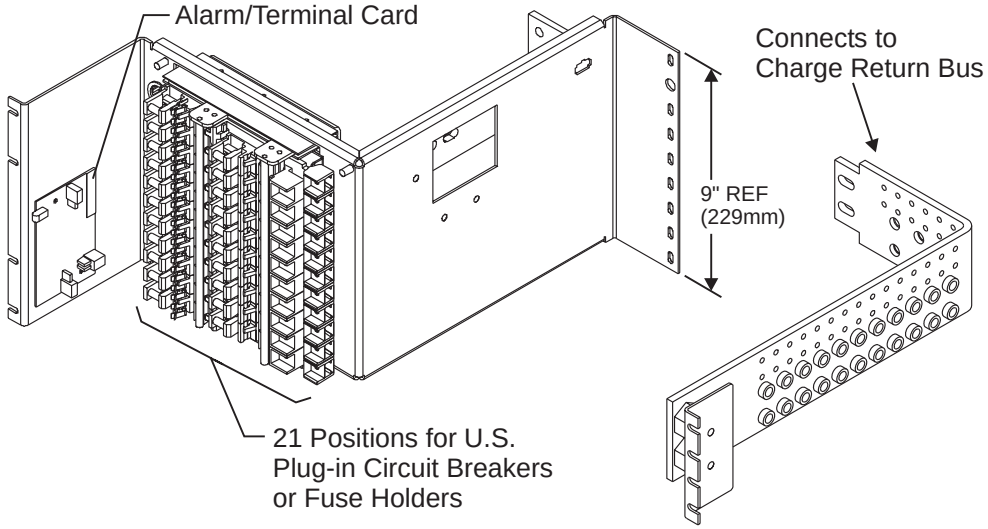


Figure 8-2: H569-437 G41/51 (ED83143-30 G112/114)
DC Distribution Panel

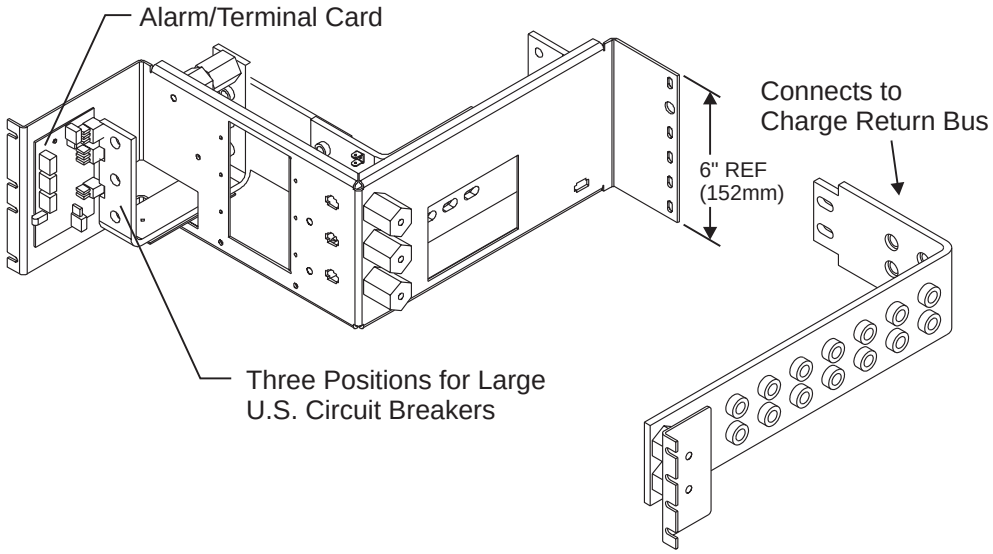


Figure 8-3: H569-437 G42 (ED83143-30 G102/103)
DC Distribution Panel

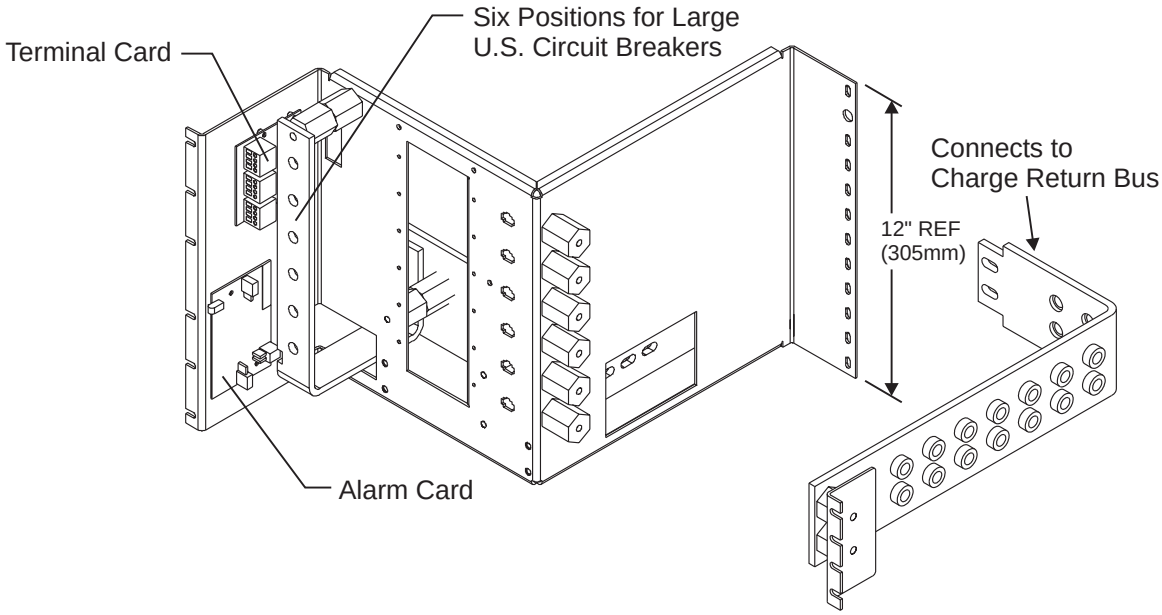


Figure 8-4: H569-437 G43 (ED83143-30 G101/104)
DC Distribution Panel

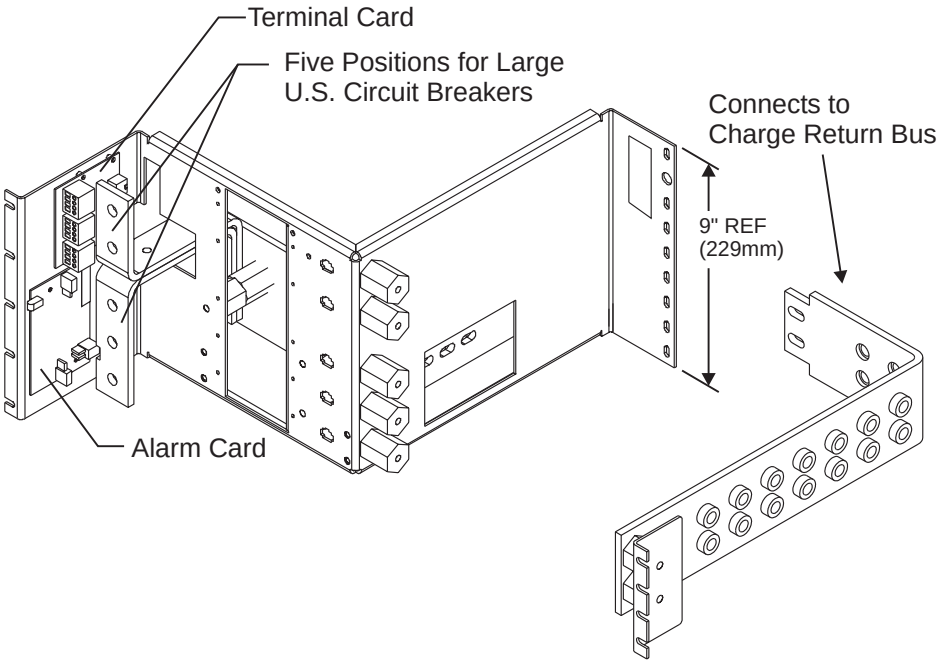


Figure 8-5: H569-437 G44 (ED83143-30 G105/106)
DC Distribution Panel

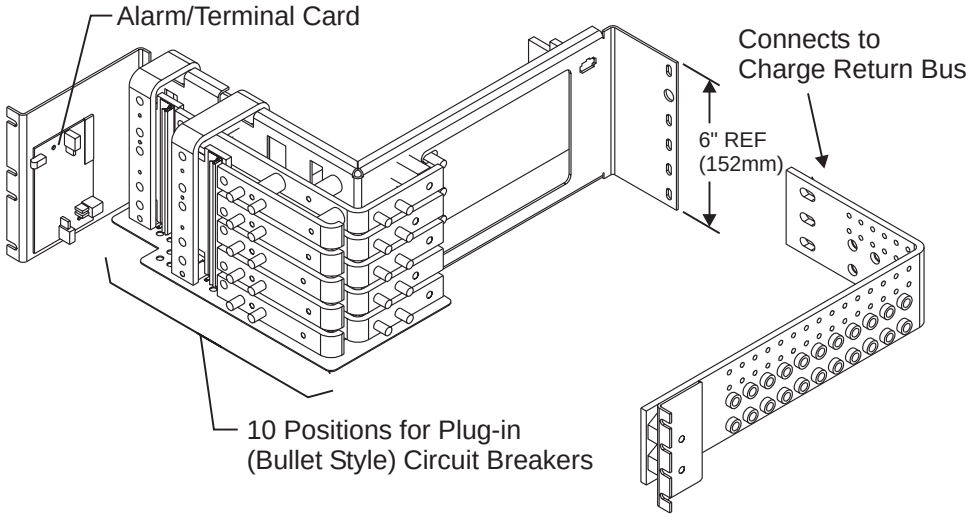


Figure 8-6: H569-437 G45 (ED83143-30 G115/116)
DC Distribution Panel

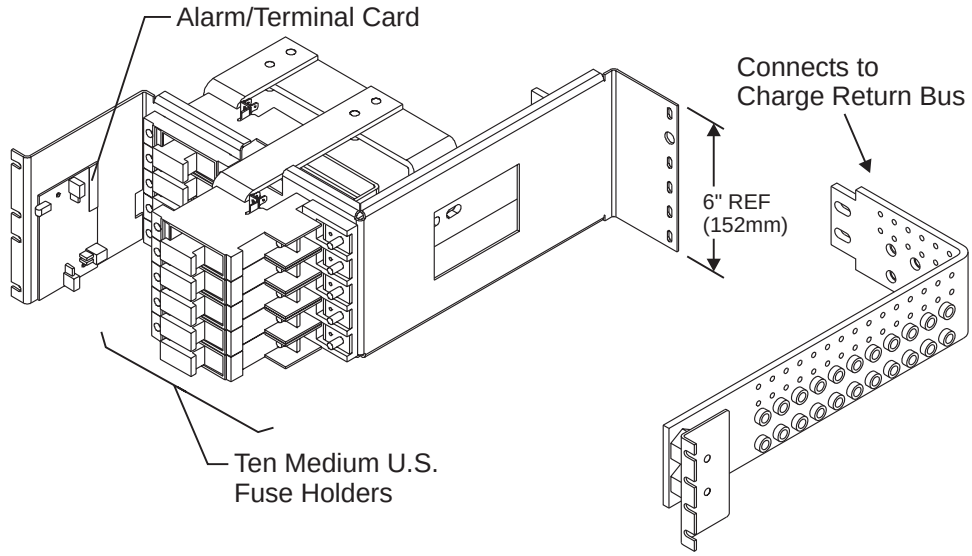


Figure 8-7: H569-437 G52 (ED83143-30 G153)
DC Distribution Panel

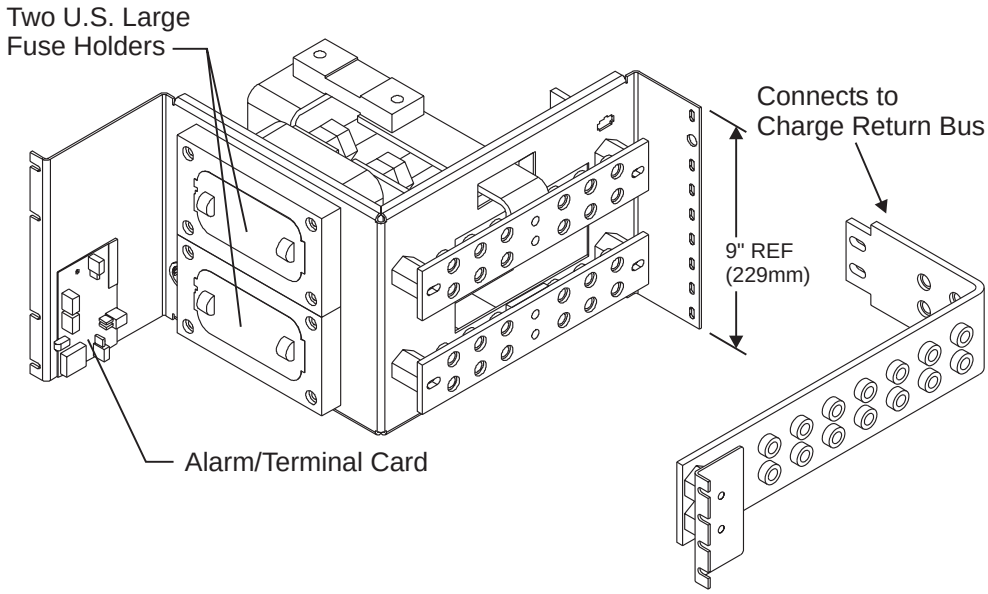


Figure 8-8: H569-437 G53 (ED83143-30 G151/152)
DC Distribution Panel

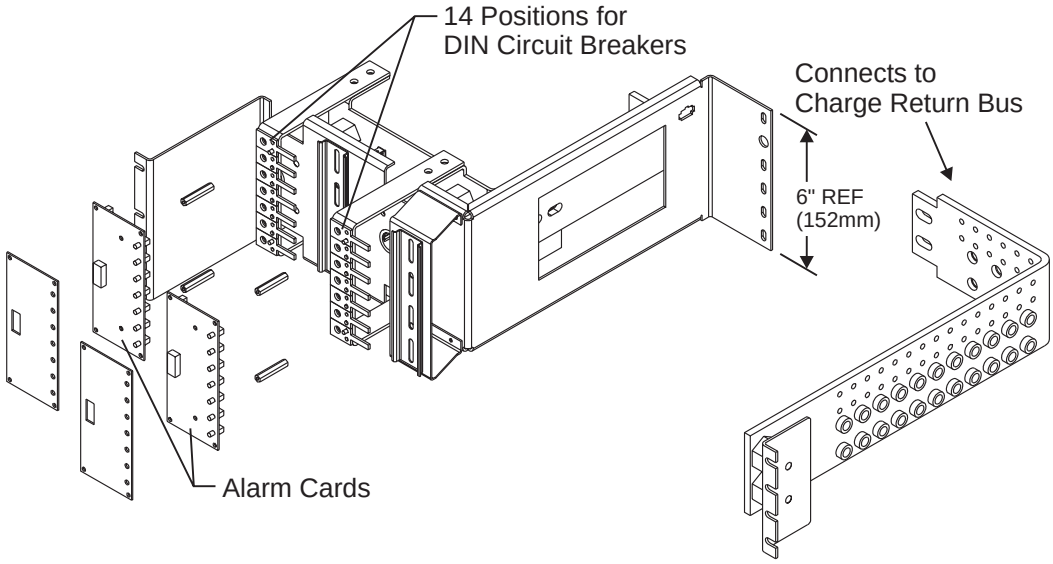


Figure 8-9: H569-437 G60 (ED83143-30 G120/126)
DC Distribution Panel

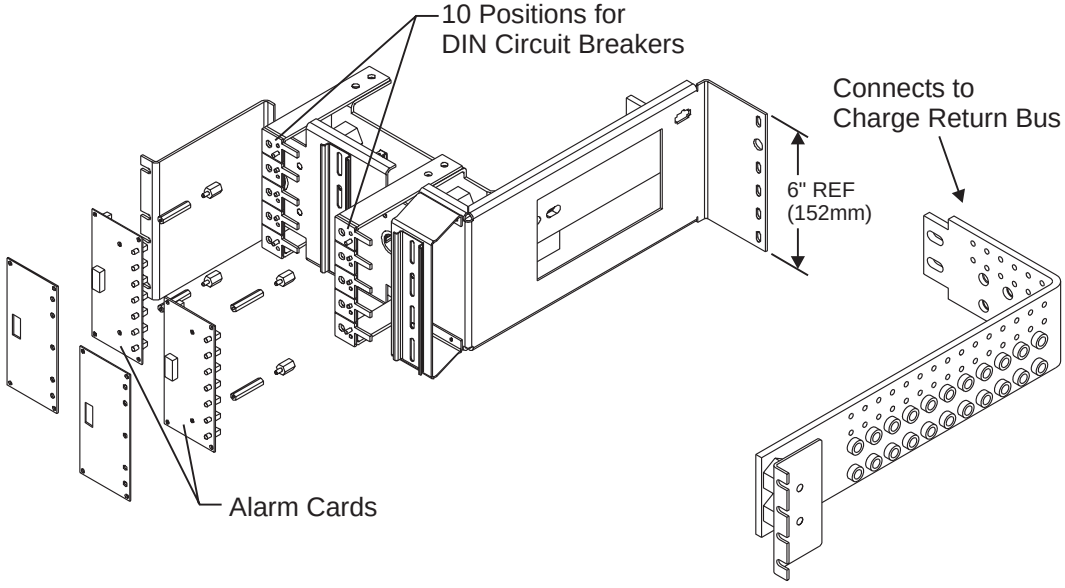


Figure 8-10: H569-437 G61 (ED83143-30 G125/129)
DC Distribution Panel

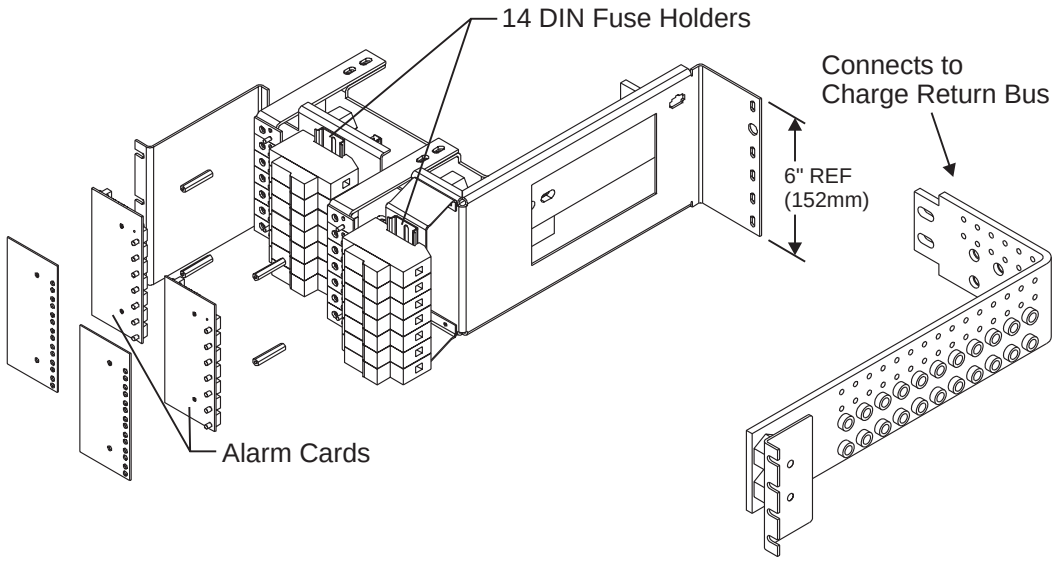


Figure 8-11: H569-437 G65 (ED83143-30 G124/128)
DC Distribution Panel

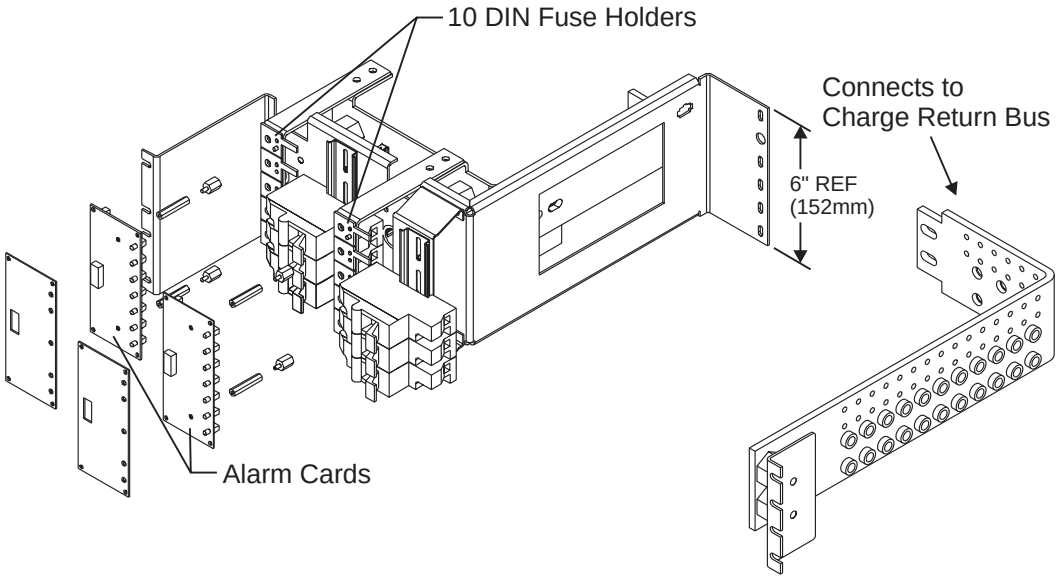


Figure 8-12: H569-437 G66 (ED83143-30 G123/127)
DC Distribution Panel

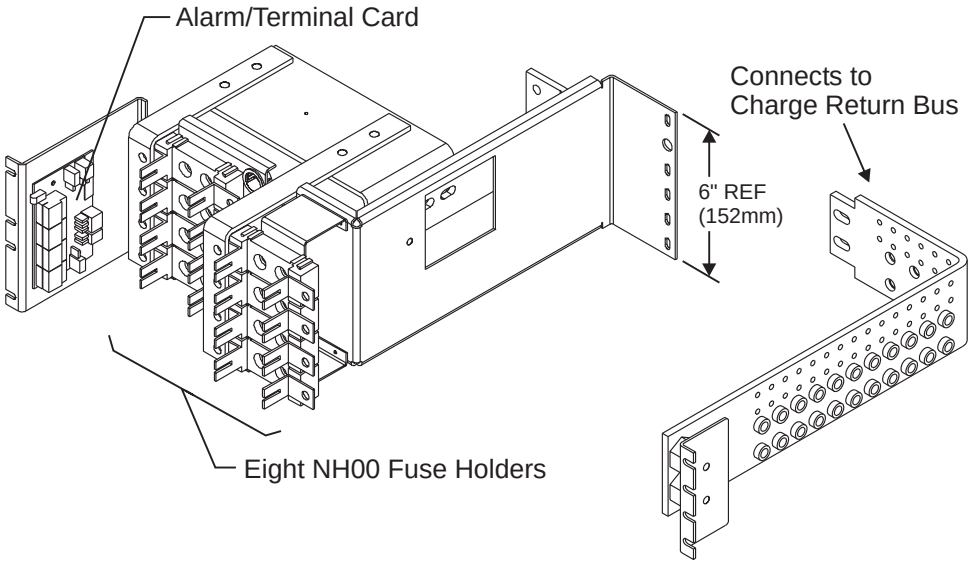


Figure 8-13: H569-437 G67 (ED83143-30 G122)
DC Distribution Panel

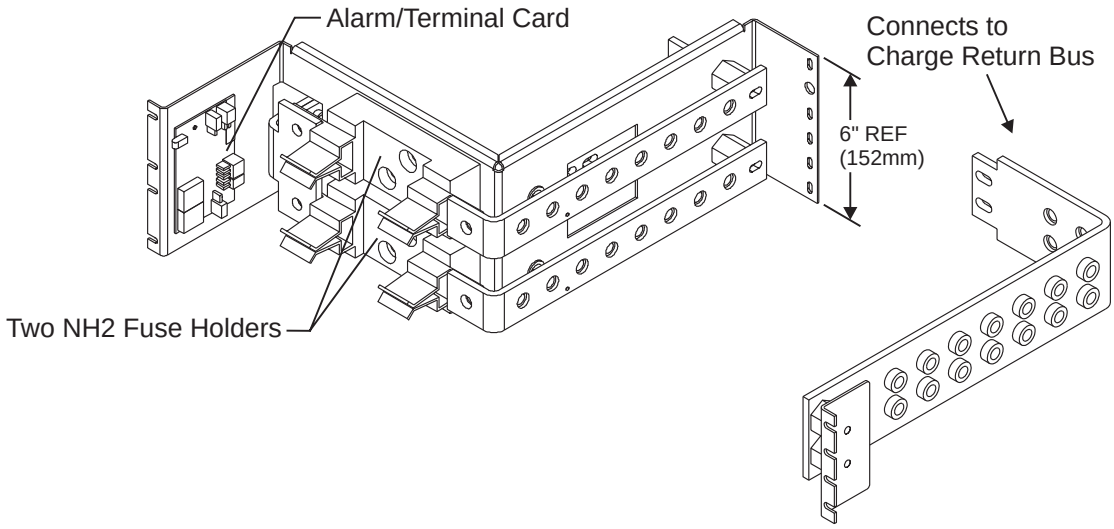


Figure 8-14: H569-437 G68 (ED83143-30 G121)
DC Distribution Panel

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

Millennium Systems

A BLJ terminal board is located inside the door of each initial and supplemental cabinet of a Millennium system. The BLJ is the termination point for distribution alarms in each cabinet. It uses the rectifier serial bus to communicate with the controller.

Vector Systems

The Vector controller, which is installed in the initial cabinet, contains a BLJ terminal connection board. This board is daisy-chained to a BLJ board in each supplemental cabinet.

Bay Interface Card

Millennium Systems

Each initial and supplemental cabinet in a Millennium system has a 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.

Vector Systems

The initial cabinet contains the Vector controller, which consists of a BIC2 control board and a BLJ terminal connection board. Supplemental cabinets do not require a BIC.

Illustrations

BLJ and BIC Locations

Figure 9-1 shows the location of the BLJ terminal board and Bay Interface Card (BIC).

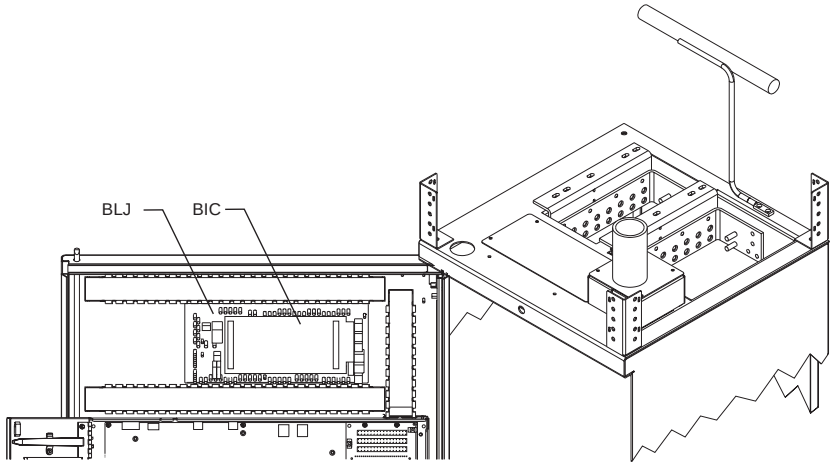


Figure 9-1: Location of BLJ Terminal Board and Bay Interface Card

Replacing a BIC

Figure 9-2 shows the straps required prior to replacing a Bay Interface Card (BIC). (See "BIC Failure" in Table 14-C.) Straps are backups to ensure continous operation of LVBD and LVLD contactors.

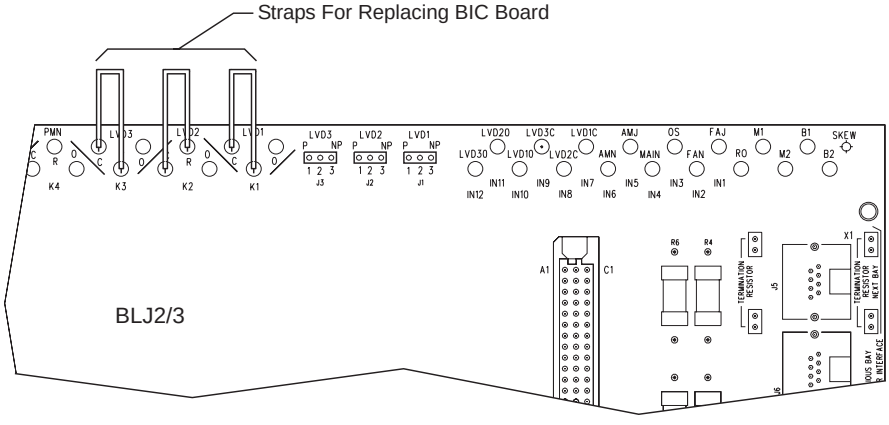


Figure 9-2: Required Straps Prior to Replacing a Bay Interface Card (BIC)

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

Units Per Initial Cabinet		
	Full Height	**Half Height**
Rectifiers	1 - 12	1 - 8
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	0°C to 45°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) Backup High Voltage Shutdown[3] (BUHVSD)	596B4 Float 28.75V[1] Nom.[2] 596B4 Boost 28.75V[1] Nom.[2] 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	100 amperes			
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

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
Operating Temperature	-40°C to 65°C (rectifier only)
Operating Relative Humidity	5% to 90%
Heat Release 24Vdc, 100A Output 24Vdc, 80A Output	Per Rectifier: 390 Watts (1331.3 BTU/hr.) 312 Watts (1065 BTU/hr.)
Short Term Operating Relative Humidity	5% to 90%
Storage Temperature	-45°C to 85°C
Storage Relative Humidity	5% to 90%
Altitude	-50 to 4000 meters Note: For altitudes above 1500 meters, derate the temperature by 0.656° Celsius per 100 meters.
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)
Environmental	
Temperature	0°C-50°C
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 shelves of rectifiers that are connected phase to phase	G73F	G6
AC Input Circuit Breaker Panel Half-height cabinet with two shelves of rectifiers that are connected phase to phase	G71H	G6
AC Input Circuit Breaker Panel Full-height cabinet with two shelves of rectifiers that are connected phase to neutral	G74F	G6M
AC Input Circuit Breaker Panel Half-height cabinet with two shelves of rectifiers that are connected phase to neutral	G74H	G6M
AC Input Circuit Breaker Panel Full-height cabinet with three shelves of rectifiers that are connected phase to phase	G72F	G7
AC Input Terminal Strip Panel Half-height cabinet with two shelves of rectifiers that are connected phase to phase or phase to neutral	G76H	G8
AC Input Terminal Strip Panel Full-height cabinet with three shelves of rectifiers that are connected phase to phase or phase to neutral	G77F	G9

Battery Connection Panels

Table 10-E: Battery Connection Panels

Description	H569-437 Group No.	ED83143-30 Group No.
LVBD: (2) 500A contactors with 1000A shunts	G30	G132
LVBD: 1200A contactor with 1500A shunt	G31	G131
Fuse holder for 315-630A NH3 DIN fuse with 600A shunt	G35	G142
LVBD: 800A contactor with 1000A shunt	G36H	G133
(2) fuse holders for 315-630A NH3 DIN fuses with 600A shunts	G34	G141
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

DC Distribution Panels

Table 10-F: DC Distribution Panels

Description	H569-437 Group No.	ED83143-30 Group No.
13 positions for 0-100A plug-in fuse holders or circuit breakers	G40, G50	G111, G113
21 positions for 0-100A plug-in fuse holders or circuit breakers	G41, G51	G112, G114
3 positions for 125-600A circuit breakers	G42	G102, G103
6 positions for 125-600A circuit breakers	G43	G101, G104
5 positions for 125-600A circuit breakers	G44	G105, G106
10 positions for 0-150A plug-in (bullet style) circuit breakers	G45	G115, G116
10 fuse holders for 1-60A fuses	G52	G153
2 fuse holders for 100-600A fuses	G53	G151, G152
14 positions for 1-63A DIN circuit breakers	G60	G120, G126
10 positions for 80-125A DIN circuit breakers	G61	G125, G129
14 fuse holders for 1-32A DIN fuses	G65	G124, G128
10 fuse holders for 1-50A DIN fuses	G66	G123, G127
8 fuse holders for 4-160A DIN NH00 fuses	G67	G122
2 fuse holders for 32-400A DIN NH2 fuses	G68	G121

11 Safety

Please read and follow all safety instructions and warnings before servicing the Galaxy Power System. Reference the GPS Installation Guide and individual module product manuals for additional 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 10 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*

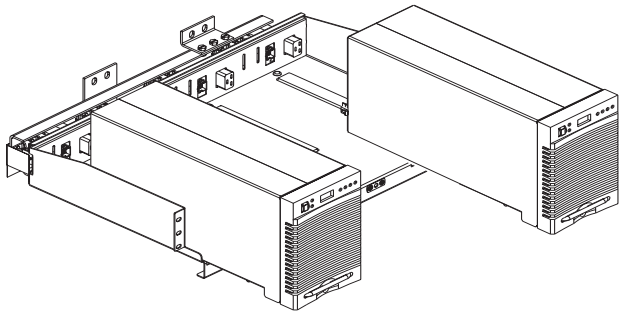
Installing or Replacing a Rectifier	
Step	**Action**
1	Locate and turn off the ac service feeding the rectifier. Note: Do not turn off ac service to the entire system, only to the rectifier that has failed.
2	Turn the rectifier's ON/STBY switch to STBY. ⚠**Caution** **Rear portion of the rectifier or 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. Follow the directions for the “ID Not Configured” alarm in Table 14-E (Millennium) or “rid” in Table 15-E (Vector). 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

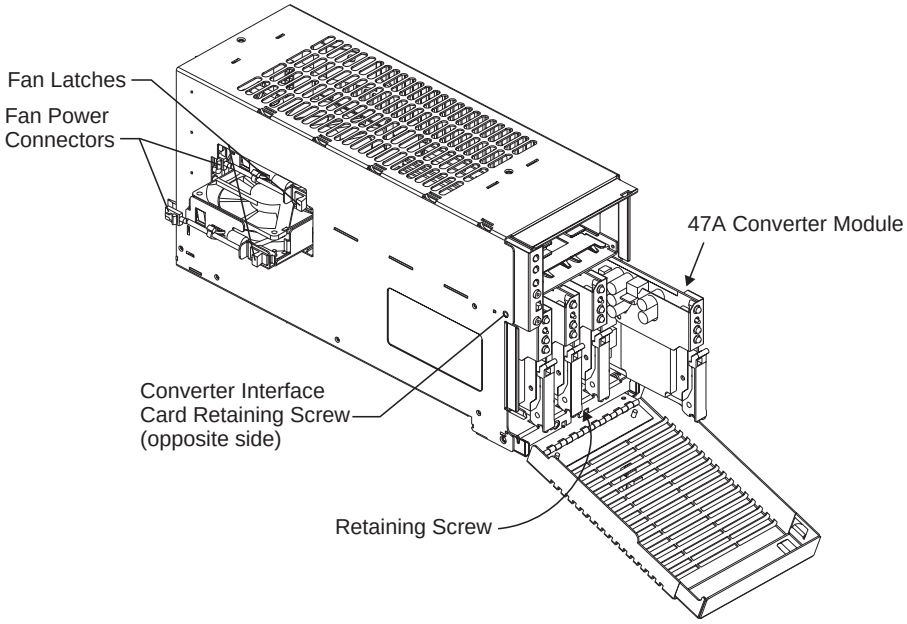


Figure 12-2: Detail of Converter Components

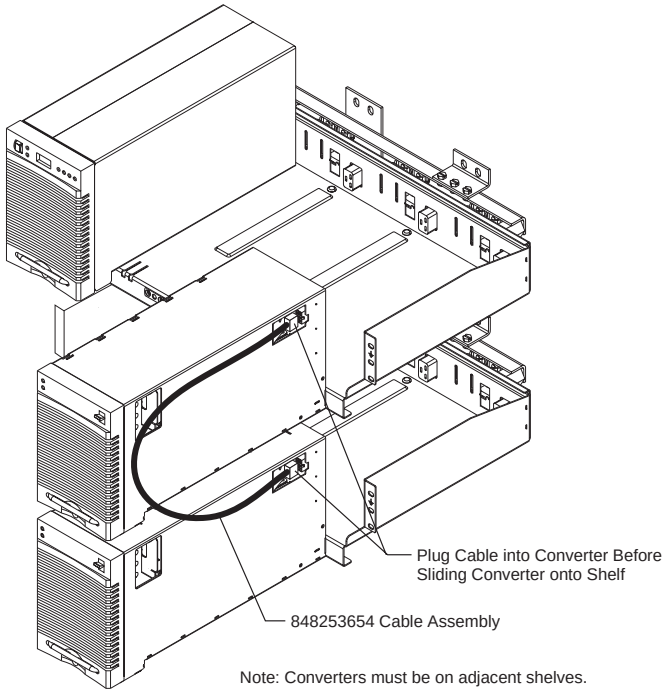


Figure 12-3: Cable Connection Between Two Converter Carriers

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
407226786	Lens cover, red
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
108029679	Display board (BSK1)
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)
108029695	Modem board (BSM1)
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)
108402017	VC Control Panel (BMW3)
108173782	24V VC Control Board (BIC2)

Replacement Parts, continued

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

Software

EasyView software is a Windows-compatible communications package designed specifically for use with Galaxy controllers.

Table 12-E: Software

Ordering Code	Description
847473774	EasyView Software Package

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 the local Regional Technical Assistance Center (RTAC) at 1-800-CAL-RTAC (1-800-225-7822).

⚠ ***Safety***

Review all safety instructions and warnings in Section 11 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.

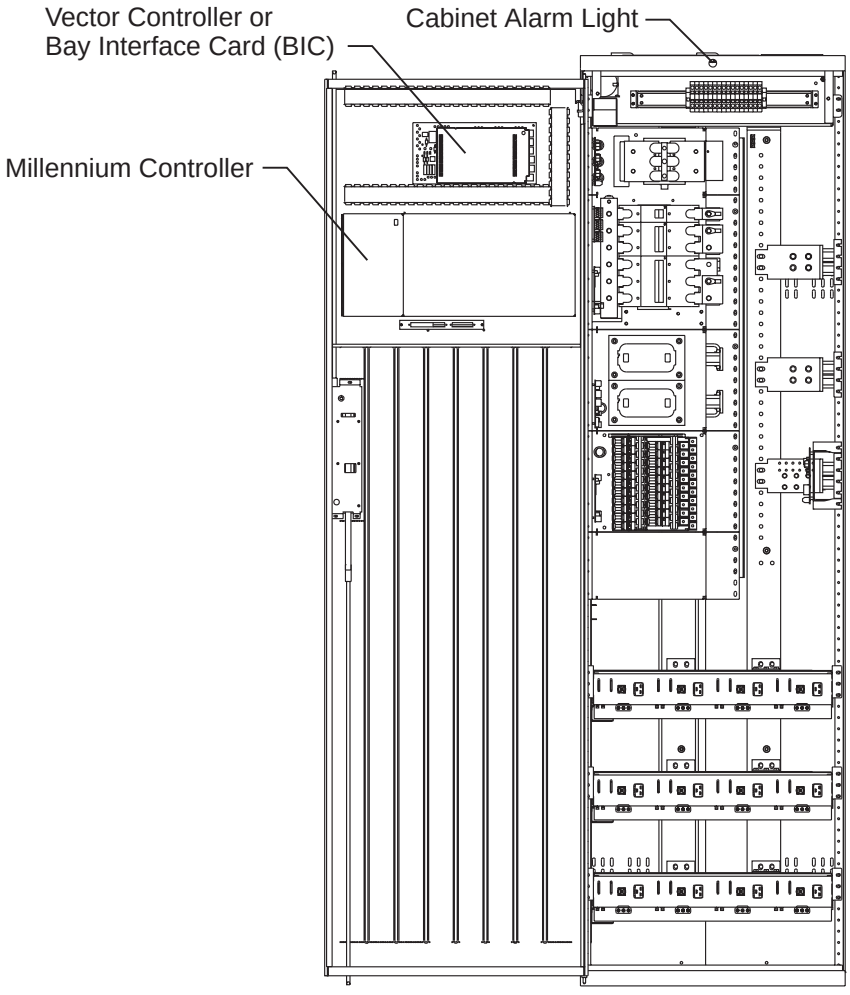


Figure 13-1: Location of Cabinet Alarm

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 your RTAC representative.

   If the entire panel is blank, check the controller fuse (F3 basic power for the Millennium; F1 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 your RTAC representative.

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	14-A, AC Alarms
BATT	14-B, Battery Alarms
BD	14-F, Miscellaneous Alarms
CTRL	14-C, Controller Alarms
DIST	14-D, Distribution Alarms
RECT	14-E, Rectifier and Converter Related Alarms
RM	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.	

Section 15, *Troubleshooting Vector Systems*	
Alarm LED	**Table**
AC	15-A, AC Alarms
BATT	15-B, Battery Alarms
BD	15-F, Miscellaneous Alarms
CTRL	15-C, Controller Alarms
DIST	15-D, Distribution Alarms
RECT	15-E, Rectifier and Converter Related Alarms
No LED*	15-F, Miscellaneous Alarms
*If an alarm condition exists, but no alarm LED is lit, refer to Table 15-F.	

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

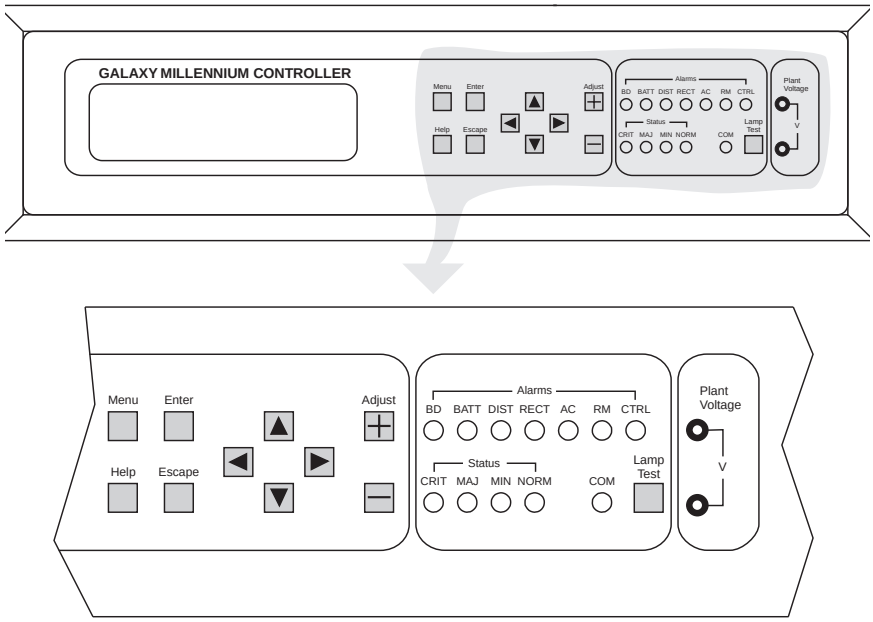


Figure 13-2: Millennium Controller Display

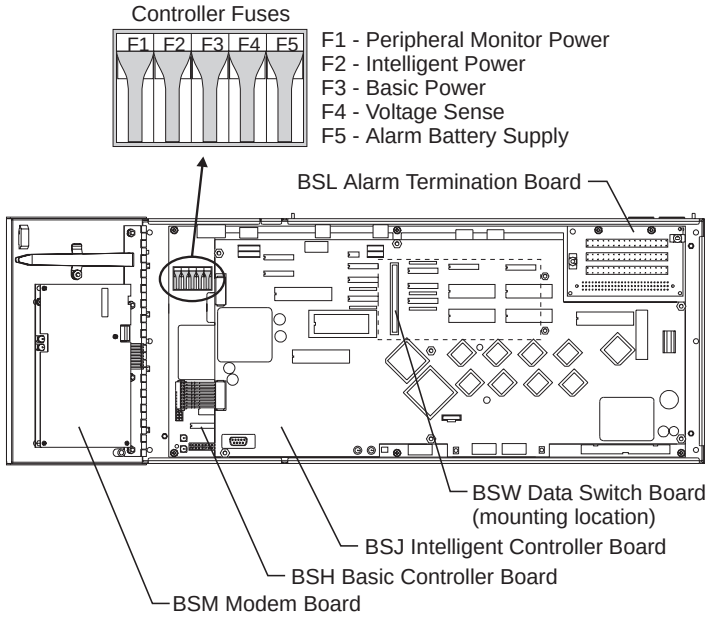


Figure 13-3: Location of Millennium Controller Fuses and Boards

Reference Figures, continued

Vector Controller

The Control Board is mounted on top of the BLJ terminal connection board. The controller issues alarms off the BLJ board. There is a mnemonic abbreviation for each alarm, which is shown on the controller display, along with associated alarm LEDs. These mnemonics and related alarms are described in the Galaxy Vector Controller product manual.

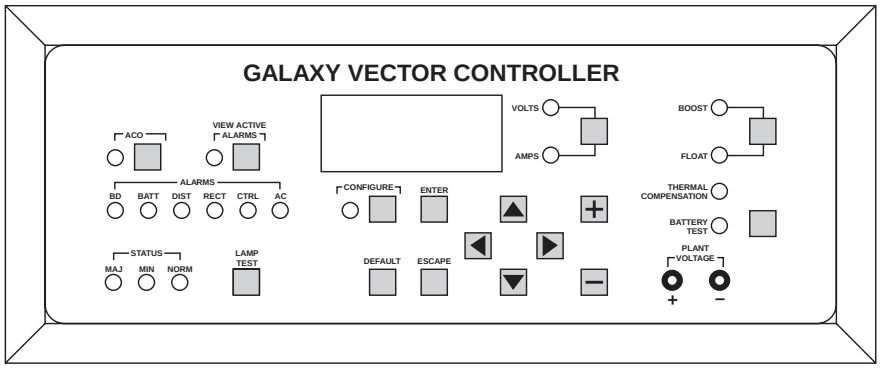


Figure 13-4: Vector Controller Display

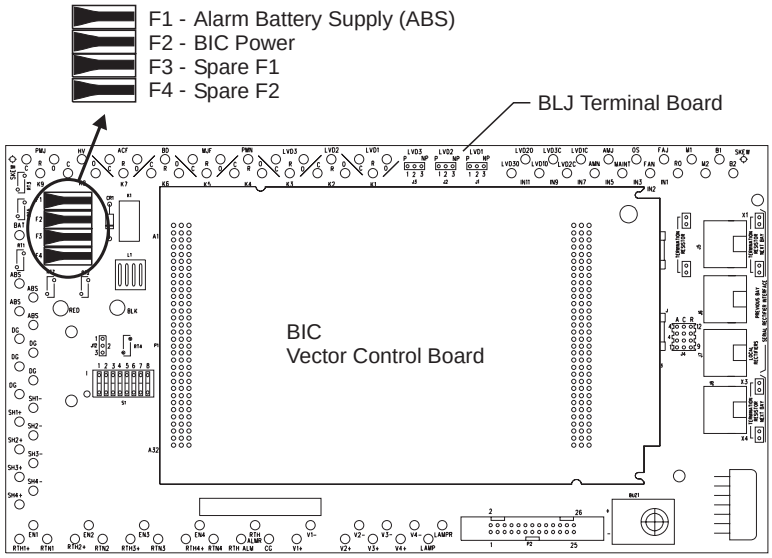


Figure 13-5: Location of Vector Controller Fuses and Boards

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.

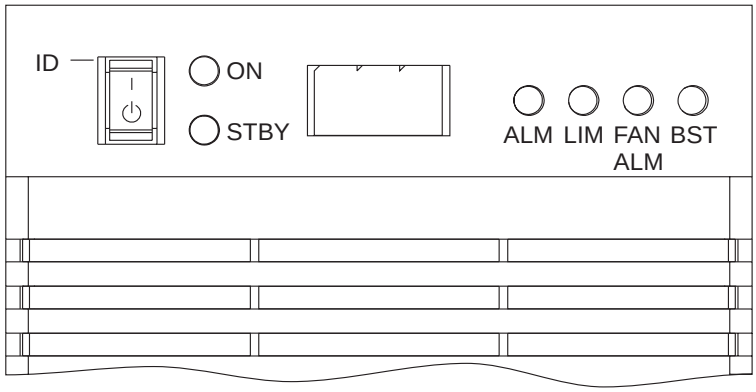


Figure 13-6: Rectifier Display

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.

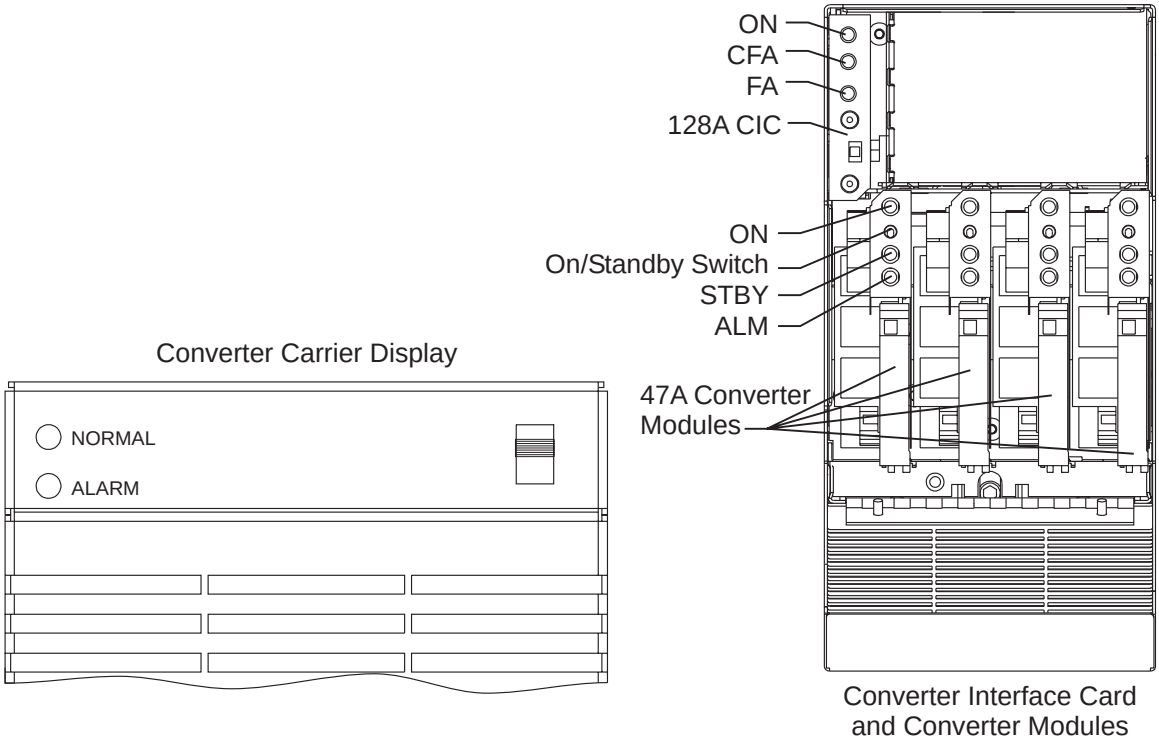


Figure 13-7: Converter Status Panels

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.

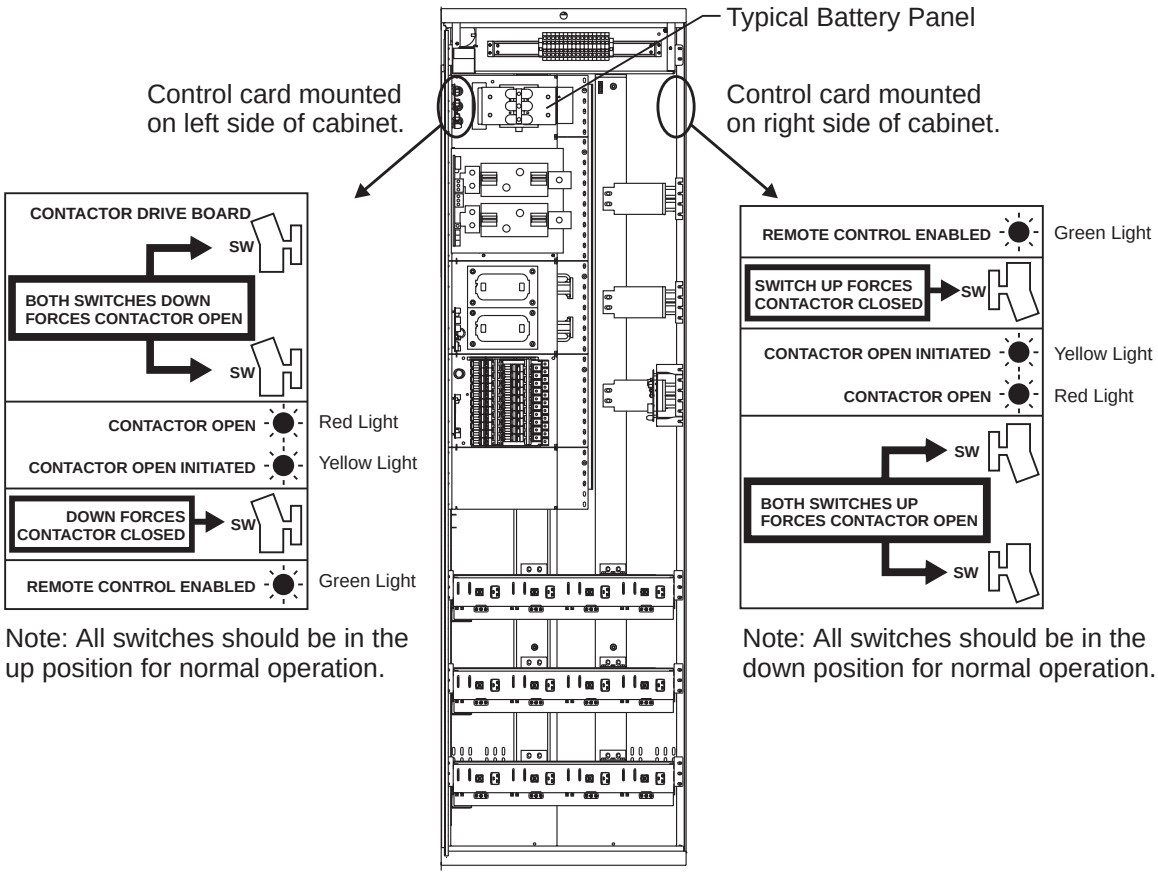
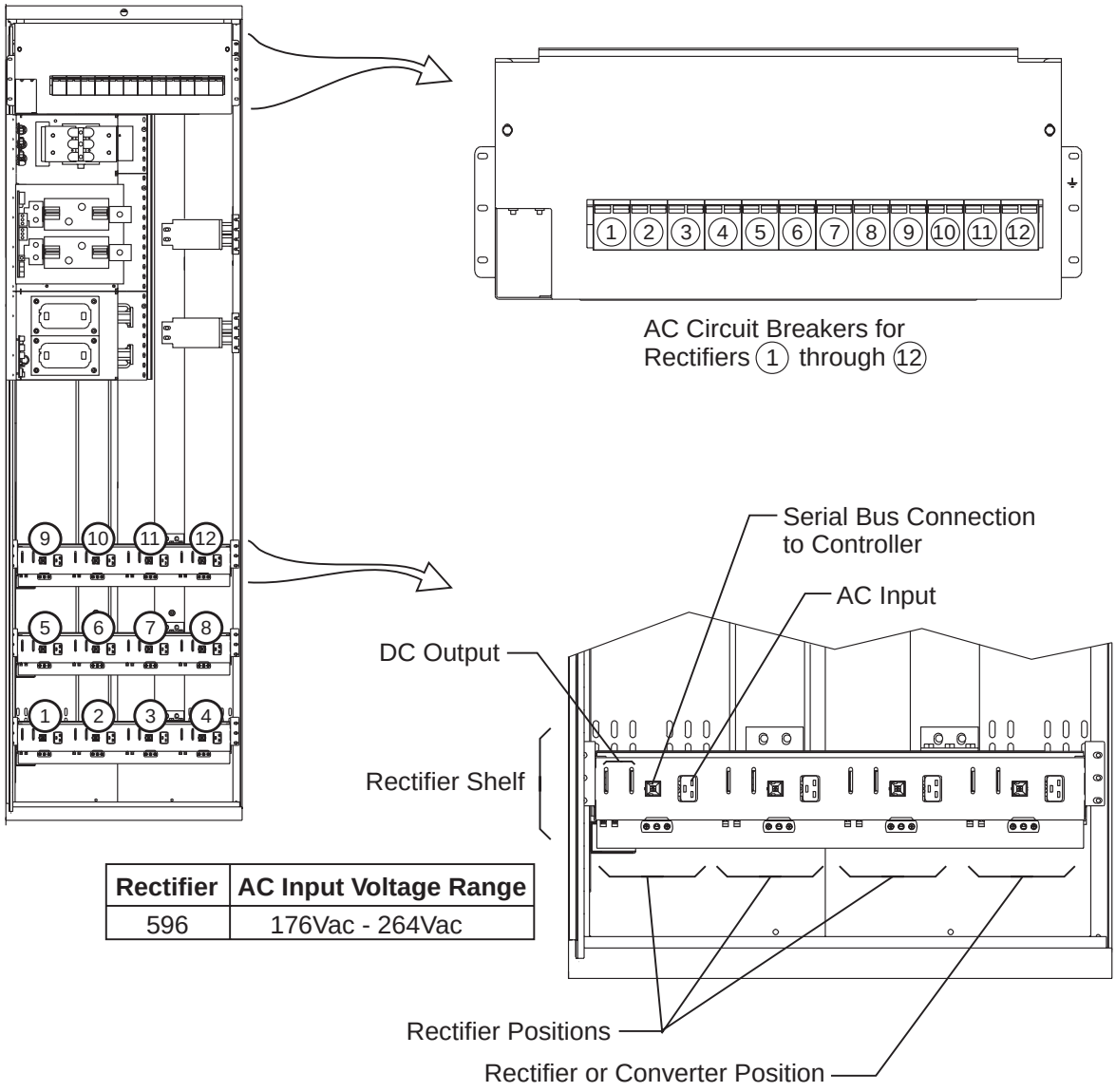


Figure 13-8: Low Voltage Battery Disconnect Contactor Control Switches

Reference Figures, continued

AC Input



Rectifier	AC Input Voltage Range
596	176Vac - 264Vac

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

Reference Figures, continued

DC Distribution

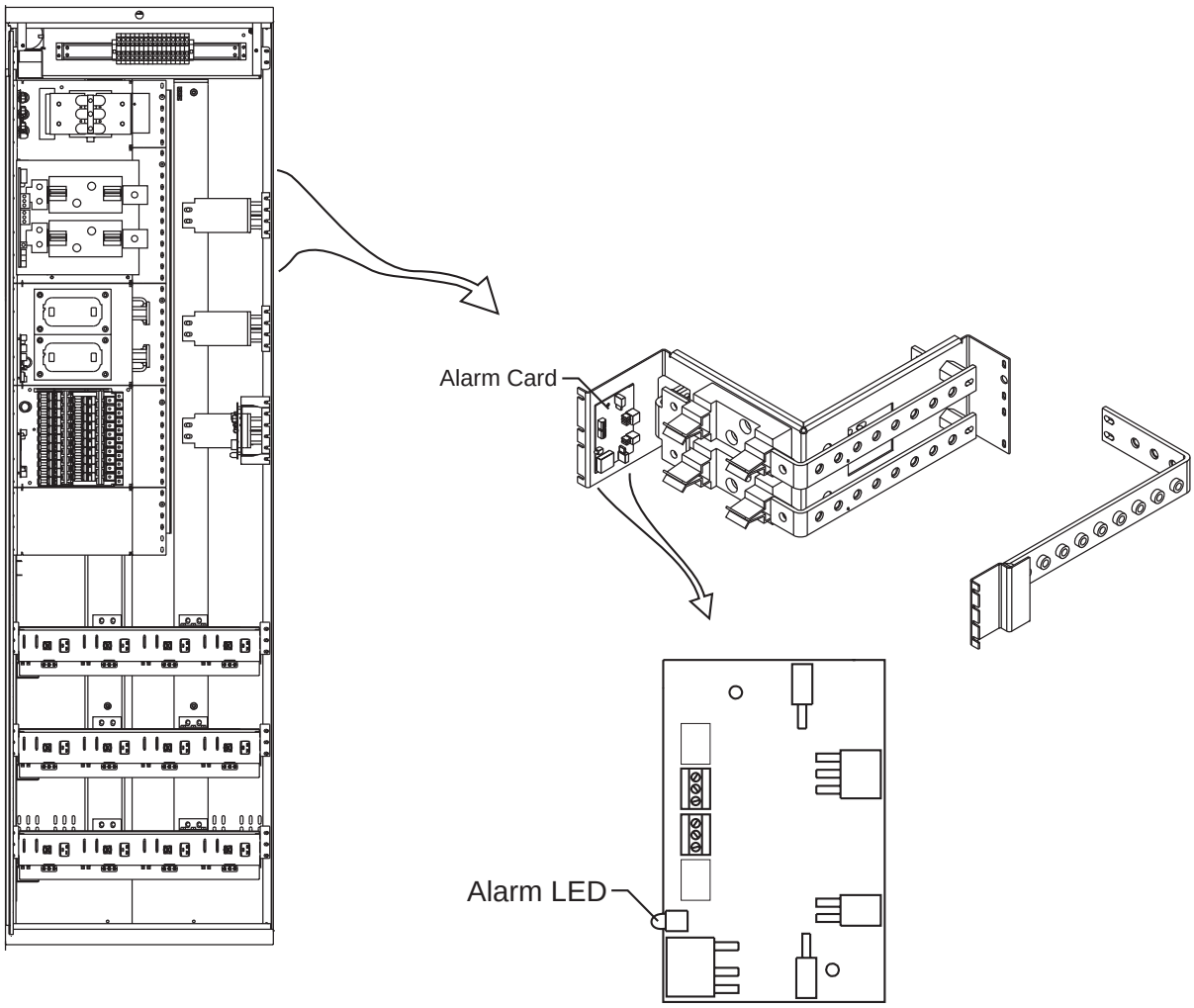


Figure 13-10: Detail of DC Distribution Panel

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.

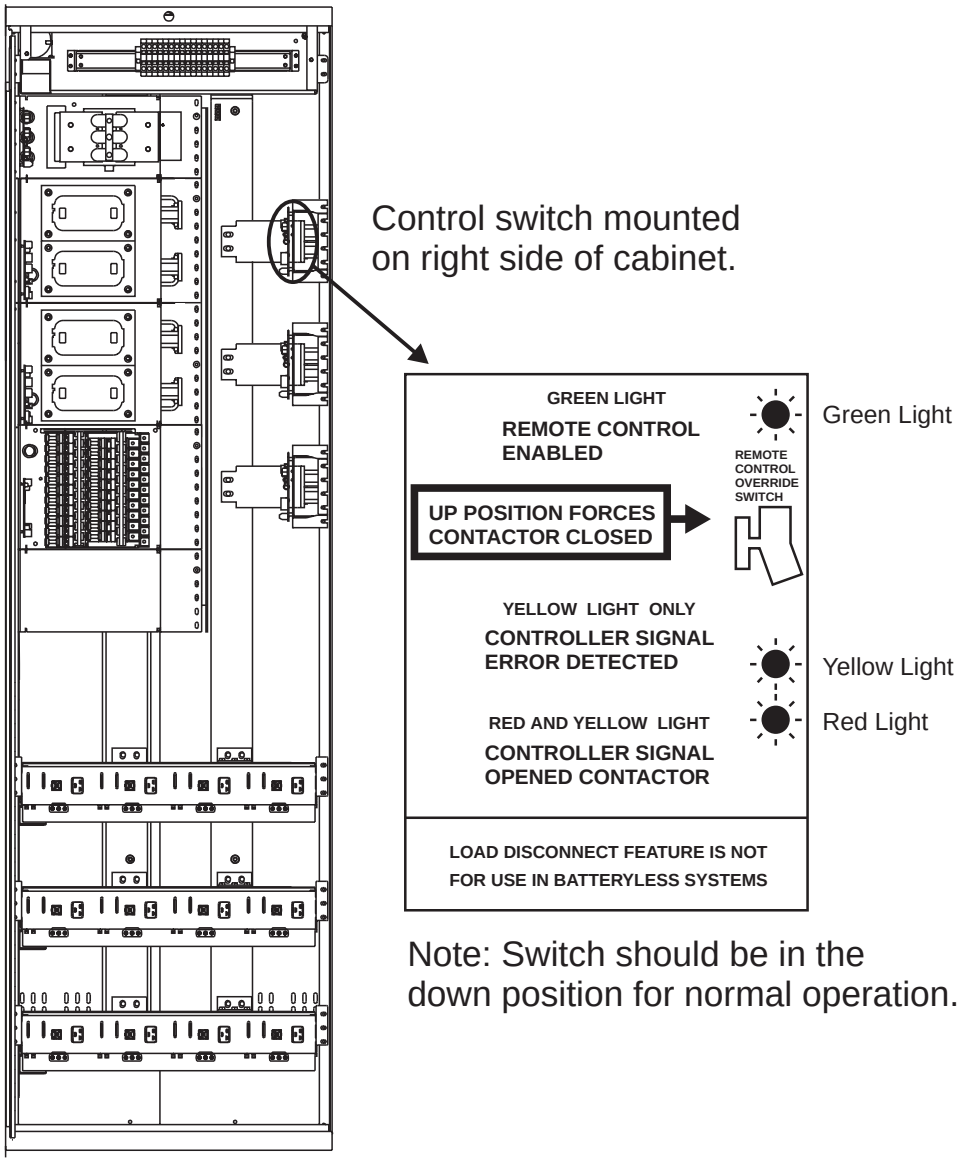


Figure 13-11: Low Voltage Load Disconnect Contactor Control Switches

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 the local Regional Technical Assistance Center (RTAC) at 1-800-CAL-RTAC (1-800-225-7822).

Troubleshooting Tables

Organization

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

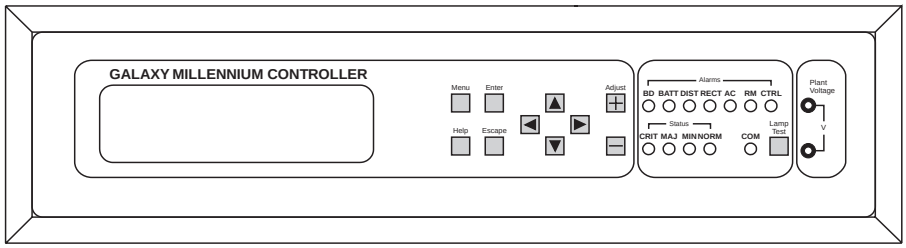
Table Reference

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

Alarm LED	Table
AC	14-A, AC Alarms
BATT	14-B, Battery Alarms
BD	14-F, Miscellaneous Alarms
CTRL	14-C, Controller Alarms
DIST	14-D, Distribution Alarms
RECT	14-E, Rectifier and Converter Related Alarms
RM	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 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	MIN	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	MIN	Engine Transfer Timeout	Engine may have alarm.	Remote engine or connection to engine has failed.	Call your local RTAC representative.
AC	MIN	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.

BATT 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)
BATT	CRIT	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 your local RTAC representative. 2. Investigate other alarms that may be present (rectifier-related alarms and the AC Fail alarm may also occur during the fault condition).
BATT* *Alarm must be configuredt o turn on the BATT LED; not a factory default.	MAJ	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 your local RTAC representative.
BATT* *Alarm must be configuredt o turn on the BATT LED; not a factory default.	MAJ	Contactor 1 Fail	--	Contactor or drive board has failed.	Call your local RTAC representative.
BATT	MIN	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)
BATT	MIN	Low Reserve Time	--	Controller has calculated that battery reserve time is below the alarm threshold level.	Call your local RTAC representative.
BATT	MIN	Battery Thermal Alarm	Alarm on 210E unit, if equipped	Batteries have exceeded temp threshold	•Check room ambient temperature against battery temperature threshold •Call your local RTAC representative

CTRL 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)
CTRL	MAJ	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 your local RTAC representative.

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)
CTRL	MAJ	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 your local RTAC representative.

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)
CTRL	MAJ	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.
CTRL	MAJ	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)
CTRL	MAJ	Controller Fail	--	•BSH failure •BSJ failure •Option board failure •Display failure **•BIC failure→**	1. Strap K1, K2, K3 on BLJ3 from "C" to "R" prior to replacing BIC. See Figure 9-2. 2. Replace BIC.
CTRL	MAJ	Circuit Pack Fail	--	See "Controller Fail".	See "Controller Fail".
CTRL	MAJ	Controller Fuse	--	Fuse has operated.	Replace the controller fuse labeled F2 (intelligent power).
CTRL	MAJ	Alarm Battery Supply Fuse	--	Fuse has operated.	Replace the controller fuse labeled F5 (alarm battery supply).
CTRL	MAJ	Remote Peripheral Fuse	--	Fuse has operated.	Replace the controller fuse labeled F1 (option power).
CTRL	MAJ	Sense/Control Fuse	--	Fuse has operated.	Replace the controller fuse labeled F4 (voltage sense).
CTRL	MAJ	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.
CTRL	MAJ	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 your local RTAC representative.

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)
CTRL	MIN	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 your local RTAC representative.
CTRL	MIN	Self Fail Test	--	See “Controller Fail”.	See “Controller Fail”.
CTRL	MIN	Thermal Probe Failure	--	Battery thermal probe has failed.	Call your local RTAC representative.

DIST 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)
DIST	MAJ	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.
DIST	MAJ	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.
DIST* *Alarm must be configuredt o turn on the DIST LED; not a factory default.	MAJ	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 your local RTAC representative.
DIST* *Alarm must be configuredt o turn on the DIST LED; not a factory default.	MAJ	Contactor 2 (or 3) Fail	--	Contactor or drive board has failed.	Call your local RTAC representative.

RECT 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)**
RECT	MAJ	ID Not Configured	None	None	Rectifier ID number has not been set.	1. Press ON/STBY switch up and hold for five seconds until display starts blinking "0". 2. Release switch; display should continue to blink. 3. Depress switch and release. Display will increment up one number on each release of the switch, but will remain flashing. 4. Once the desired ID number appears, depress and hold the switch for five seconds. The display will cease to blink, and then revert to the rectifier current.
RECT	MAJ	ID Conflict	None	None	Two or more rectifiers have the same ID number.	See above.
RECT	MAJ	Multiple Rectifier Fail	ALM	None	More than one rectifier has an ALM LED lit.	See alarms listed below.
RECT	MAJ	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.

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)**
RECT	MIN	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.
RECT	MIN	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.
RECT	MIN	Rectifier Fail	ALM	CB	Circuit breaker alarm: •DC output circuit breaker open •Internal rectifier failure	1. Toggle the ON/STBY switch into the STBY position; toggle the DC output circuit breaker into the OFF position and then into the ON position. Return the ON/STBY switch to 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)**
RECT	MIN	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.
RECT	MIN	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.
RECT	MIN	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 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)**
RECT	MIN	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.
RECT	MIN	Rectifier Fail	FAN ALM	None	Fan failure	Replace the fan in the rectifier.
RECT	MIN	Manual Off	STBY	Blank	Rectifier has been manually turned off.	Turn rectifier on.
RECT	MIN	External Transfer Shutdown	STBY	TR	System is operating on external engine.	No action required.
RECT	MIN	High Float Voltage	None	None	Configuration problem	Call your local RTAC representative.
RECT	MIN	Excess Rectifier Drain	None	None	Internal rectifier fault	Replace rectifier.
RECT	MIN	Excess System Drain	None	None	System load exceeds shunt rating.	Call your local RTAC representative.

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)**
RECT	MIN	Limited Recharge	None	None	Rectifier capacity has been exceeded.	Install more rectifiers.
RECT	MIN	External Transfer Shutdown	STBY	TR	System is operating on external engine.	No action required.
Converter Related Alarms (See Figure 13-7)						
Controller LED	**Controller Alarm Status**	**Millennium Controller Display**	**Converter LED**		**Possible Problem(s)**	**Possible Solution(s)**
RECT	MAJ	Multiple Converter Fail	CFA		•More than one converter modules are turned off. (STBY LEDs are lit.) •More than one converter module has failed.	1. Turn on modules if off. 2. Replace modules.
RECT	MAJ	Converter Fan Major	CFA		Both fans in a converter carrier have failed.	Replace fans.
RECT	MAJ	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 your local RTAC representative for assistance.

Converter Related Alarms (See Figure 13-7)					
Controller LED	**Controller Alarm Status**	**Millennium Controller Display**	**Converter LED**	**Possible Problem(s)**	**Possible Solution(s)**
RECT	MIN	Converter Fail	CFA	•Converter module manually turned off (STBY LED is lit.) •Converter module failure	1. Turn on module if off. 2. Replace module.
RECT	MIN	Converter Fan Minor	CFA	One fan in a converter carrier has failed.	Replace fan.

BD and RM 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)
BD	MAJ	Battery on Discharge	Rectifiers may say ACF.	Temporary condition that may be associated with other alarms	Call your local RTAC representative.
RM	MIN	Module Failure	Green LED on RPM will not blink.	Remote Peripheral Module has failed.	Call your local RTAC representative.
RM	MIN	Measurement Out of Range	--	•Data being sensed exceeds remote peripheral module's capability. •Remote peripheral module has failed.	Call your local RTAC representative.
None	MAJ	Auxiliary Major	Auxiliary equipment may have alarm.	Problem with operation of auxiliary equipment	Call your local RTAC representative.
None	MIN	Auxiliary Minor	Auxiliary equipment may have alarm.	Problem with operation of auxiliary equipment	Call your local RTAC representative.
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 your local RTAC representative.

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 the local Regional Technical Assistance Center (RTAC) at 1-800-CAL-RTAC (1-800-225-7822).

Troubleshooting Tables

Organization

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

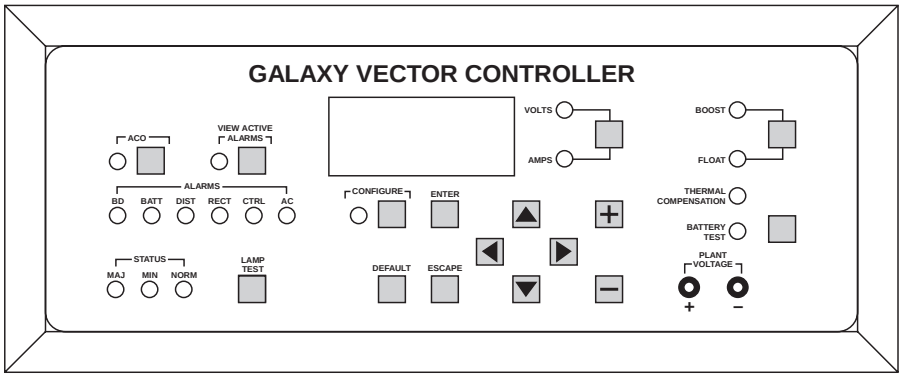
Table Reference

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

Alarm LED	Table
AC	15-A, AC Alarms
BATT	15-B, Battery Alarms
BD	15-F, Miscellaneous Alarms
CTRL	15-C, Controller Alarms
DIST	15-D, Distribution Alarms
RECT	15-E, Rectifier and Converter Related Alarms
No LED*	15-F, Miscellaneous Alarms
*If an alarm condition exists, but no alarm LED is lit, refer to Table 15-F.	

Vector Display Reference

The Vector front display is shown below.



AC Alarm LED

Table 15-A: AC Alarms
(See Figure 13-9)

Controller LED	Controller Alarm Status	Vector Controller Display	Other Indication(s)	Possible Problem(s)	Possible Solution(s)
AC	MAJ	nACF	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).
AC	MIN	ACF	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.
AC	MIN	ACF	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.

BATT Alarm LED

Table 15-B: Battery Alarms
(See Figure 13-8)

Controller LED	Controller Alarm Status	Vector Controller Display	Other Indication(s)	Possible Problem(s)	Possible Solution(s)
BATT	MAJ	LLO	--	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 your local RTAC representative. 2. Investigate other alarms that may be present (rectifier-related alarms and the AC Fail alarm may also occur during the fault condition).
BATT	MAJ	C1O	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 your local RTAC representative.
BATT	MAJ	C1F	--	Contactor or drive board has failed.	Call your local RTAC representative.
BATT	MAJ	bta	Alarm on 210E unit, if equipped	Batteries have exceeded temperature threshold.	Call your local RTAC representative.

CTRL Alarm LED

Table 15-C: Controller Alarms
(See Figures 13-4 and 13-5)

Controller LED	Controller Alarm Status	Vector Controller Display	Other Indication(s)	Possible Problem(s)	Possible Solution(s)
CTRL	MAJ	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 your local RTAC representative.
CTRL	MAJ	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.
CTRL	MIN	tPA	--	Battery thermal probe has failed.	Call your local RTAC representative.

DIST Alarm LED

Table 15-D: Distribution Alarms
(See Figures 13-10 and 13-11)

Controller LED	Controller Alarm Status	Vector Controller Display	Other Indication(s)	Possible Problem(s)	Possible Solution(s)
DIST	MAJ	CdSt	FA LED on converter is lit.	A fuse or circuit breaker in the converter distribution has operated.	Replace fuse or reset circuit breaker.
DIST	MAJ	C2O	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 your local RTAC representative.
DIST	MAJ	C2F	--	Contactor or drive board has failed.	Call your local RTAC representative.
DIST	MAJ	FAJ	Alarm LED on dc distribution panel is lit.	DC load fuse or circuit breaker has operated.	Replace fuse or reset circuit breaker.
DIST	MAJ	FAJ	--	Fuse has operated.	Replace the controller fuse labeled F2 (alarm battery supply).

RECT Alarm LED

Table 15-E: Rectifier and Converter Related Alarms

Rectifier Related Alarms (See Figures 13-6 and 13-9)						
Controller LED	**Controller Alarm Status**	**Vector Controller Display**	**Rectifier LED**	**Rectifier Display**	**Possible Problem(s)**	**Possible Solution(s)**
RECT	MAJ	rid	None	None	Rectifier ID number has not been set.	1. Press ON/STBY switch up and hold for five seconds until display starts blinking “0”. 2. Release switch; display should continue to blink. 3. Depress switch and release. Display will increment up one number on each release of the switch, but will remain flashing. 4. Once the desired ID number appears, depress and hold the switch for five seconds. The display will cease to blink, and then revert to the rectifier current.
RECT	MAJ	rid	None	None	Two or more rectifiers have the same ID number.	See above.
RECT	MAJ	nrFA	ALM	None	More than one rectifier has an ALM LED lit.	See rectifier alarms listed below.

Table 15-E: Rectifier and Converter Related Alarms

Rectifier Related Alarms (See Figures 13-6 and 13-9)						
Controller LED	**Controller Alarm Status**	**Vector Controller Display**	**Rectifier LED**	**Rectifier Display**	**Possible Problem(s)**	**Possible Solution(s)**
RECT	MAJ	nrFA	--	--	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 your local RTAC representative.
RECT	MAJ	HO	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.
RECT	MIN	rFA	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 your local RTAC representative.

Table 15-E: Rectifier and Converter Related Alarms

Rectifier Related Alarms (See Figures 13-6 and 13-9)						
Controller LED	**Controller Alarm Status**	**Vector Controller Display**	**Rectifier LED**	**Rectifier Display**	**Possible Problem(s)**	**Possible Solution(s)**
RECT	MIN	rFA	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.
RECT	MIN	rFA	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.
RECT	MIN	rFA	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 15-E: Rectifier and Converter Related Alarms

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

Table 15-E: Rectifier and Converter Related Alarms

Rectifier Related Alarms (See Figures 13-6 and 13-9)						
Controller LED	**Controller Alarm Status**	**Vector Controller Display**	**Rectifier LED**	**Rectifier Display**	**Possible Problem(s)**	**Possible Solution(s)**
RECT	MIN	rFA	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.
RECT	MIN	rFA	FAN ALM	None	Fan failure	Replace the fan in the rectifier.
RECT	MIN	rOFF	STBY	Blank	Rectifier has been manually turned off.	Turn rectifier on.
RECT	MIN	HFO	None	None	Configuration problem	Call your local RTAC representative.

Table 15-E: Rectifier and Converter Related Alarms

Converter Related Alarms (See Figure 13-7)					
Controller LED	**Controller Alarm Status**	**Vector Controller Display**	**Converter LED**	**Possible Problem(s)**	**Possible Solution(s)**
RECT	MAJ	CFJ	CFA	Both fans in a converter carrier have failed.	Replace fans.
RECT	MAJ	Cid	None		1. Pull CIC card out of carrier. 2. Move plastic tab. 3. Set DIP switches. 4. Call your local RTAC representative for assistance.
RECT	MAJ	nCFA	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.
RECT	MAJ	nCFA	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 your local RTAC representative.

Table 15-E: Rectifier and Converter Related Alarms

Converter Related Alarms (See Figure 13-7)					
Controller LED	**Controller Alarm Status**	**Vector Controller Display**	**Converter LED**	**Possible Problem(s)**	**Possible Solution(s)**
RECT	MIN	cFA	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 your local RTAC representative.
RECT	MIN	CFA	CFA	•Converter module manually turned off (STBY LED is lit.) •Converter module failure	1. Turn on module if off. 2. Replace module.
RECT	MIN	CFn	CFA	One fan in a converter carrier has failed.	Replace fan.

BD Alarm LED or No LED

Table 15-F: Miscellaneous Alarms

Controller LED	Controller Alarm Status	Vector Controller Display	Other Indication(s)	Possible Problem(s)	Possible Solution(s)
BD	MAJ	bod	Rectifiers may say ACF.	Temporary condition that may be associated with other alarms	Call your local RTAC representative.
None	MAJ	AUJ	Auxiliary equipment may have alarm.	Problem with operation of auxiliary equipment	Call your local RTAC representative.
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 your local RTAC representative.
None	None	None	--	Fuse has operated.	Replace the controller fuse labeled F1 (power).

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

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

Warranty Period

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

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

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

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

E. The defective or nonconforming Products or parts which are replaced shall become Seller's property.

F. If Seller determines that a Product for which warranty service is claimed is not defective or nonconforming, Customer shall pay Seller all costs of handling, inspecting, testing, and transportation and, if applicable, traveling and related expenses.

G. Seller makes no warranty with respect to defective conditions or nonconformities resulting from actions of anyone other than Seller or its subcontractors, caused by any of the following: modifications, misuse, neglect, accident, or abuse; improper wiring, repairing, splicing, alteration, installation, storage, or maintenance; use in a manner not in accordance with Seller's or Vendor's specifications or operating instructions, or failure of Customer to apply previously applicable Seller modifications and corrections. In addition, Seller makes no warranty with respect to Products which have had their serial numbers or month and year of manufacture removed, altered, or with respect to expendable items, including, without limitation, fuses, light bulbs, motor brushes, and the like.

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