



***Galaxy Power System 4848/100  
with Dual Rectifier Shelf  
(GPS 4848/100)  
H569-434***

Note: Instructions in this manual reference installation and setup of the Galaxy Millennium Controller. For Galaxy Millennium II installation and setup, refer to the Millennium II Product Manual 167-792-181.

User's Guide  
Select Code 167-792-166  
Comcode 108994042  
Issue 3  
February 2008



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***(GPS 4848/100)***  
***H569-434***

**Notice:**

The information, specifications, and procedures in this manual are subject to change without notice. Lineage Power assumes no responsibility for any errors that may appear in this document.



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# ***1 Introduction***

## ***GPS 4848/100***

### ***Overview***

The Galaxy Power System (GPS) 4848/100 provides -48 volt telecommunications powering solutions in worldwide markets. The GPS 4848/100 combines 220 and 200-ampere, fan-cooled, switchmode rectifiers, microprocessor control technologies, battery and load disconnect/reconnect options, and a comprehensive line of fuse and circuit breaker dc distribution options in a modular front-access design. This modularity ensures easy access, simplified installation and maintenance, and allows the system to expand in capacity and features as power needs grow.

With 14,080-ampere maximum capacity, distribution flexibility, and universal ac input capability, the GPS 4848/100 supports switching, transmission, and wireless applications in central office locations and environmentally controlled remote sites (huts or vaults). For centralized architecture, bus bars are available to 14,080A.

### ***Notes***

This document includes information for 595LT series rectifiers. For information about 595A and 595B series rectifiers see the GPS 4848/100 product Manual.

595A and 595B series rectifiers (full width, one per shelf) are fully supported by GPS 4848/100 with Dual Rectifier Shelves.





## ***GPS 4848/100, continued***

### ***Safety***

- UL<sup>1</sup> Listed (US and Canada): UL Subject 1801 with applicable sections of UL1950/CSA<sup>2</sup> 950)
- VDE Licensed to VDE 0805/IEC950/EN60950

### ***Electromagnetic Compliance***

- Emission:
  - FCC Part 15 Class B
  - EN55022 (CISPR 22) Radiated/Conducted Emission, Class B
- Immunity
  - IEC/EN 61000-4-2 ESD level 3 and 4
  - IEC/EN 61000-4-3 Radiated Immunity, 10V/m
  - IEC/EN 61000-4-4 Electrical Fast transients/Burst, level 4
  - IEC/EN 61000-4-5 Lightning Surge, level 4

### ***CE Marking***

- CE marked per European Union Council Directives:
  - Low-Voltage Directive (73/23/EEC) and
  - EMC Directive (89/336/EEC) as amended by CE Marking Directive (93/68/EEC)

### ***Telcordia***

- GR-63 and GR-1089 NEBS (including Level 3 testing)
- Report by an independent test laboratory - NRTL

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1. UL is a registered trademark of Underwriters Laboratories, Inc.  
2. CSA is a registered trademark of Canadian Standards Association.

## ***Customer Service Contacts***

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

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

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

### ***Customer Training***

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

### ***Downloads and Software***

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



## ***Overview, continued***

### ***System Components***

The power system accepts alternating current from the commercial utility or a standby ac power source and rectifies it to produce dc power for the using equipment. The system's control and alarm functions interact with the rectifiers and the office. In addition, the system provides overcurrent protection and charge, discharge, and distribution facilities. Battery reserve automatically provides a source of dc power if the commercial or standby ac fails. Battery reserve can be engineered to supply dc power for a specific period of time. In normal practice, battery capacity is sized to provide 3 to 8 hours of reserve time.

**AC Input** connects the commercial and/or standby ac power sources to the rectifiers within the system and provides overcurrent protection. In some applications the ac service is wired directly to the rectifiers and overcurrent protection is provided at the service panel.

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

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

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

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

**Battery Connection Panel** provides connection points for the battery strings through battery disconnect fuse, contactors, current monitoring shunts, and equalize converters.

## ***Architecture***

### ***Introduction***

For the GPS 4848/100 system, the basic system components, i.e., ac input panels, battery connection panels, dc distribution panels, rectifiers, and controller, can be configured to form two distinct system architectures: distributed or centralized.

### ***Distributed***

In this system each cabinet contains ac distribution, dc distribution panels, battery connection panels, rectifiers, termination points for load circuits, and a battery shunt. The initial cabinet also contains the system controller and, as such, it can function as a stand-alone system. The rectifier output buses are interconnected to permit cabinets to share current and ensure common voltage references for all system rectifiers. Because each cabinet is basically a self-contained system, the overall system capacity can be increased by simply adding cabinet/battery entities. However, growing the system requires a distinct, dedicated floor plan.

During normal operation, the readings from the battery shunts are summed and subtracted from the rectifier current to obtain the system load current. While the batteries are providing the system load power, the individual battery shunts may be monitored to determine the status of the individual battery sections.

Cabinets can be equipped with load and/or battery disconnect/reconnect contactors. Battery contactors prevent battery damage during deep discharges by disconnecting batteries. Load contactors can extend the time critical loads operate on battery discharge by disconnecting non-critical loads during discharge.

Figure 2-2 shows an example of GPS 4848/100 components configured in a distributed architecture; Figure 2-3 gives a front view of the distributed initial and growth cabinets.













## **3**                      ***Galaxy Millennium Controller***

### ***Overview***

***Mounting Location***        The Galaxy Millennium Controller mounts inside the front door with the display viewed from the outside.

***Circuit Boards***            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 control boards monitor each other's status and issue appropriate alarms in the event a failure occurs. Circuit packs are accessed by opening the hinged cover from the left side.

### ***Reference Material***

***Controller Product Manual***        A Galaxy Millennium Controller, Select Code 167-792-180, is furnished with every GPS 4848/100. Refer to the 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.



## ***User Interface and Display, continued***

### ***LEDs***

Two columns of LEDs show the severity and source of active alarms. An alarm event may activate two LEDs: one Alarm Status LED and one Equipment Status LED. More than one of the Equipment Status LEDs may be active simultaneously. In that case, the Alarm Status LED that is active will be that of the most severe active alarm.

The first column has five LEDs. The first four indicate the severity of the reported alarms: Critical, Major, Minor, and Normal. The fifth LED, labeled Battery on Discharge, illuminates when the plant voltage is below the threshold set for this alarm condition in the plant configuration.

The second column includes seven LEDs, six of which indicate the source of the alarm: AC System, Battery, Controller, Distribution, Rectifier, or Remote Module. The final Modem LED will be active whenever the controller modem port is in use.

The pushbutton identified with an illuminated lamp icon can be used to test the controller's circuit pack and front panel LEDs. It will also test the indicators of all serially connected devices.

### ***Pushbutton Controls***

A group of pushbutton keys beneath 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 the general description of these keys.

- Up arrow key: Use to navigate the menu; press the key to move the cursor up one line.
- Down arrow key: Use to navigate the menu; press the key to move the cursor down one line.
- Left arrow key: Use to navigate the menu; press the key to move the cursor left one field.
- Right arrow key: Use to navigate the menu; press the key to move the cursor right one field.
- MENU key: Press this key any time to view the MAIN menu.
- HELP key: Press this key to display limited on-line help information.
- ENTER key: Use this key to select a menu item.
- ESCAPE key: Use this key to return to the immediately higher level menu.

## ***User Interface and Display, continued***

### ***Test Jacks***

A pair of test jacks allows direct measurement of the system voltage being monitored, normally the battery voltage. This is the same point regulated as system voltage and displayed on the front panel.







## ***Features***

### ***Output Voltage Adjustment***

This feature allows the rectifier output voltage to be set and regulated by the controller.

### ***Output Current "Walk-in"***

This feature 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.

### ***Electronic Current Limit***

When the output current tends to increase above the current limit set point (30% to 100% of maximum output), the current limit circuit overrides voltage regulation and load share to safely limit the output current of the rectifier, thus preventing damage to itself, the battery, or the load.

### ***Selective High Voltage Shutdown (SHVSD)***

This feature allows the rectifier to respond and shut down at the output high voltage threshold set through the Galaxy controller.

### ***Backup High Voltage Shutdown (BHVSD)***

This is a hardwired feature independent of the rectifier's microcontroller. This feature is always active and will operate whether communicating with the controller or not and whether the rectifier's microcontroller is active or failed.

### ***Restart***

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

### ***Output Circuit Breaker***

The output circuit breaker located on the front panel protects the power system from rectifier malfunction and may be used to disconnect the rectifier from the system output bus.

### ***Fan Alarm and Control***

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

## ***Features, continued***

### ***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 may result in a rectifier shutdown and the issuing of a thermal alarm (TA).

### ***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.

### ***Autonomous Operation of the Rectifier***

If communication with the Galaxy controller is lost, the rectifier will continue to operate and deliver regulated power to the system load.

### ***Connectorized***

The rectifiers provide the controller with a full complement of status and alarm messages. The rectifier status and alarm signals, ac input, and dc output are all connectorized for easy installation and maintenance. All connections automatically occur as the rectifier is physically mated to its shelf.

### ***“Forced” Load Sharing***

The controller forces rectifiers to load share by sending messages to them. In the event communication to the controller is lost or the controller malfunctions, load share balance is maintained while ac or dc power is continuously applied to the rectifiers.

## **5**                      ***AC Input Panels***

### ***Overview***

#### ***AC Service***

The ac input panel provides the facility to terminate the 3-phase ac service to the GPS 4848/100. Depending upon the option ordered, the panel will connect 3-wire delta or 3-wire wye service to provide the phase-to-phase ac voltage required for the rectifiers.

In some systems, circuit breakers are provided in the AC Input Panel to protect the conductors providing ac service to the individual rectifiers. In other systems, the circuit breakers protecting these conductors are located in the building's ac service panel. In either case, conductors to each rectifier are protected by a dedicated circuit breaker.

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

#### ***Illustrations***

Circuit breaker panels are shown in Figures 5-1 through 5-4, 5-8, and 5-9. Terminal strip panels are shown in Figures 5-5 through 5-7.













## **6**                      ***Battery Connection Panels***

### ***Overview***

#### ***Introduction***

Batteries are connected to the GPS 4848/100 cabinets based on the system architecture.

#### ***Distributed Architecture***

For distributed power architecture, the batteries are terminated on battery connection panels with shunts that monitor the battery charge / discharge current through circuits on the cabinet BIC (Bay Interface Card). These battery connection panels are located either in the very top of the cabinet (shunt-only panels) or directly below the ac input panel.

As options, these panels may also include fuses or low battery voltage disconnect/reconnect (LVBD/R) contactors. When equipped with contactor(s), contactor control card(s) provide local/manual control of the contactor(s) and communications with the controller for configured/remote control.

Off Line Equalize (OLE) battery connection panels additionally provide means to manually equalize single battery sections. A plug-in dc to dc converter provides up to 65V to fully charge battery section cells, equalizing cell float voltages. This restores fully charged cell capacity to each cell in the section. A timer terminates the manually initiated equalize operation.

#### ***Centralized Architecture***

For systems with centralized architecture, the batteries are connected between the system charge and charge return buses. In turn, these buses are connected to rectifier termination buses located behind the ac input panels.

#### ***Illustrations***

The battery connection panels are illustrated in Figures 6-1 through 6-9.

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











## **7**                      ***DC Distribution Panels***

### ***Overview***

#### ***Function***

A variety of dc distribution panels are available featuring large or small fuses and circuit breakers of both domestic and European design. All panels are equipped with an alarm card. When a fuse operates or a circuit breaker trips, a red LED on the alarm card lights, the cabinet alarm lights, and the alarm is transmitted to the controller. Replacement fuses and plug-in circuit breakers are listed in the *Replacement Parts* section.

#### ***Illustrations***

The dc distribution panels are illustrated in Figures 7-1 through 7-14.

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























## **8**                      ***Circuit Boards***

### ***Overview***

#### ***Function***

Circuit boards (sometimes referred to as “cards” or “circuit packs”) are included in bays, battery connection panels, and dc distribution panels to provide data required by the controller and to control devices such as contactors and lamps.

#### ***Terminal Boards***

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

#### ***Alarm Boards***

Alarm boards perform two functions:

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

#### ***Alarm/Terminal Boards***

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

#### ***BLJ Terminal Board***

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

## ***Overview, continued***

***Bay Interface Card*** Each cabinet 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. The BIC also provides connection of the system serial rectifier bus to the bay rectifiers. See Figure 1-1.

***Contactor Control Board*** Contactor control boards provide four functions:

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

# 9 *Specifications*

## *GPS 4848/100*

**Table 9-A: Galaxy Power System 4848/100 Specifications**

<b>Electrical</b>	
Nominal output voltage	-48Vdc
Operating Voltage Range (Float or Boost)	-44Vdc to -58Vdc
Output Current (System Maximum)	14,080A
Nominal Input Voltage (595LTA or 595A3 Rectifier)	380-480Vac, 3-wire plus ground
Nominal Input Voltage (595LTB or 595B3 Rectifier)	200-240Vac, 3-wire plus ground
Input Voltage Range per phase (595LTA or 595A3 Rectifier)	320Vac - 530Vac
Input Voltage Range per phase (595LTB or 595B3 Rectifier)	176Vac - 254Vac
Input Frequency Range	47 Hz - 63 Hz
System Efficiency (including ac and dc cables)	>88%
Regulation (line and load range with controller)	± 0.5%
AC Ripple	<100mVrms
Output Noise	<2mV psophometric
Electromagnetic Immunity	10V/meter over 20 MHz - 2000 MHz

**Table 9-A: Galaxy Power System 4848/100 Specifications (Continued)**

<b>Physical</b>	
Width, Depth	600 mm, 600 mm (23.6 in. x 23.6 in.)
Weight (approximate, per cabinet)	250 kg (551 lbs.)
Height (cabinet only)	2134 mm (84.0 in.)
Height (cabinet with link bus bar)	2274 mm (89.5 in.)
<b>Environmental</b>	
Heat Release, per cabinet	at 54Vdc, 220A dc
Number of Rectifiers	595A / LTA                                  595B / LTB
4	4,120W    (14,100 BTU / hr)                                  4,720W    (16,100 BTU / hr)
5	5,150W    (17,600 BTU / hr)                                  5,900W    (20,200 BTU / hr)
6	6,180W    (21,100 BTU / hr)                                  7,080W    (24,200 BTU / hr)
7	7,210W    (24,600 BTU / hr)                                  8,260W    (28,200 BTU / hr)
8	8,240W    (28,100 BTU / hr)                                  9,440W    (32,200 BTU / hr)
12	12,360W    (42,200 BTU / hr)                                  14,200W    (48,300 BTU / hr)
14	14,420W    (49,200 BTU / hr)                                  16,500W    (56,400 BTU / hr)
per Rectifier	1,030W    (3,520 BTU / hr)                                  1,180W    (4,050 BTU / hr)
Operating Temperature	0°C to 40°C
Operating Relative Humidity	5% - 95%
<b>Units Per Initial Cabinet</b>	
Rectifiers	595LTA / 595LTB: 0 - 12; 595A / 595B: 0 - 6
Controller	1
Battery Modules	0 - 3
DC Distribution	1 - 6 (maximum of 5 with battery disconnect)
<b>Units Per Growth Cabinet</b>	
Rectifiers	595LTA / 595LTB: 0 - 14; 595A / 595B: 0 - 7
Battery Modules	0 - 1
DC Distribution	1 - 6 (maximum of 5 with battery disconnect)

**Table 9-A: Galaxy Power System 4848/100 Specifications (Continued)**

<b>Standards Compliance</b>	
Safety	<ul style="list-style-type: none"> <li>• UL<sup>3</sup> Listed (US and Canada): UL Subject 1801 with applicable sections of UL1950/CSA<sup>4</sup>950)</li> <li>• VDE Licensed to VDE 0805/IEC950/EN60950</li> </ul> <p><sup>3</sup>UL is a registered trademark of Underwriters Laboratories, Inc.  <sup>4</sup>CSA is a registered trademark of Canadian Standards Association.</p>
Electromagnetic Compliance	<ul style="list-style-type: none"> <li>• Emission:                             <ul style="list-style-type: none"> <li>– FCC Part 15 Class B</li> <li>– EN55022 (CISPR 22) Radiated/Conducted Emission, Class B</li> </ul> </li> <li>• Immunity                             <ul style="list-style-type: none"> <li>– IEC/EN 61000-4-2 ESD levels 3 and 4</li> <li>– IEC/EN 61000-4-3 Radiated Immunity, 10V/m</li> <li>– IEC/EN 61000-4-4 Electrical Fast Transients/Burst, level 4</li> <li>– IEC/EN 61000-4-5 Lightning Surge, level 4</li> </ul> </li> </ul>
CE Marking	<ul style="list-style-type: none"> <li>• CE marked per European Union Council Directives:                             <ul style="list-style-type: none"> <li>– Low-Voltage Directive (73/23/EEC)</li> <li>– EMC Directive (89/336/EEC)</li> </ul>                             as amended by CE Marking Directive (93/68/EEC)                         </li> </ul>
Telcordia	<ul style="list-style-type: none"> <li>• GR-63 and GR-1089 NEBS (including Level 3 testing)</li> <li>• Report by an independent test house</li> </ul>

## Rectifiers

**Table 9-B: 595LT Series Rectifier Specifications**

Electrical										
Output Voltage	52Vdc typical									
Output Voltage Adjustment	44-58Vdc float/boost									
Regulation (with controller)	±0.5%									
Output Current	595LTA 220A At 50°C	595LTB 0°C to 40°C 0°C to 37°C 200A 200A								
High Voltage Shutdown (selected by controller)	Float/boost 44-60Vdc (56Vdc default)									
Backup High Voltage Shutdown	Float/boost 59-60Vdc (59.5Vdc nominal)									
Ripple	100mVrms									
Noise	<2mV psophometric									
Current Limit Set Point	60Adc - 220Adc									
	595LTA Rectifier	595LTB Rectifier								
Nominal Input Voltage (3-wire plus ground)	380 - 480 Vac	200 - 240 Vac								
Input Voltage Range (per phase)	320 - 530 Vac	176 - 275Vac								
Input Current	20A at 480Vac 25A at 380Vac 30A	40A at 208Vac 35A at 240Vac 50A								
Specified	23.7A at 320Vac 20.4A at 380Vac 16.2A at 480Vac	44.1A at 176Vac 38.8A at 200Vac 37.3A at 208Vac 32.3A at 240Vac								
RatedMaximum										
TypicalMaximum										
Frequency Range	47 - 63 Hz									
Power Factor	0.98 from 50% to 100% load									
Total Harmonic Distortion	<5% from 50% to 100% load									
<p><b>AC Surge Protection:</b> It is important that ac surges reaching rectifiers do not exceed the capacity of the rectifier internal surge protection. Protection must be provided external to the GPS system to limit surge energy reaching the rectifiers. Site surge protection must be coordinated with rectifier internal surge protection and must clamp at a lower voltage than the rectifier internal protection. The internal protection voltage and current characteristics of the rectifiers are as follows:</p>										
<p><b>595LTA</b></p> <table> <thead> <tr> <th>Phase to Phase Voltage</th> <th>MOV Conduction Current</th> </tr> </thead> <tbody> <tr> <td>625 Vac (RMS)</td> <td>0 A</td> </tr> <tr> <td>940 Vpeak</td> <td>1 mA</td> </tr> <tr> <td>1650 Vpeak</td> <td>100 A</td> </tr> </tbody> </table>			Phase to Phase Voltage	MOV Conduction Current	625 Vac (RMS)	0 A	940 Vpeak	1 mA	1650 Vpeak	100 A
Phase to Phase Voltage	MOV Conduction Current									
625 Vac (RMS)	0 A									
940 Vpeak	1 mA									
1650 Vpeak	100 A									
<p><b>595LTB</b></p> <table> <thead> <tr> <th>Phase to Phase Voltage</th> <th>MOV Conduction Current</th> </tr> </thead> <tbody> <tr> <td>320 Vac (RMS)</td> <td>0 A</td> </tr> <tr> <td>462 Vpeak</td> <td>1 mA</td> </tr> <tr> <td>810 Vpeak</td> <td>100 A</td> </tr> </tbody> </table>			Phase to Phase Voltage	MOV Conduction Current	320 Vac (RMS)	0 A	462 Vpeak	1 mA	810 Vpeak	100 A
Phase to Phase Voltage	MOV Conduction Current									
320 Vac (RMS)	0 A									
462 Vpeak	1 mA									
810 Vpeak	100 A									











# ***10***

## ***Safety***

Please read and follow all safety instructions and warnings before servicing the GPS 4848/100. Reference the Safety section of the GPS Installation Guide and individual module product manuals for safety statements specific to the modules.



# ***11 Maintenance and Replacement***

## ***Requirements***

### ***System***

With the exception of the battery, periodic maintenance specific to the power system is not required. The ac service for the building must be maintained with ANSI specified limits. The temperature and humidity within the power room must be maintained within the limits specified in Section 9 of this product manual.

Refer to Table 11-A for system replacement parts.

### ***Batteries***

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

### ***Controller***

For replacement circuit packs for the Galaxy Millennium Controller, refer to Table 11-B.





















































# **13**                      ***Troubleshooting Millennium Systems***

## ***Introduction***

***In This Section***                      This section provides information for locating and interpreting visual indicators to help identify problems.

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

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









**CTRL Alarm LED**

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

<b>Controller LED</b>	<b>Controller Alarm Status</b>	<b>Millennium Controller Display</b>	<b>Other Indication(s)</b>	<b>Possible Problem(s)</b>	<b>Possible Solution(s)</b>
CTRL	MAJ	Controller Fail	--	<ul style="list-style-type: none"> <li>•<b>BSH failure</b>→</li> <li>•BSJ failure</li> <li>•Option board failure</li> <li>•Display failure</li> <li>•BIC failure</li> </ul>	<p>Check the BSH board to see if the green LED is extinguished and the yellow LED is lit. If so, perform the following steps:</p> <ol style="list-style-type: none"> <li>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.</li> <li>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.</li> <li>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.</li> <li>4. If the problem is not corrected, call technical support.</li> </ol>

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

Controller LED	Controller Alarm Status	Millennium Controller Display	Other Indication(s)	Possible Problem(s)	Possible Solution(s)
CTRL	MAJ	Controller Fail	--	<ul style="list-style-type: none"> <li>•BSH failure</li> <li>•BSJ failure→</li> <li>•Option board failure</li> <li>•Display failure</li> <li>•BIC failure</li> </ul>	<p>Check the BSJ board to see if the green LED is extinguished and the yellow LED is lit. If so, perform the following steps:</p> <ol style="list-style-type: none"> <li>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.)</li> <li>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.</li> <li>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.</li> <li>4. If the problem is not corrected, call technical support.</li> </ol>

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

Controller LED	Controller Alarm Status	Millennium Controller Display	Other Indication(s)	Possible Problem(s)	Possible Solution(s)
CTRL	MAJ	Controller Fail	--	<ul style="list-style-type: none"> <li>•BSH failure</li> <li>•BSJ failure</li> <li>•<b>Option board failure</b>→</li> <li>•Display failure</li> <li>•BIC failure</li> </ul>	<p>Check the option boards (modem and data switch) to see if the green LED is extinguished and the yellow LED is lit. If so, perform the following steps:</p> <ol style="list-style-type: none"> <li>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.</li> <li>2. If the diagnostics did not pass, or if the problem recurs, replace the failed option board.</li> </ol>
CTRL	MAJ	Controller Fail	--	<ul style="list-style-type: none"> <li>•BSH failure</li> <li>•BSJ failure</li> <li>•Option board failure</li> <li>•<b>Display failure</b>→</li> <li>•BIC failure</li> </ul>	<p>If the front panel LCD module, LEDs, or switches fail, perform the following steps:</p> <ol style="list-style-type: none"> <li>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.</li> <li>2. Press SW200 to reset the BSH board.</li> <li>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.</li> </ol>

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

Controller LED	Controller Alarm Status	Millennium Controller Display	Other Indication(s)	Possible Problem(s)	Possible Solution(s)
CTRL	MAJ	Controller Fail	--	<ul style="list-style-type: none"> <li>•BSH failure</li> <li>•BSJ failure</li> <li>•Option board failure</li> <li>•Display failure</li> <li>•BIC failure→</li> </ul>	<ol style="list-style-type: none"> <li>1. Strap K1, K2, K3 on BLJ from “C” to “R” prior to replacing BIC. See Figure 8-2.</li> <li>2. Replace BIC.</li> </ol>
CTRL	MAJ	Circuit Pack Fail	--	See “Controller Fail”.	See “Controller Fail”.
CTRL	MAJ	Controller Fuse	--	Fuse has operated.	Replace the controller fuse labeled F2 (intelligent power).
CTRL	MAJ	Alarm Battery Supply Fuse	--	Fuse has operated.	Replace the controller fuse labeled F5 (alarm battery supply).
CTRL	MAJ	Remote Peripheral Fuse	--	Fuse has operated.	Replace the controller fuse labeled F1 (option power).
CTRL	MAJ	Sense/Control Fuse	--	Fuse has operated.	Replace the controller fuse labeled F4 (voltage sense).
CTRL	MAJ	Bay Interface ID Conflict	--	Two or more bay interface cards (BICs) have the same ID number.	Following instructions printed on the label over the BIC, adjust the DIP switches to change the ID number.
CTRL	MAJ	Major Communication Fail Alarm	Blinking ALM LED on rectifiers or red LED on BIC	Loss of communication with controller: <ul style="list-style-type: none"> <li>•Defective interface from BIC or multiple rectifiers to controller</li> <li>•Internal failure of controller, BIC, or multiple rectifiers</li> </ul>	<ol style="list-style-type: none"> <li>1. Verify that the controller is powered and operating correctly.</li> <li>2. If there are no controller alarms, replace the equipment that has lost communication.</li> <li>3. If the problem is not corrected, call technical support.</li> </ol>



**RECT Alarm LED**

**Table 13-E: Rectifier Related Alarms**  
(See Figures 12-4 and 12-6)

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

**Table 13-E: Rectifier Related Alarms (Continued)**  
(See Figures 12-4 and 12-6)

<b>Controller LED</b>	<b>Controller Alarm Status</b>	<b>Millennium Controller Display</b>	<b>Rectifier LED</b>	<b>Rectifier Display</b>	<b>Possible Problem(s)</b>	<b>Possible Solution(s)</b>
RECT	MIN	Rectifier Fail	ALM	TA	Thermal alarm: •Excessive ambient temperature •Internal rectifier failure	<ol style="list-style-type: none"> <li>1. Verify that there is no obstruction of the fan inlet.</li> <li>2. Toggle the ON/STBY switch into the STBY position and then back into the ON position.</li> <li>3. If the problem is not corrected, replace the rectifier.</li> </ol>
RECT	MIN	Rectifier Fail	ALM	CB	Circuit breaker alarm: •DC output circuit breaker open •Internal rectifier failure	<ol style="list-style-type: none"> <li>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.</li> <li>2. If the problem is not corrected, replace the rectifier.</li> </ol>

**Table 13-E: Rectifier Related Alarms (Continued)**  
 (See Figures 12-4 and 12-6)

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 InF FSE LS	Internal rectifier failure	<ol style="list-style-type: none"> <li>1. Place the ac circuit breaker for the rectifier in the OFF position.</li> <li>2. Remove the rectifier from the shelf.</li> <li>3. Wait for 30 seconds or until all front panel display LEDs have extinguished.</li> <li>4. Replace the rectifier.</li> <li>5. Return the ac breaker to the ON position.</li> <li>6. Place the rectifier ON/STBY switch into the ON position.</li> <li>7. If the problem is not corrected, replace the rectifier.</li> </ol>
RECT	MIN	Rectifier Fail	ALM	LO	Low output voltage: <ul style="list-style-type: none"> <li>•Excessive output current</li> <li>•Internal rectifier failure</li> </ul>	<ol style="list-style-type: none"> <li>1. Toggle the ON/STBY switch into the STBY position and then back into the ON position.</li> <li>2. If the problem is not corrected, replace the rectifier.</li> </ol>



**Table 13-E: Rectifier Related Alarms (Continued)**  
(See Figures 12-4 and 12-6)

Controller LED	Controller Alarm Status	Millennium Controller Display	Rectifier LED	Rectifier Display	Possible Problem(s)	Possible Solution(s)
RECT	MIN	Rectifier Fail	ALM	SEN	Thermal sensor failure: •Internal rectifier failure	<ol style="list-style-type: none"> <li>1. Place the ac circuit breaker for the rectifier in the OFF position.</li> <li>2. Remove the rectifier from the shelf.</li> <li>3. Wait for 30 seconds or until all front panel display LEDs have extinguished.</li> <li>4. Replace the rectifier.</li> <li>5. Return the ac breaker to the ON position.</li> <li>6. Place the rectifier ON/STBY switch into the ON position.</li> <li>7. If the problem is not corrected, replace the rectifier with a new one.</li> </ol>
RECT	MIN	Rectifier Fail	FAN ALM	None	Fan failure	Replace the fan in the rectifier.
RECT	MIN	Manual Off	STBY	Blank	Rectifier has been manually turned off.	Turn rectifier on.
RECT	MIN	External Transfer Shutdown	STBY	TR	System is operating on external engine.	No action required.
RECT	MIN	High Float Voltage	None	None	Configuration problem	Call technical support.
RECT	MIN	Excess Rectifier Drain	None	None	Internal rectifier fault	Replace rectifier.

**Table 13-E: Rectifier Related Alarms (Continued)**  
 (See Figures 12-4 and 12-6)

<b>Controller LED</b>	<b>Controller Alarm Status</b>	<b>Millennium Controller Display</b>	<b>Rectifier LED</b>	<b>Rectifier Display</b>	<b>Possible Problem(s)</b>	<b>Possible Solution(s)</b>
RECT	MIN	Excess System Drain	None	None	System load exceeds shunt rating.	Call technical support.
RECT	MIN	Limited Recharge	None	None	Rectifier capacity has been exceeded.	Install more rectifiers.
RECT	MIN	Rectifier Fail	ALM	ILC	Rectifier not fully seated.	<ol style="list-style-type: none"> <li>1. Place the ac circuit breaker for the rectifier in the OFF position.</li> <li>2. Remove the rectifier from the shelf.</li> <li>3. Wait for 30 seconds or until all front panel display LEDs have extinguished.</li> <li>4. Replace the rectifier.</li> <li>5. Return the ac breaker to the ON position.</li> <li>6. Place the rectifier ON/STBY switch into the ON position.</li> <li>7. If the problem is not corrected, replace the rectifier with a new one.</li> </ol>







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

- D. If Seller has elected to repair or replace a defective Product, Customer shall have the option of removing and reinstalling or having Seller remove and reinstall the defective or nonconforming Product. The cost of the removal and the reinstallation shall be borne by Customer. With respect to Cable and Wire Products, Customer has the further responsibility, at its expense, to make the Cable and Wire Products accessible for repair or replacement and to restore the site. Products returned for repair or replacement will be accepted by Seller only in accordance with its instructions and procedures for such returns. The transportation expense associated with returning such Product to Seller shall be borne by Customer. Seller shall pay the cost of transportation of the repaired or replacing Product to the destination designated by Customer.
- E. Except for batteries, the defective or nonconforming Products or parts which are replaced shall become Seller's property. Customer shall be solely responsible for the disposition of any batteries.
- F. If Seller determines that a Product for which warranty service is claimed is not defective or nonconforming, Customer shall pay Seller all costs of handling, inspecting, testing, and transportation and, if applicable, traveling and related expenses.
- G. Seller makes no warranty with respect to defective conditions or nonconformities resulting from actions of anyone other than Seller or its subcontractors, caused by any of the following: modifications, misuse, neglect, accident, or abuse; improper wiring, repairing, splicing, alteration, installation, storage, or maintenance; use in a manner not in accordance with Seller's or Vendor's specifications or operating instructions, or failure of Customer to apply previously applicable Seller modifications and corrections. In addition, Seller makes no warranty with respect to Products which have had their serial numbers or month and year of manufacture removed, altered, or experimental products or prototypes or with respect to expendable items, including, without limitation, fuses, light bulbs, motor brushes, and the like. Seller's warranty does not extend to any system into which the Product is incorporated. This warranty applies to Customer only and may not be assigned or extended by Customer to any of its customers or other users of the Product.

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

# Revision History

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<b>Issue 4</b>	Added Figure 7-15; Corrected air dam comcode
<b>Issue 3</b>	Rebranding
<b>Issue 2</b>	Updated Battery Connection Panel info to include H569-434 G32A; Updated Table 9-A and 9-B specifications; Included info regarding vacant rectifier slots; Included Rectifier display message and LED information.

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