Lucent Technologies
Bell Labs Innovations

Galaxy Power System 4804AP (GPS 4804AP) H569-450

Product Manual
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Comcode 108780917
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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 4804AP

Lucent Technologies developed the Galaxy Power System (GPS) 4804AP to support -48 volt telecommunications powering solutions for Asia Pacific market. The GPS 4804AP combines 50 ampere, fan-cooled, switch mode 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 400-ampere maximum capacity, distribution flexibility, and universal ac input capability, the GPS 4804AP 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.

Figures 1-1 and 1-2 illustrate the GPS 4804AP with Millennium Controller (with Battery Stand) and Vector Controller (without Battery Stand).

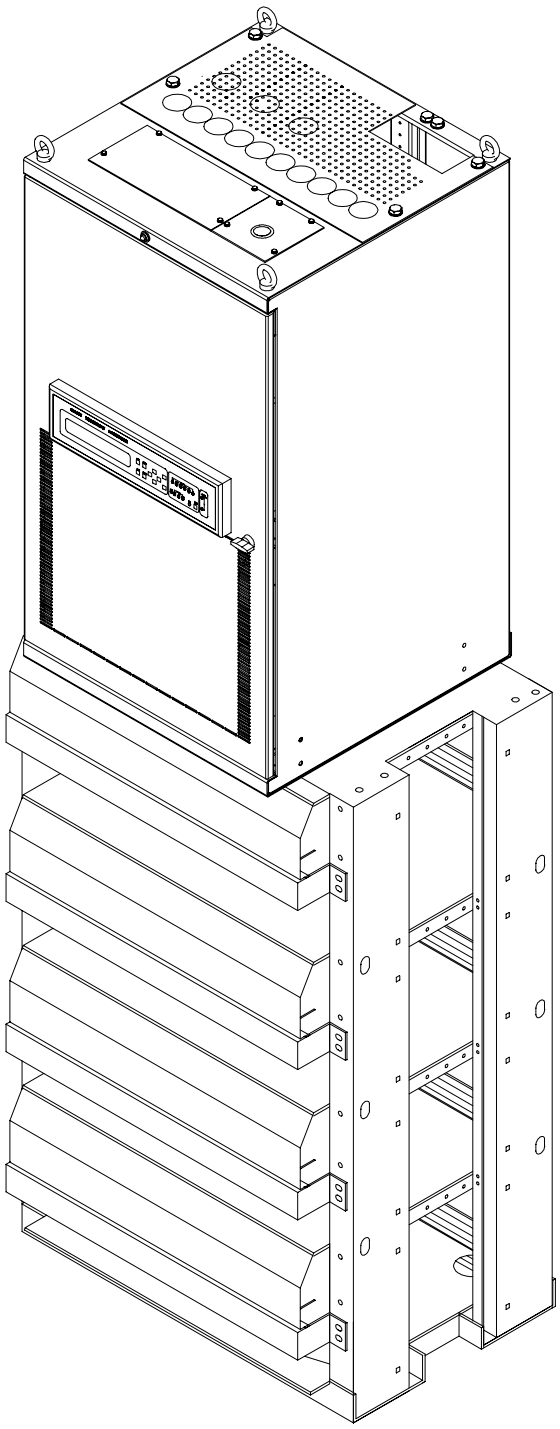


Figure 1-1: GPS 4804AP Cabinet with Galaxy Millennium Controller (with Battery Stand)

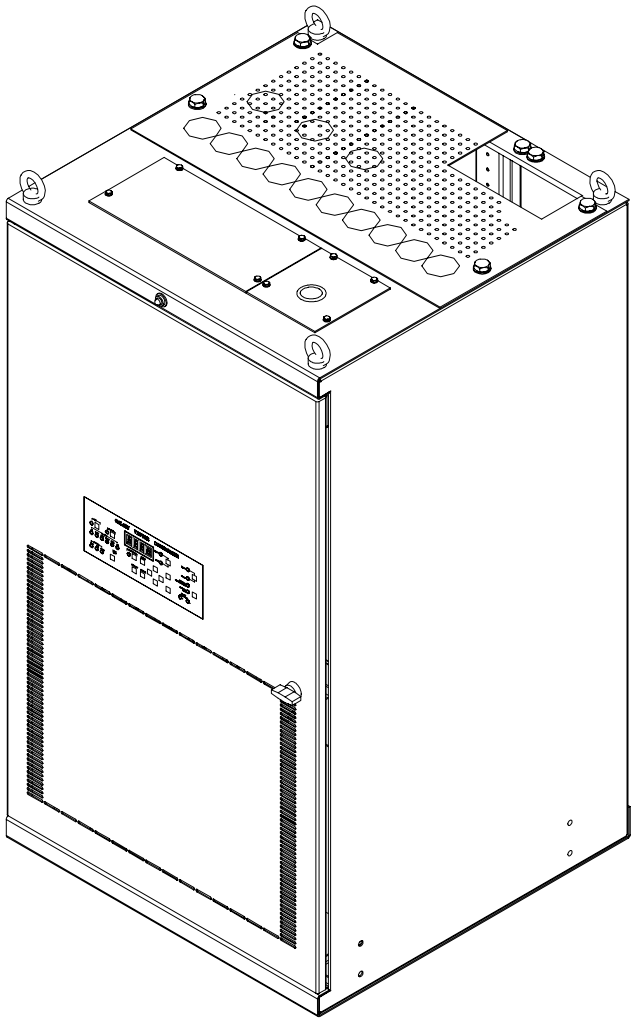


Figure 1-2: GPS 4804AP Cabinet with Galaxy Vector Controller (without Battery Stand)

Customer Assistance Contacts

Customer Training Lucent Technologies offers customer training on this and other power products. For information call 65-240-8680. This number is answered from 8:30 a.m. until 5:30 p.m., Singapore Time, Monday through Friday.

Customer Service Customers can call 65-240-8680 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. This number is answered from 8:30 a.m. until 5:30 p.m., Singapore Time, Monday through Friday.

Technical Support Technical support for Lucent Technologies customers is available around the region during the normal product warranty period and also while specific contractual agreements extend this service. Customers can call 65-240-8680 to contact a product specialist to answer your technical questions and assist in troubleshooting problems.

Product Repair and Return Repair and return service is provided for Lucent Technologies customers around the region. Customers can 65-240-8680. Alternatively, contact your local sales representative.

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."

2 System Description

Overview

Block Diagram

A basic block diagram of the Galaxy Power System GPS 4804AP is shown in Figure 2-1. It illustrates the arrangement and interconnections of the system components from the ac input to the dc output.

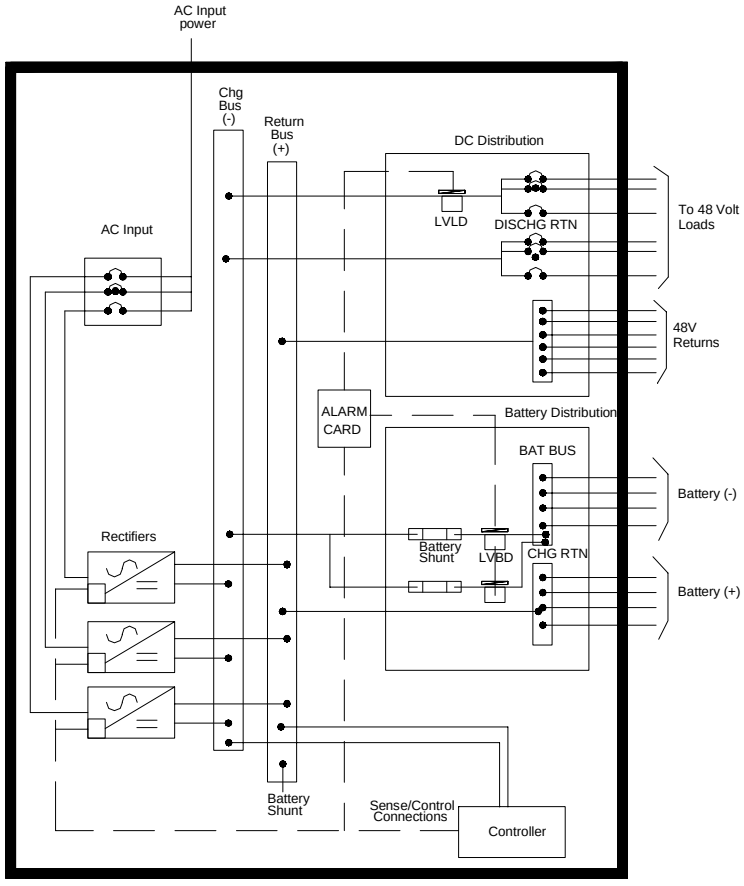


Figure 2-1: Block Diagram of the GPS 4804AP

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 over-current 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 over-current protection.

Rectifiers convert an ac source voltage into the dc voltage level required to charge and float the batteries and to power the using equipment.

Controller provides the local and remote control, monitoring, and diagnostic functions required administering 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 over-current 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 contactors and current monitoring shunts.

Architecture

Configuration

The GPS 4804AP is available in a single cabinet, shown in Figures 1-1, 1-2 and 2-2. Each cabinet contains ac distribution, dc distribution panels, a battery connection panel, rectifiers, termination points for load circuits, and a system controller.

Illustrations

Figure 2-1shows the block diagram of the GPS 4804AP. Figures 2-2 and 2-3 show the schematic and open door view of the GPS 4804AP cabinet.

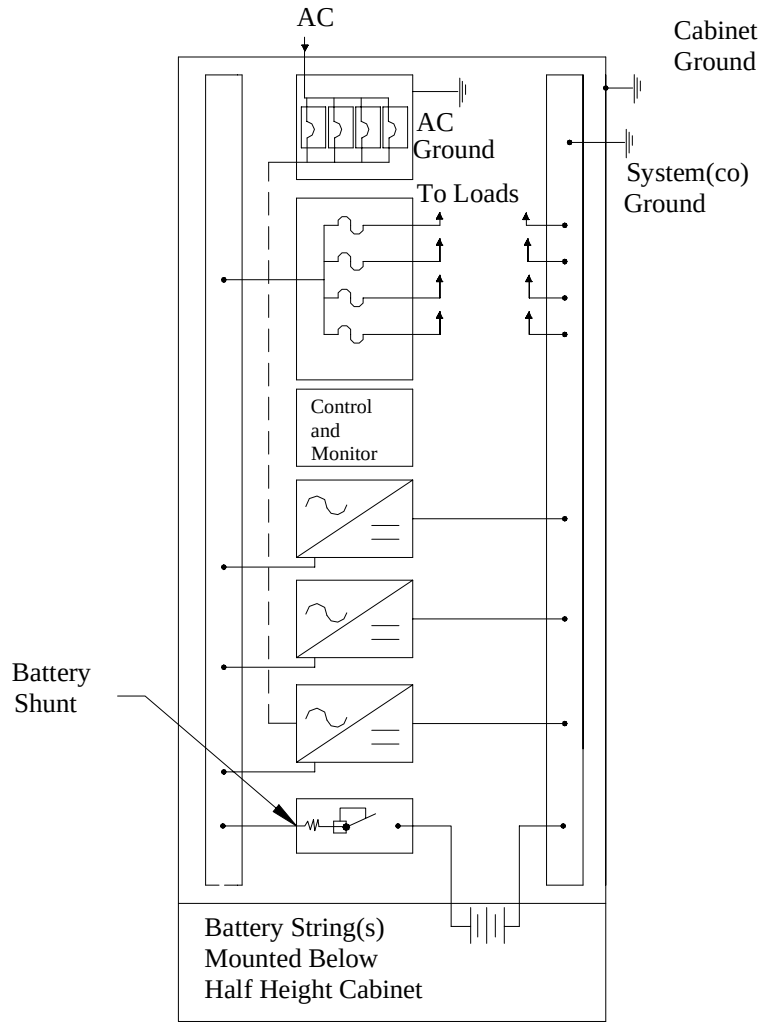


Figure 2-2: Schematic of GPS 4804AP Cabinet

Architecture, continued

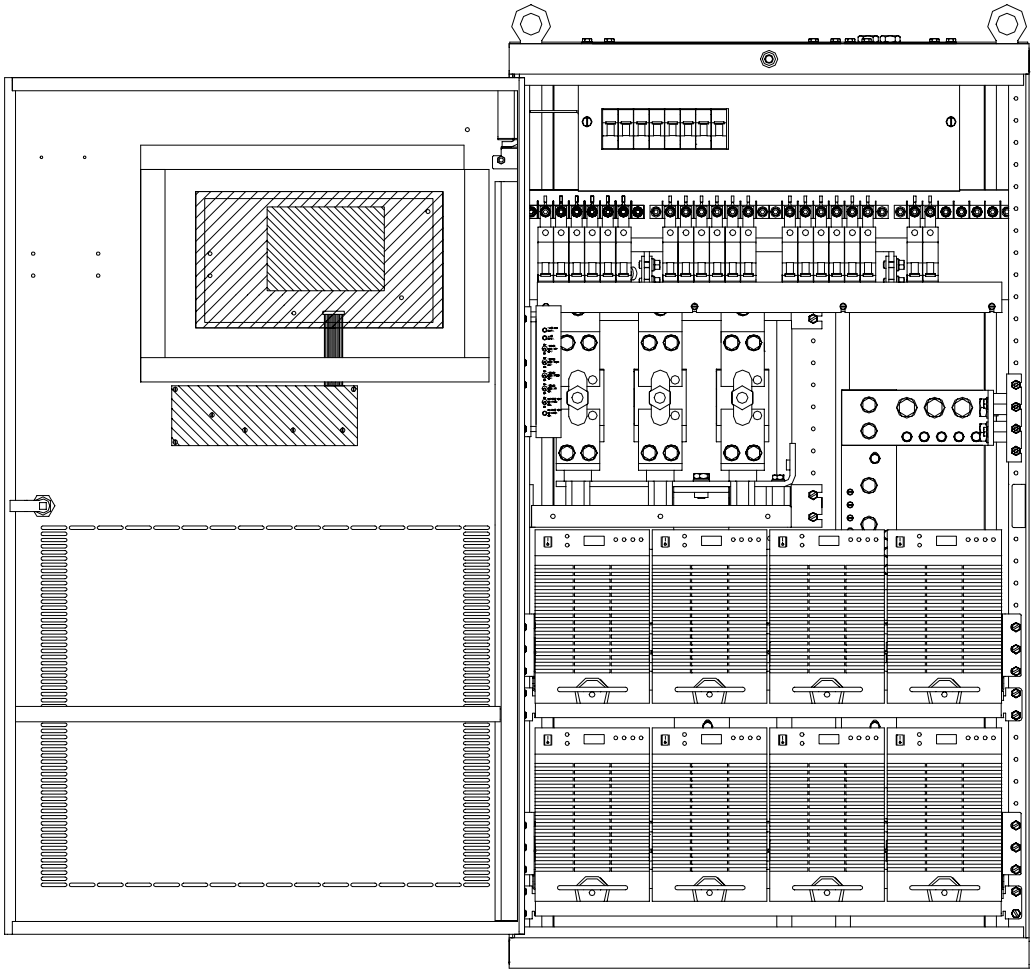


Figure 2-3: GPS 4804AP Cabinet with Door Open

3 Galaxy Controllers

Introduction

The GPS 4804AP is available with the Galaxy Millennium Controller and 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.

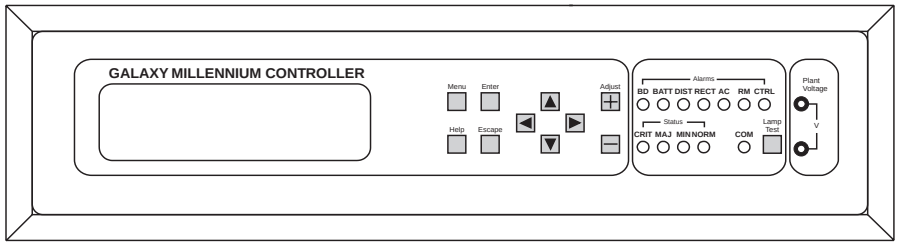


Figure 3-1: Galaxy Millennium Controller Front Panel

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:

- 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: Displays limited on-line help information.
- ESCAPE: Return to the immediate higher level menu.
- Up arrow: Moves the cursor up one line.
- Down arrow: Moves the cursor down one line.
- Left arrow: Moves the cursor left one field.
- Right arrow: Moves the cursor right one field.
- 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 alphanumeric 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.

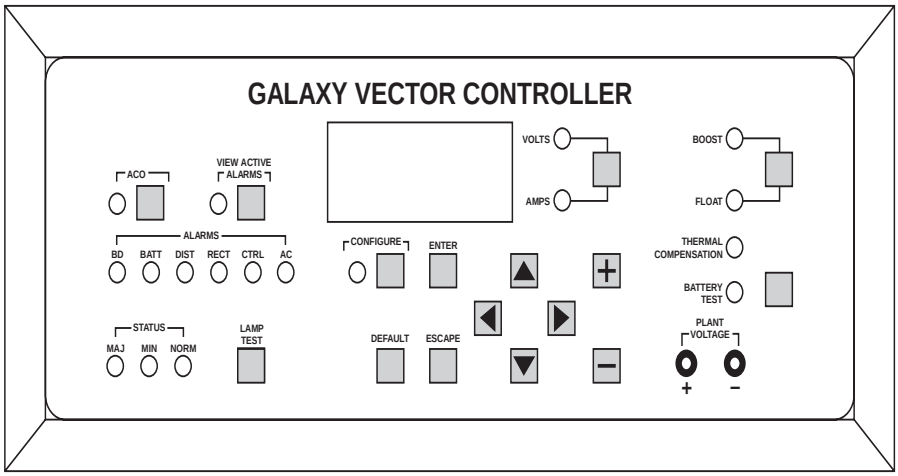


Figure 3-2: Galaxy Vector Controller Front Panel

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 4804AP. 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

596A

The 596A 50-ampere rectifier operates from single-phase ac service with a phase-to-neutral voltage within the range of 176-264Vac.

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

The 596A rectifier is **UL recognized**, 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.

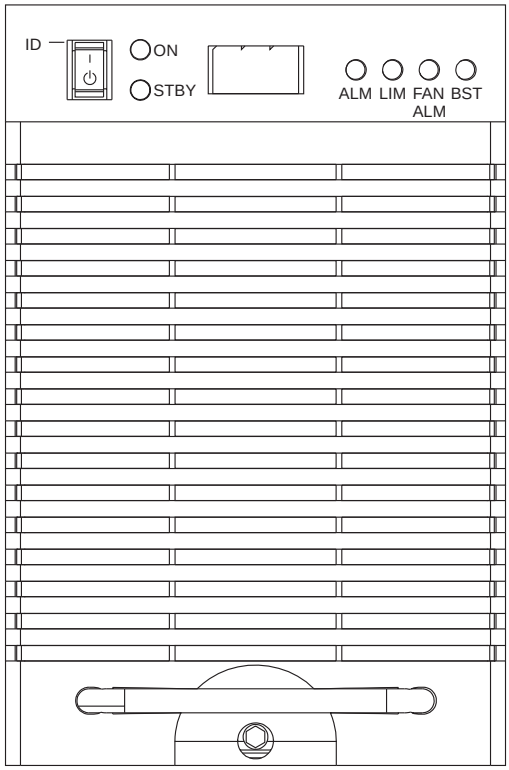


Figure 4-1: Rectifier Front Panel

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

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

Electronic Current Limit

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

High Voltage Shutdown (HVSD)

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

Restart

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

Fan Alarm and Control

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

Thermal Alarm

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

Autonomous Operation

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

Controller Communications Alarm

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

Features, continued

Connectorized

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

"Forced" Load Sharing

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

5 AC Input Panels

Overview

AC Service

The ac input panel provides the facility to terminate 3-phase ac service to the GPS 4804AP plant and internally distribute individual 1-phase ac supplies to each of the plant rectifier positions. The panel will connect 4 wire (three phases + neutral) input ac services. Alternatively facility to terminate a bulk single-phase supply to the GPS 4804AP plant and internally distribute individual 1-phase ac supplies to each of the plant rectifier positions. The panel will connect 2 wire (one phase + neutral) input ac services.

In the systems, Miniature Circuit Breakers (MCB) are provided to protect the conductor providing ac service to the individual rectifiers.

Cross Reference of Cabinets and AC Panels

Table 5-A identifies which cabinet uses each of the AC panels.

Table 5-A: AC Input Panels

S. No.	Description	Figure
H 569-450 G20	Half Height cabinet with maximum of two shelves of rectifiers (maximum of 8 single pole circuit breakers) that are connected to three phase (3Φ, 4 wire)	Figure 5-1
H 569-450 G21	Half Height cabinet with maximum of two shelves of rectifiers (maximum of 8 single pole circuit breakers) that are connected to single phase (1Φ, 2 wire)	Figure 5-2

Illustrations

AC Input Panels are shown in Figures 5-1 and 5-2.

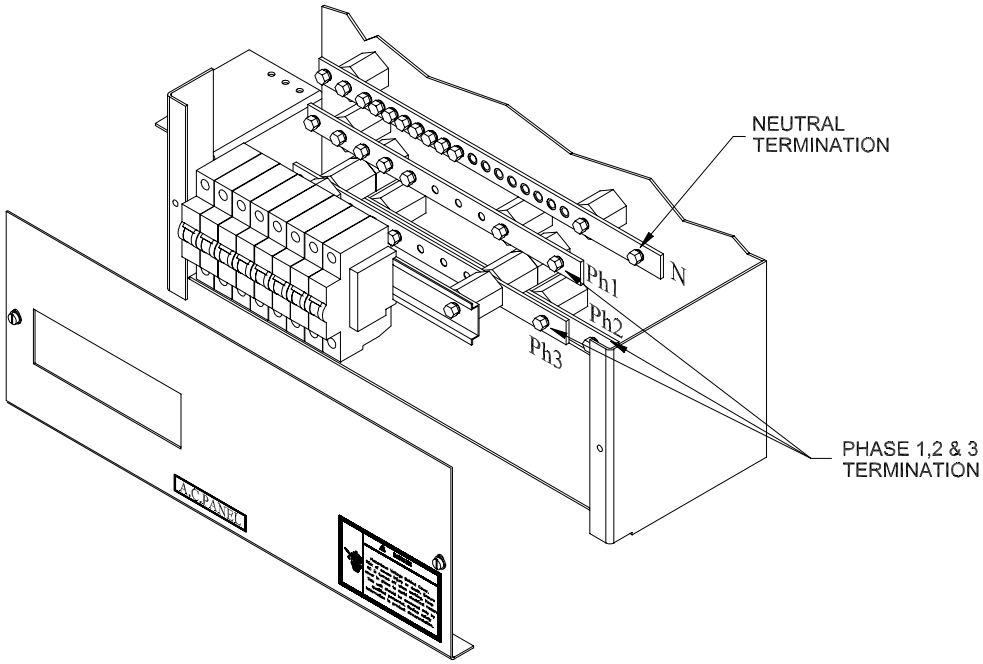


Figure 5-1: H569-450 G20 AC Panel (Three Phase) for GPS 4804AP Power System

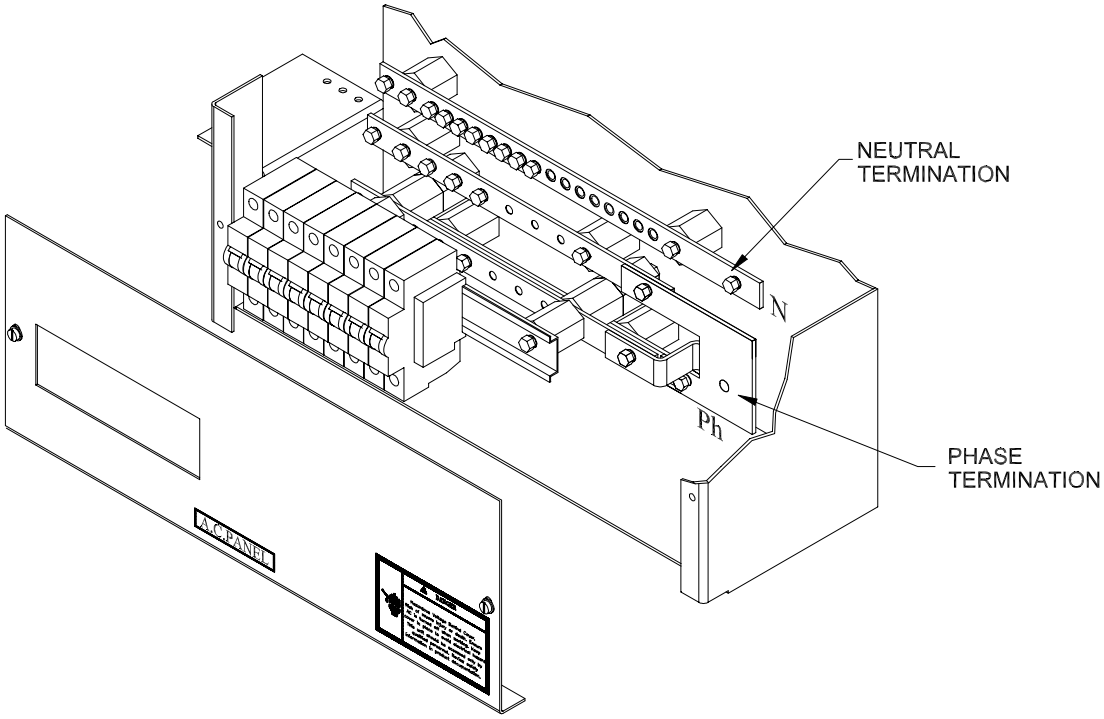


Figure 5-2: H569-450 G21 AC Panel (Single Phase) for GPS 4804AP Power System

6 Battery Connection Panels

Overview

Function

Batteries are connected to the GPS 4804AP cabinets on battery connection panels located in the cabinet directly below the ac input panel.

All panels include the battery shunts that communicate with the controller to provide battery current information. The panels may include low voltage battery disconnect/reconnect (LVBD/R) contactors or low voltage load disconnect/reconnect contactors (LVLD/R). An Alarm card provides local/manual control of the contactors.

Notes: 1) The Alarm card is common for the Battery Connection Panels and the DC Distribution Panels.
2) When LVLD/R Contactor is selected, six positions in the DC Distribution will be assigned as critical loads.

Cross Reference of Cabinets and Battery Connection Panels

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

Table 6-A: Battery Connection Panels

Panel	Description	Figure
H 569-450 G30	Battery Connection Panel with 2 x 400A Battery Contactors (LVBD/R)	Figure 6-1
H 569-450 G31	Battery Connection Panel with 2 x 400A Battery Contactors (LVBD/R), 1 x 400A contactor for DC Distribution (LVLD/R)	Figure 6-2
H 569-450 G32	Battery Connection Panel 1 x 600A battery Contactor (LVBD/R)	Figure 6-3
H 569-450 G33	Battery Connection Panel with 1 x 600A battery Contactor (LVBD/R), 1 x 400A contactor for DC Distribution (LVLD/R)	Figure 6-4

Illustrations

The battery connection panels are shown in Figures 6-1 through 6-4.

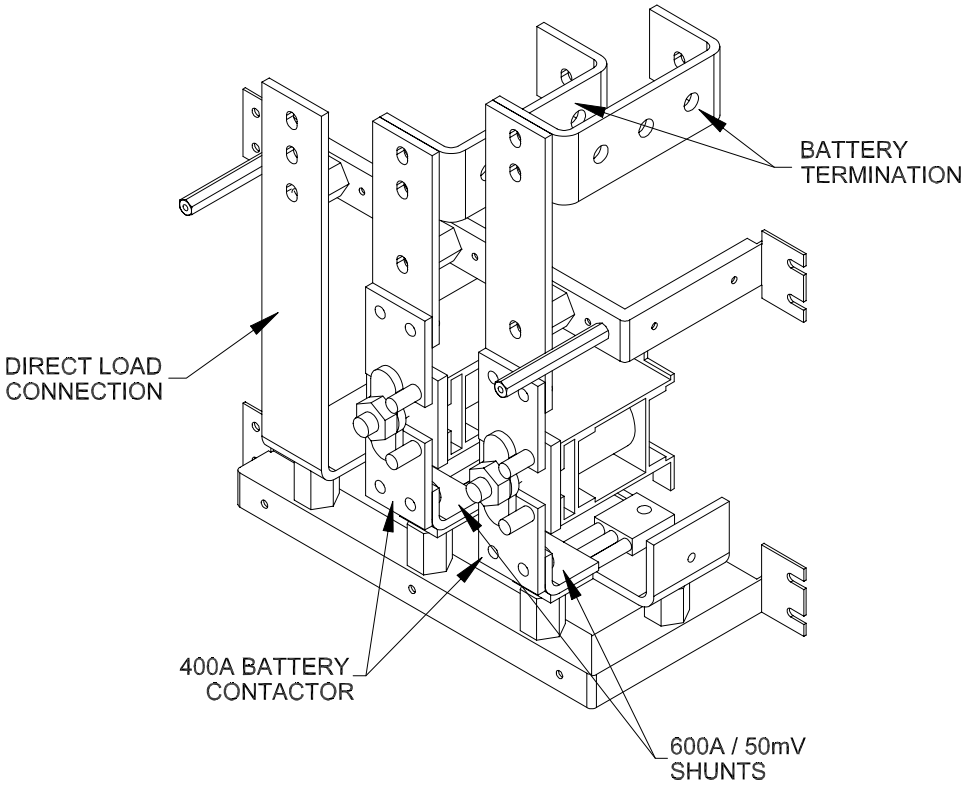


Figure 6-1: H 569-450 G30 Battery Connection Panel with 2 x 400A Battery Contactors (LVBD/R)

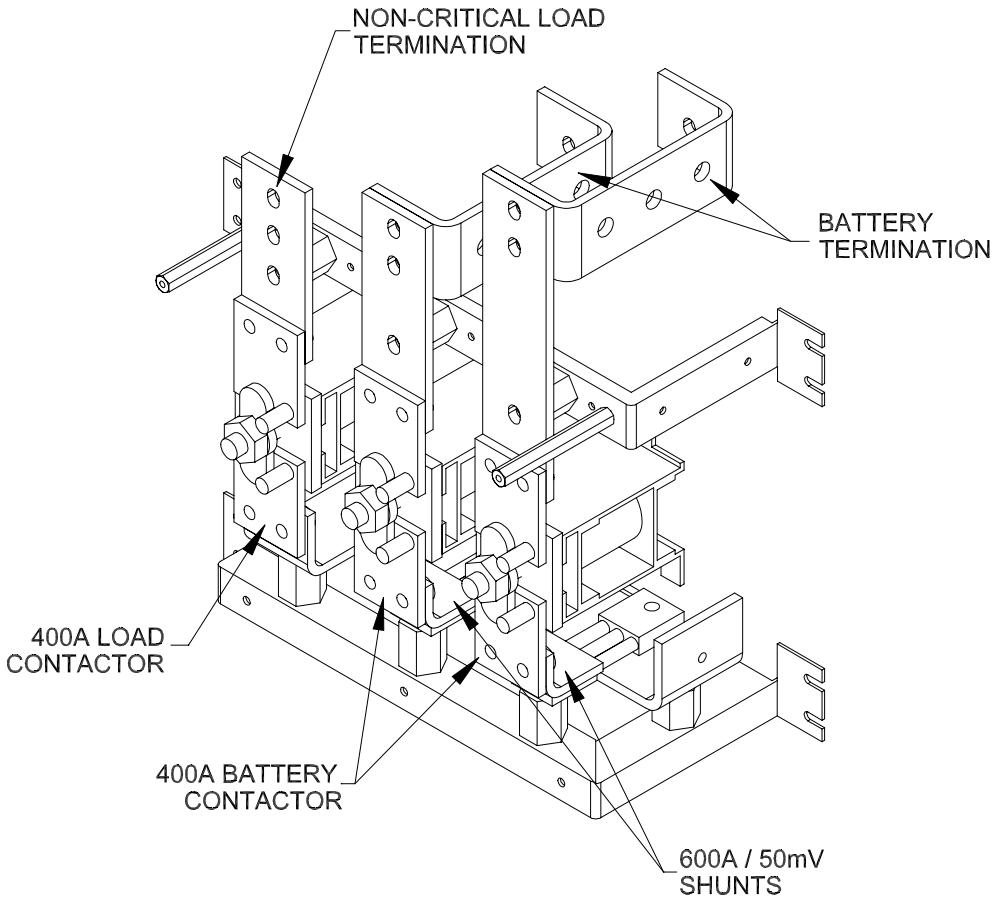


Figure 6-2: H 569-450 G31 Battery Connection Panel with 2 x 400A Battery Contactors (LVBD/R), 1 x 400A Contactor for DC Distribution (LVLD/R)

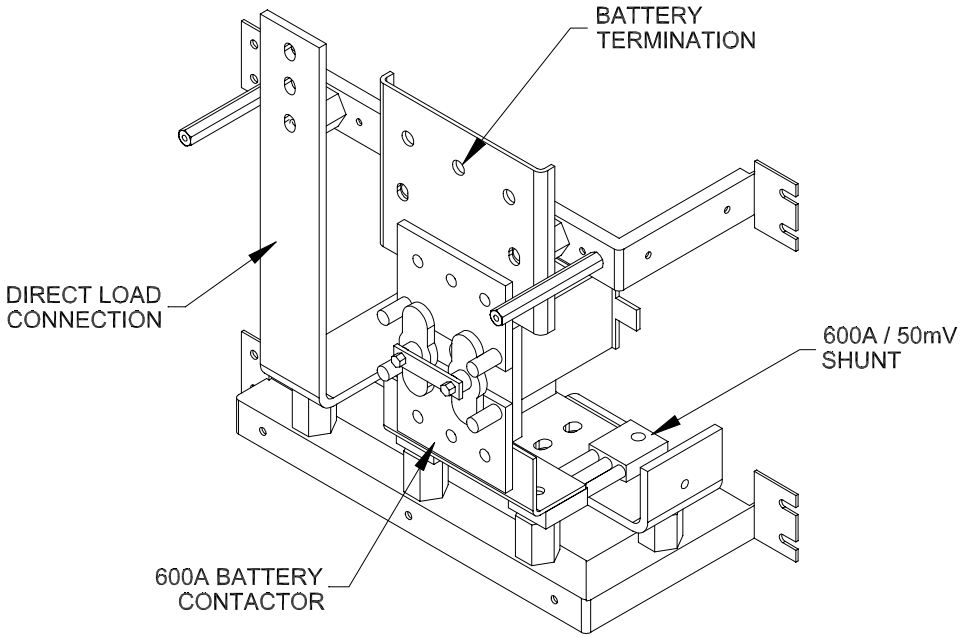


Figure 6-3: H 569-450 G 32 Battery Connection Panel with 1 x 600A Battery Contactor (LVBD/R)

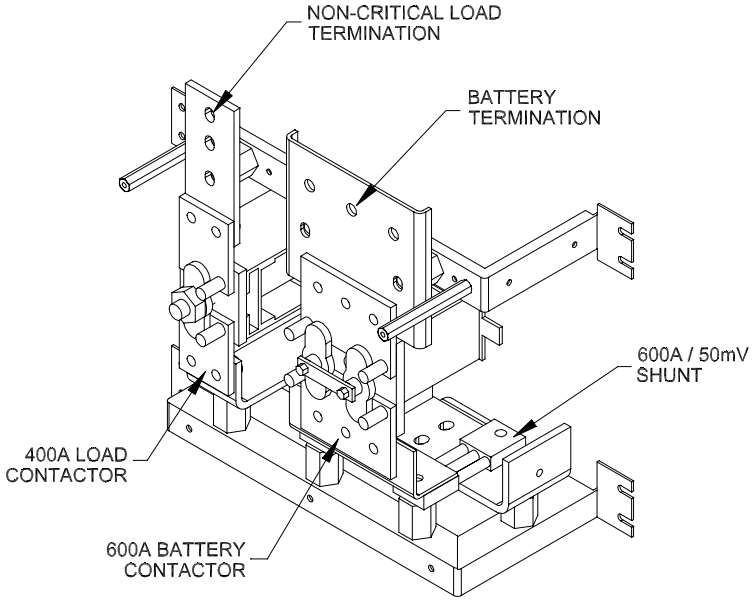


Figure 6-4: H 569-450 G33 Battery Connection Panel with 1 x 600A Battery Contactor (LVBD/R), 1 x 400A Contactor for DC Distribution (LVLD/R)

7 DC Distribution Panel

Overview

Function

The dc distribution panel is available for the GPS 4804AP system with DIN standard Miniature Circuit Breakers (MCB). An Alarm card provides local alarm and also communicates the alarm to the controller. When a circuit breaker trips, a red LED on the Alarm card lights, the cabinet alarm lights, and the alarm is transmitted to the controller.

Notes: 1) The Alarm card is common for the Battery Connection Panels and the DC Distribution Panels.
2) When LVLD/R Contactor is selected, six positions in the DC Distribution will be assigned as critical loads.
3) When output current is greater than 63A, multiple pole MCB will be used with the output terminals shorted. When multiple pole MCB are used in DC Distribution, number of output position will be reduced from 24 positions suitably.

Cross Reference of Cabinets and DC Distribution Panels

Table 7-A identifies which cabinet uses the dc distribution panel.

Table 7-A: DC Distribution Panels

Panel	Description	Figure
H 569-450 G40	24 Position Miniature Circuit Breaker (MCB) Panel	Figure 7-1

Illustration

The dc distribution panel is illustrated in Figure 7-1.

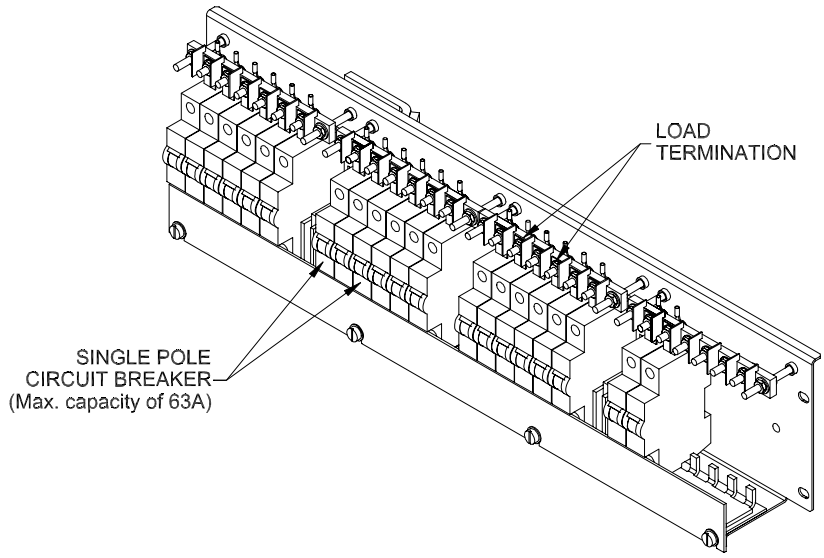


Figure 7-1: H 569-450 G40 24-Position (DC Distribution) Miniature Circuit Breaker Panel for GPS 4804AP

8 Circuit Boards

Overview

Function

Circuit boards (sometimes referred to as “cards”) are included in the cabinet.

Alarm Board

The circuit board performs the following functions:

- Monitors battery connection and dc distribution panel functions and activate local indicators when faults occur on the panel
- Provides alarm data to the controller
- Provides local control for the LVBD/R and LVLD/R Contactors
- Provides capacitor charge
- Interfaces between Galaxy Controller and other plant components

BLJ Terminal Board

Millennium Systems A BLJ terminal board is located inside the door of each 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 cabinet, contains a BLJ terminal connection board.

Bay Interface Card

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

Vector Systems The cabinet contains the Vector controller, which consists of a BIC3 control board and a BLJ terminal connection board.

Alarm Card

This circuit board contains circuitry to control three contactors (Contactor 1, one number, is designated for Load and Contactors 2A and 2B are designated for battery) and help in MCB trip/failure detection.

LVD Control Operation The switches S1 to S4 in the circuitry are used to manually operate the contactors along with DIP switch S7 on the circuit board. Necessary settings for configuring the contactors as load and battery contactors, their disconnection and reconnection thresholds need to be done in the Galaxy Controller. Refer to relevant portion of the Galaxy product manual (Select Code 167-792-180 for the Galaxy Millennium Controller and Select Code 167-792-112 for Galaxy Vector Controller) for configuring the required parameters.

Remote Control Mode The control for the contactors are provided by the Galaxy Controller depending on the output voltage of the Power System. If the output voltage goes below the respective disconnect threshold voltages, the respective contactors will open generating alarm. L2 “LVD OPEN” will glow on the alarm card and the alarm will be transmitted to the Galaxy Controller. BATT MAJ or DIST MAJ LED on the Galaxy Controller will glow depending on the type of the contactor opening. (Load contactor will generate DIST and Battery contactor will generate BATT alarm). Respective contactors will close automatically once the output voltage goes above the reconnect threshold voltages [1]. The switch position in Remote Control Mode

- S1 to S3 in “ON” position.
- S4 in “OFF” position.
- Both switches of DIP Switch S7 in “OFF” position

[1] Contactor designated as load contactor will only close if no ac alarm exists in the Power system, irrespective of the output voltage of the power system.

Manual Switch OFF Mode Switches are provided in the Alarm card to switch “OFF”, open the contactors manually overriding the Galaxy controller. Switch S1 to S3 are used to open the contactors manually by putting the control switches in OFF position. Alarms are generated in the Alarm card and the Galaxy Controller. (L2 “LVD OPEN” on the Alarm card and BATT MAJ or DIST MAJ on the Galaxy Controller)

Note: Manual Switch “OFF” of the contactors can isolate the load and battery strings from the power system.

Alarm Card, continued

Manual Forced ON Mode This operation is used to forcefully keep the contactors in close position even if the output voltage of the power system is below the disconnect threshold voltage. No alarms are generated in this condition. The switch position in manual forced ON mode

- S1 to S3 in “ON” position
- S4 in “ON” position
- DIP Switch S7, switch 1 “ON” position for contactor 1 (Load Contactor)
- DIP Switch S7, switch 2 “ON” position for contactor 2A and 2B (Both Battery Contactor)

Fuse/MCB Failure Detection The DIP switches S8 to S11 in the circuitry should be made ON for the equipped fuses/MCB in the distribution panel. The label DIP SW assignment pasted on the Bay will give the description of the Switch corresponding to the fuses. The corresponding dip-switches has to be made ON for the equipped fuses in the distribution. When the fuse fails or trips, L1 “FUSE/CB OPEN” LED will glow in the alarm card and the alarm will be transmitted to the Galaxy Controller. DIST-MAJ alarm will be issued in the controller.

Capacitor Charge SW The switch S5 in the circuitry is the capacitor charge switch. This switch has been provided for charging the Capacitors in the GPDF panel of the 5ESS switch or when the load is connected across high value capacitor. The capacitors in the GPDF fuse panel or other loads have to be charged before turning ON the MCB in the distribution otherwise it will cause heavy sparking. For charging the capacitors, connect a wire (Multimeter probe can be used) from the socket J1 to the output side of the fuse holder and then switch on the capacitor charge switch, L3 capacitor charge On LED will light up and go off.After the capacitor charge On LED (L3) goes off, remove the wire from the socket and turn ON the MCB. Repeat the procedure for insertion of other MCB. This procedure needs to be followed only when turning ON the MCB in a live plant connected to GPDF or load with high value capacitor connected across the load.

Illustrations

BLJ Board

Figure 8-1 shows the location of the BLJ Terminal Board and the Bay Interface Card (BIC).

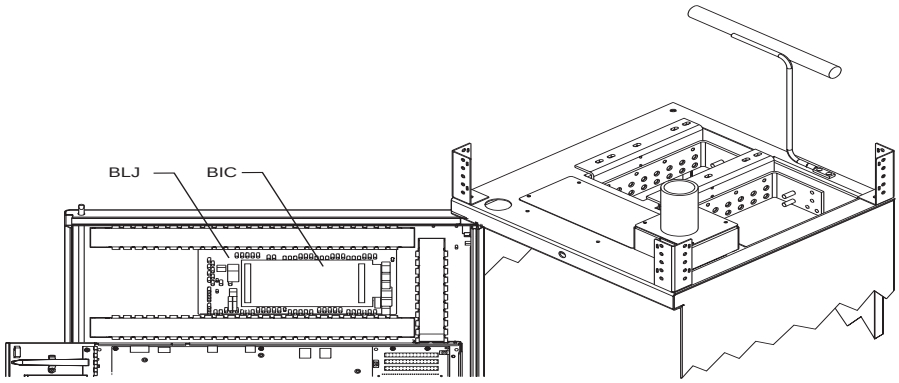


Figure 8-1: Location of BLJ Terminal Board and Bay Interface Card

BIC Board

Figure 8-2 shows the straps required prior to replacing a Bay Interface Card (BIC). (See "BIC Failure" in Table 13-C.)

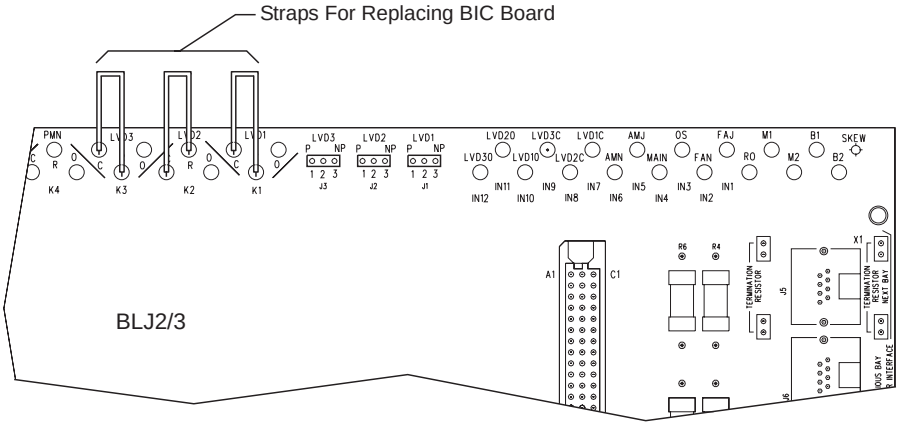


Figure 8-2: Required Straps Prior to Replacing a Bay Interface Card (BIC)

Illustrations, continued

Battery/DC Distribution Alarm Circuit Pack

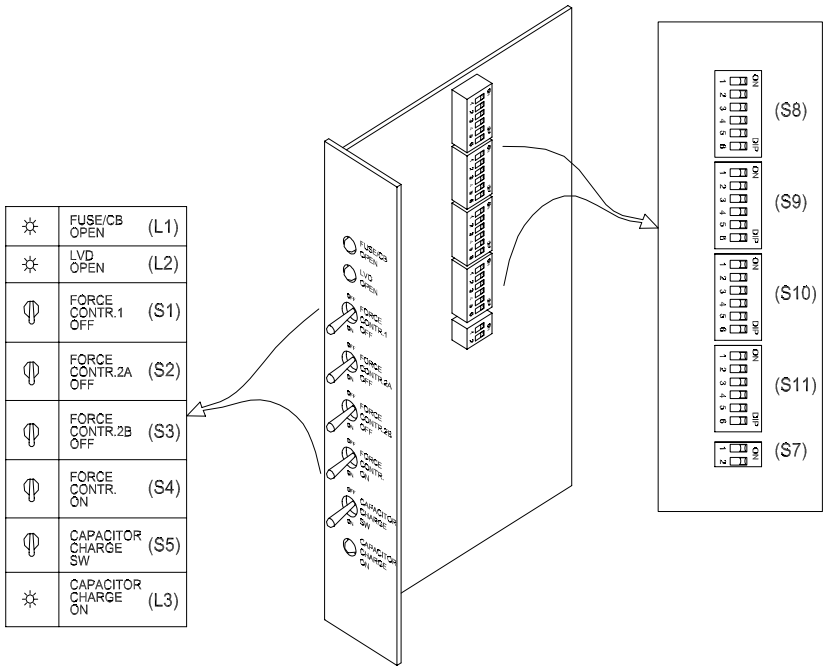


Figure 8-3: Battery/DC Distribution Alarm Circuit Pack for GPS 4804AP Power System

9 Specifications

GPS 4804AP

Table 9-A: Galaxy Power System 4804AP Specifications

Electrical	
AC Input	
Input Distribution	175A Circuit breaker for single phase (maximum 8 rectifiers, 2-shelf system) 75A circuit breaker for three phase (maximum 8 rectifiers, 2-shelf system)
Wire Size	70 mm^2 cable for single phase 25 mm^2 cable for three phase
System Output	
System Voltage	-48
Output Current	50 - 400 amperes
Physical	
Cabinet	
Nominal Cabinet Dimensions (H x W x D)	1066 H x 600 W x 600 D mm
Units Per Cabinet	
Rectifiers	1 - 8
Controller	1
Battery Disconnect Modules	0 - 1
DC Distribution	0-1

Table 9-A: Galaxy Power System 4804AP Specifications

Environmental	
Operating Ambient Temperature	0°C to 50°C
Altitude	-50 to 4000 meters Note: For altitudes between 1500 and 4000 meters, de-rate the maximum temperature by 0.656°C per 100 meters.
Humidity	5% to 90% non-condensing
Radiated and Conducted Emission	EN 55022 (CISPR 22) Radiated/Conducted Emission, Class A
Electromagnetic Immunity	IEC/EN 61000-4-2 ESD level 4 IEC/EN 61000-4-3 Radiated Immunity, 10V/m, Level 3 IEC/EN 61000-4-4 Electrical Fast Transients/Burst, Level 4 (Damage Free) IEC/EN 61000-4-5 Lightning Surge, Level 4 IEC/EN 61000-4-6 Conducted Immunity, Level 3
Safety	Applicable sections of IEC 60950
Standards Compliance	
Agency Approvals	CE Marked per European Council Directive: Low-Voltage Directive and EMC Directive

Rectifier

Table 9-B: 596A Rectifier Specifications

Electrical	
Input	
Voltage Range	176-264Vac, 2-wire, single phase
Frequency Range	45 - 65 Hz
Power Factor	> 0.98 for loads > 50%
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 than the internal protection. The internal protection of the 596A has the following voltage and current characteristics: **Phase to Phase Voltage** — **MOV Conduction Current** 625Vac (RMS) — 0A 940Vpeak — 1mA 1600Vpeak — 100A	
Output	
Output Current	50 amperes
Float/Boost Voltage	44-58Vdc
Regulation	±0.5%
Ripple	100 mVrms
Noise	< 2mV Psophometric
Permanent Overload	55A
Current Limit Set Point	15A-55A Note: When using the maximum 16 rectifiers in a cabinet, do not exceed 50 amperes current limit per rectifier at 65°C.
Physical	
Width	133 mm (5.2 in.)
Height	203 mm (8 in.)
Depth	502 mm (19.8 in.)
Weight	8.6 kg (19 lbs.).
Environmental	
Efficiency	> 90% typical
Operating Temperature	-40°C to +65°C
Operating Relative Humidity	5% to 90%
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 55022, level B, conducted and radiated (CISPR 22)

Table 9-B: 596A Rectifier Specifications

Standards Compliance	
Safety Standard	EN 60950 (IEC950)
Certification Marks	UL, VDE, CE Rectifiers are individually UL Recognized and/or CSA Certified to UL1950 and CSA C22.2 No 234/950. Rectifiers are also approved to IEC-950/ EN60950 by an EC Notified Body and have outputs classified as SELV.

AC Input Panels

Table 9-C: AC Input Panels

Description	H 569 - 450 Group Number
Half Height cabinet with maximum of two shelves of rectifiers (maximum of 8 single pole circuit breakers) that are connected to three phase (3Φ, 4 wire)	G20
Half Height cabinet with maximum of two shelves of rectifiers (maximum of 8 single pole circuit breakers) that are connected to single phase (1Φ, 2 wire)	G21

Battery Connection Panels

Table 9-D: Battery Connection Panels

Description	H 569 - 450 Group Number
Battery Connection Panel with 2 x 400A Battery Contactors (LVBD/R)	G30
Battery Connection Panel with 2 x 400A Battery Contactors (LVBD/R), 1 x 400A contactor for DC Distribution (LVLD/R)	G31
Battery Connection Panel 1 x 600A battery Contactor (LVBD/R)	G32
Battery Connection Panel with 1 x 600A battery Contactor (LVBD/R), 1 x 400A contactor for DC Distribution (LVLD/R)	G33

DC Distribution Panel

Table 9-E: DC Distribution Panel

Description	H 569 - 450 Group Number
24 Position Miniature Circuit Breaker (MCB) Panel	G40

10 Safety

Safety Statements

Please read and follow all safety instructions and warnings before servicing the Galaxy Power System GPS 4804AP. Reference the individual module product manuals for additional safety statements specific to the modules.

- The plant must be in a restricted access area (dedicated equipment rooms, equipment closets, or the like) in accordance to the applicable local codes.

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

- Do not install this equipment over combustible surfaces.

- This equipment has been evaluated for use in a continuous ambient temperature of up to 50°C.

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

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

Safety Statements, continued

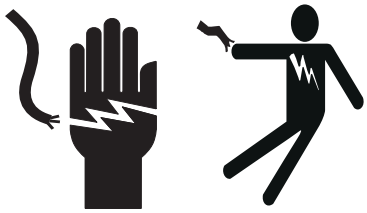
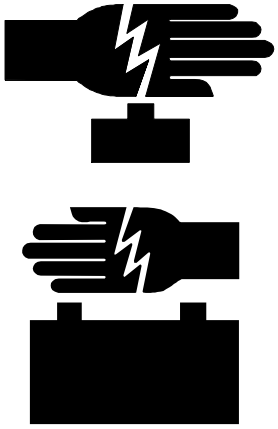
- External circuit breakers must be sized as required by the applicable local codes. Refer to the equipment ratings to assure rating of equipment will not exceed 80% of the value of the breaker chosen.

- The short circuit current capacity of the battery input to the dc distribution panel is 10,000 amperes.

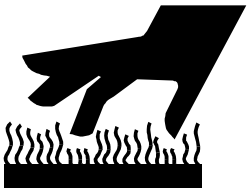
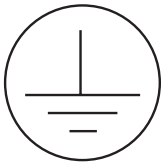
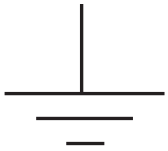
Caution: The equipment is to be used in the building installation with 4 pole, 125A Circuit Breaker or 2 pole, 175A Circuit Breaker and Earth leakage current detector on all conductors.

Warning Statements and Safety Symbols

The symbols may sometimes be accompanied by some type of statement; e.g., “Hazardous voltage/energy inside. Risk of injury. This unit must be accessed only by qualified personnel.”

	This symbol identifies the need to refer to the equipment instructions for important information.
	These symbols (or equivalent) are used to identify the presence of hazardous ac mains voltage.
	This symbol is used to identify the presence of hazardous ac or dc voltages. It may also be used to warn of hazardous energy levels.
	One of these two symbols (or equivalent) may be used to identify the presence of rectifier and battery voltages. The symbol may sometimes be accompanied by some type of statement, for example: “Battery voltage present. Risk of injury due to high current. Avoid contacting conductors with uninsulated metal objects. Follow safety precautions.”

Warning Statements and Safety Symbols, continued

	This symbol is used to identify the presence of a hot surface. It may also be accompanied by a statement explaining the hazard. A symbol like this with a lightning bolt through the hand also means that the part is or could be at hazardous voltage levels.
	This symbol may also be used to identify the presence of a hot surface. The marked item should not be touched without taking care.
	This symbol is used to identify the protective safety earth ground for the equipment.
	This symbol is used to identify other bonding points within the equipment.
	This symbol is used to identify the need for safety glasses and may sometimes be accompanied by some type of statement, for example: "Fuses can cause arcing and sparks. Risk of eye injury. Always wear safety glasses."

Precautions

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

- This unit must be installed, serviced, and operated only by skilled and qualified personnel who have the necessary knowledge and practical experience with electrical equipment and who understand the hazards that can arise when working on this type of equipment.

- The Galaxy Power System can be powered by multiple ac inputs. Ensure that the appropriate circuit protection device for each ac input being serviced is disconnected before servicing the equipment.

- For equipment connected to batteries, disconnecting the ac alone will not necessarily remove power to the equipment. Make sure the equipment is not also powered by the batteries or the batteries are not connected to the output of the equipment.

- High leakage currents may be possible on this type of equipment. Make sure the equipment is properly safety earth grounded before connecting power.

- Hazardous energy and voltages are present in the unit and on the interface cables that can shock or cause serious injury. Follow all safety warnings and practices when servicing this equipment. Exercise care when servicing this area.

- Batteries may be connected in parallel with the output of the rectifiers. Turning off the rectifiers will not necessarily remove power from the bus. Make sure the battery power is also disconnected and/or follow safety procedures while working on any equipment that contains hazardous energy/voltage.

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

Precautions, continued

- In addition to proper job training and safety procedures, the following are some basic precautions that should always be used:
  - Use **only** properly insulated tools.
  - Remove all metallic objects (key chains, glasses, rings, watches, or any other jewelry).
  - Wear safety glasses.
  - Test circuits before touching.
  - Lock out and tag any circuit breakers/fuses when possible to prevent accidental turn on.
  - Be aware of potential hazards before servicing equipment.
  - Identify exposed hazardous electrical potentials on connectors, wiring, etc. (note the condition of these circuits, especially any wiring).
  - Use care when removing or replacing any covers - avoid contacting any circuits.

11 Installation

Introduction

This section provides instructions for installing Lucent Technologies Galaxy Power System GPS 4804AP that uses the 596A (48V/50A) rectifiers.

Relevant Product Documentation

GPS 4804AP

Ordering Guide	H 569 - 450
Manufacturing Drawings	YYH4804XX
Wiring Table	WD-YYH4804XX
Product Manual	167-792-162

Galaxy Millennium Controller

Manufacturing Drawings	J85501K-1
Wiring Diagram	T83413-30
Product Manual	167-792-180

Galaxy Vector Controller

Wiring Diagram	T83314-30
Product manual	167-792-112

Remote Peripheral Monitoring System

Ordering Guide	J85501G-1
Wiring Diagram	T83275-30
Schematic Drawing	SD-83275-01
Product Manual Select Code	167-790-063

EasyView Software

Product Manual	193-104-105

Installation Preparations

Tools and Hardware

You will need the following tools and hardware to install the Galaxy Power System:

- Material-handling equipment to unload the cabinet at the installation site, remove from shipping container, and set in final position [minimum lifting capacity: 900 lbs. (410Kg)]

  Note: Use the equipment weights and dimensions as a guideline for choosing material-handling equipment.

- Drill and drill bits to install floor anchors
- 3/16-inch (5mm) Allen-head wrench (provided)
- ***Insulated*** hand tools
- Screw drivers (flat-blade and Phillips)
- Wire cutters and stripper
- Torque wrenches (see Table 11-A)
- 35-513in-lbs (4-58Nm)
- Sockets

Metric	English Equivalent	Hardware
8mm	5/16”	M5
10mm	--	M6
13mm	1 /2”	M8
17mm	11/16”	M10
19mm	3 /4”	M12

- Crimp tools
  - 22-16 gauge
  - 10-500 MCM (5-120mm^2)
- Jeweler’s screwdriver
- Digital multimeter (DMM) with 0.05% accuracy on dc scale
- Load box (200 amperes @ 48V)
- Laptop or personal computer (PC) loaded with Windows 3.1 or later (optional)
- ESD wrist strap

Installation Preparations, continued

Torque Settings for Metric Hardware

Table 11-A: Torque Settings for Metric Hardware

Screw Size	Torque (Nm)	Torque (in-lbs)
M2	0.24	2
M2.5	0.48	4
M3	0.9	8
M3.5	1.4	12
M4	2	18
M5	4	35
M6	7	62
M8	18	160
M10	34	300
M12	58	513

Unpacking

Before opening the packaging, carefully inspect the outside in the presence of shipping personnel for signs of damage. Carefully open the packaging to verify that the contents are complete and undamaged. If damaged, follow the shipping carrier's procedure for filing a damage claim. If the equipment must be returned, it should be repacked in the original shipping crate.

Location

Before continuing, verify that the following conditions exist at the installation site:

- Floor is conditioned[1] and clean.
- Batteries and associated stands are in place.
- Cable rack not supported by cabinets is in place.
- Job Site Documentation is available that details cabinet locations, dc distribution assignments, and Remote Peripheral Monitoring Module location and assignment.

[1]Refers to removal of any combustible flooring, e.g., carpet, wood, etc.

Cabinet Installation

Illustrations Refer to the following figures for the cabinet installation procedure:

Figure Number	Illustrates
11-1	Footprint for a Galaxy Power System (GPS) 4804AP without a battery stands.
11-2	Footprint for a standard IR battery stands.
11-3	Details of the cabinet installation procedure.
11-4	Details of cabinet and System Central Office Ground

Cabinet Installation, continued

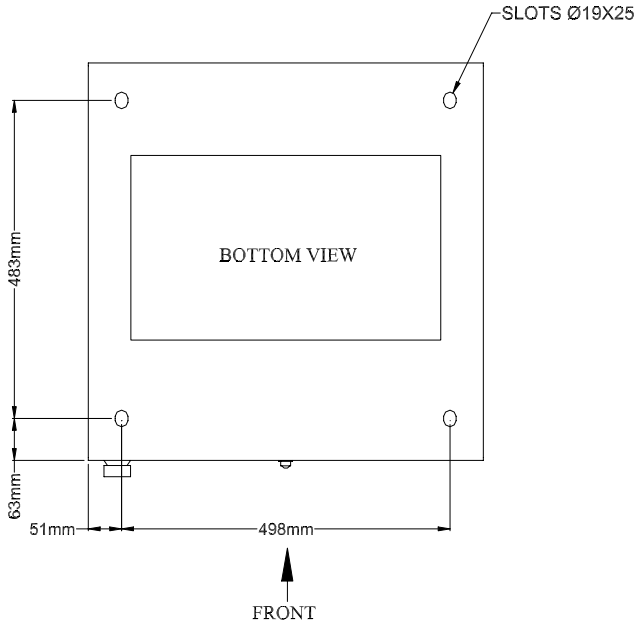


Figure 11-1: Footprint (No Battery Stand)

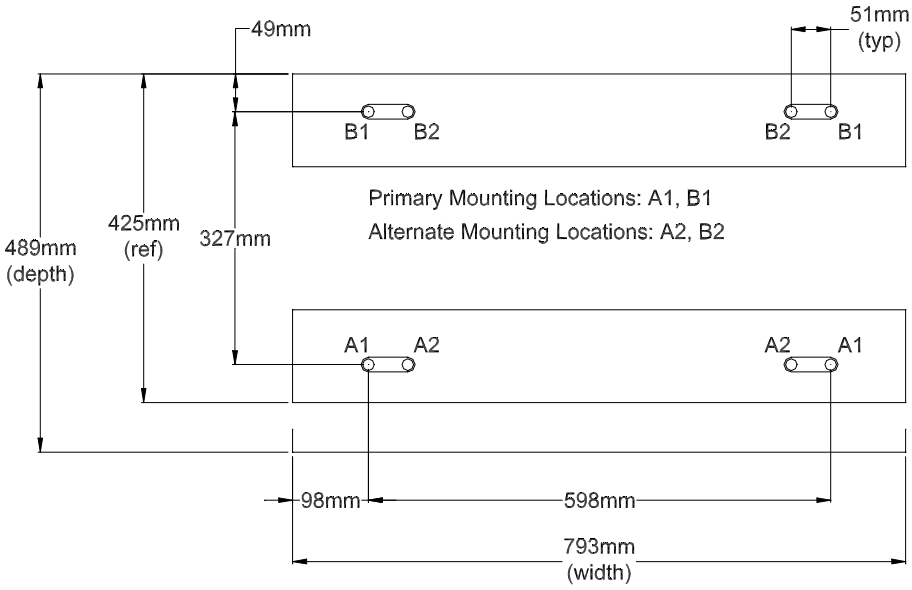


Figure 11-2: Footprint for Standard IR Battery Stand

Cabinet Installation, continued

Mounting Specifications

Table 11-B: GPS Mounting Specifications

Comcode	Anchor Type (HILTI)	Hole Size	Wrench	Torque
847135720	(4) 3/8" drop in	1/2" bit 1-9/16" deep	--	85 in-lbs
847135712	(4) 3/8" self drill	--	--	85 in-lbs

Mounting Plates for Unigy Batteries

Table 11-C: Mounting Plates for Unigy Batteries

Module Type	Capacity 8-hour Rate	Comcode
6A-75-9 3A-75-17 3A-75-19	12V,310Ah 6V, 630Ah 6V, 700Ah	848275509
6A-75-11 3A-75-21 3A-75-23	12V,390Ah 6V, 785Ah 6V, 865Ah	848275517
6A-75-13 3A-75-25 3A-75-27	12V,470Ah 6V, 945Ah 6V, 1025Ah	848275533
6A-75-15 3A-75-29 6A-75-31	12V,550Ah 6V, 1100Ah 6V, 1175Ah	848275558
3A-85-33	6V, 1400Ah	848299673

Note: For the installation of GPS 4804AP Power System on IR125 and Unigy II battery module assembly, refer to Installation Guide for Galaxy Power Systems (Select Code 167-792-157).

Cabinet Installation, continued

Locating and Anchoring Cabinet

Refer to Figure 11-3 for this procedure.

Locating and Anchoring Cabinet	
Step	**Action**
1	Using a drill bit, drill anchor holes to the depths specified in Table 11-B.
2	Locate the cabinet in position using two or four anchor bolts and hold-down washers.
3	Shim under cabinet corners to level.
4	Torque anchors as specified in Table 11-B.

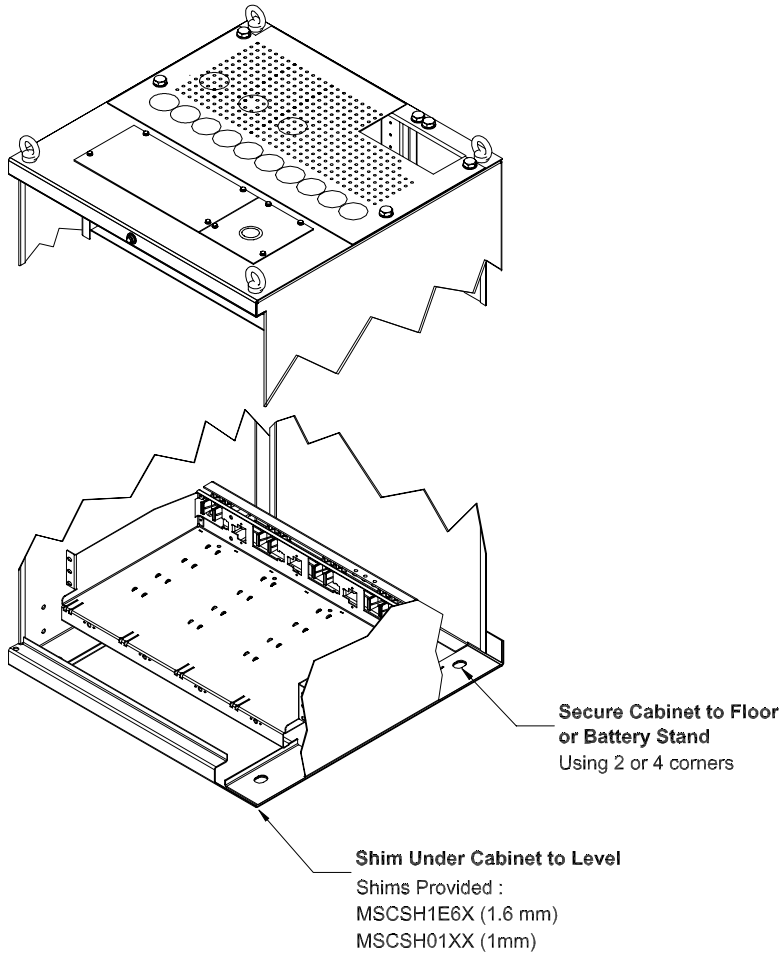


Figure 11-3: Locating and Anchoring Cabinet

Cabinet Installation, continued

Cabinet Ground

Refer to Figure 11-4 for this procedure.

The next step is to ground the cabinet framework. Local grounding practices will determine the grounding method and the size of cable connected to the cabinet. A 2-gauge pigtail, as shown in Figure 11-4, is provided for this purpose.

Cabinet Ground	
Step	**Action**
1	Run and connect the framework ground lead as shown in Figure 11-4.
2	Torque connection as specified in Figure 11-4.

Central Office Ground

Refer to Figure 11-4 for this procedure.

The system ground should be connected to the building's principal ground point (Central Office Ground). The conductor size must conform to local standards. Connection to the power system is through the M10 studs located on the distribution return bus. See Figure 11-4 to locate the studs.

Central Office Ground	
Step	**Action**
1	Run and connect the system ground lead to the cabinet return bus. This connection will connect the return side of the dc system to earth ground.
2	Torque connection as specified in Figure 11-4.

Cabinet Installation, continued

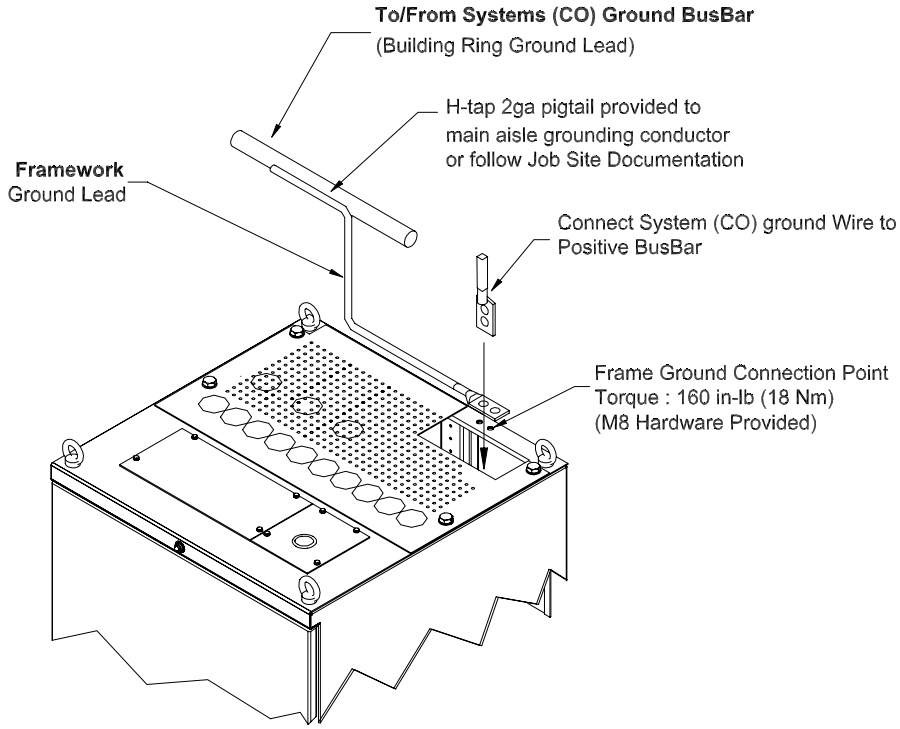


Figure 11-4: Cabinet and Central Office Ground

AC Connection and Wiring

Safety

Read Section 10, *Safety*, carefully before connecting ac to the Galaxy Power System.

596 Rectifiers (48V, 50A)

The 596 rectifiers operate from 208/240Vac power at a frequency of 50/60 Hertz and produce dc output (596A, 48Vdc). The ac power is phase-to-neutral, and shall be within the specified voltage range of the rectifier.

The system supports two ac input schemes:

- A single bulk 4-wire (3-phase + neutral) can be brought into the ac panel located in the cabinet. The panel is factory equipped to have a phase-to-neutral distribution to each rectifier through a single-pole ac circuit breaker.
- A single bulk 2-wire (phase-to-phase or phase-to-neutral) feed can be brought into the ac panel located in the cabinet. The panel is factory equipped to have a phase to neutral or phase to phase distribution to each rectifier through a single-pole ac circuit breaker.

Illustrations

Figure 11-5 illustrates a three phase + neutral AC panel.
Figure 11-6 illustrates a single phase + neutral AC panel.
Figure 11-7 shows the rectifier positions and numbering scheme.
Table 11-D shows the lug requirement for the AC terminations.

AC Cable Routing

⚠ **Caution: Follow all local codes and practices when performing the steps to connect ac to the power system.**

AC Cable Routing	
Step	**Action**
1	Clearly label the main ac circuit breaker panel, stating that installers are working in the ac cabling.
2	Check that all ac circuit breakers are turned OFF.
3	Route the ac cables to the cabinet as required by local building codes.
4	At the cabinet, route the ac cables through the access hole(s) in the top of the cabinet. The ac box extender can be used to create more cabling space.
5	Install terminal lugs (if applicable) to cables.

AC Connection and Wiring, continued

Completing the AC Connection

Completing the AC Connection	
Step	**Action**
1	Terminate earth ground to the appropriate termination point. Terminate lines 1, 2, 3, and neutral to the appropriate termination points.
2	Verify that there are no shorts or bad contacts in the service cables.
3	Turn the main ac circuit breaker ON.
4	Use an ac voltmeter to check that the proper phase-to-phase or phase-to-neutral ac voltage is present at the input to the ac panel.
5	Replace the ac panel front cover. If the ac panel is equipped with rectifier circuit breakers, mark the ac panel front cover label with rectifier position numbers (they may already be factory-marked). See Figure 11-7.
6	**Do not** turn the rectifier circuit breakers ON.
7	Turn OFF the main ac circuit breaker.

Table 11-D: Cable Size and Termination Lug Requirements

AC Connection	Recommended Cable Size	Recommended Lug Description
Three Phase + Neutral Connection	25 Sq.mm Copper Flexible cable	25 Sq.mm Single hole Lugs
Single Phase + Neutral Connection	75 Sq.mm Copper Flexible cable	75 Sq.mm Single hole Lugs

AC Connection and Wiring, continued

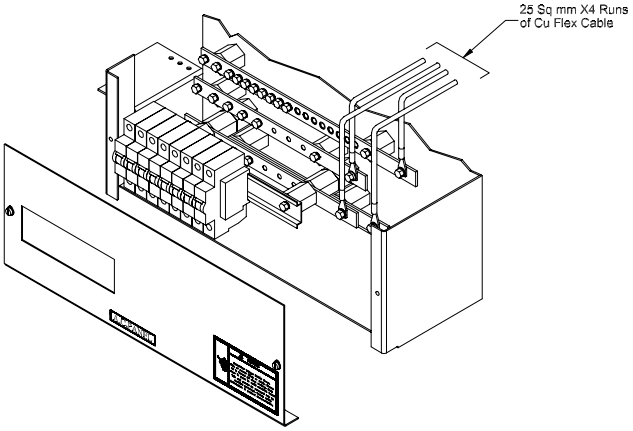


***Figure 11-5: AC Panel (Three Phase)
for GPS 4804AP Power System***

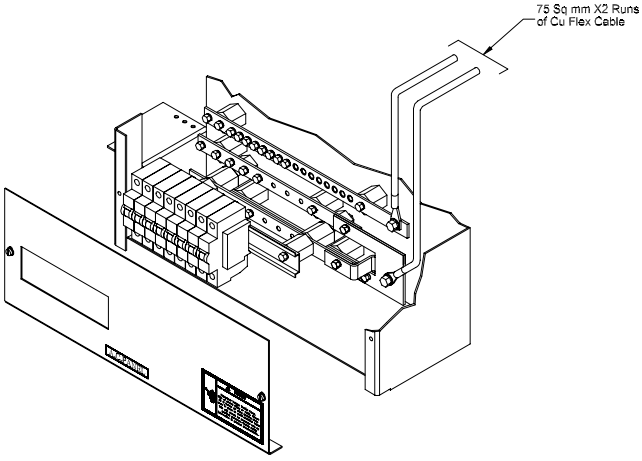


***Figure 11-6: AC Panel (Single Phase)
for GPS 4804AP Power System***

Addition of Second Rectifier Shelf at Site

⚠ Caution: Use only insulated tools for mounting the rectifier shelf. Do not short/touch bus bars.

Mounting Second Rectifier Shelf	
Step	**Action**
1	Switch OFF the AC Supply to the cabinet. Verify that no AC voltage is available to the bay before proceeding any further. Battery DC Voltage will be available in the cabinet.
2	Assemble the rectifier shelf support (two) on the rear left and right side, 13th hole from the bottom of the cabinet using fasteners 901078717.
3	Assemble the Keying bracket (one) on the front left and right side, 11th and 12th hole from the bottom of the cabinet using fasteners 901078717.
4	Assemble bus bar links, BBPTHDRXX and BBPTHDLXX (bus bars connecting rectifier shelf the cabinet bus bars) to the rectifier shelf using fasteners SCM08H25X (M8 x 25 Bolt)
5	Place the rectifier shelf in the cabinet aligning with the help of Keying bracket and the two supports at the back of the cabinet. Once the shelf is aligned, secure the shelf to the cabinet using fasteners, 901078717. Note: Ensure that no damage happens to the cable assembly pre-wired to the rectifier shelf.
6	Connect the rectifier shelf bus bars to the cabinet bus bars using M8 x 25 fasteners (SCM08H25X). Ensure to use plain and spring washers when connecting the bus bars. Torque as per Table 11-A
7	Remove the AC Panel Cover
8	Route the AC connection cables parallel to the cables routed from the bottom shelf. Secure the cables with the help of cable ties and tie mounts provided. Note: Avoid routing the cables over sharp bends and corners.

Continued on next page.

Addition of Second Rectifier Shelf at Site, continued

Mounting Second Rectifier Shelf, continued	
Step	**Action**
9	Terminate the cables to the bus bar in the AC panel and the miniature circuit breakers as follows All Black Cables: Neutral Bus Bar Red Cable: Breaker 5 output Yellow Cable (No ferrule): Breaker 6 output Blue Cable: Breaker 7 output Yellow Cable (Ferrule Number 4): Breaker 8 output
10	Connect the controller interface cable to the in line connector JK 555052-2 (407671163) on the bottom rectifier shelf.
11	Ensure that all the cable terminations are secure and properly terminated.
12	Stick the rectifier number labels starting from left to right, as shown in Figure 11-7.

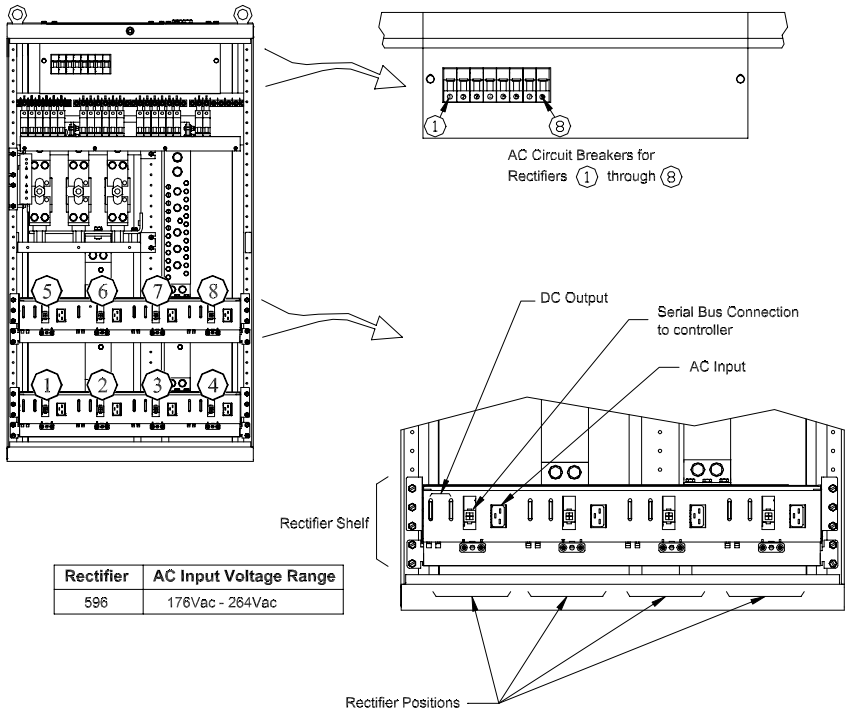


Figure 11-7: Rectifier Position and Numbering Scheme

Addition of Second Rectifier Shelf at Site, continued

Rectifier Shelf Kit

Comcode	Description	Quantity
YDRS4812X, YHACCAHH2	Rectifier shelf with AC Cable assembly.	1 set
407671163	Inline Connector JK555052-2	1
901078717	Self taping Screw	12
SCM06H142	6mm Captive screw	6
SCM08H25X	M8X25 Bolt	4
WAM08PXXX	M8 plain washer	4
WAM08SXXX	M8 Spring Washer	4
MSPCT150N	Cable Tie 150mm	8
BBPTHDRXX	Bus bar link Rect. Shelf	1
BBPTHDLXX	Bus bar link Rect. Shelf	1
	Rectifier Position Label	1

DC Distribution Assembly and Connections

DC Distribution Panels

DC (load) distribution panels offer circuit breakers (DIN styles). Circuit breaker panels have protectors from 1 – 225 amperes to satisfy a wide range of distribution needs.

Panels are available with a low voltage load disconnect (LVLD) contactor for load-shedding applications.

DC distribution panel is equipped with an alarm card that monitors and communicates to the controller any operated circuit breaker and provides a visual LED that indicates an operated protector.

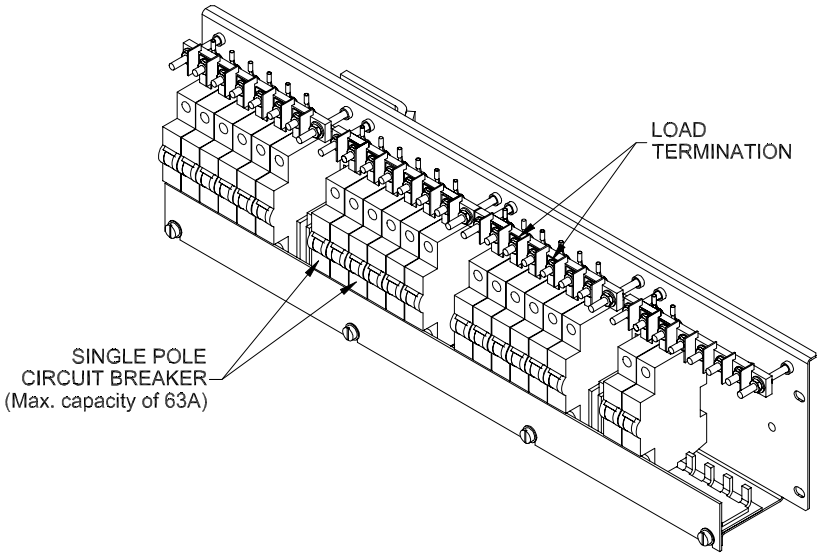


Figure 11-8: 24 Position (DC Distribution) Circuit Breaker Panel for GPS 4804AP

Connecting Loads

Cable Routing Strategy

As with any power system, cabinet positioning with respect to cable racks, batteries, and the ac service is very important in order to ensure easy installation, proper maintenance, and graceful growth of the system in the future.

Cabinet is arranged to separate ac leads from dc leads to minimize electrical noise transmitted to the load. Run ac cable in an ac conduit mounted above the front of the cabinet. Route dc leads along a cable rack above the back of the cabinet.

Large Circuit Breakers

The circuit breakers of higher capacity using three poles in parallel need a shorting link, which is used to short the three poles of the circuit breaker. The output dc cable is connected to the shorting link.

⚠ **Caution: Turn OFF breaker before beginning procedure.**

Connecting Load Termination Cables

Connecting Load Termination Cables

Step	Action
1	Install alarm wires and load shunt wires to panel. (if not pre-wired). Plug cable onto the output receptacle on the panel.
2	The circuit breakers are generally mounted to the dc distribution panel. Connect the output cable to the output of the circuit breaker with the pre-installed hardware. In case the breaker is not installed, refer to installation of breaker.

Connecting Loads, continued

Installing a Miniature Circuit Breaker

Installing a Miniature Circuit Breaker

Step	Action
1	Remove the insulator protective cover mounted at the bottom of the dc distribution.
2	Remove the tooth provided in the dc distribution panel of the cabinet from the position where a new circuit breaker is to be mounted.
3	Connect this tooth to the output of the circuit breaker required to be added to the system and tighten with the in built fasteners in the circuit breaker.
4	Now place the circuit breaker in the dc distribution panel as shown in Figure 11-9 and tighten the circuit breaker using the circuit breaker fasteners (in built).
5	Connect the output tooth (connected as per 1) to the dc distribution.
6	Activate the corresponding DIP Switch on the distribution alarm circuit pack.
7	Terminate the load cable from the dc distribution as earlier described.

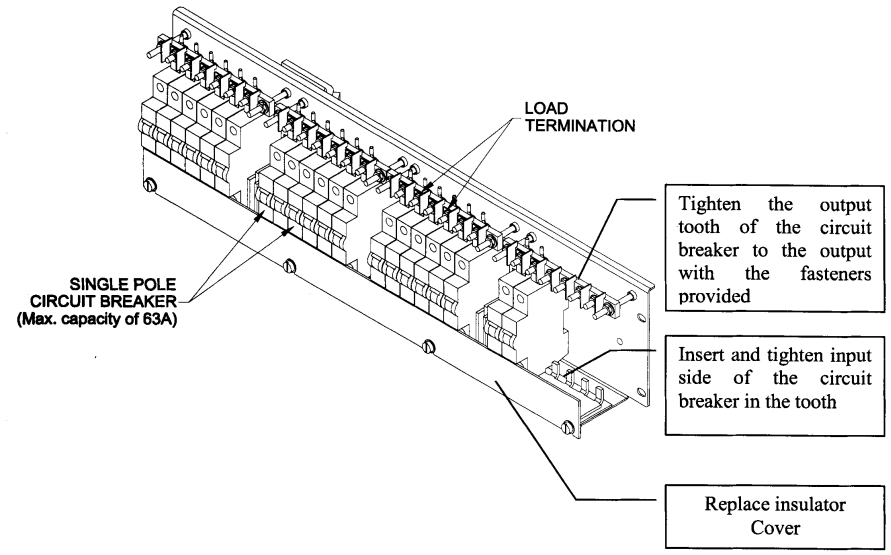


Figure 11-9: Inserting a Circuit Breaker in the DC Panel

Low Voltage Disconnect Feature

Alarm Card

If the dc distribution panel is equipped with a low voltage load disconnect (LVLD) feature, the alarm card provided in the system is used to operate the load contactor. The voltage levels will be set during the controller setup. Refer to Chapter 8, *Circuit Boards* for operation details.

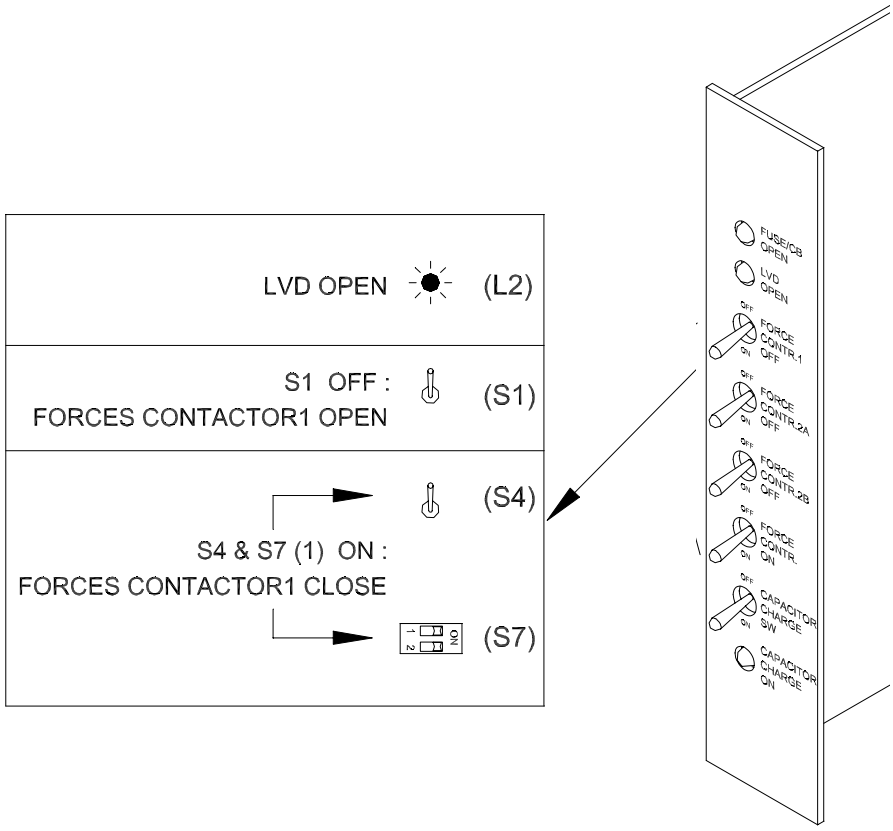


Figure 11-10: Switch Positions for Controlling Low Voltage Load Disconnection

Remote Peripheral Monitoring

Note: The Remote Peripheral Monitoring feature is not available on the Galaxy Vector Controller.

Introduction

The Remote Peripheral Monitoring measurement and control modules provide data acquisition and control functions for today's power environment. System capacity is added in a modular fashion with measurement modules and control modules. Each measurement module consists of six input channels and one temperature channel. A control module provides three separate control relays. The modules, which communicate back to the controller, are physically connected in a daisy-chain bus configuration. The user can program various alarm and control functions with the modules when used with a Galaxy controller.

Connection Units

Two types of connection units are available for various module types. Table 11-E shows the module types and the corresponding connection units.

Table 11-E: Connection Units

Module Type(s)	Module Code(s)	Connection Unit Comcode
Voltage	221A/B/C/D	847635851
Shunt	221F	
Transducer	221J	
Binary	222A	
Temperature	223T	
Control Relay*	214A	847629342
*For the 214A Control Relay Module, the maximum relay contact voltage is 110Vdc and maximum current is 0.3Adc. Wiring depends on the voltage, current, local building codes, and various other characteristics of the controlled point.		

Current Limiting Resistors

Current limiting resistors (100K-ohm) are required for the measurement inputs of the voltage, current, and binary modules. Comcode 847540424 current limiting resistor assemblies are available for connections that do not already have them. All shunts (load and battery) and some voltage points that are provided with the GPS cabinet already have current limiting resistors.

For the 214A Control Relay module, the maximum relay contact voltage is 110Vdc and maximum current is 0.3Adc. Wiring depends on the voltage, current, local building codes, and various other characteristics of the controlled point.

Remote Peripheral Monitoring, continued

RPM Installation

RPM Installation

Step	Action
1	Make required equipment connections (except for the temperature input) to the connection units as shown in Figures 11-11 and 11-12. Correct polarity must be maintained. Cable length should not exceed 100 ohms per wire.
2	Route the wires connected to the module through the open-faced bottom of the connection unit. Place a cable tie through the opening at the bottom of the connection unit and around the connected wires for strain relief. (See Figures 11-11 and 11-12.)
3	In the connection units, TB102 is used for communications input/output. Use shielded twisted pair cable (comcode 407377704) to wire the communications bus as shown in Figure 11-13. Polarity is not essential for the input/output communications bus wiring (except for shield).
4	To verify that no shorts exist between any of the three cable connections (blue, white, or shield) on the final bus module, place a terminating resistor (560 ohm, comcode 405298308) in the socket of the final bus module for each of the three buses. Measure the resistance across the blue and white wires of the module containing the terminating resistor. The resistance measurement should be in the range of 560-600 ohms.

Continued on next page.

Remote Peripheral Monitoring, continued

RPM Installation, continued

Step	Action
5	Using a jeweler's screwdriver, set the address on each module before it is attached to the connection unit. (See Figure 11-14.) Secure each module to the connection unit with the two clips provided. Write the connected equipment description and module address on the label on the front of the module. ⚠ **Caution** **Each module requires a unique address for proper communications between the module and controller. All addresses are valid except 00. No two modules should have the same address! The unique address is set via two switches (SW1 - Hi and SW2 - Low) located on the Peripheral Monitoring module. The switch display numbers/letters are in hexadecimal. For example:** **SW1-Hi = D** **SW2-Low = 8** **(The HEX address is D8)**
6	Connect from the first module back to the controller interface circuit pack as shown in Figure 11-13. Wrap each bus wire twice through one of the supplied 406712968 inductor beads prior to its termination at the controller. Note: Use only one inductor bead for each bus.
7	Using the circuit pack installation guide corresponding to the Galaxy controller, install the bus controller circuit pack. Follow instructions provided in the controller documentation for initiating communications between the controller and the modules.

Remote Peripheral Monitoring, continued

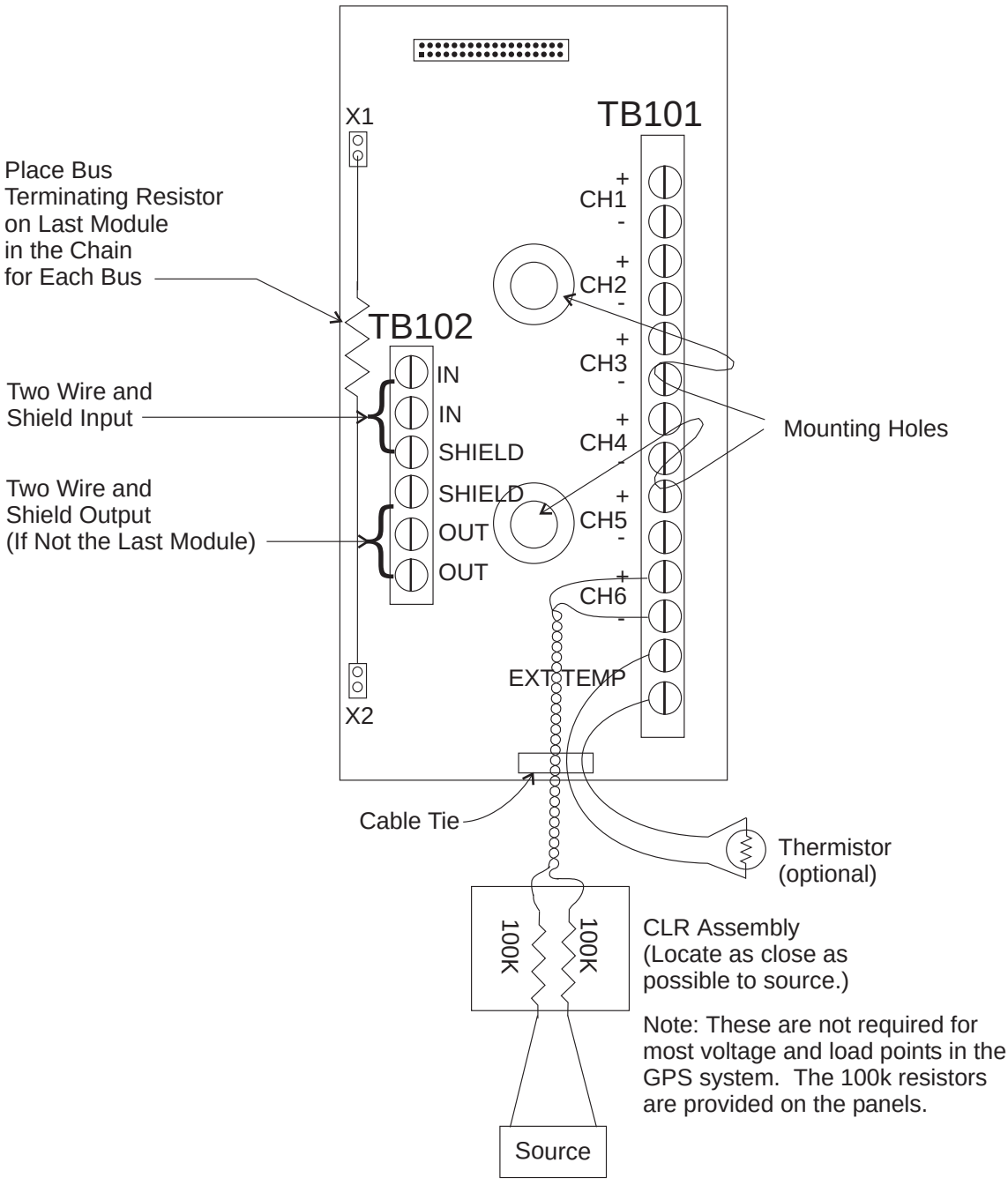


Figure 11-11: Connection Unit 847635851 (for all Modules Except Control Relay)

Remote Peripheral Monitoring, continued

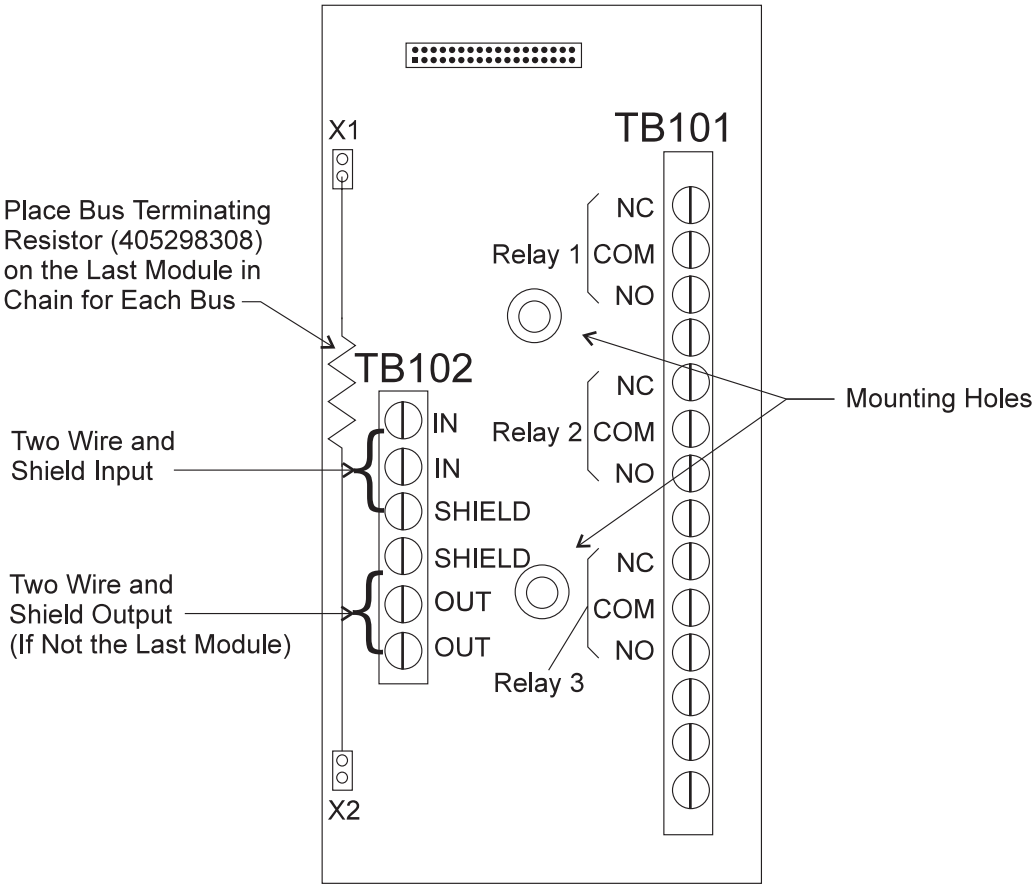
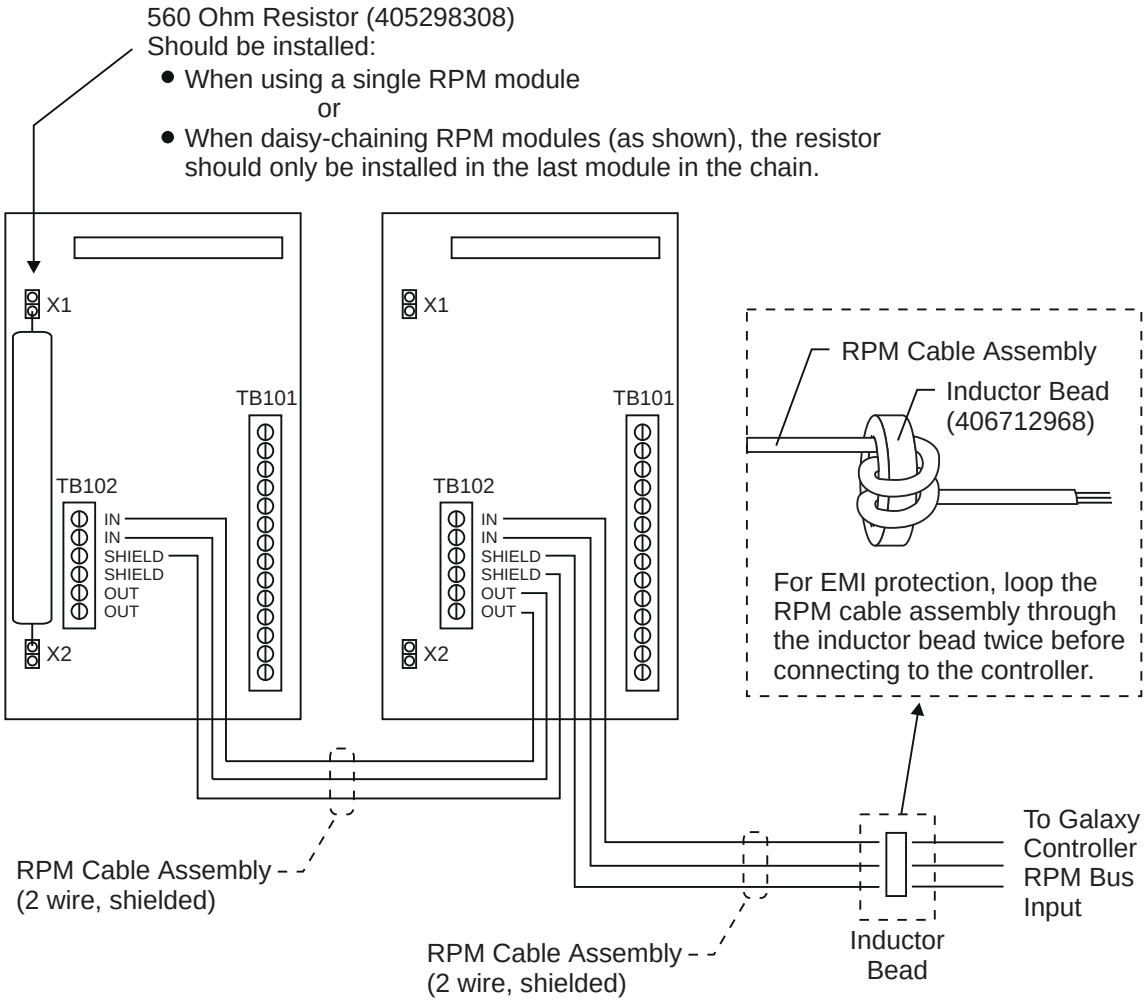


Figure 11-12: Connection Unit 847629342 (for Control Relay Module Only)

Remote Peripheral Monitoring, continued



- Up to 95 RPM modules can be daisy-chained on a single bus as shown.
- Maximum bus length, from the controller to the last RPM module in the chain, is 300 meters.

Figure 11-13: Connection to the Controller (All Modules)

Remote Peripheral Monitoring, continued

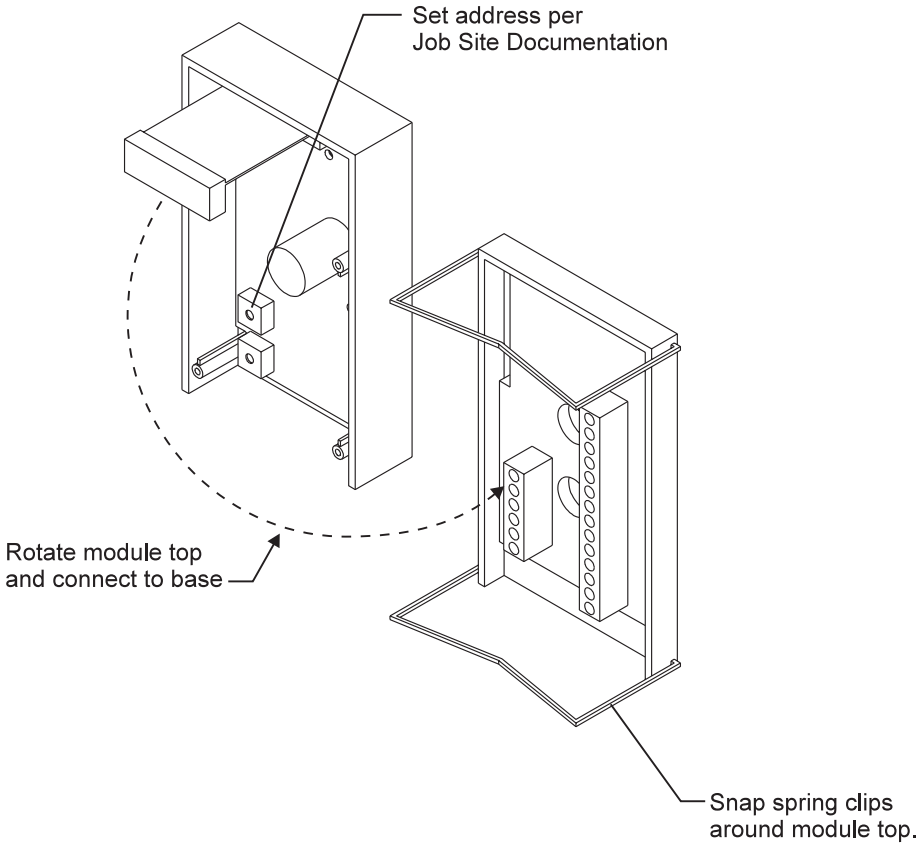
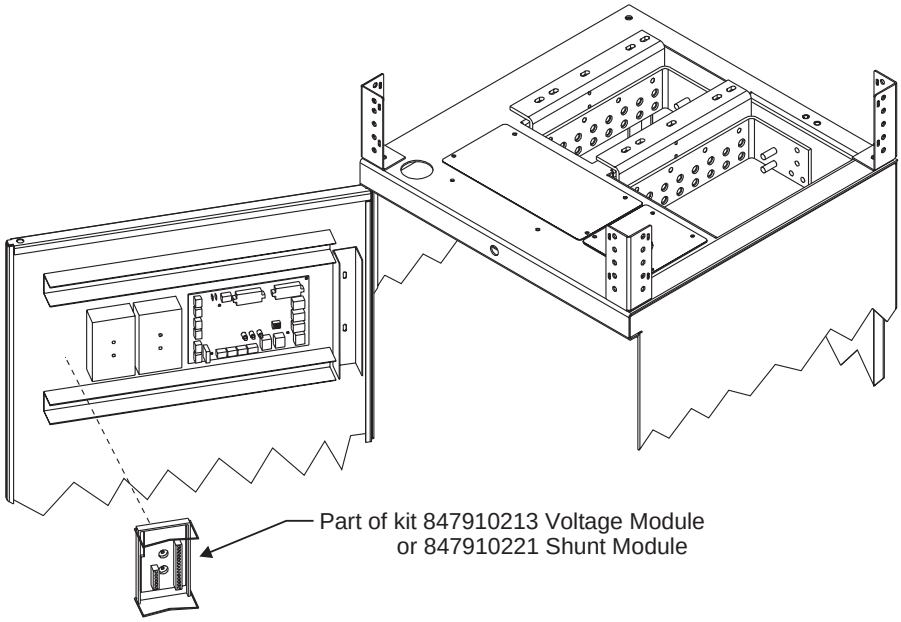


Figure 11-14: Remote Peripheral Monitoring Module Assembly

Remote Peripheral Monitoring, continued

Mounting Locations

Figure 11-15 shows possible mounting locations for the RPMs.



RPM Kits
847910213 ACU221C Kit, 0-60Vdc Voltage Peripheral Monitoring Module
847910221 ACU221F Kit, Shunt Peripheral Monitoring Module

Kits consist of:
One 847635851 RPM Base
Two 900633504 Hex Nuts
One 847910239 Communication Cable (20 ft.)
One ACU221C or ACU221F Module

Figure 11-15: Possible RPM Mounting Locations

Battery Connection Panels

Overview

Battery strings or sections may be connected to the cabinet through contactors and a shunt. The shunts in each battery connection are required to obtain a system load reading.

The contactors are equipped with alarm cards that report back to the controller if the battery section is taken off the system bus. Charge and discharge current can be read from the front panel of the Galaxy controller when battery section shunts are properly wired and programmed. Disconnect voltage levels on contactor panels are controlled by the Galaxy controller.

Options

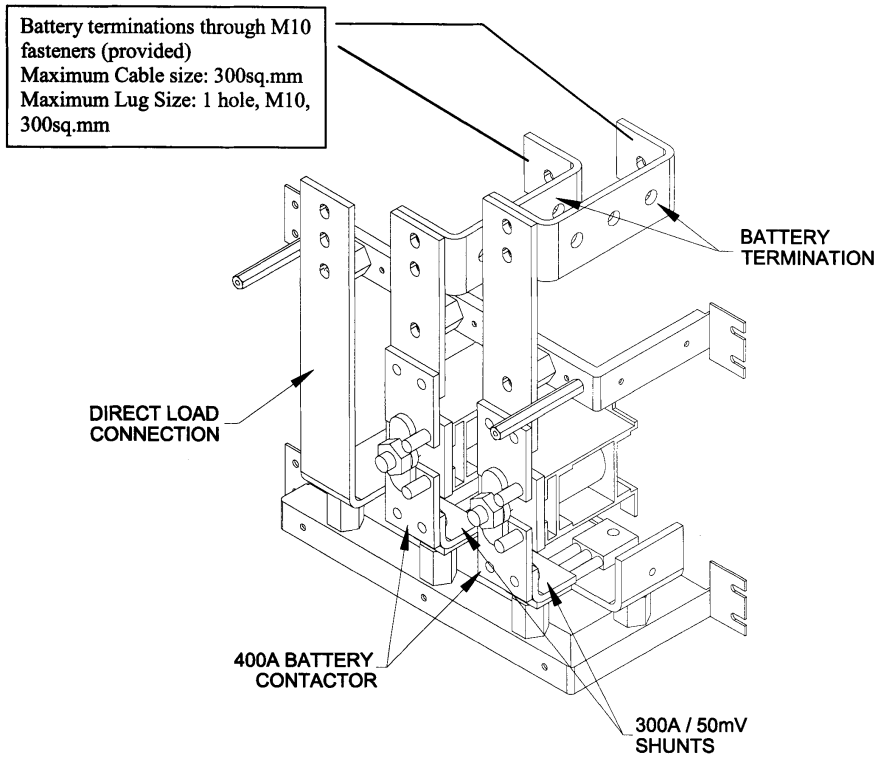


Figure 11-16: LVD (Battery) Panel with 2 x 400A Battery Contactors

Battery Connection Panels, continued

Options, continued

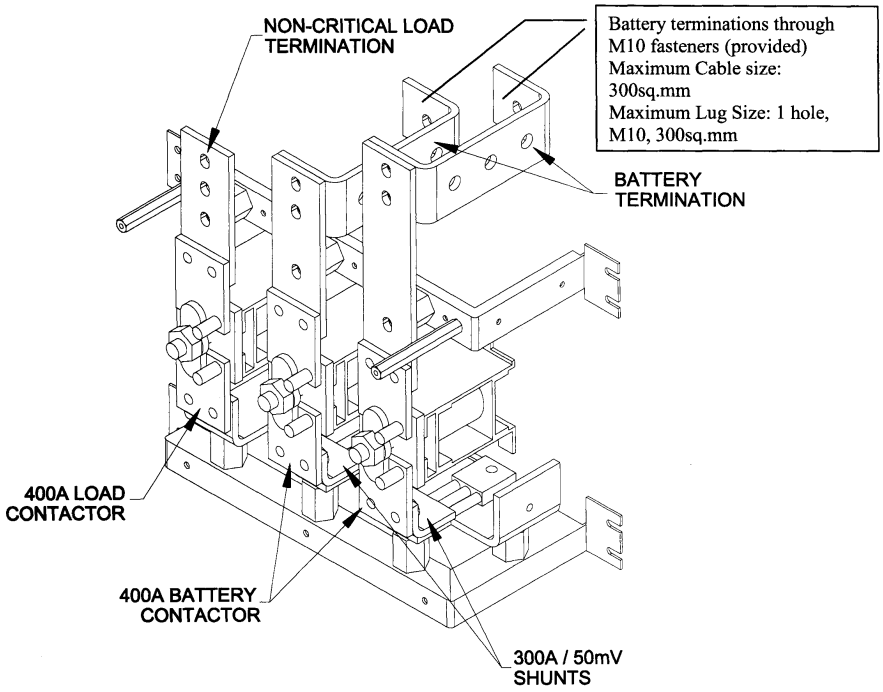


Figure 11-17: LVD (Battery) Panel with 2 x 400A Battery Contactors and 1 x 400A Load Contactor

Battery Connection Panels, continued

Options, continued

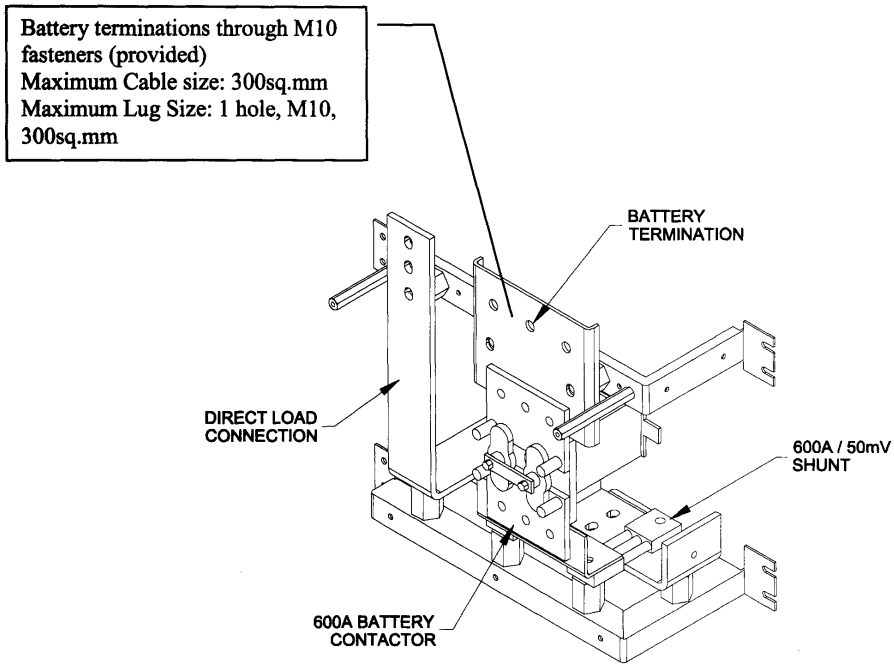


Figure 11-18: LVD (Battery) Panel with 1 x 600A Battery Contactor

Battery Connection Panels, continued

Options, continued

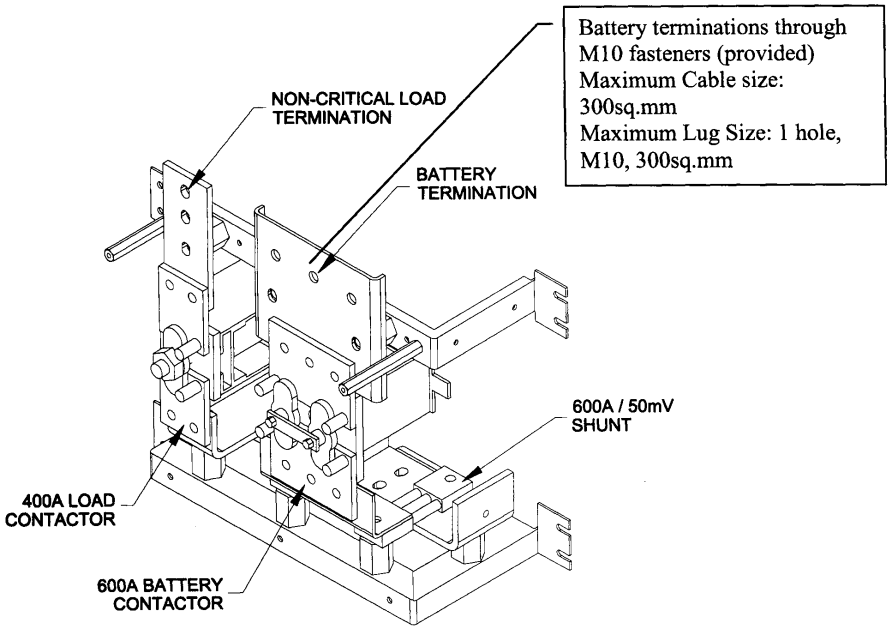


Figure 11-19: LVD (Battery) Panel with 1 x 600A Battery Contactor and 1 x 400A Load Contactor

Battery Connection Panels, continued

Connecting (+) and (-) Conductors

Battery (-) conductors are connected to the exposed bus bar ends of the battery contactors. Battery (+) conductors are connected to the battery return bus. See Figure 11-16 to Figure 11-19 to locate the battery connection panels.

Installing Battery Connection Panels

For all battery connection panels, connect the first wire lead towards the back of the cabinet.

Installing Battery Connection Panels

Step	Action
1	Before making any battery connections: a. Verify that the battery fuses and alarm fuses are not installed. b. If the panel is equipped with contactors, place the forced-off switches on the Alarm board in the forced **OPEN** position. See Figure 11-20.
2	Verify that all ac and dc protectors are **OFF**.
3	Terminate the appropriate conductors with terminal lugs as required. Use heat shrink insulating sleeves over any exposed lug shanks as necessary.
4	Connect the cabinet end of the battery cables to the contactors and return bus. Next connect the battery end of the cables. Tape the terminal lugs as required for safety during installation. If a battery contactor is not being used to keep the batteries off the bus, do not connect the leads at the batteries.
5	Use a dc voltmeter to check the voltages at the contactors, battery bus, and return bus. **Verify the polarity.**
6	If the battery connection panel is equipped with contactors, do not place the forced-off switches on the Alarm board in the **NORMAL** position at this time. See Figure 11-20.
7	Refer to the Alarm Card in *Section 8, Circuit Boards* for operation of the Alarm card for control of the contactors.

Battery Connection Panels, continued

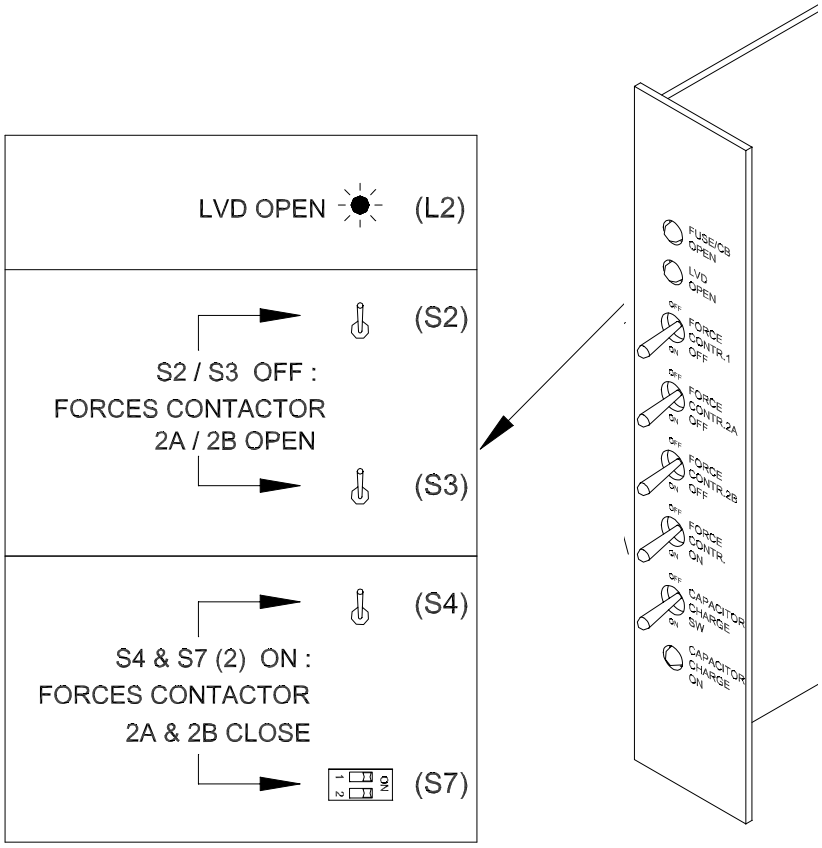


Figure 11-20: Switch Positions for Controlling Low Voltage Battery Disconnection

Thermal Probe Connections

In This Section

This section provides procedures for installing thermal probes or 210E Thermal Probe Multiplexer modules through the BLJ board in SCF, Millennium, and Vector controller systems.

Safety

Galaxy Power Systems must be installed, serviced, and operated only by skilled and qualified personnel who have the necessary knowledge and practical experience with electrical equipment and who understand the hazards that can arise when working on this type of equipment. Refer to the controller manuals for additional connections.

⚠ Caution

Wear grounded antistatic wrist straps when installing thermal probes or 210E modules. The wrist strap must contact the skin and is not to be worn over clothing.

Making Connections

Thermal monitoring connections to the controller are made through the BLJ board located on the cabinet door. Cables are then routed to the lower cable guide as shown in Figure 11-21, then to thermal probe locations or to externally located 210E modules.

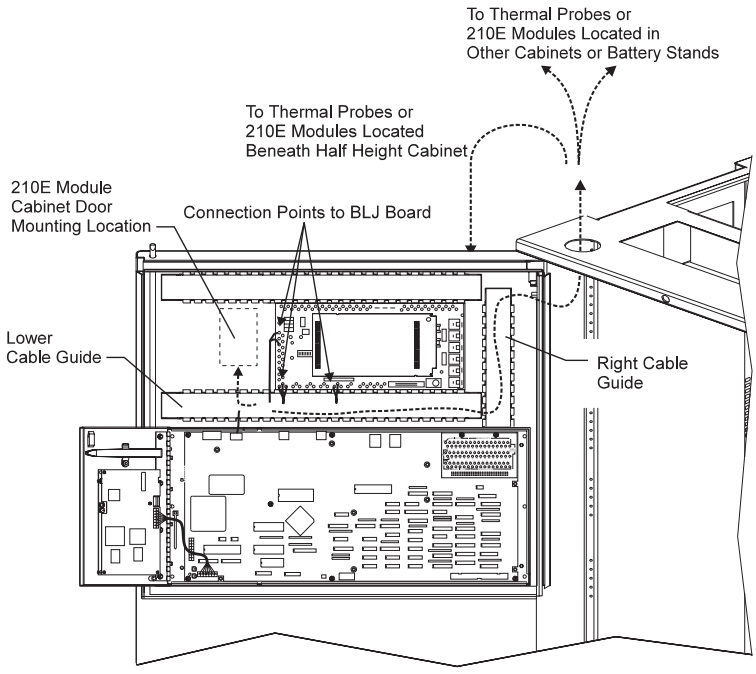


Figure 11-21: Thermal Probe and 210E Cabling Routing

Thermal Probe Connections, continued

Connecting Thermal Probe Cable Assembly to a BLJ Board

This procedure is for connecting the Thermal Probe Cable Assembly to the BLJ board. If installing 210E modules, skip to "*Connecting a 210E* Module to a BLJ Board."

- One thermal probe can be connected to Millennium or SCF systems (through the BLJ board).
- Up to four thermal probes can be connected to Vector systems (through the BLJ board).

Connecting Thermal Probe Assembly to a BLJ Board	
Step	**Action**
1	Connect Thermal Probe Cable Assembly (847307410 – 10 feet (3 meters) or 848314563 - 16 feet (4.88 meters) to the BLJ Board. Use a piece of small gauge wire (26-22 gauge) to make the enable strap connection.
2	Proceed to "Connecting Thermal Probe Cable Assembly to Ring Type or Paddle Type Probes."

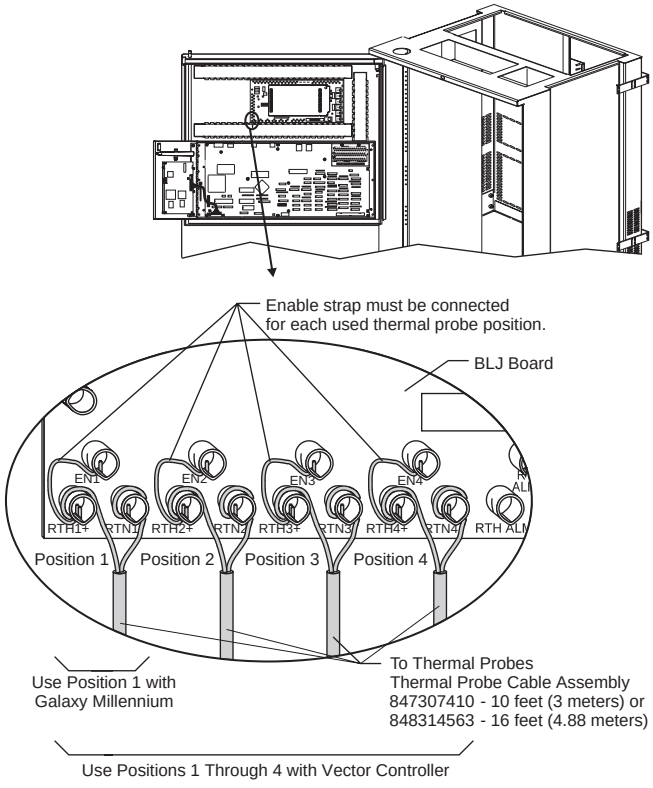


Figure 11-22: Thermal Probe Cable Assembly Connection to BLJ Board

Thermal Probe Connections, continued

Connecting a 210E Module to a BLJ Board

Thermal probes can be connected to a 210E module that will monitor the temperature of the probes and provide the highest temperature to its output.

- One 210E module can be connected to Millennium or SCF systems (through the BLJ board).
- Up to three 210E modules can be connected to a Vector system (through the BLJ board).
- Each 210E module requires two connections to the BLJ board (see Figure 11-23):
  - The Power Cable Assembly 847900180 supplies fused system voltage to the 210E module. Connection is made to the ABS and DG terminals of the BLJ board. Multiple ABS and DG terminals are available as required.
  - The Alarm and Signal Cable Assembly connects to the BLJ board using cable assembly 848302048 - 8 feet (2.4 meters).

Note: The order of connections is not important, but it should be noted that alarms will be generated if a 210E module is connected to the controller and powered up with no thermal probes connected.

Connecting a 210E Module to a BLJ Board	
Step	**Action**
1	Connect the Power Cable Assembly (847900180) to the ABS and DG terminals of the BLJ Terminal Board. See Figure 11-23.
2	Connect the Alarm and Signal Cable Assembly (847157674) to the BLJ board using cable assembly 848302048. See Figure 11-23. Note: The length of the 848302048 cable assembly is 8 feet (2.4 meters). The cable assembly can be cut to a shorter length if mounting the 210E module on the bay door.

Continued on next page.

Thermal Probe Connections, continued

Connecting a 210E Module to a BLJ Board, continued

Connecting a 210E Module to a BLJ Board, continued	
Step	**Action**
3	Connect cable assembly to 210E module. Refer to Figure 11-24.
4	To connect the cable assembly to thermal probes, proceed to "Connecting Thermal Probe Cable Assembly to Ring Type or Paddle Type Probes."

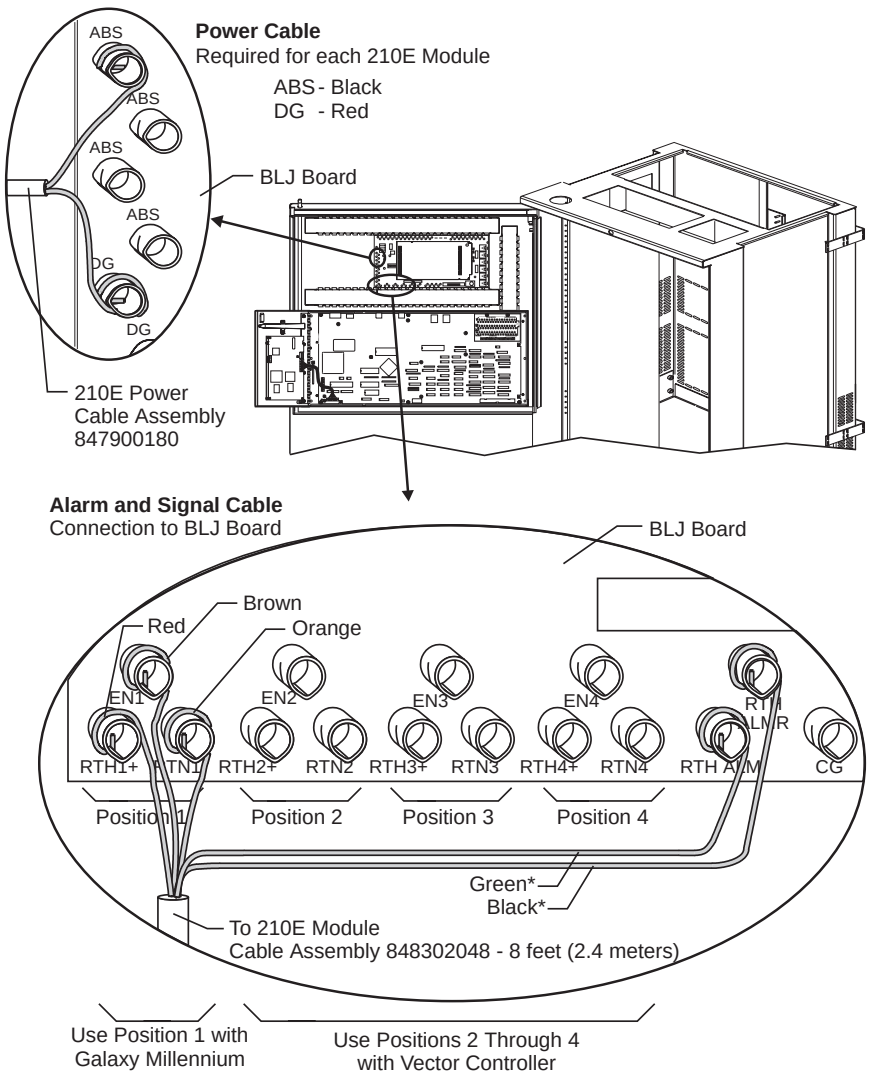


Figure 11-23: 210E Cable Connections to BLJ Board

Thermal Probe Connections, continued

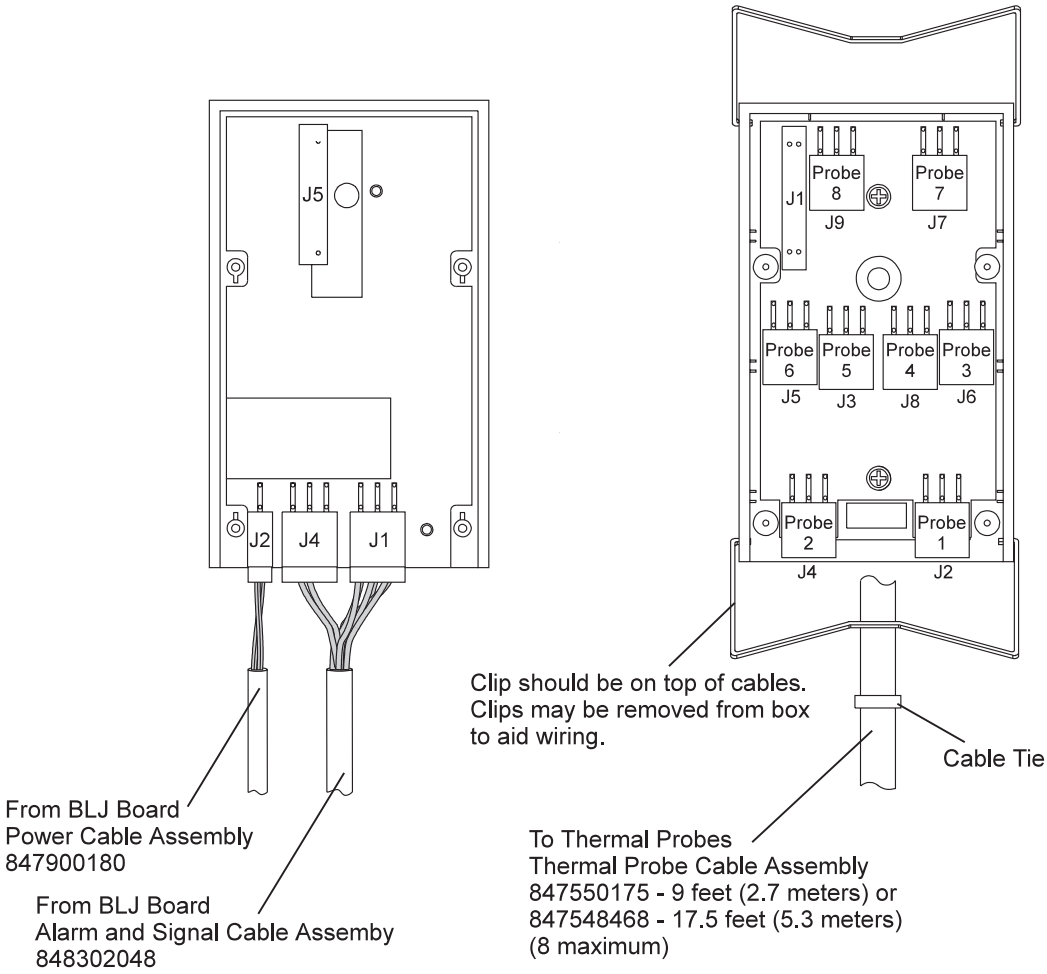


Figure 11-24: Cable Connections to 210E Module

Thermal Probe Connections, continued

Connecting Thermal Probe Cable Assembly to Ring Type or Paddle Type Probes

This procedure is for connecting the thermal probe cable assembly to thermal probes.

Two types of thermal probes are currently available (see Figure 11-25):

- Ring type, which connects directly to a battery terminal
- Paddle type, which is inserted between adjacent batteries

Connecting Thermal Probe Cable Assembly to Ring Type or Paddle Type Probes	
Step	**Action**
1	Connect cable to ring type or paddle type probes. See Figure 11-25.

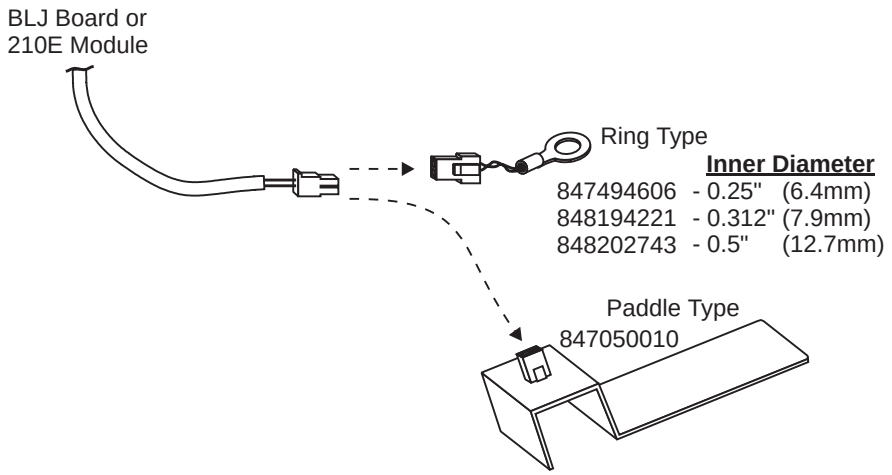


Figure 11-25: Thermal Probe Connection

Connection of Office Alarms

This section explains the installation procedure to connect the office alarms.

Connecting Office Alarms	
Step	**Action**
1	Choose the appropriate illustration from the following list • Figure 11-26: Galaxy Millennium Controller with Barrel Terminal Alarm Board • Figure 11-27: Galaxy Millennium Controller with Wire Wrap Alarm Board • Figure 11-28: Galaxy Vector Controller with Barrel Terminal Alarm Board
2	Route wires (installer provided, 22-gauge maximum) from the office alarm block back to the controller by following the numbered sequence of the steps on the illustration

Connection of Office Alarms, continued

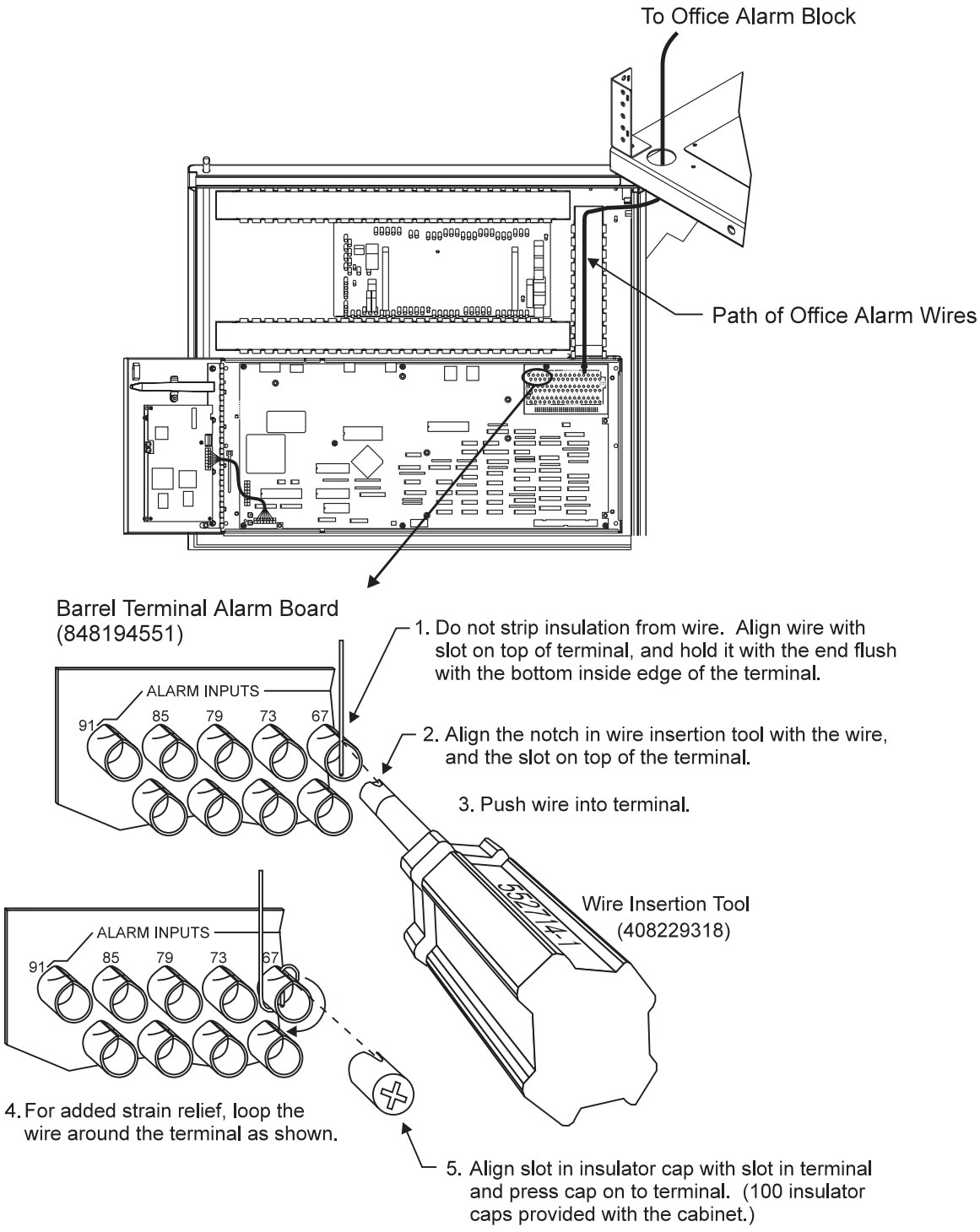


Figure 11-26: Galaxy Millennium Controller with Barrel Terminal Alarm Board

Connection of Office Alarms, continued

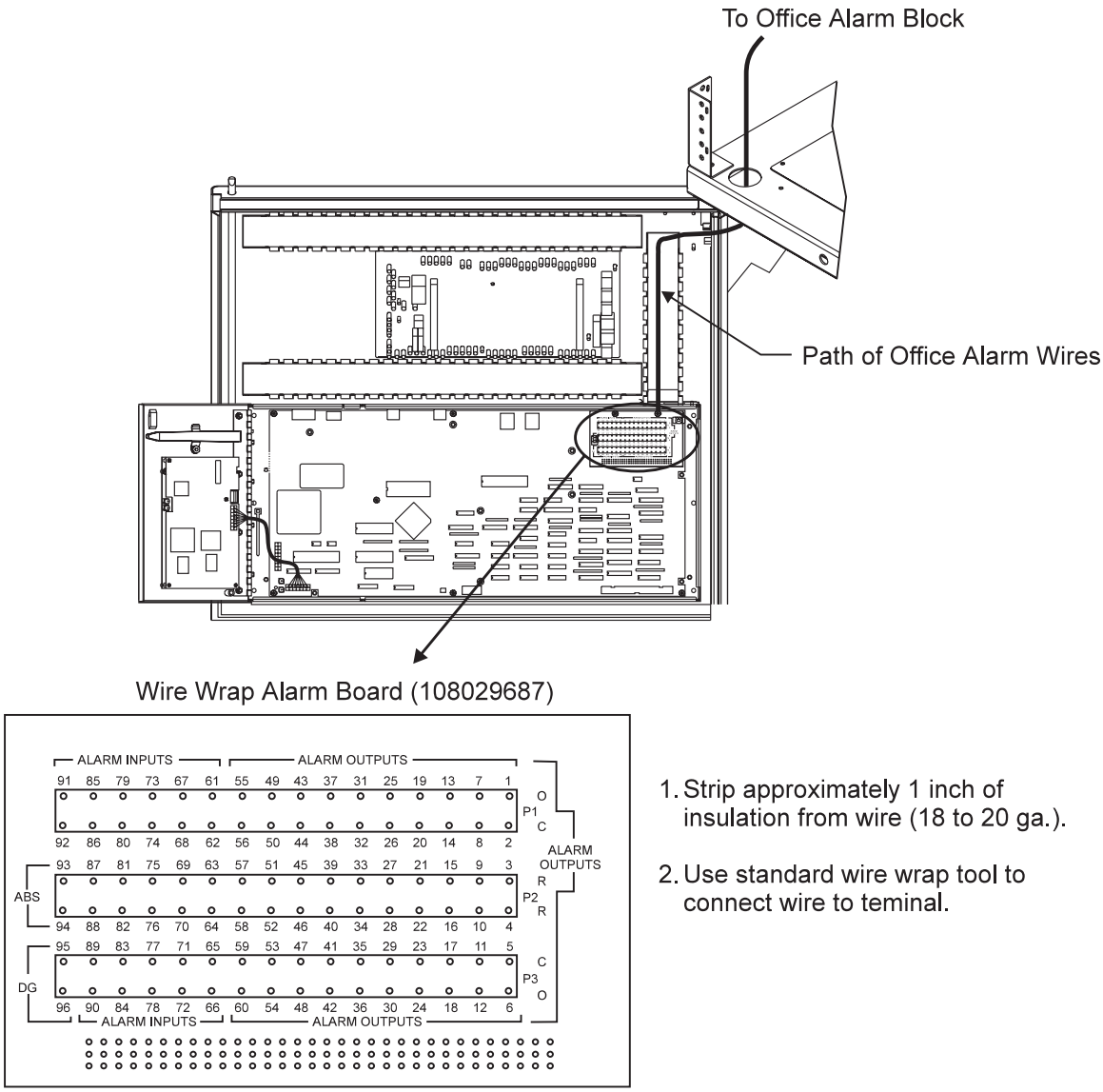


Figure 11-27: Galaxy Millennium Controller with Wire Wrap Alarm Board

Connection of Office Alarms, continued

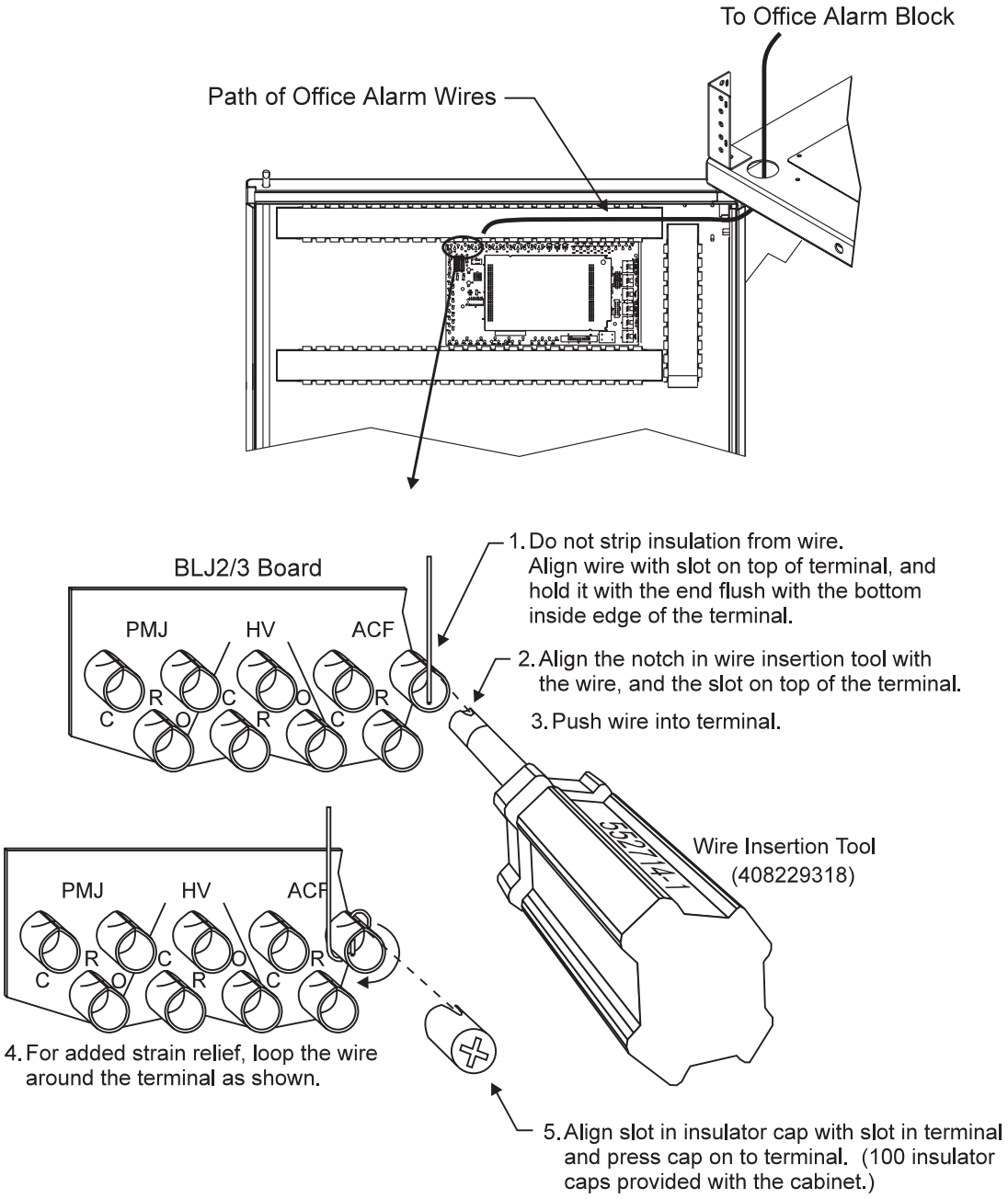


Figure 11-28: Galaxy Vector Controller with Barrel Terminal Alarm Board

Power Up and Installation Completion

Initial System Checkout and Preparation for Power Up

Prior to installing converters (if equipped) and rectifiers, verify that the correct ac voltage is present at the ac connectors in the rectifier shelves.

Note: Disregard if this was done as part of the AC Connection and Wiring procedure.

Some of the following procedures are performed while ac voltage is present at the cabinet; **exercise extreme caution** and observe all precautions described in the safety section of this product manual.

Refer to the following figures for illustrations of the controller front panels:

Figure 11-29: Vector
Figure 11-30: Millennium

Power Up and Installation Completion, continued

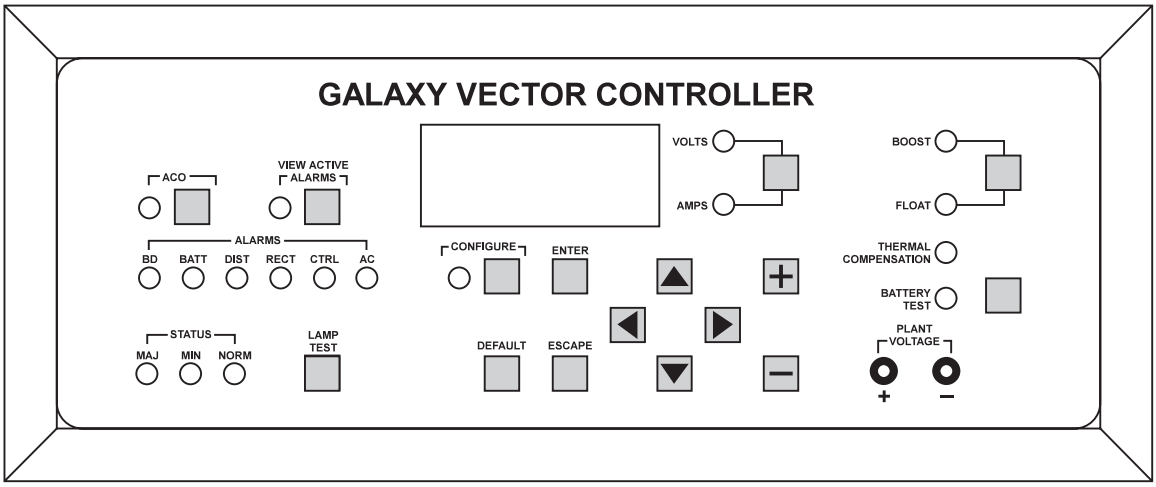


Figure 11-29: Galaxy Vector Controller Front Panel

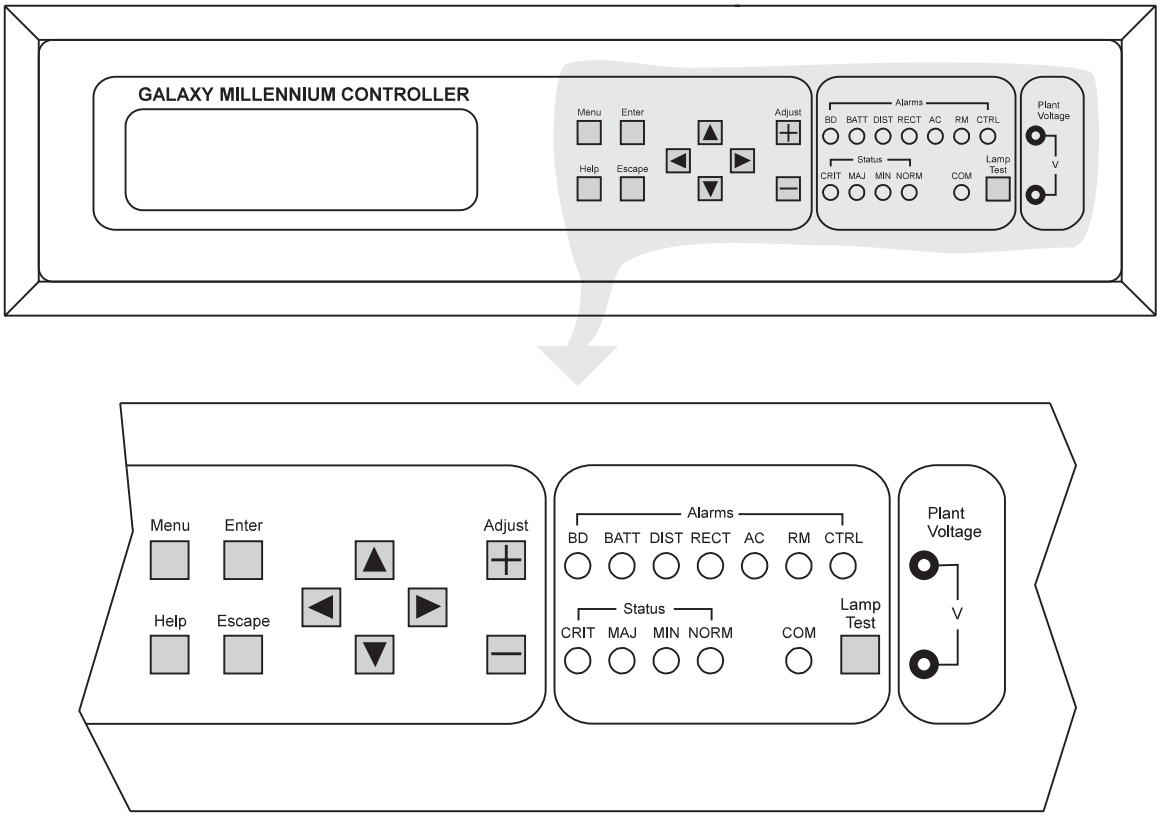


Figure 11-30: Galaxy Millennium Controller Front Panel

Power Up and Installation Completion, continued

Initial Power Up of the System

Initial Power Up of the System	
Step	**Action**
1	To turn up the system while using the factory default firmware and software loaded in the Galaxy controller, proceed as follows: ⚠ **Warning** **Before proceeding with the initial power up of the system, verify:** • **Batteries are disconnected from the system bus.** • **The ac source circuit breakers are turned OFF.** • **The system ac and dc load circuit breakers/fuses are OFF or removed.**
2	Install a rectifier in slot one. See Figure 11-31. • Verify that the control switch on the front of the rectifier is in the standby (STBY) position • Place the rectifier on the appropriate shelf assembly. Note: Install rectifiers vertically, starting at the bottom left side of the shelf assembly and working *up* and *left to right* (if applicable). • Carefully slide the rectifier toward the rear of the shelf assembly. Push until the unit is seated. • Gently pushing against the right side of the rectifier, use a 5mm (3/1-inch) Allen-head wrench (T-handle) to turn the recessed locking screw clockwise to secure the rectifier to the shelf.
3	Turn ON the ac source circuit breaker and the ac circuit breaker for the installed rectifier.
4	Turn ON the rectifier's power switch
5	Verify that the controller and the optional contactor control boards power up.
6	If the controller has alpha-character capability, verify that the text on the display is in English. If Spanish text is required, follow instructions on the Help menu to make the change.
7	If the controller has intelligent cards, activate the memory backup battery.
	Continued on next page.

Power Up and Installation Completion, continued

Initial Power Up of the System, continued	
Step	**Action**
8	Verify the following: • Green LEDs are illuminated on the rectifier and LVLD and LVBD contactor control boards.(Alarm Card) • The system voltage is 52.08 volts (48V system). • The system current is zero. • The controller's RECT and MAJ LEDs illuminate. • The controller's audible alarm (if equipped) is sounding. • The controller display indicates one warning.
9	Turn OFF the controller's audible alarm (if equipped). Note: This alarm will retire on its own after the rectifier ID is set in Step 10.
10	To set the rectifier slot ID number, follow these steps: a. Depress and hold the rectifier's power switch in the UP position for approximately five seconds. The number displayed will begin to blink, indicating that a new ID can be set. b. To set the ID, depress and release the switch until the desired ID number is reached. c. Once the desired ID number is reached, continue to hold the switch depressed until the display stops blinking. The new ID number is now set. Note: Abandoning this process before the display stops blinking will default the ID to the last number set.
11	Follow Step 2 to install the remaining rectifiers, and follow Step 10 to set their ID numbers.
12	Verify that the system voltage again reads 52.08 volts.

Power Up and Installation Completion, continued

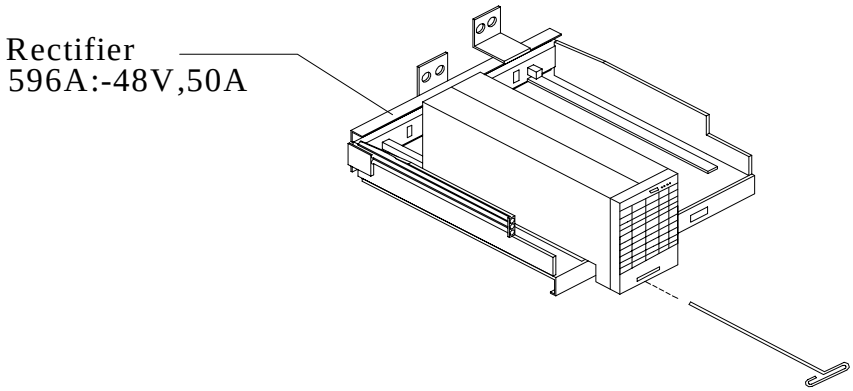


Figure 11-31: Installing Rectifiers

Lamp Test

Lamp Test	
Step	**Action**
1	Depress LAMP TEST on the controller display.
2	Verify that the LEDs on the rectifiers and controller illuminate. **Note:** The green NORMAL LEDs will remain illuminated on the rectifiers, controller, and the remote peripheral monitoring modules (optional). The other controller LEDs will extinguish after several seconds, and the remaining system LEDs will extinguish within approximately 10 seconds.

Power Up and Installation Completion, continued

Voltage Calibration

Voltage Calibration	
Step	**Action**
1	Using a calibrated digital voltmeter (DVM), measure the system voltage from the front panel voltage test jacks.
2	If the voltage on the controller display does not match the DVM reading, adjust the controller display. To move to the correct screen to make the adjustment, follow the appropriate procedure below: • Galaxy Millennium controllers, press the following key sequence: **Main → Config → Plant → Enter** Move to ADJ PLV on the menu. • Galaxy Vector controllers, use the following key sequence: **Config → Up arrow key (until FPC is on the display)→ Enter**
3	Use the ADJUST keys to calibrate the system voltage to match the reading of the DVM. Press ENTER to use the new calibrated system voltage. Press the ESCAPE key until the default screen is displayed. Verify that the system voltage reading reflects the new value.

Power Up and Installation Completion, continued

Setting the System Float Voltage

Setting the System Float Voltage	
Step	**Action**
1	Enter the appropriate key sequence: • Galaxy Millennium controllers: **Main → Config → Rect Mngr → Enter** • Galaxy Vector controllers: **Config → Up arrow key (until FSP is on the display)→ Enter**
2	Verify that the HFV and HVSD alarm thresholds are set above the float voltage to be specified in Step 3.
3	Use the adjust keys to set the system float voltage.

Setting the System Shunt

Setting the System Shunt	
Step	**Action**
1	Enter the appropriate key sequence: • Galaxy Millennium controllers: **Main → Config → Shunt Type → Enter** • Galaxy Vector controllers: **Config → Up arrow key (until S*typ* is on the display)→ Enter**
2	Select the Shunt type: None, Load, or Battery “None” for Galaxy Millennium Controller “0” for Galaxy Vector Controller

Power Up and Installation Completion, continued

Setting the Low-Voltage Battery Disconnect Configuration

Setting the LVBD Configuration	
Step	**Action**
1	Enter the appropriate key sequence: • Galaxy Millennium controllers: **Main → Config → Low V Disc → Contactor 2→ Type-Battery → Change Thresholds → Enter** • Galaxy Vector controllers: **Config → Up arrow key (until C2*t*Y is on the display)→ 2(battery) → Enter** Note: The LVBD configuration must be set. No alarm lights will show if this is not set.

Connecting Batteries

⚠ **Caution: Review and observe precautions outlined in Section 10, *Safety,* before proceeding.**

Connecting Batteries	
Step	**Action**
1	**Turn the system OFF.** Turn the rectifiers to STBY. Open the rectifier circuit breakers and system load circuit breakers, if equipped.
2	Connect the batteries to the system. Set the battery contactor board switches from forced open to normal state
3	**Turn the system ON.** Turn ON all rectifiers.
4	Observe that all rectifiers share the battery charging load current. When this current stabilizes or drops to a level equal to several amperes per string, proceed to the next section.
Note: Refer to illustrations in this section and Section 6, *Battery Connection Panels*.	

Power Up and Installation Completion, continued

Testing Rectifiers and Load Share

Testing Rectifiers and Load Share	
Step	**Action**
1	Turn all rectifiers to STBY.
2	Connect a resistive load box (proper voltage) to the system's positive and negative bus bars.
3	Verify that the system load is less than 50 amperes.
4	Increase the system load to 50 amperes.
5	Turn ON all the rectifiers; after approximately 60 seconds, verify that the load is divided equally among all the rectifiers (within 2 amperes).
6	Reduce the system load. Verify that the rectifiers continue to share the load.
7	Remove system load.

Testing Temperature Compensation (Optional Feature)

Testing Temperature Compensation (Optional Feature)	
Step	**Action**
1	Enter the appropriate key sequence: • Galaxy Millennium controllers: **Main → Config → Bat Mngr → STC → Enter** • Galaxy Vector controllers: **Config → Up arrow key (until *btAt* is on the display)→ Enter**
2	Enable the slope thermal compensation feature, if installed.
3	Verify that the battery threshold configurations are set at values that will enable the test to perform properly.
4	If thermal probes are installed, heat one of the probes to simulate a battery operating at high temperature.
5	Verify that the system voltage is reduced from the nominal float voltage value as the thermal probe is heated.
6	Allow the thermal probe to cool and verify that the system voltage returns to the nominal value.

Power Up and Installation Completion, continued

Testing Additional Alarms

Alarm operation may be verified while the system operates at float voltage.

Testing Additional Alarms	
Step	**Action**
1	Turn OFF the ac circuit breaker of rectifier #1. Verify that the AC and MIN alarm LEDs illuminate, the rectifier displays ACF, and the controller alarms screen indicates RECTIFIER FAIL : G01 (Millennium controllers) or rFA: (Vector controllers).
2	Turn ON the ac circuit breaker of rectifier #1. Verify that the rectifier starts and the alarms retire.
3	Simulate a load circuit breaker alarm by shorting the alarm contacts on the circuit breakers or inserting an operated alarm fuse. Verify that the DIST and MAJ alarm LEDs illuminate and the controller alarms screen indicates EXTERNAL FUSE MAJOR (Millennium controllers) or FAJ (Vector controllers).

Testing the BD Alarm and High Voltage Shutdown

For additional information about the High Voltage Shutdown feature and test, consult the Galaxy controller product manual.

Testing the BD Alarm and High Voltage Shutdown	
Step	**Action**
1	Set the system load to 25 amperes.
2	Turn all rectifiers to STBY.
3	As the system voltage drops, observe that the BD alarm activates at the programmed BD threshold.
4	Turn ON a single rectifier after the BD activates. Observe that the BD retires as the system voltage rises above the BD threshold.
5	Turn ON the remaining rectifiers and increase the system load until all rectifiers have a minimum of 25 amps. Increase the system voltage to the HV level. (The HV factory default is 55.0V.) Verify that the rectifiers shut down.
6	Immediately after the rectifiers shut down, return the system to the float voltage. Verify that the rectifiers restart.

Power Up and Installation Completion, continued

Galaxy Millennium Controller System Alarm Test

The Alarm Test provides a means of testing the operation of any or all of the system alarm relays and their wiring to the connected alarm system. The test cannot be performed if any alarms are active. In addition, Rectifier HVSD (High Voltage Shut Down) and RFA (Rectifier Fail Alarm) tests can be included. For additional information, consult the appropriate Galaxy controller product manual.

Galaxy Millennium Controller System Alarm Test	
Step	**Action**
1	Connect all office alarm wiring from the controller's office alarm terminal block to the office alarm monitoring system.
2	Enable the alarm test feature. Note: Both the Galaxy Millennium controllers have factory hardware and software switches to enable the alarm test feature. • Hardware: – For the Millennium controller, enable a DIP switch on the BSH board. • Software: – For the Millennium controllers, use the following key sequence to get to the menu with the software switch: **Menu → Config → Alarm → TEST ALA : ON (H,S)**
3	Once the Alarm Test feature has been enabled: • For the Millennium controller, use the front panel key sequence **Menu → Maint Oper → Alarm Tes**t → **Enter** to start the Alarm Test.

Connecting to Load

The system is ready to connect to using equipment. Install or turn on load protectors when needed.

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 in specified limits. The temperature and humidity within the power room must be maintained within the limits specified in Section 9 of this product manual.

Refer to Table 12-A for system replacement parts.

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

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

Requirements, continued

Rectifier Fan Assembly

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

Two approaches can be taken to fan maintenance.

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

- The second approach, assuming one has remote alarm capability, is to wait until the fan fails. The rectifier will safely shut down and issue both a fail alarm and a thermal alarm. The fan can then be replaced. Since it is likely that all the rectifiers in that installation are of roughly the same age, all rectifier fans at that site should be replaced at that time.

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

Replacements Procedures

Installing or Replacing a Rectifier

Installing or Replacing a Rectifier

Step	Action
1	Locate and turn off the ac service feeding the rectifier. Note: Do not turn off ac service to the entire system, only to the rectifier that has failed.
2	Turn the rectifier's ON/STBY switch to STBY. ⚠ **Caution** **Rear portion of the rectifier that is in operation is HOT to the touch. Use appropriate precautions.**
3	(Steps 3 and 4 for replacement only. For a new installation, proceed to Step 5.) Locate the Allen-head bolt in the center of the rectifier front panel. Using the Allen wrench provided, rotate the bolt counterclockwise to release the rectifier for removal.
4	⚠ **Caution** **Handle the rectifier with 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.**

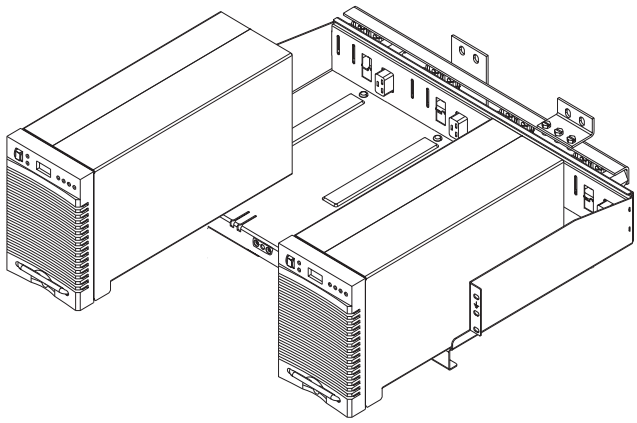


Figure 12-1: Detail of Rectifier Position

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 fans 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 new fans.
6	Reconnect the ribbon cable removed in Step 3.
7	Attach the front cover.
8	Install the rectifier, following instructions in the "Installing or Replacing a Rectifier" procedure in this section.

Replacement Parts

System Table 12-A provides a list of replacement parts for GPS 4804AP.

Table 12-A: GPS 4804AP System Replacement Parts

Cabinet	
Ordering Code	**Description**
402328926	0.18 ampere alarm fuse
405673161	0.5 ampere alarm fuse
406530725	1-1/3 ampere alarm fuse
406421032	2 ampere alarm fuse
848262622	BLJ3 terminal board
MSPMLNK2X	Wire insertion tool
108409343	BIC7 bay interface card (Millennium only)
PWCALCPXX	Alarm Card
MSLRD4818	Cabinet alarm lamp holder
MSBD4802X	Cabinet alarm lamp, 48V
Rectifier	
107598120	596A, 50A rectifier
407840792	Fan assembly
MSDTA3E16	Allen-head wrench
406530725	1-1/3 ampere fuse (GMT)
406204230	3 ampere fuse (GMT)
406677880	Battery TL5101 for CP BSJ

Replacement Parts, continued

Millennium Controller Circuit Boards

Table 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	Alarm barrel terminal (BSL2)
108029653	Basic control board (BSH1)
847950912	LCD module assembly display board
108029661	Intelligent control board (BSJ1)
108029695	Modem board (BSM1)
108163601	Data switch board (BSW1)

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)
108259615	48V VC Control Board (BIC3)

Documentation

Table 12-D lists other documentation associated with the GPS 4804AP.

Table 12-D: Product Documentation GPS 4804AP

Document Number	Description
GPS 4804AP	
H569-450	GPS 4804AP Ordering Guide
YYH4804XX	Manufacturing Drawings
WD-YYH4804XX	Wiring Table
Galaxy Millennium Controller	
J85501K-1	Manufacturing Drawings
T83413-30	Wiring Drawing
167-792-180	Product Manual
Galaxy Vector Controller	
T83314-30	Wiring Drawing
167-792-112	Product Manual
Remote Peripheral Monitoring	
J85501G-1	Manufacturing Drawings
T83275-30	Wiring Drawing
SD-83275-01	Schematic Drawing
167-790-063	Product Manual
Software	
847473774	EasyView Software Package

Software

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

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 65-240-8680.

Safety

Review all safety instructions and warnings in Section 10 before troubleshooting the GPS 4804AP.

⚠ 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 4804AP:

- 3/16-inch (5mm) Allen-head wrench
- Insulated hand tools
- Calibrated digital voltmeter (DVM) with 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 plant 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.

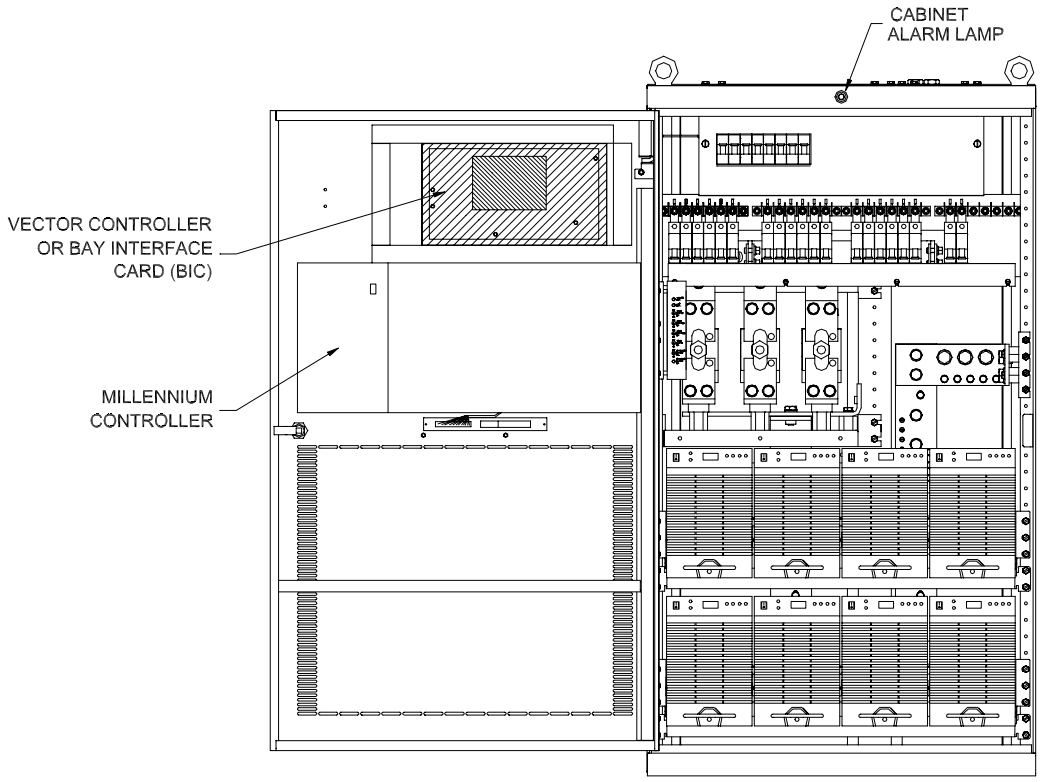


Figure 13-1: Location of Cabinet Alarm

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 Related 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 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	Low Voltage Battery Disconnect Contactor Control Switches
13-8	Detail of AC Input Panel and Rectifier Shelf
13-9	Detail of DC Distribution Panel
13-10	Low Voltage Load Disconnect Contactor Control Switches

Millennium Controller

Basic Controller

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

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

Intelligent Controller

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

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

Reference Figures, continued

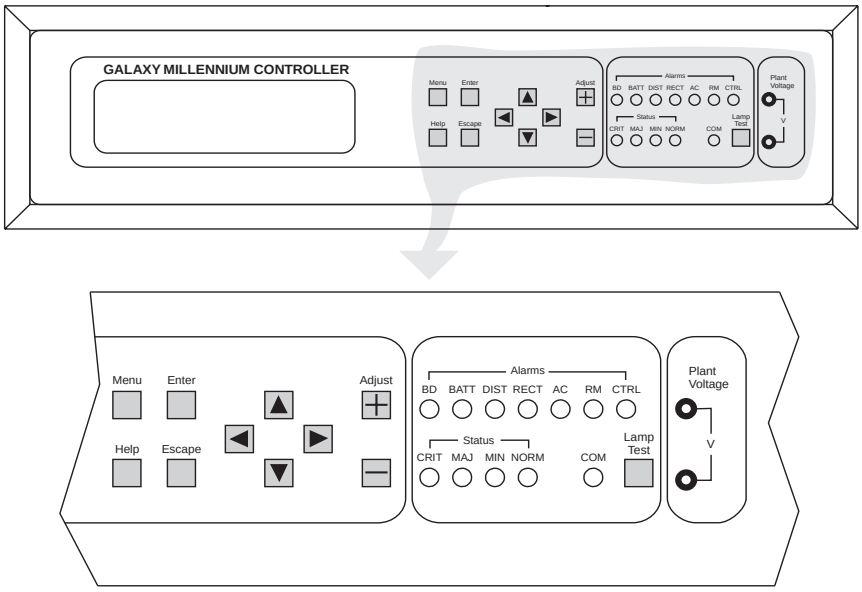


Figure 13-2: Millennium Controller Display

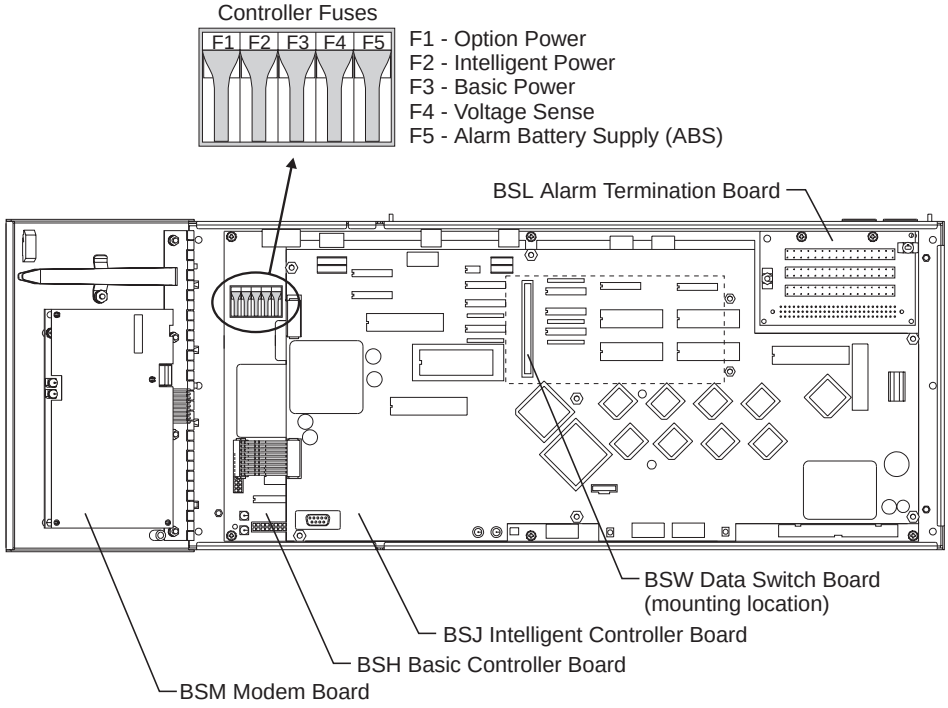


Figure 13-3: Location of Millennium Controller Fuses and Boards

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.

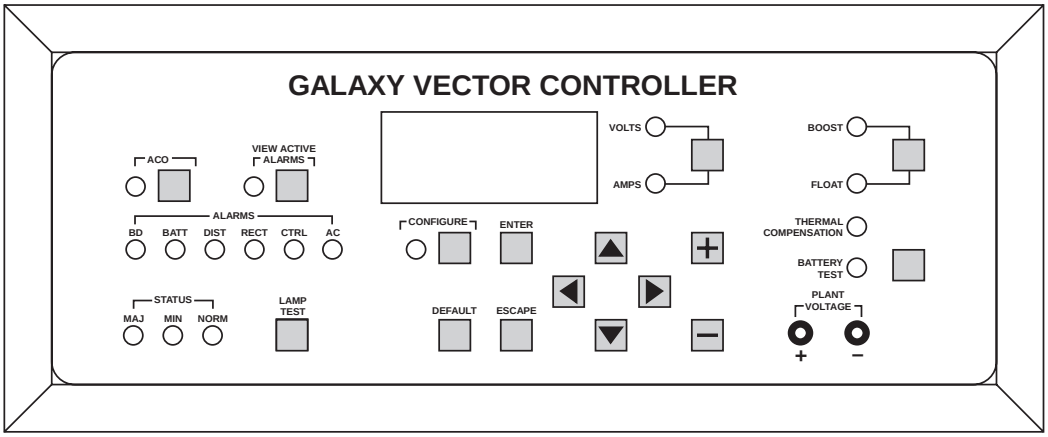


Figure 13-4: Vector Controller Display

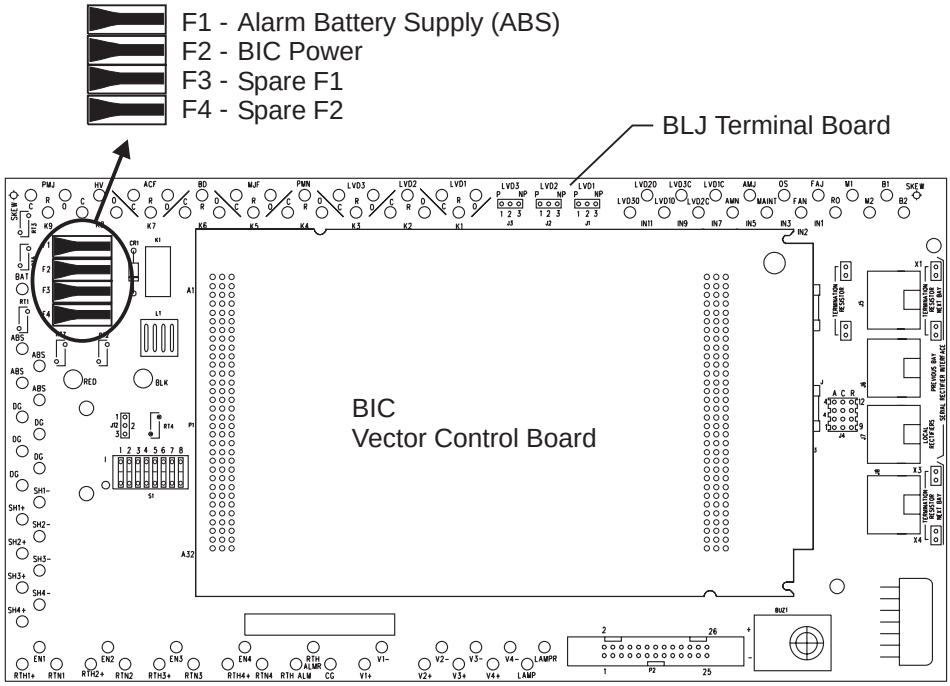


Figure 13-5: Location of Vector Controller Fuses and Boards

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.

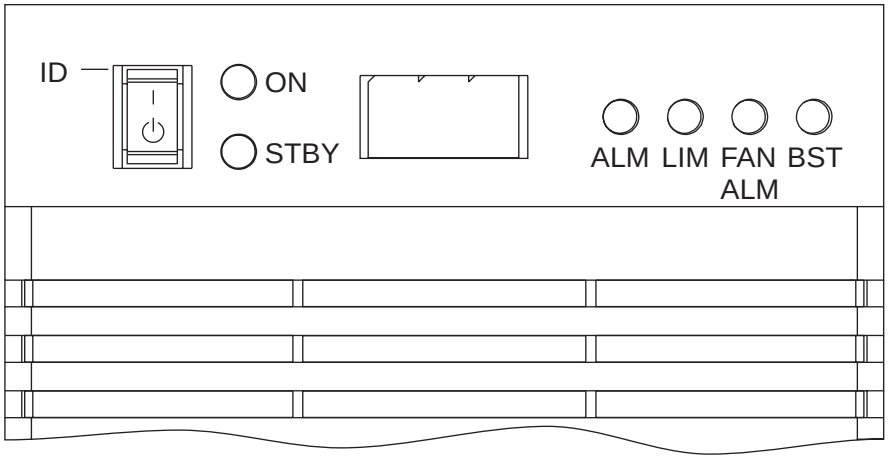


Figure 13-6: Rectifier Display

Reference Figures, continued

Battery Alarms

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

Figure 13-7 shows the location of the contactor control board in the GPS cabinet.

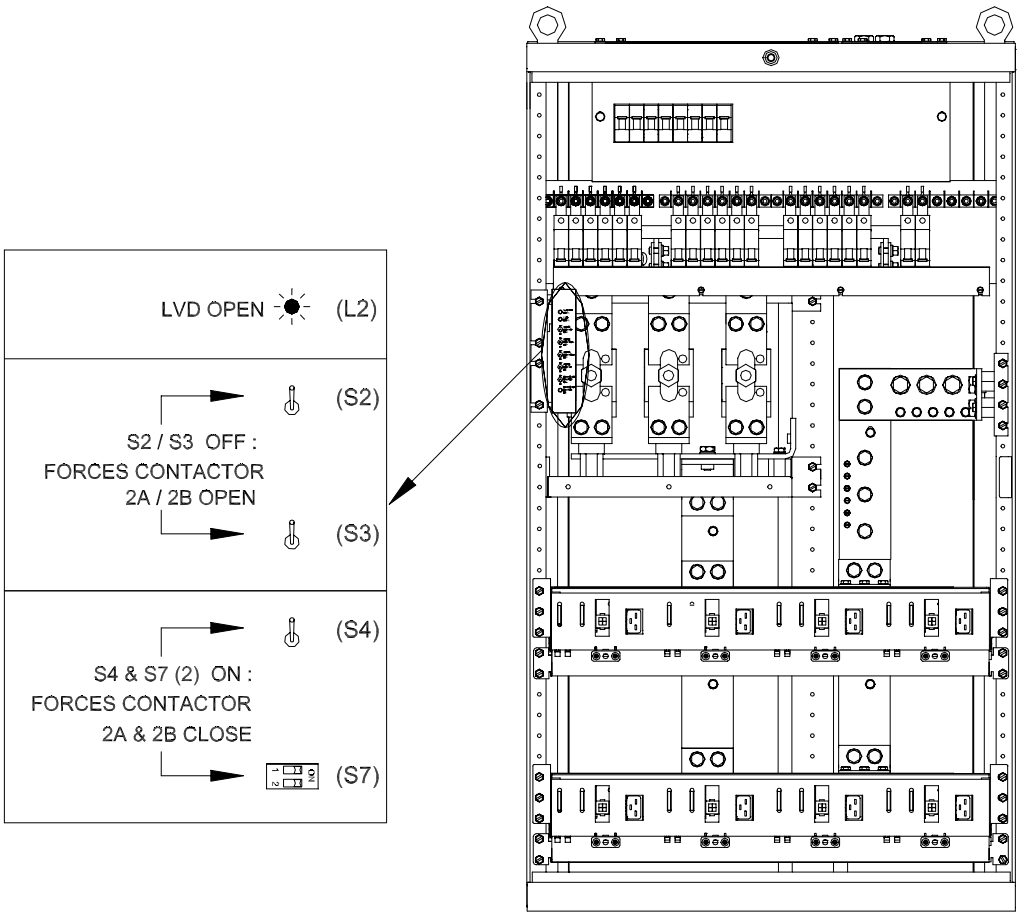


Figure 13-7: Low Voltage Battery Disconnect Contactor Control Switches

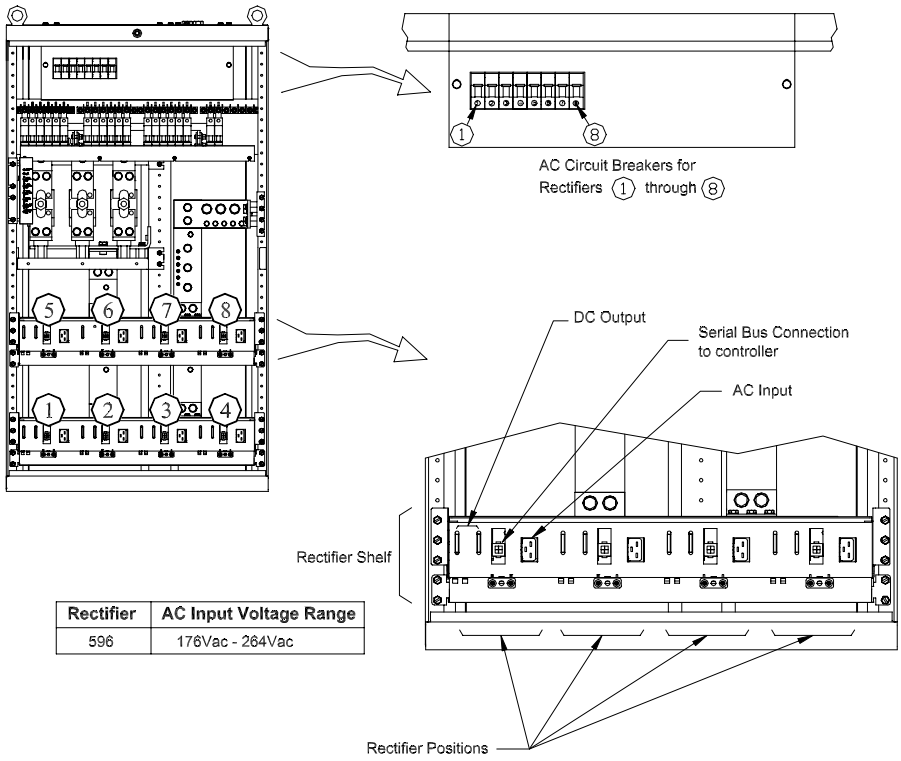
Reference Figures, continued

Miscellaneous Alarms

Miscellaneous alarms include those related to:

- AC input (see Figure 13-8)
- DC distribution (see Figure 13-9)
- Low voltage load disconnect (see Figure 13-10)

AC Input



Rectifier	AC Input Voltage Range
596	176Vac - 264Vac

Figure 13-8: Detail of AC Input Panel and Rectifier Shelf

Reference Figures, continued

DC Distribution

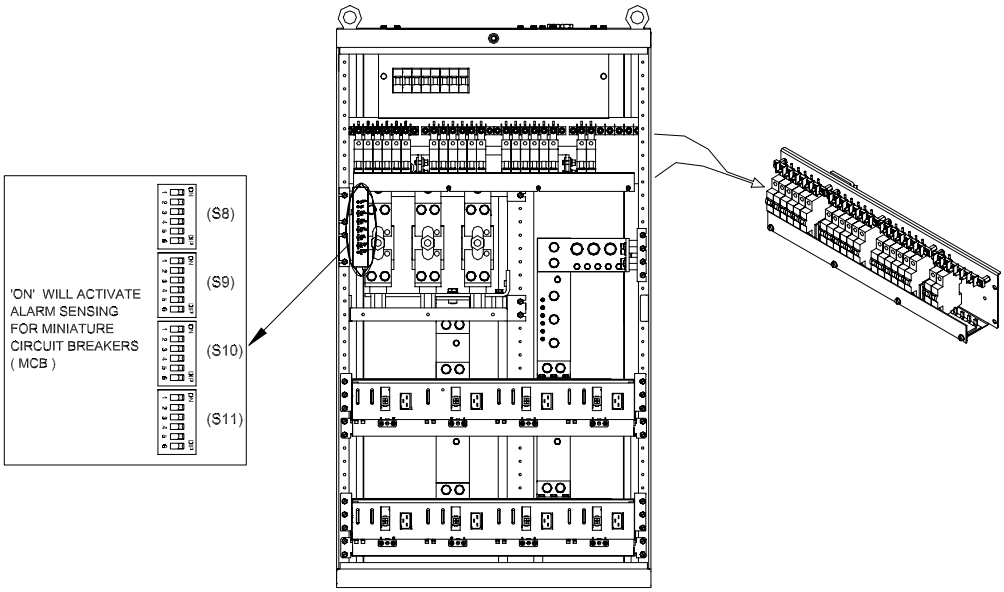


Figure 13-9: Detail of DC Distribution Panel

Reference Figures, continued

Low Voltage Load Disconnect

The low voltage load disconnect (LVLD) contactor control is available in the Alarm card (Refer Section 8 of the manual). The Alarm Card is mounted on the left side of the cabinet, as shown in Figure 13-10.

The manual contactor control switch (S4 & DIP Switch S7, Switch 1) 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. Switch S1 is used to disconnect the load. It is to be used during servicing or for emergency disconnection of the loads.

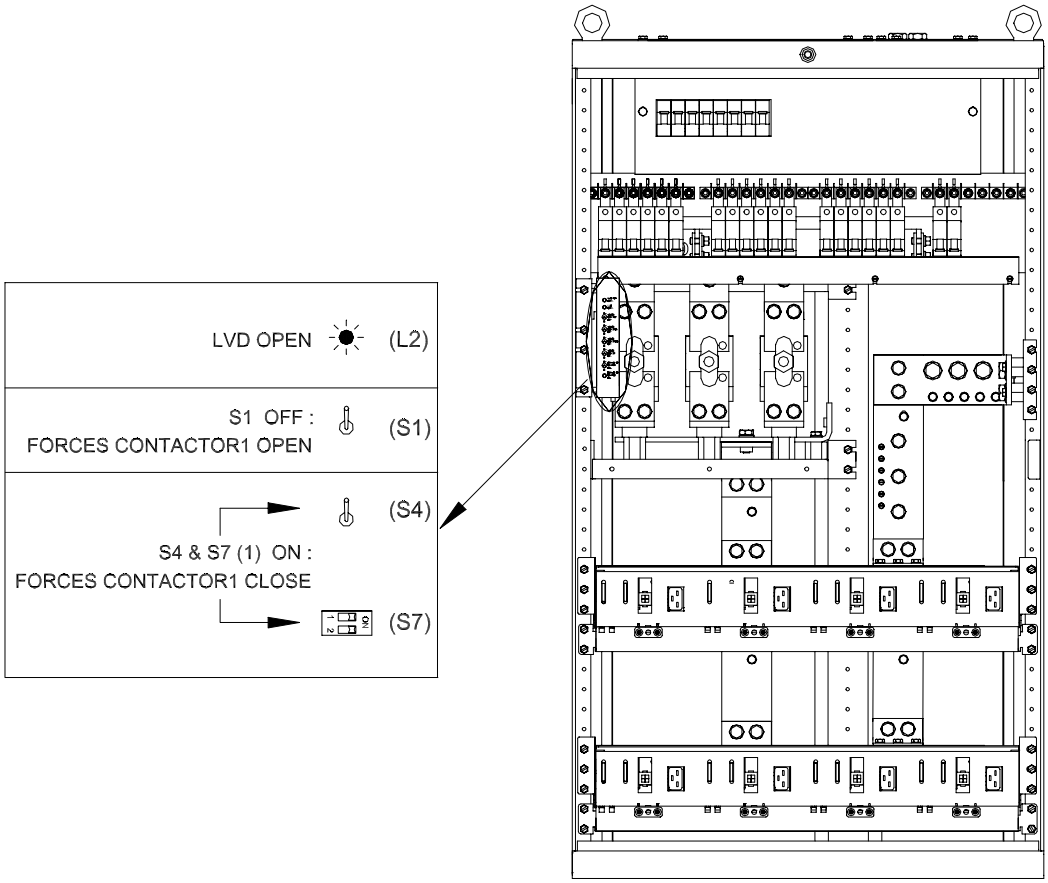


Figure 13-10: Low Voltage Load Disconnect Contactor Control Switches

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 Preparation*s, thoroughly before proceeding.

Technical Assistance When visual indicators do not identify a defective part, notify the local Regional Technical Assistance Center (RTAC) or LFS Team at 65-240-8680

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).

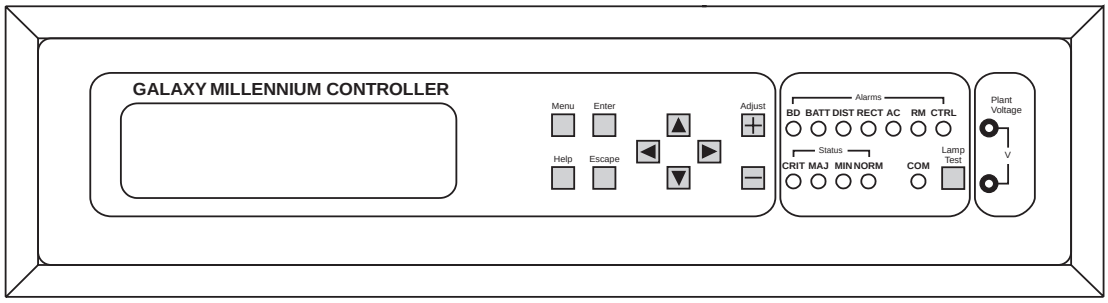
Table Reference

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 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 13-8)

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 13-7)

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 configured to 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 13-7). 2. If the problem is not corrected, call your local RTAC representative.
BATT* *Alarm must be configured to turn on the BATT LED; not a factory default.	MAJ	Contactor 1 Fail	--	Contactor or drive board has failed.	Call your local RTAC representative.

Table 14-B: Battery Alarms

(See Figure 13-7)

Controller LED	Controller Alarm Status	Millennium Controller Display	Other Indication(s)	Possible Problem(s)	Possible Solution(s)
BATT	MIN	Open String	Alarm LED on battery fuse panel is lit.	Battery fuse has operated.	Replace the operated fuse.
BATT	MIN	Low Reserve Time	--	Controller has calculated that batteries are low.	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.

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	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.
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 8-2. 2. Replace BIC. CTRL MAJ Circuit Pack Fail -- See “Controller Fail” Alarm. See “Controller Fail” Alarm.
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).

Table 14-C: Controller Alarms
(See Figures 13-2 and 13-3)

Controller LED	Controller Alarm Status	Millennium Controller Display	Other Indication	Possible Problem(s)	Possible Solution(s)
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 red LED on BIC	Loss of communication with controller: • Defective interface from BIC or multiple rectifiers to controller • Internal failure of controller, BIC, or multiple rectifiers	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	Possible Problem(s)	Possible Solution(s)
CTRL	MIN	Minor Communication Fail Alarm	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 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” Alarm.	See “Controller Fail” Alarm.
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 13-9 and 13-10)

Controller LED	Controller Alarm Status	Millennium Controller Display	Other Indication	Possible Problem(s)	Possible Solution(s)
DIST	MAJ	External Fuse Major	Alarm LED on dc distribution panel will be lit.	DC load fuse or circuit breaker has operated.	Replace fuse or reset circuit breaker.
DIST* *Alarm must be configured to 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 13-10). 2. If the problem is not corrected, call your local RTAC representative.
DIST* *Alarm must be configured to 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 Related Alarms
(See Figures 13-6 and 13-8)

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.

Table 14-E: Rectifier Related Alarms

(See Figures 13-6 and 13-8)

Controller LED	Controller Alarm Status	Millennium Controller Display	Rectifier LED	Rectifier Display	Possible Problem(s)	Possible Solution(s)
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.
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.

Table 14-E: Rectifier Related Alarms
(See Figures 13-6 and 13-8)

Controller LED	Controller Alarm Status	Millennium Controller Display	Rectifier LED	Rectifier Display	Possible Problem(s)	Possible Solution(s)
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 Related Alarms
(See Figures 13-6 and 13-8)

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. Remover 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.

Table 14-E: Rectifier Related Alarms

(See Figures 13-6 and 13-8)

Controller LED	Controller Alarm Status	Millennium Controller Display	Rectifier LED	Rectifier Display	Possible Problem(s)	Possible Solution(s)
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.
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. Remover 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.

Table 14-E: Rectifier Related Alarms
(See Figures 13-6 and 13-8)

Controller LED	Controller Alarm Status	Millennium Controller Display	Rectifier LED	Rectifier Display	Possible Problem(s)	Possible Solution(s)
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.
RECT	MIN	Limited Recharge	None	None	Rectifier capacity has been exceeded.	Install more rectifiers.

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.

Table 14-F: Miscellaneous Alarms

Controller LED	Controller Alarm Status	Millennium Controller Display	Other Indication(s)	Possible Problem(s)	Possible Solution(s)
None	None	None	Red LED is lit on some battery contactor drive boards, while green LED is lit on others.	If a green LED is lit despite a contactor open command issued by the controller, the drive card or the contactor has failed.	Call 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) or LFS Team at 65-240-8680

Troubleshooting Tables

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).

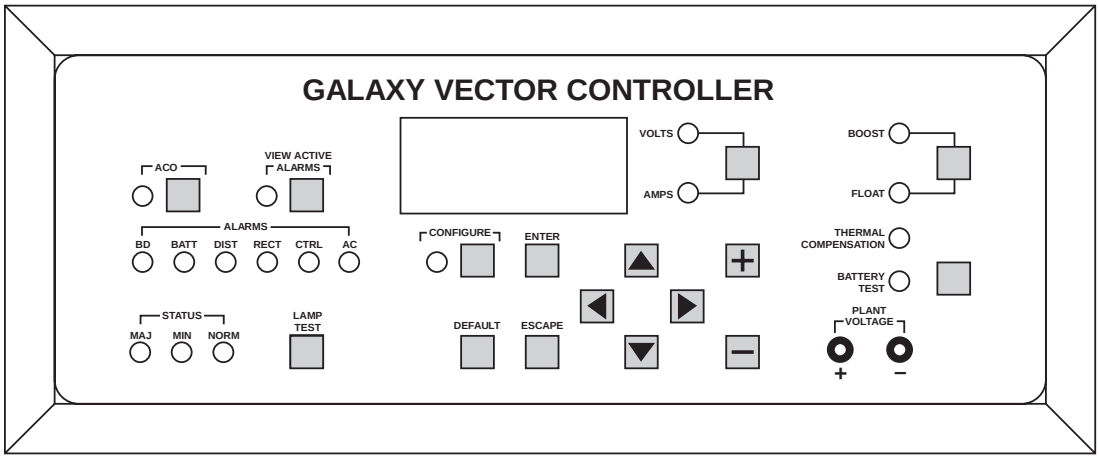
Table Reference

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 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 for quick reference while using the troubleshooting tables.



AC Alarm LED

Table 15-A: AC Alarms
(See Figure 13-8)

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 13-7)

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 13-7). 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.

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 • 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 13-9 and 13-10)

Controller LED	Controller Alarm Status	Vector Controller Display	Other Indication(s)	Possible Problem(s}	Possible Solution(s)
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 13-10). 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 will be 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 Related Alarms
(See Figures 13-6 and 13-8)

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.

Table 15-E: Rectifier Related Alarms

(See Figures 13-6 and 13-8)

Controller LED	Controller Alarm Status	Vector Controller Display	Rectifier LED	Rectifier Display	Possible Problem(s)	Possible Solution(s)
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.
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.

Table 15-E: Rectifier Related Alarms

(See Figures 13-6 and 13-8)

Controller LED	Controller Alarm Status	Vector Controller Display	Rectifier LED	Rectifier Display	Possible Problem(s)	Possible Solution(s)
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.
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.

Table 15-E: Rectifier Related Alarms

(See Figures 13-6 and 13-8)

Controller LED	Controller Alarm Status	Vector Controller Display	Rectifier LED	Rectifier Display	Possible Problem(s)	Possible Solution(s)
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.
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.

Table 15-E: Rectifier Related Alarms

(See Figures 13-6 and 13-8)

Controller LED	Controller Alarm Status	Vector Controller Display	Rectifier LED	Rectifier Display	Possible Problem(s)	Possible Solution(s)
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 Related Alarms

(See Figures 13-6 and 13-8)

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. Remover the rectifier from the shelf. 3. Wait for 30 seconds or until all front panel display LEDs have extinguished. 4. Replace the rectifier. 5. Return the ac breaker to the ON position. 6. Place the rectifier ON/ STBY switch into the ON position. 7. If the problem is not corrected, replace the rectifier with a new one.

Table 15-E: Rectifier Related Alarms

(See Figures 13-6 and 13-8)

Controller LED	Controller Alarm Status	Vector Controller Display	Rectifier LED	Rectifier Display	Possible Problem(s)	Possible Solution(s)
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.

BD 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.