



H5692448 Power Systems

Infinity M^1 (NE-M)

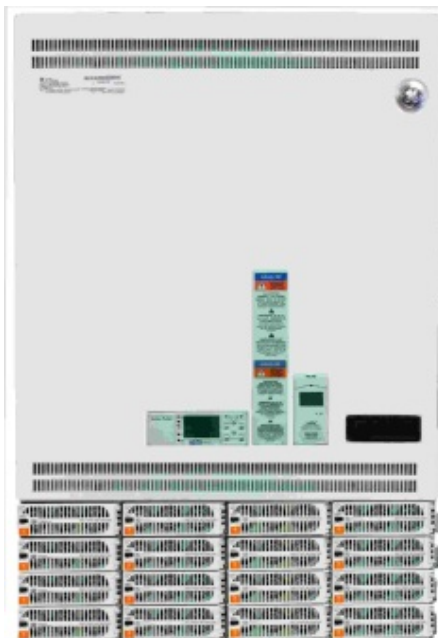
with

Galaxy Millennium™ II Controller

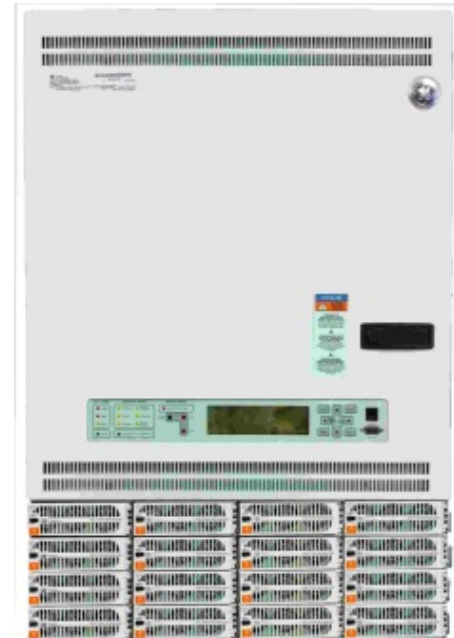
or

Galaxy Pulsar™ Plus Controller

and Eco Capability



**Pulsar Plus Controller
equipped**



**Millennium II Controller
equipped**

Issue 6 and later of this manual cover all NE-M systems, replacing CC848845333 NE-M with *Millennium II Installation Guide*.

Issue 5 and earlier of this manual covered only NE-M with Pulsar Plus.

¹ Trademark of General Electric Company

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Introduction

This manual is intended as a guide in assisting equipment understanding, installation, testing, and troubleshooting. For additional assistance contact Customer Service or access additional information on-line.

Reference Documents

Document	Title
	Infinity M Product Line Brochure – Specifications and Ordering Guide
H5692448-AD	NE System, 24V and/or 48V Assembly Drawing
CC848815341	Galaxy Pulsar Plus ² Family Product Manual
108994645	Galaxy Millennium II ³ Installation and User's Guide

Customer Service Contacts

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

Services provided include initiating the spare parts procurement process, ordering documents, product warranty administration, and providing other product and service information.

GE Energy phones are staffed from 7:00 am to 5:00 pm USA Central Time Zone (GMT -6), Monday through Friday, on normal business days. At other times, this number is still available, but for emergencies only.

Calling from	Phone Number
<ul style="list-style-type: none"> United States, Canada, Puerto Rico, and the US Virgin Islands 	+1 877 546 3243
<ul style="list-style-type: none"> All other countries 	+1 972 244 9288
	Or
	USADCC ⁴ + 877 546 3243

Or contact your local field support center or your sales representative to discuss your specific needs.

On-Line Power Systems Product Manuals and Software

Product manuals, product line brochures, and software are available on-line. Software includes Easy View and SNMP MIB.

www.gecriticalpower.com

² Referred to as "Pulsar Plus" throughout this document.

³ Referred to as "Millennium II" throughout this document.

⁴ The USA direct country code for the country where the call is originating

Product Description

Infinity M (NE-M) is available in multiple system arrangements - **Figure 1**. Refer to the *Infinity M Product Line Brochure* for detail description.

Single or Dual Output Voltage

Primary DC Voltage (Battery and Rectifiers)	Secondary DC Voltage (dc/dc Converters)
24V	none
24V	48V
48V	none
48V	24V

Battery Connections

- Direct connection to *NE-M* system bus
- Through battery maintenance switches or circuit breakers located at the battery
- Through a Low Voltage Battery Disconnect (LVBD)

DC Distribution

- DC Voltage: Primary only or Primary and Secondary
- Low Voltage Load Disconnect (LVLD) (Primary DC Voltage option)
- Selectable distribution options

Universal Power Shelf

- Accepts rectifiers or converters interchangeably in any power slot
- Can be installed with no AC connected, making it a converter only shelf

AC Feeds

- Front accessible terminal blocks
- One or two rectifier positions per feed

The controller monitors and controls system operation.

Controller

- Pulsar Plus
 - Eco features included
- Millennium II

Framework

- 84 inch, 72inch, or 42 inch frame
- Sub-frame - mount in customer provided 23 inch frame

Eco Capable Systems - Pulsar Plus only

Eco capable systems (Eco systems) add support for multiple power inputs of multiple types, including PV (photo voltaic or solar) arrays.

Power Input

- PV (photo voltaic or solar) arrays
- AC generators
- AC mains

Rectifiers

*NE Eco Rectifiers*⁵

- Input - AC or DC (PV or solar) input
- MPPT (Maximum Power Point Tracking) maximizes power harvested from PV arrays
- Recommended for all rectifier positions in *Eco* systems

Controller

- Pulsar Plus
- Eco features included (PV, Gen Set, etc.)

⁵ **REQUIRED** – Eco rectifiers in all DC (PV or solar) powered rectifier positions.

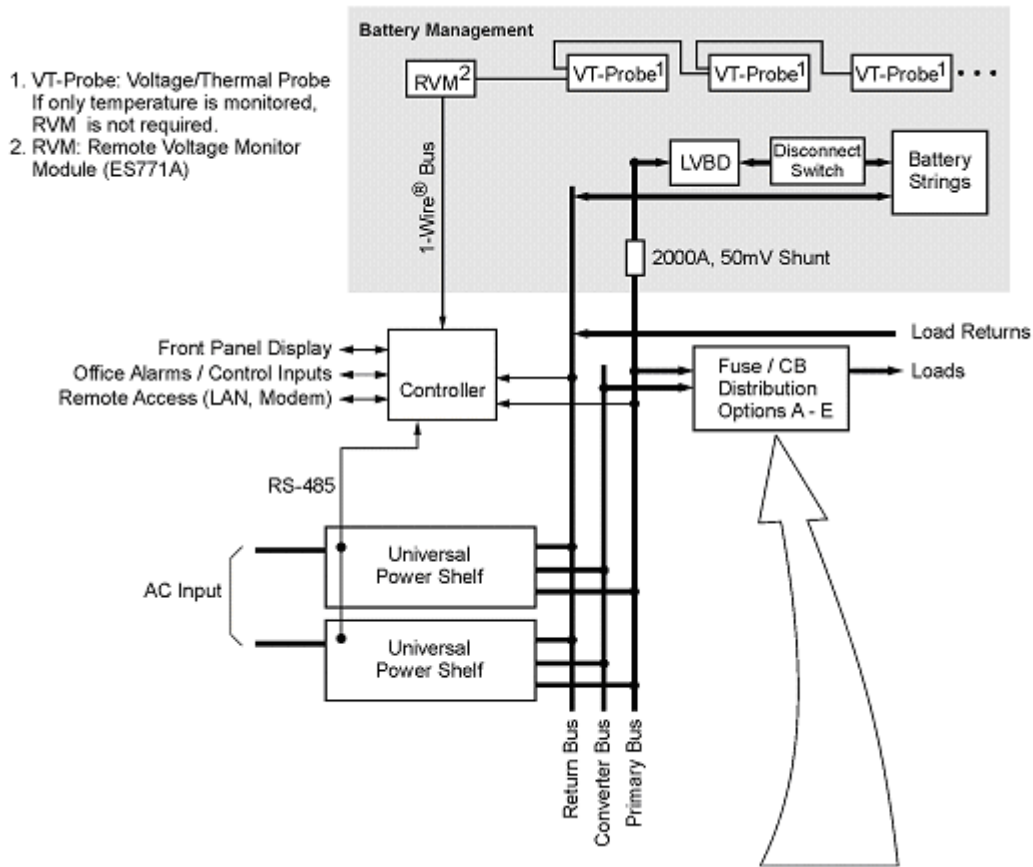
RECOMMENDED – Eco rectifiers in all Eco system rectifier positions.

NOT RECOMMENDED – non-Eco rectifiers in Eco systems.

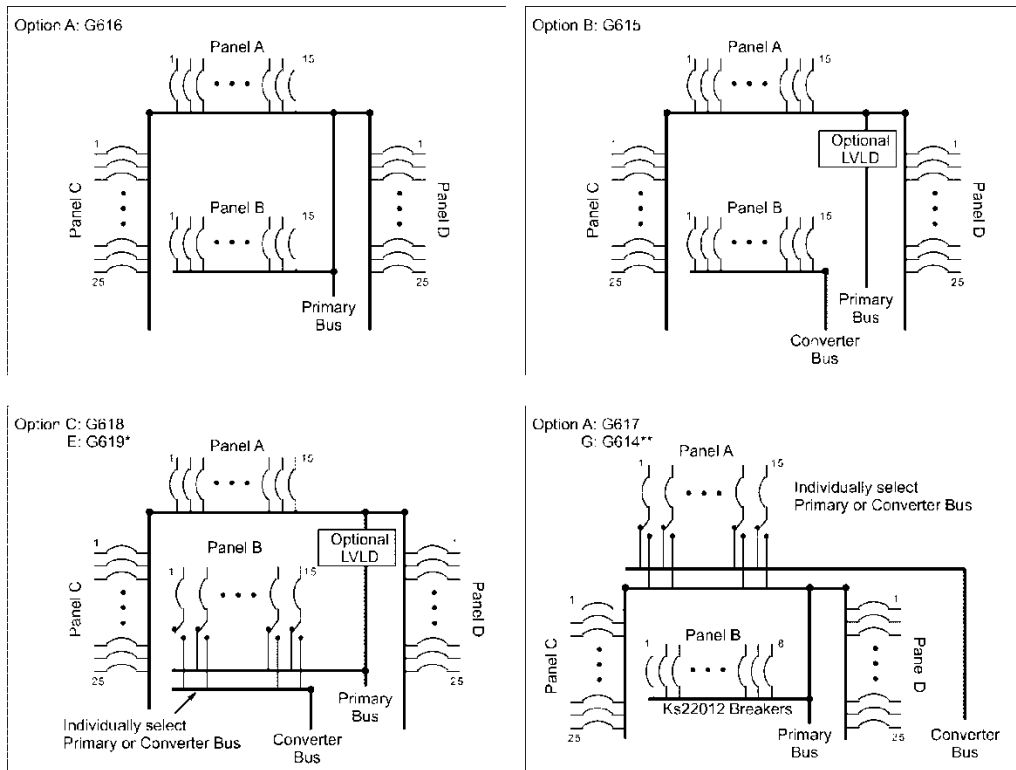
Non Eco rectifiers will not function properly when powered by DC (PV or solar) input in Eco systems.

Use of non-Eco rectifiers in Eco systems increases the risk of improperly filling all system rectifier positions.

Non Eco rectifiers may be installed in AC powered rectifier positions of Eco systems.



1. VT-Probe: Voltage/Thermal Probe
If only temperature is monitored, RVM is not required.
2. RVM: Remote Voltage Monitor Module (ES771A)



* Option E: Selectable distribution on both A and B Panels
**Option G: No Converter Bus - Panel A is on Primary Bus

Figure 1 Block Diagram

Components

- Frameworks:
 - Full-Height Frame
 - Half-Height Frame
 - Sub-frame
 - with frame mounting brackets
 - Pulsar Plus or Millennium II controller
 - NE830 Redundant Voltage Monitor
 - NE-Series Rectifiers and Converters
 - Front accessible AC terminal blocks
-
- Battery Options and Monitoring:
 - Battery Trays with Disconnect Breakers or Anderson PowerPole® disconnects
 - LVBD Contactors
 - Thermal/Voltage Probes
 - External Ambient Temperature Probes
 - Battery Shunt
-
- dc distribution options:
 - Bullet terminal breakers up to 250A
 - Bolt-in KS22012 breakers up to 600A
 - TPS fuses up to 70A
 - GMT fuses up to 15A
 - LVLD Contactor

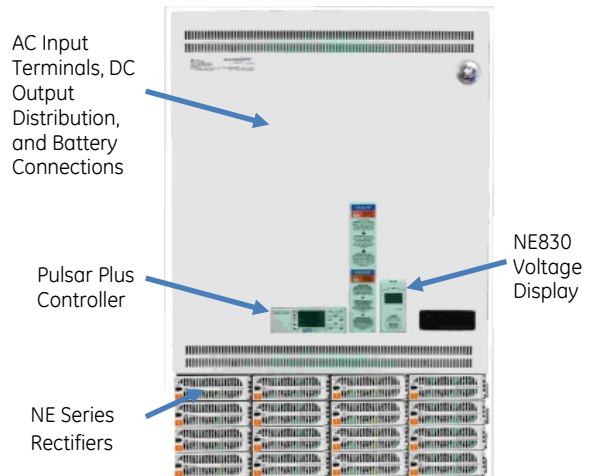
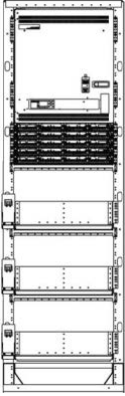
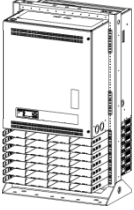
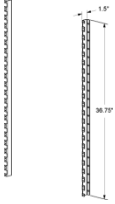


Figure 2 NE-M Components

Frameworks

	Framework	Description
 <p>Figure 3 Frame - Full-Height</p>	<p>Full-Height - Heavy Duty</p>	<ul style="list-style-type: none"> • Floor Mount • 84" - 44RU equipment space • 72" - 38RU equipment space • 1200 lb zone 4 • 1800 lb zone 2
 <p>Figure 4 Frame - Half Height</p>	<p>Half-Height</p>	<ul style="list-style-type: none"> • Mounted on top of floor-mounted batteries or battery stand • 42" Half-Height (21RU equipment space) • Supports systems with up to seven universal shelves
 <p>Figure 5 Sub-frame</p>	<p>Sub-frame</p>	<ul style="list-style-type: none"> • Mounting Brackets for shipping <i>NE-M</i> for field installation in a customer provided 23" framework • 36.75" (21RU) High
	<p>Kick Plates for Full Height Framework</p>	<ul style="list-style-type: none"> • 15" depth • 24" depth

Controller – Pulsar Plus

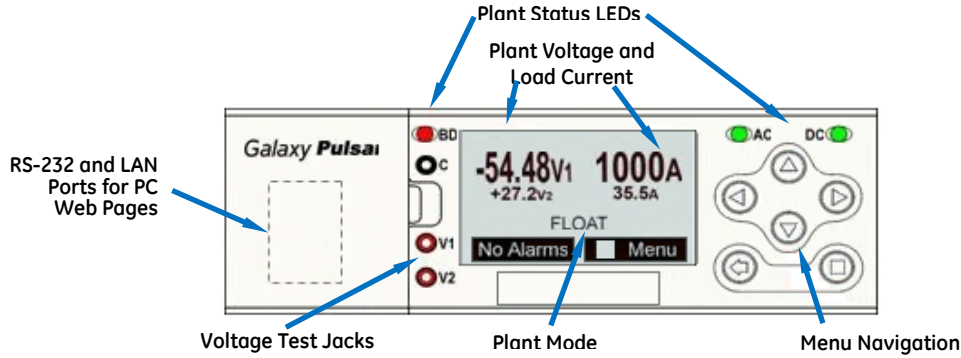


Figure 6 Pulsar Front Panel

- Local or remote viewing and configuration of system parameters, alarm thresholds, and user-definable alarm inputs and relays
- Extensive rectifier/converter Monitoring and Control
- Advanced Battery Management to maximize and manage battery health
- Emergency Power Off (EPO) to meet local emergency services code requirements
- System voltage and current monitoring
- LVBD and LVLD Low Voltage Disconnect contactor control and monitoring
- dc Distribution monitoring
- Standard and Programmable Alarms
- Extensive Voltage, Current, Temperature, and Binary Input monitoring
- Standard and programmable Office Alarm relays
- Digital communications to all system devices

See the *Pulsar Plus Controller Family Product Manual* for further detail.

Controller – Millennium II

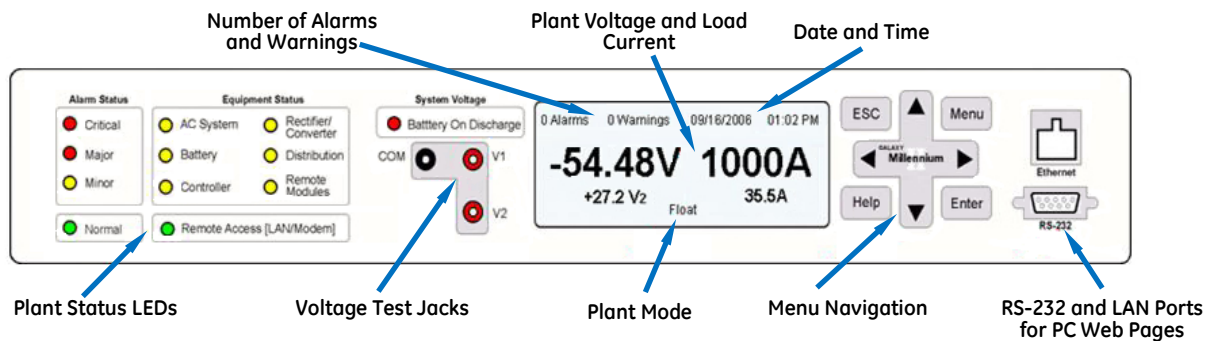


Figure 7 Millennium II Controller Front Panel

- Local or remote viewing and configuration of system parameters, alarm thresholds, and user-definable alarm inputs and relays
- Extensive rectifier/converter Monitoring and Control
- Advanced Battery Management to maximize and manage battery health
- Emergency Power Off (EPO) to meet local emergency services code requirements
- System voltage and current monitoring
- LVBD and LVLD Low Voltage Disconnect contactor control and monitoring
- dc Distribution monitoring
- Standard and Programmable Alarms
- Extensive Voltage, Current, Temperature, and Binary Input monitoring
- Standard and programmable Office Alarm relays
- Digital communications to all system devices
- Remote Peripheral Modules (RPMs)

See the *Galaxy Millennium II Installation and User's Guide* for further detail.

Aux Display - NE830A (Optional)

The Aux Display is a voltage monitor that alarms when the voltage of the power system is out of the normal operating range. It is mounted on the door of the distribution box.

Figure 8 NE830 Display

- Fully independent of the main system controller
 - Displays one or two system voltages and battery state:

NORMAL
 48V
54.5V

NORMAL
 48V 24V
54.5V 27.3V

 - Single voltage systems, -48V, +24V
 - Dual voltage systems, -48V and +24V with common return
- The display and LED color indicates battery charge state and wiring errors:
 - Green display = batteries are not discharging
 - Red display = batteries are discharging
 - Amber display = wiring error
- A Battery on Discharge alarm relay with form-C contacts is provided
- Can be panel, wall or frame rail mounted within 150 ft of the power system

Rectifiers and Converters

NE-Series rectifiers and converters are hot-pluggable for quick, simple, plug-and-play installation without tools.

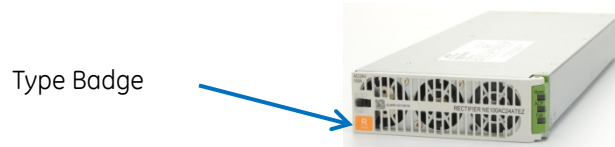


Figure 9 Rectifier and Converter Type Badge

NE Eco Rectifiers







- Input AC or DC (PV or solar)
- Compatibility All *Infinity* Rectifier Positions
- Eco Feature MPPT (Maximum Power Point Tracking) maximizes power harvested from PV arrays

NE Non-Eco Rectifiers

- Input AC only
- Compatibility All AC powered *Infinity* Rectifier Positions⁶

Table 1 Rectifiers and Converters			
Rectifier/Converter	Input	Output	Eco Compatible

⁶ Non Eco rectifiers will not function properly when powered by DC (PV or solar) input in Eco systems.

Table 1 Rectifiers and Converters				
Eco Rectifier  blue	NE050ECO48ATEZ	ac 110/208/220/240 Vac dc 60Vdc (+/-30V) to 310Vdc (+/-150) 11A max	48V, 50A	Yes ⁷
Eco Rectifier  orange	NE100ECO24TEZ	ac 110/208/220/240 Vac dc 60Vdc (+/-30V) to 310Vdc (+/-150) 11A max	24V, 100A ⁸	Yes ⁷
Converter  blue	NE040DC48ATEZ	24 Vdc	48V, 40A	Yes
	NE030DC48A		48V, 30A	Yes
Converter  orange	NE075DC24A	48 Vdc	24V, 75A	Yes
Rectifier  blue	NE075AC48ATEZ	110/208/220/240 Vac	48V, 75A ⁹	AC Only ¹⁰
	NE050AC48ATEZ	110/208/220/240 Vac	48V, 50A	
	NE050AC48A ¹¹	208/220/240 Vac		
Rectifier  orange	NE100AC24ATEZ	110/208/220/240 Vac	24V, 100A	AC Only ¹⁰
	NE100AC24A ¹¹	208/220/240 Vac		
	NE850 Slot Filler			

⁷ **REQUIRED** – Eco rectifiers in all DC (PV or solar) powered rectifier positions.

RECOMMENDED – Eco rectifiers in all Eco system rectifier positions.

NOT RECOMMENDED – non-Eco rectifiers in Eco systems.

Non Eco rectifiers will not function properly when powered by DC (PV or solar) input in Eco systems.

Use of non-Eco rectifiers in Eco systems increases the risk of improperly filling all system rectifier positions.

Non Eco rectifiers may be installed in AC powered rectifier positions of Eco systems.

⁸ 44A with 120Vac input

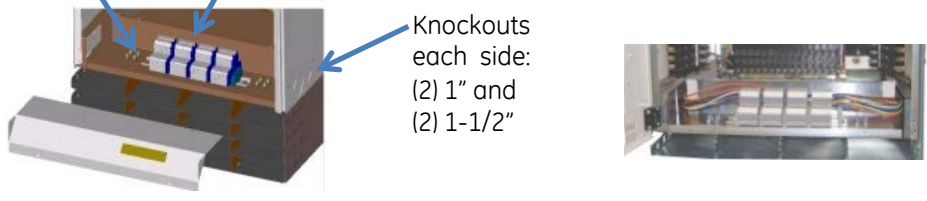
⁹ 22A with 120Vac input

¹⁰ **NOT RECOMMENDED for use in Eco systems** - Non Eco rectifiers will not function properly when powered by DC (PV or solar) input in Eco systems.


Use of non-Eco rectifiers in Eco systems increases the risk of improperly filling system rectifier positions.

¹¹ Non-TEZ rectifiers are no longer orderable and have lower efficiency than TEZ rectifiers

Power Input Panel

<p>Power Input</p> <p>Terminal blocks in a front access panel at the bottom of the distribution box.</p>	<p>Conduit Ground ¼-20 x 0.75" or 0.625" Studs</p> <p>Terminal Blocks Accept 24- 6 AWG wire. Straps provided to feed rectifier pairs.</p> <p>Knockouts each side: (2) 1" and (2) 1-1/2"</p>  <p style="text-align: center;">Figure 10 Power Input Panel</p>
---	--

Battery Options and Monitoring Features

 <p>Figure 11 Battery Stand</p>	<p>Battery Options</p> <ul style="list-style-type: none"> • Designed for operation with GE flooded, VRLA and Durathon™ Sodium batteries, as well as other vendors' batteries. • Battery trays are available for 100Ahr to 170Ahr batteries with Anderson PowerPole® connectors or circuit breaker disconnects. • Half-height and third-height systems can be mounted on floor-mounted VRLA strings or on GE Universal Battery Stands. <p>Battery Monitoring Features</p> <ul style="list-style-type: none"> • Open String (OS) Alarms • Emergency Power Off (EPO) for disconnecting batteries from the system • Temperature/voltage probes (up to 16) used in Battery Management options <ul style="list-style-type: none"> • Slope Thermal Compensation – High and Low Temperature • Battery High Temp Disconnect • Mid-String Voltage Monitoring • Battery Discharge Test • Battery Shunt • Low Voltage Battery Disconnect/Reconnect Contactor (LVDB) with Emergency Power Off (EPO)
--	---

dc Distribution and Battery Termination

Configuration	Features
<p>Figure 12 DC Distribution Bullet & Bolt-In</p>	<ul style="list-style-type: none"> • Door Mounted Controller • (12) pair Battery and Return bus landings for battery cables • LVBD Contactor • (80) Bullet Distribution positions arranged for: <ul style="list-style-type: none"> • Bullet terminal breakers to 250A • TPS fuse holders for fuses to 70A • GMT Fuse Module - (6) position • (8) KS22012 circuit breaker positions • LVLD Contactor • Up to 8 Universal Power Shelves
<p>Figure 13 DC Distribution - Bullet</p>	

Installation

Follow all site engineering instructions. This section is provided only as a guide.

Preparation

Safety

Read and follow all safety statements, warnings, and precautions in the Safety section of this manual and manuals of all other equipment before installing, maintaining or repairing the equipment.

Installation Tools

You will need the following tools.

- Wire cutters and strippers
- Heat shrink gun
- 5/16-inch (8 mm) hex driver
- Digital meter with an accuracy of $\pm 0.02\%$
- Screw drivers (flat-blade and Phillips)
- ESD wrist strap
- 24 or 48V test load
- Calibrated clamp-on dc current meter (0.1 ADC sensitivity)
- Torque wrench
- Socket wrenches:
 - 7/16" and 9/16" - cable connections
 - 19 mm - anchor bolts
- 12" extension for socket
- Masonry drill kit as required
- Compression for installation of various compression lugs
- Protective canvas
- Insulating rubber mat
- Standard insulated installation tools, screwdrivers, etc.
- Controller Manual
Galaxy Pulsar Plus Family Product Manual
or
Galaxy Millennium II Installation and User's Guide
- Windows-based personal computer laptop (PC) and cable to connect the PC communications port to the local port of the controller or a CAT5 LAN cable. (Optional. See the controller manual for more information).

Equipment Identification

Identify the equipment you have received. Follow procedural steps which match the equipment being installed.

Anchor Frame

Ventilation space is required to the rear of the equipment: 4" to solid surface, 6" to heat producing surface.

Floor Mounted Frame

Using the 847135688 Floor Anchor Kit (recommended):

Anchor Type (Hilti)	Wrench	Torque
(4) 12 mm Cap Bolts	19 mm	720 in-lb 60 ft-lb 82 Nm

Note: For systems with tray mounted batteries at sites requiring Seismic Zone 4 rating, (2) 847135688 kits are required to provide (8) floor anchors.

Note: If using Equivalent Floor Anchors, make sure the floor anchors are rated for this application.

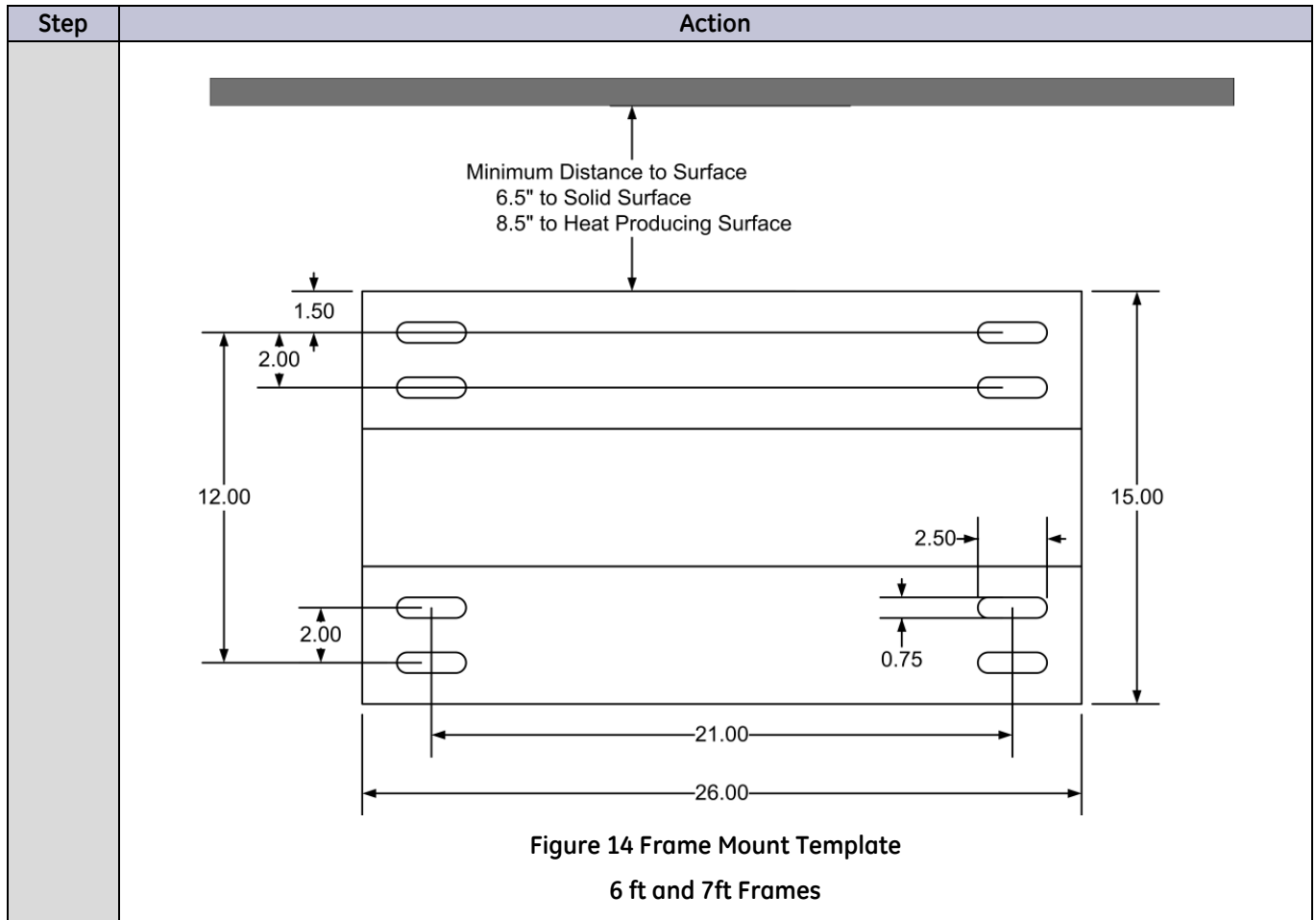


Figure 14 Frame Mount Template
6 ft and 7ft Frames

CAUTION: Health Hazard
Follow safe floor drilling procedures to prevent possible asbestos exposure.

1	Drill anchor holes.
2	Place frame and install floor anchors according to manufacturer requirements.

Step	Action
1	<p>Verify that the rack is positioned to provide adequate ventilation space to the rear of the equipment: 4" to solid surface, 6" to heat producing surface. Distance required to rear of mounting rails: 16.5" to solid surface, 18.5" to heat producing surface.</p> <p>Position the sub-frame system in the rack as desired. Secure the sub-frame system into the rack with at least (12) frame mounting screws, 6 screws per side.</p> <p>Torque to 35 in-lb – 5/16 socket.</p> <div data-bbox="613 394 1088 949" style="text-align: center;"> </div> <p style="text-align: center;">Figure 16 Mount Sub-Frame</p>

Ground Frame

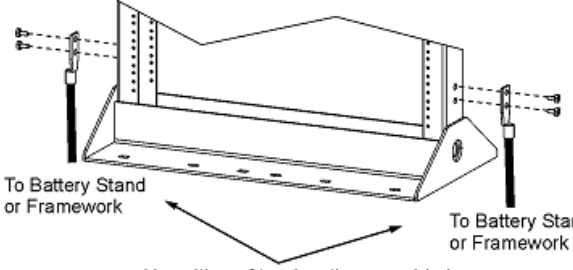
Floor Mounted Frame

Select a Frame Ground landing on the top of the frame and clean.

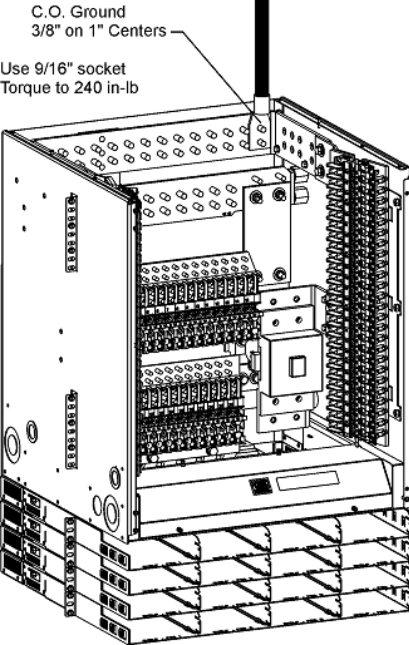
Step	Action
1	<p>Secure Frame Ground connection with provided hardware: (2) ¼-20 x ¾" HH Bolt (2) ¼-inch lock washer (2) ¼-inch flat washer</p> <p>If required by local code or practice, treat with an oxidation inhibitor such as NO-OX.</p> <p>Torque to 65 in-lb - 7/16" socket.</p> <div data-bbox="971 1327 1307 1795" style="text-align: center;"> </div> <p style="text-align: center;">Note: Lug landings are ¼" on 5/8" and 1" centers.</p> <p style="text-align: center;">Figure 17 Ground Frame</p>

Battery or Battery Stand Mounted Frame

If required by local code or practice, battery or battery stand mounted frames may be grounded to the frame or chassis of the other equipment. Select a Frame Ground landing at the side of the frame and clean.

Step	Action
<p>1</p>	<p>Secure Frame Ground connection with provided hardware: (2) 1/4-20 x 3/4" HH Bolt (2) 1/4-inch lock washer (2) 1/4-inch flat washer</p> <p>If required by local code or practice, treat with an oxidation inhibitor such as NO-OX.</p> <p>Torque to 65 in-lb - 7/16" socket.</p> <div data-bbox="824 289 1446 653" style="text-align: center;">  <p>Use either of two locations provided for frame ground connection to supporting framework.</p> <p>Note: Lug landings are 1/4" on 5/8" centers.</p> <p>Figure 18 Ground Short Frame</p> </div>

Connect Central Office Ground (COG)

Step	Action
<p>1</p>	<p>Secure COG connection with provided hardware: (2) 3/8-16 nut (2) 3/8-inch lock washer (2) 3/8-inch flat washer</p> <p>If required by local code or practice, treat with an oxidation inhibitor such as NO-OX.</p> <p>Torque to 240 in-lb - 9/16" socket.</p> <div data-bbox="868 871 1380 1543" style="text-align: center;">  <p>C.O. Ground 3/8" on 1" Centers</p> <p>Use 9/16" socket Torque to 240 in-lb</p> <p>Figure 19 CO Ground Landing</p> </div> <p>Note: Lug landings are 3/8" on 1" centers.</p>

Install PV/AC Partition Kit – NE-M Eco systems only

This section applies only to NE-M Eco systems

NE-M Eco systems power some rectifiers from PV (photo voltaic or solar array) and others from ac, typically a generator. Each terminal block powering rectifiers can be connected to either PV or ac, but not both.

The PV/AC Partition Kit (150028727) divides the Input panel into separate input sections for PV and AC fed terminal blocks.

The position of the partition is site specific. Follow all site engineering instructions. This position indicated in this section is only an example.

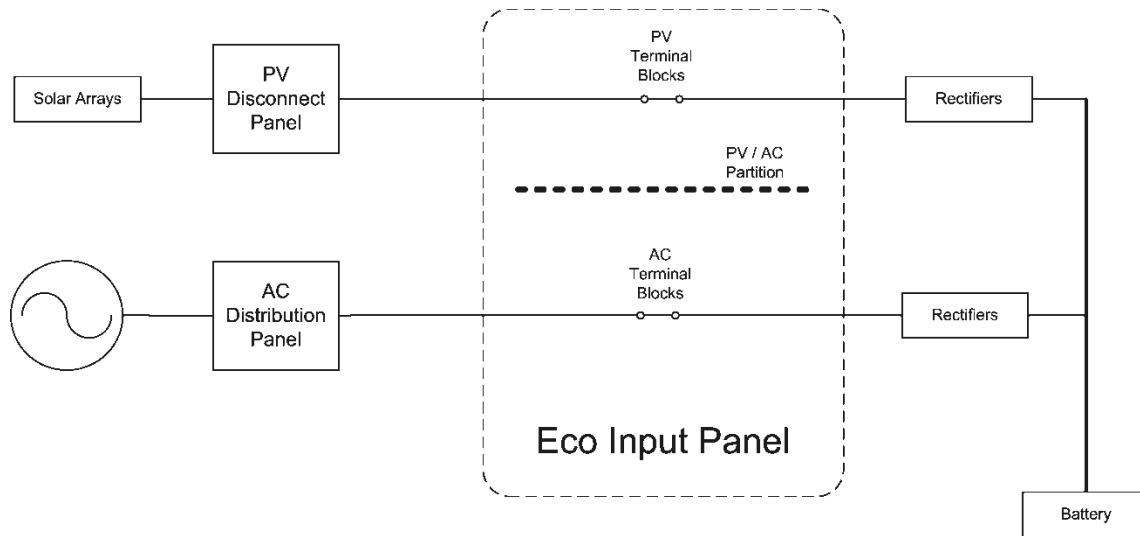



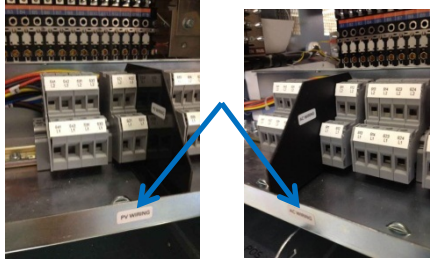



Figure 20 Eco Input Panel

CAUTION: Personal injury and Equipment Damage
 PV Disconnect Panel with disconnects rated at 300Vdc on each PV conductor is required for use with Solar Arrays (PV sources).

Step	Action	
1	Remove the Input Panel cover (4 captive screws).	 <p data-bbox="1063 1627 1404 1659">Figure 21 Input Panel Screws</p>

Step	Action	
2	<p>Apply labels onto PV/AC Partition as shown.</p> <ul style="list-style-type: none"> Place "PV WIRING" label on the left (PV) side of partition. Place the "AC WIRING" label on the right (AC) side of partition. 	 <p data-bbox="1084 751 1385 783">Figure 22 Partition Labels</p>
3	<p>Make space for the PV/AC Partition - Separate DIN rail Terminal Blocks to make space for the PV/AC Partition.</p> <p>Loosen screws securing all DIN spacer blocks to the left of the Partition location specified in the site engineering instructions.</p>	
4	<p>Slide Terminal Blocks and spacer to the left of the Partition location to the left to allow installation of the PV/AC Partition.</p>	 <p data-bbox="1084 1591 1385 1623">Figure 23 Partition Insert</p>
5	<p>Install PV/AC Partition in the location specified in the site engineering instructions.</p> <p>Snap the Partition onto the DIN rail.</p>	
6	<p>Slide the loosened Terminal Blocks and spacer block to the right snugly against the Partition.</p> <p>The Partition lower edge will be under the Terminal Block on its left.</p>	
7	<p>Tighten screws securing all DIN spacer blocks s to the left of the Partition.</p>	

Step	Action	
8	Apply labels to the Input Panel chassis. <ul style="list-style-type: none"> Place "PV Wiring" label on the left (PV) side of partition. Place the "AC Wiring" label on the right (AC) side of partition. 	 <p data-bbox="1073 436 1393 468">Figure 24 Label Input Panel</p>
9	Replace the Input Panel cover and secure fasteners.	
10	Apply 2 labels to Input Panel cover in any available space. <ul style="list-style-type: none"> Warning label Max Power-Point label 	 <p data-bbox="1036 856 1430 888">Figure 25 Label Input Panel Cover</p>

Connect Input Power

WARNING: Shock Hazard
 Disconnect all input branch circuits prior to making input connections to the system. When connecting to any source, ensure compliance to all local and national wiring rules.

CAUTION: Equipment Damage
 PV inputs must be current limited to 11A maximum.

Terminal Block are arranged to allow addition of shelves (to the bottom) and terminal blocks (from the inside out). Example shown is for 4-shelf system; up to 6 shelves are allowed.

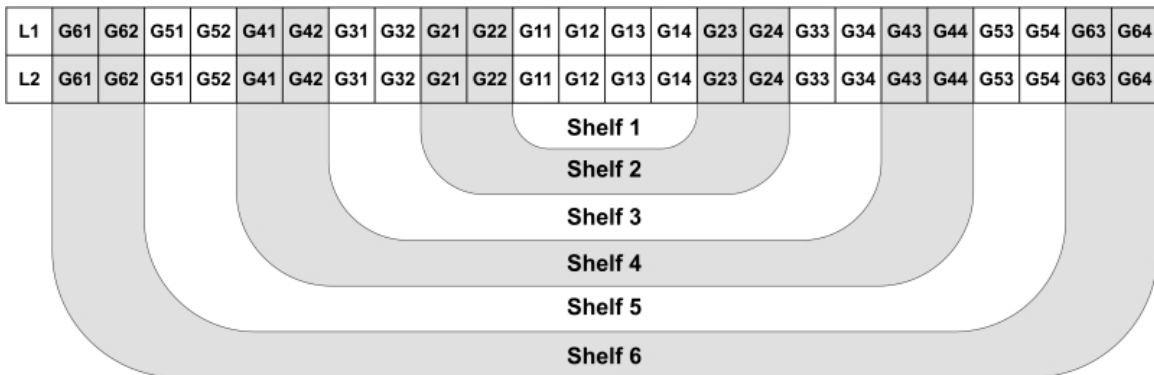


Figure 26 Input Power Terminal Block Positions

	Position 1	Position 2	Position 3	Position 4
Row 1	G11	G12	G13	G14
Row 2	G21	G22	G23	G24
Row 3	G31	G32	G33	G34
Row 4	G41	G42	G43	G44
Row 5	G51	G52	G53	G54
Row 6	G61	G62	G63	G64

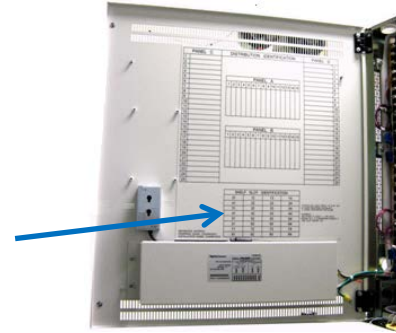


Figure 27 Rectifier and Shelf Numbering

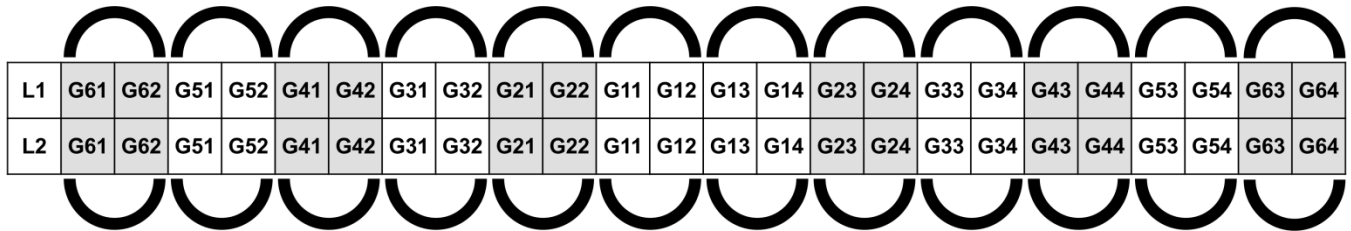


Figure 28 Rectifier Dual Feed Jumper Positions – ac feeds only

Step	Action
1	<p>Route and attach conduit or other commercial fittings.</p> <p>Input power is connected to terminal blocks located within the Input Panel. Terminal blocks for up to six shelves may be present.</p> <p>AC Bridging jumpers¹²</p> <ul style="list-style-type: none"> AC inputs - jumpers may be installed to power two rectifier positions with one AC feed. PV inputs - Do not apply AC bridging jumpers. Each PV feed must power a single rectifier. <p>Figure 26 shows Input Power Terminal Block Positions.</p>
	<p>Figure 29 Input Conduit Locations</p>
	<p>AC input feeds to rectifier pairs?</p> <p>Yes – go to Step 2.</p> <p>No – go to Step 4.</p>

¹² shipped with each system

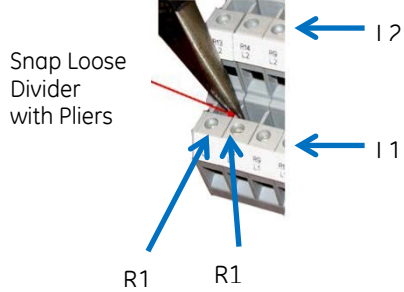
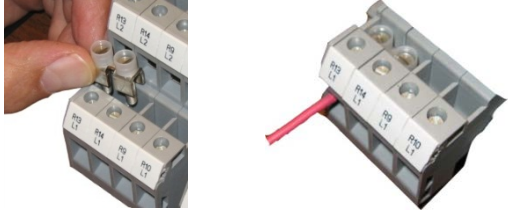
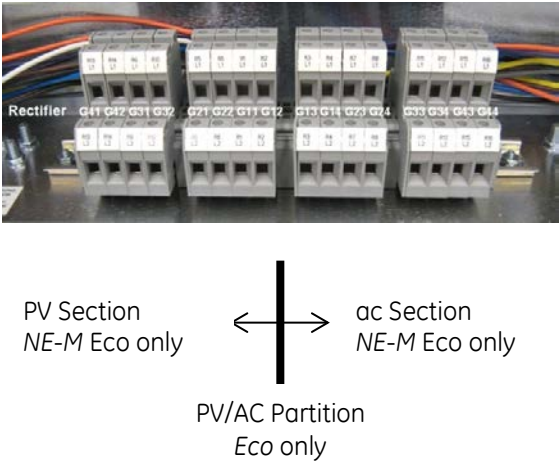
Step	Action	
2	<p>Snap loose L1 and L2 plastic dividers on Input terminal blocks for each single fed rectifier pair.</p> <p>Figure 28 shows rectifier AC dual feed jumper positions.</p>	 <p>Figure 30 Input Jumper Dividers</p>
3	<p>Install AC bridging jumpers connecting each AC fed rectifier pair L1 positions.</p> <p>Install AC bridging jumpers to connect each AC fed rectifier pair L2 positions.</p> <p>Torque to 10 in-lb.</p>	 <p>Figure 31 AC Bridging Jumper</p>
4	<p>CAUTION: Equipment Damage or Malfunction <i>NE-M Eco</i> systems must keep PV input feeds separate from AC input feeds. The PV/AC partition separates PV inputs from AC inputs. Connect PV input feeds only to the PV section of the Input Panel. Connect AC input feeds only to the AC section of the Input Panel</p>	
	<p>CAUTION: Equipment Damage or Malfunction <i>NE-M Eco</i> systems PV input feeds must be connected as follows: Positive PV to L1 Negative PV to L2.</p>	
5	<p>Pull and terminate input feed wires to the terminal blocks in the Input Panel.</p> <ul style="list-style-type: none"> ac input feeds to the AC section of the Input Panel PV input feeds to the PV section of the Input Panel Positive PV to L1 Negative PV to L2. <p>Torque to 10 in-lb.</p> <p>Figure 27 shows rectifier and shelf numbering.</p>	 <p>Figure 32 Input Panel Sections</p>

Table 2 Conduit Size - Input Feed						
Rectifiers per Conduit	Rectifiers per feed	Min. External Breaker	Wire Gage	Minimum Conductor Rating ¹³	Conductors per Conduit ^{14, 15}	Conduit Size
AC Feeds – All rectifiers except NE075AC48xxxx						
7	1	20A	10	40A*0.87*0.5 = 17.5A Rating	15 (50% derated)	1"
10	1	20A	10	40A*0.87*0.4 = 17.5A Rating	21 (40% derated)	1-1/2"
6	2	40A	8	55A*0.87*0.8 = 38.3A Rating	7 (80% derated)	1"
8	2	40A	6	75A*0.87*0.7 = 45.6A Rating	9 (70% derated)	1-1/2"
AC Feeds –NE075AC48xxxx Only						
6	1	30A	6	75A*0.87*0.5 = 32.6A Rating	13 (50% derated)	1"
10	1	30A	4	95A*0.87*0.4 = A Rating	21 (40% derated)	1-1/2"
6	2	60A		A*0.87*0.8 = 3A Rating	7 (80% derated)	1"
8	2	60A		*0.87*0.7 = A Rating	9 (70% derated)	1-1/2"
PV Feeds						
7	1	15A/300Vdc	10	40A*0.87*0.5 = 17.5A Rating	15 (50% derated)	1"
10	1	15A/300Vdc	10	40A*0.87*0.4 = 17.5A Rating	21 (40% derated)	1-1/2"

Install Battery Trays

Optional battery trays are suitable for use with general trade batteries such as Northstar Battery NSB110FT and NSB170FT.

Step	Action
1	<p>Position the battery tray in the frame with frame mounting brackets on both front and back of frame as shown.</p> <p>Secure with provided screws.</p> <p>Torque to 35 in-lb – 5/16" socket.</p>

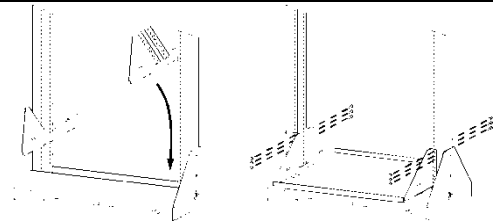


Figure 33 Battery Trays

¹³ Based on NEC 90°C Conductor, Number of Wires in Conduit, and 45°C Ambient

¹⁴ Including 1 ground per conduit

¹⁵ AC and PV feeds must be in separate conduits.

Install Batteries

WARNING: Energy and Chemical Burn

All batteries contain hazardous electrical energy. Lead-acid batteries contain sulfuric acid and explosive hydrogen gas. Follow all precautions noted in the literature accompanying the batteries. Use only insulated tools.

CAUTION: Equipment Damage

Equipment frame anchoring, load rating, and seismic zone rating should be verified before field installing trays and batteries.

Tray Mounted Batteries

The system can be configured with battery trays sized for various batteries and may include optional factory installed battery disconnect or battery mid-string voltage and temperature monitoring units. Compatible batteries include:

- Power Battery CSL-12100
- GE East Penn 12AVR100-3ET
- Equivalent 100 AH front-terminal batteries
- North Star NSB110
- North Star NSB170
- GE East Penn 12AVR150-3ET
- Equivalent 110-170AH front-terminal batteries

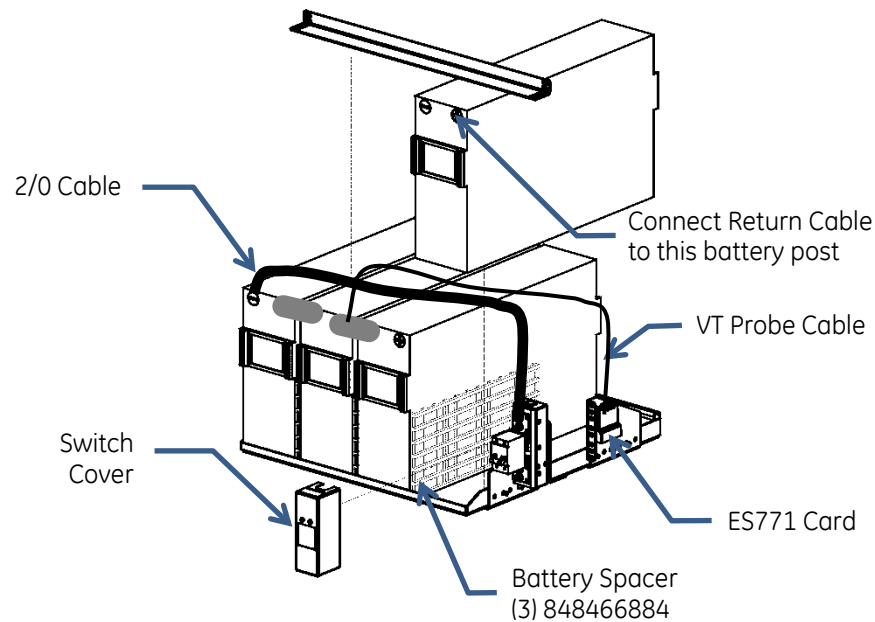
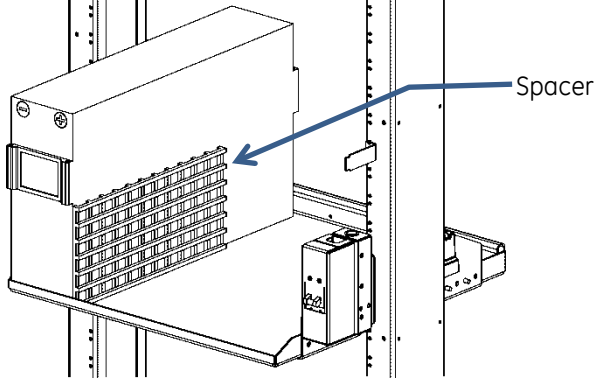
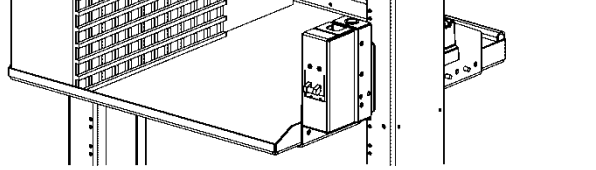
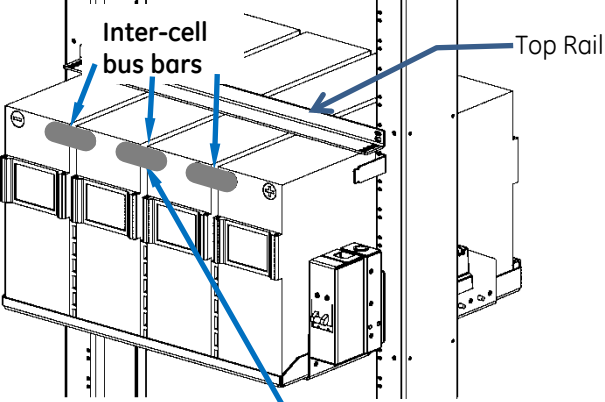


Figure 34 Batteries in Tray – 48V

Step	Action	
Notes:	<p>1. Steps show four 12V batteries per shelf – one string of -48V batteries.</p> <p>2. 1 Battery Disconnect Switch per shelf shown.</p> <p>Other options</p> <ul style="list-style-type: none"> • 2 Battery Disconnect Switches per shelf (left and right) (two 24V battery strings per shelf) • 1 or 2 Anderson Disconnects per shelf • No Battery Disconnect Switches or Anderson Disconnects - Battery cables shipped loose. 	
1	Place four batteries on each battery tray.	
2	Position three Battery Spacers between the batteries.	 <p style="text-align: center;">Figure 35 Place Batteries</p>
3	<p>48V Battery Strings: Interconnect three inter-cell bus bars to configure one 48V battery string per the battery manufacturer's instructions.</p> <p>24V Battery Strings: Interconnect two inter-cell bus bars to configure two 24V battery strings per the battery manufacturer's instructions.</p>	
4	Attach the battery securing top rail.	<p style="text-align: center;">Figure 36 Battery Inter-Cell Bus Bars</p>

External Batteries

Step	Action	
1	Place batteries on battery trays, battery stands, or other satisfactory supporting surface and interconnect per manufacturer's instructions to create 24V or 48V strings as required.	
	Is an external disconnect switch being used?	
	Yes – go to Step2.	No – Finished.
2	Physically mount switch to an appropriate place and ensure it is in the OFF position prior to making any connections	
3	Connect the battery hot conductor(s) to the line side of the disconnect switch and torque connection per manufacturer's specification.	
4	Connect the load side conductor to the disconnect switch and torque connection per manufacturer's specification.	

Connect Batteries

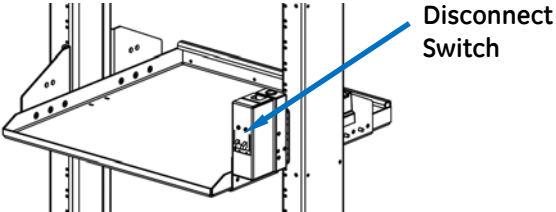
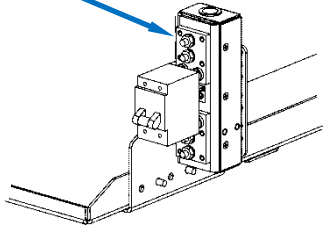
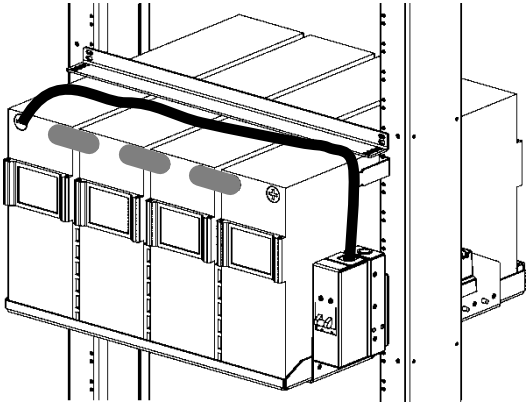
Tray Mounted Batteries

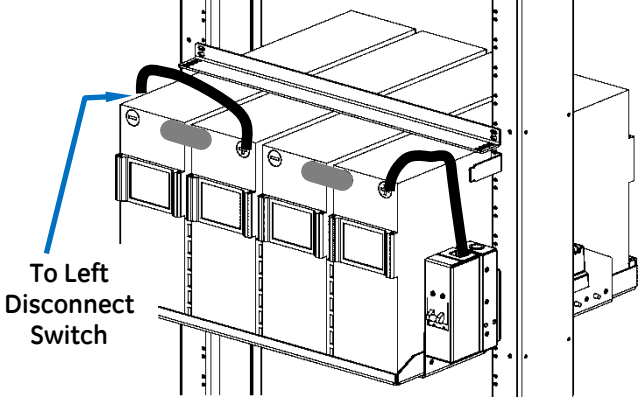
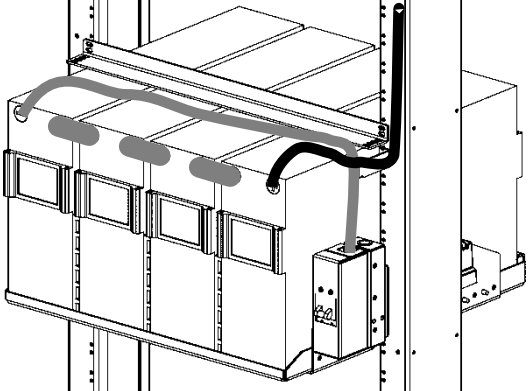
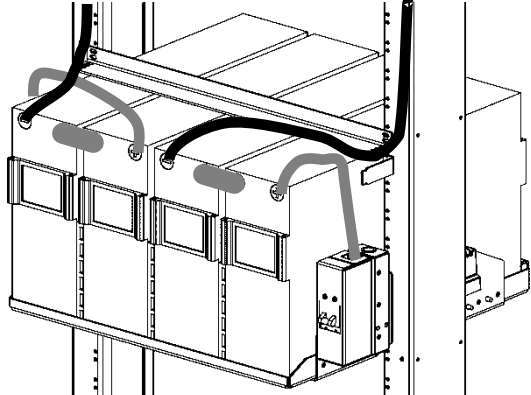
Go to the procedure for the disconnect method provided on the trays:

- Battery Disconnect Switch Connection
- Anderson Connector Connection
- Direct to Battery Bus Connection

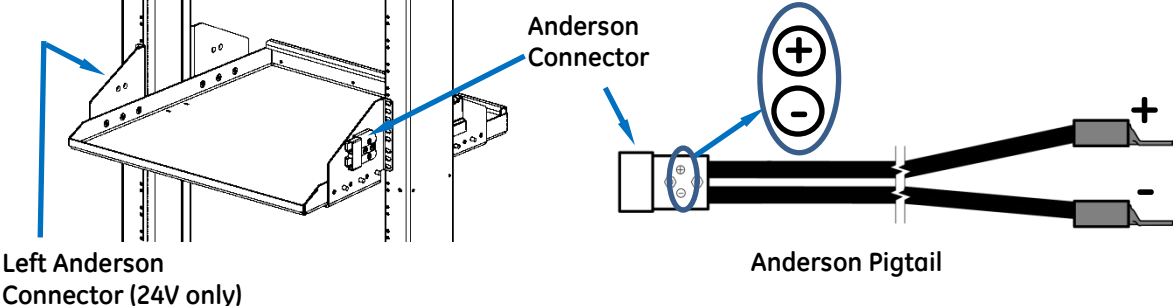
Battery cables from factory mounted battery trays are factory installed and terminated to the distribution panel.

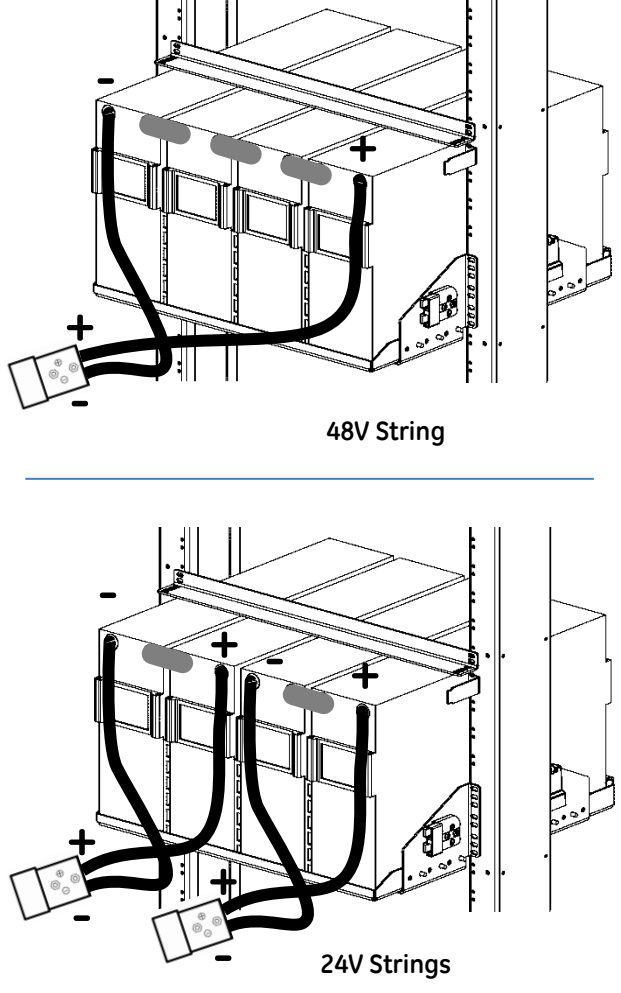
Battery Disconnect Switch Connection

Step	Action	Action
1	<p>Ensure disconnect switch is in the OFF position (downward) prior to making any connections.</p> <p>Remove the two 6/32 screws to remove the plastic cover.</p>	 <p style="text-align: right;">Disconnect Switch</p> <p style="text-align: center;">Figure 37 Battery Disconnect Switch</p>
2	<p>Connect one end of the 2/0 cable to the input bus of the disconnect switch with 1/4-20 hex nuts provided.</p> <p>Torque to 65 in-lb – 7/16" socket.</p>	 <p style="text-align: left;">Input Bus</p> <p style="text-align: center;">Figure 38 Batt Disconnect Switch Input Bus</p>
3	<p>Re-attach clear plastic cover to disconnect switch and secure with 6-32 screws.</p>	
4	<p>48V Battery Strings</p> <p>Connect the 2/0 cable between the V- post of the left-most battery and the input bus of the disconnect switch.</p> <p>Torque to battery manufacturer's specification.</p>	 <p style="text-align: center;">Figure 39 Battery Cable -48V</p>

Step	Action	
	<p>24V Battery Strings</p> <p>Connect the 2/0 cable between the V- post of the right-most battery of the left string and the input bus of the left disconnect switch.</p> <p>Connect the 2/0 cable between the V- post of the right-most battery of the right string and the input bus of the right disconnect switch.</p> <p>Torque to battery manufacturer's specification.</p>	 <p>Figure 40 Battery Cable +24V</p>
5	<p>48V Battery Strings</p> <p>Connect the factory-wired battery return cable to the V+ post of the right-most battery.</p> <p>Torque to battery manufacturer's specification.</p>	 <p>Figure 41 Battery Return Cable -48V</p>
	<p>24V Battery Strings</p> <p>Connect the factory-wired battery return cables to the V- posts (left most posts) of both strings.</p> <p>Torque to battery manufacturer's specification.</p>	 <p>Figure 42 Battery Return Cable +24V</p>
	<p>Battery installation is complete.</p> <p>Follow site engineering instructions regarding when to turn the disconnect switches ON.</p>	

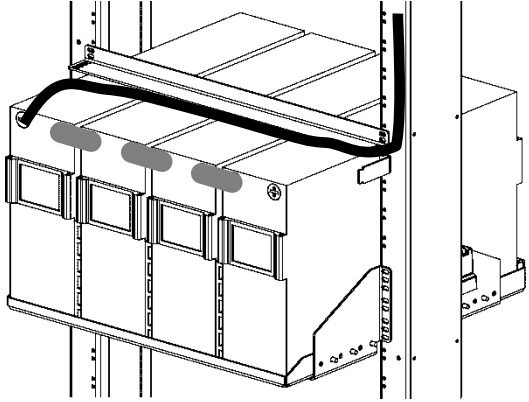
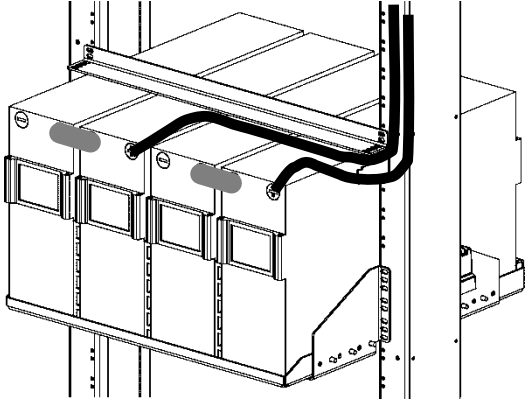
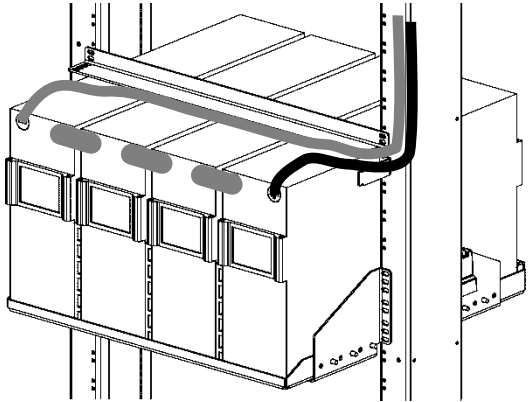
Anderson Connector Connection

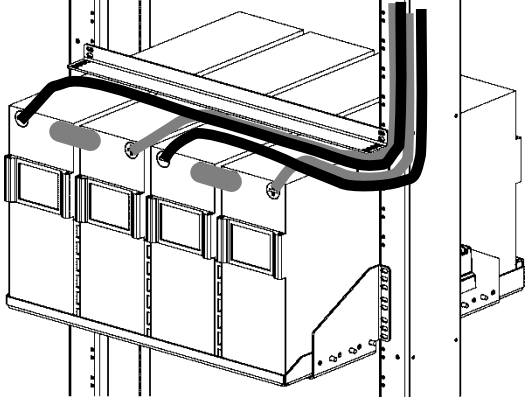
Step	Action
	 <p>Left Anderson Connector (24V only)</p> <p>Anderson Pigtail</p> <p style="text-align: center;">Figure 43 Anderson Battery Connector</p>

<p>1</p>	<p>Connect Anderson pigtail terminals to battery string positive and negative terminals.</p> <p>Positive Anderson Pigtail terminal to the Positive (right-most) battery terminal</p> <p>Negative Anderson Pigtail terminal to the Negative (left-most) battery terminal.</p> <p>Torque to battery manufacturer's specification.</p>  <p style="text-align: center;">Figure 44 Battery Connections - Anderson</p>
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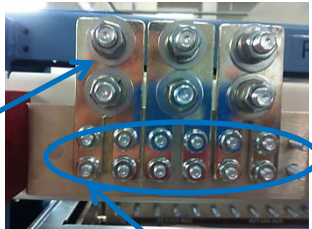
	<p>Battery installation is complete.</p> <p>Follow site engineering instructions regarding when to mate the Anderson connectors.</p>
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Direct to Battery Bus Connection

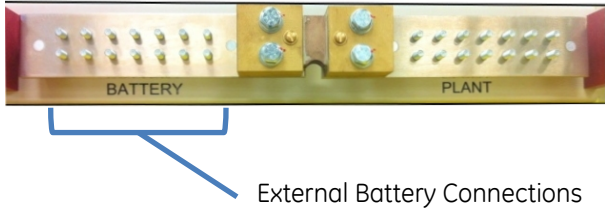
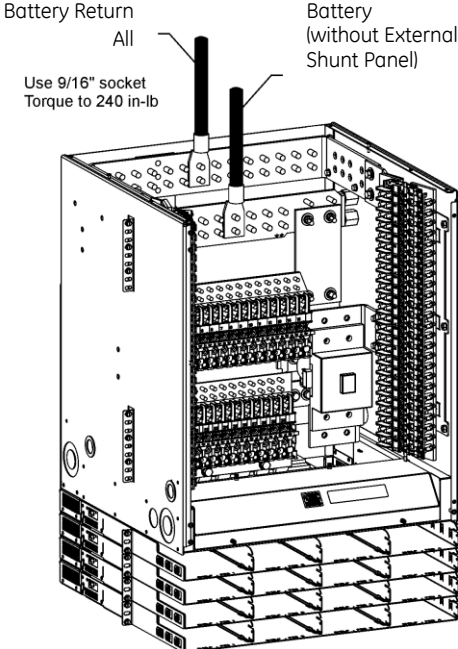
Step	Action	
	Direct battery bus connections are not factory installed.	
1	Run cables from the battery buses to the tray mounted battery strings. Insulate the battery end of the cable.	
2	Make battery cable connections to the system battery bus per the procedure in the External Battery Connection section.	
3	<p>Connect Battery Cable (hot side)</p> <p>48V Battery Strings</p> <p>Connect the 2/0 cable between the V- post of the left-most battery and the input bus of the disconnect switch.</p> <p>Torque to battery manufacturer's specification.</p> <p>24V Battery Strings</p> <p>Connect the 2/0 cable between the V- post of the right-most battery of the left string and the input bus of the left disconnect switch.</p> <p>Connect the 2/0 cable between the V- post of the right-most battery of the right string and the input bus of the right disconnect switch.</p> <p>Torque to battery manufacturer's specification.</p>	 <p style="text-align: center;">Figure 45 Battery Cable Direct -48V</p>  <p style="text-align: center;">Figure 46 Battery Cable Direct +24V</p>
4	<p>Connect Battery Return Cable (ground side)</p> <p>48V Battery Strings</p> <p>Connect the factory-wired battery return cable to the V+ post of the right-most battery.</p> <p>Torque to battery manufacturer's specification.</p>	 <p style="text-align: center;">Figure 47 Battery Return Cable Direct -48V</p>

Step	Action	
	<p>24V Battery Strings</p> <p>Connect the factory-wired battery return cables to the V- posts (left most posts) of both strings.</p> <p>Torque to battery manufacturer's specification.</p>	 <p>Figure 48 Battery Return Cable Direct +24V</p>
	<p>Battery installation is complete.</p>	

External Battery Connection

Step	Action	
	<p>Is an external Battery Shunt panel¹⁶ installed?</p>	
	<p>Yes - go to Step1.</p>	<p>No - go to Step4.</p>
<p>1</p>	<p>Battery Landings are 1/4-20 studs on 5/8" centers spaced 3/4" apart (7 landings).</p> <p>Lug adaptors use 2 landing positions and provide 3/8-16 studs on 1" centers (provided).</p>	 <p>Figure 49 External Battery Shunt Panel</p>
	<p>Are lug adapters required?</p>	
	<p>Yes - go to Step2.</p>	<p>No - go to Step3.</p>
<p>2</p>	<p>Install Lug Adapters</p> <p>Remove 1/4-20 nuts (4) from landing.</p> <p>Place lug adapter</p> <p>Secure lug adapter with 1/4-20 nuts (4).</p> <p>If required by local code or practice, treat with an oxidation inhibitor such as NO-OX.</p> <p>Torque to 65 in-lb - 7/16" socket.</p>	 <p>Figure 50 External Battery Shunt Panel Lug Adapters</p>

¹⁶ Eco systems less than 600A use an external battery panel.

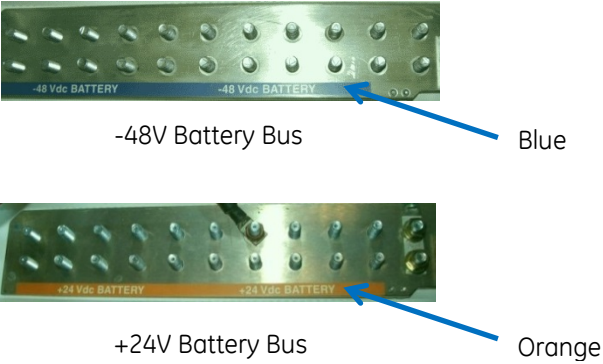
Step	Action	
3	<p>Battery Cable Connections to External Shunt Panel (Battery only, not Return) (see Step 4 for Battery Return Connections)</p> <p>Secure Battery Cable lugs with hardware (per cable): (2 sets) nut, lock washer, and flat washer.</p> <p>If required by local code or practice, treat with an oxidation inhibitor such as NO-OX.</p> <p>Torque 1/4 -20 nuts to 65 in-lb - 7/16" socket.</p> <p>Torque 3/8-16 nuts to 240 in-lb - 9/16" socket.</p>	 <p>Figure 51 External Shunt Panel Battery Connections</p>
4	<p>Battery Return Cable Connections (all) and Battery Cable Connections without External Shunt Panel</p> <p>See Step 3 for Battery Cable Connections to External Battery Panel.</p> <p>Secure Battery Cable lugs with hardware (per cable): (2 sets) 3/8-16 nut, lock washer, and flat washer.</p> <p>If required by local code or practice, treat with an oxidation inhibitor such as NO-OX.</p> <p>Torque to 240 in-lb - 9/16" socket.</p> <p>Note: Battery Landings are 3/8" studs on 1" centers spaced 1.25" apart (11 landings).</p> <p>For lugs wider than 1.25", use every other connection (6 total).</p>	 <p>Figure 52 Battery Bus Connections</p>

Connect Battery Probes

Battery probes are optional controller peripherals. See the controller manual and instructions accompany the options.

Verify Battery Bus Voltage and Polarity

Step	Action
	<p>CAUTION: Equipment Damage</p> <p>Do not install rectifiers before battery bus voltage and polarity has been verified. Rectifiers and system damage will result from incorrect battery bus polarity. The damage may not be immediately evident.</p>

Step	Action
<p>1</p>	<p>Verify that the measured voltage matches the bus label using a meter.</p> <div style="text-align: center;">  <p>-48V Battery Bus Blue</p> <p>+24V Battery Bus Orange</p> <p>Figure 53 Battery Bus Labels</p> </div>

Connect Load Wiring

Note that a space to record the distribution assignments is available on the inside of cabinet door:

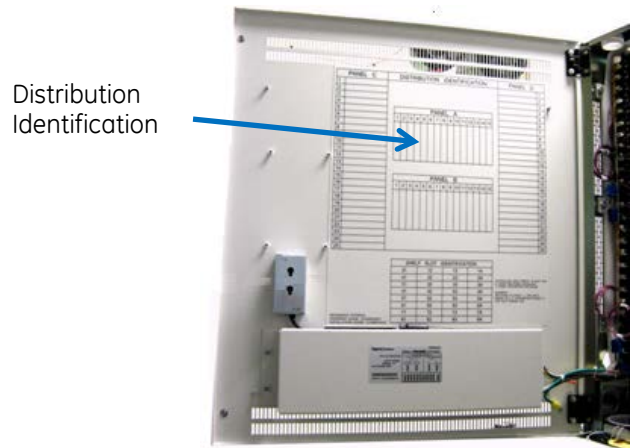


Figure 54 Distribution Assignment Record Label

WARNING: Shock Hazard and Equipment Damage
 Do not install circuit breakers or load fuses until the load equipment is ready to be energized.
 When a load is ready to be energized

1. Connect the load to the distribution panel.
2. Install the circuit breaker or fuse.

CAUTION: Equipment Damage
 Ensure Circuit Breakers are in the OFF position prior to installation.
 Ensure Fuse Holders are empty prior to installation.

Notes:

1. Start from the top most position and work down the panel. This will allow orderly and managed cable dressing as loads are added in this installation and in the future.
2. Connect the Load Return cable before the Load cable for each load. The Load Return connection is blocked by the Load cable, if installed.
3. Follow steps of each section below as appropriate to breakers and fuses to be installed.
4. Repeat steps of each section as appropriate.
5. Bolt-in breakers may be factory installed.

6. Bullet Terminal distribution panels accept Bullet Terminal Circuit Breakers, TPS Fuse Holders, and GMT Fuse Modules.
Install bulled distribution devices as shown in Figure 55.

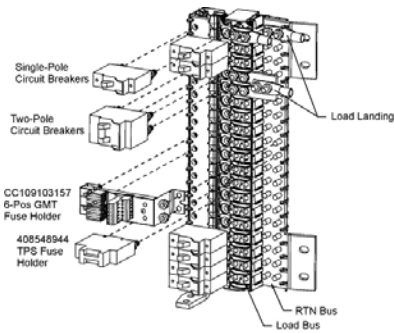


Figure 55 Vertical Bullet Distribution Panel

Step	Action
	Install bullet distribution devices into the Bullet Distribution Panel as shown in the figure above.
1	Loosen screws and swing hinged retainer cover clear of the distribution devices (if present).
2	Verify voltage and polarity between the Return bus and each distribution input bus using a voltmeter.
3	Verify that: <ol style="list-style-type: none"> 1. Load equipment is ready to be energized 2. Load equipment wiring polarity is correct at the input of the load equipment.
4	Connect Loads as described below for each type of circuit breaker or fuse holder.

GMT Fuse Holder	
1	<p>GMT Module must be installed before load connection is made. Install GMT Module into specified bullet positions.</p> <p>Secure GMT Module Return bus bar to the distribution panel Return bus bar with provided nuts.</p> <p>Torque to 65 in-lb - 7/16" socket.</p>
<p style="text-align: center;">Figure 56 GMT Fuse Module</p>	
2	Strip Load and Load Return wires 3/8" and secure in the GMT module terminal block. Torque to 13 in-lb - screw driver.
3	Dress and wire tie with service loop to provide strain relief.
4	Verify (using a voltmeter) polarity of the voltage between the Return bus and the distribution input bus.
5	Verify wiring polarity at the input of the load equipment.
	Do not install load fuses until the load equipment is ready to be energized.

1-Pole and 2-Pole Breakers and TPS Fuse Holders	
1	Secure Two-Pole adapter busses to the distribution Load and Return busses with provided (901352617) 1/4-20 nuts.
2	Secure Load and Return Cable connections with provided 1/4-20 nuts. Torque to 65 in-lb - 7/16" socket.
3	Verify (using a voltmeter) polarity of the voltage between the Return bus and the distribution input bus.
4	Verify wiring polarity at the input of the load equipment.
	Leave breaker switches in the OFF position and do not install load fuses until the load equipment is ready to be energized.

3-Pole Breakers:	
1	Secure Three-Pole adapter busses to the distribution Load and Return busses with provided 1/4-20 nuts. Torque to 65 in-lb - 7/16" socket.
2	Secure Load Cable connections with provided hardware (per cable): (2) 3/8-16 nut (2) 3/8-inch lock washer (2) 3/8-inch flat washer Torque to 240 in-lb - 9/16" socket.
3	Verify polarity (using a voltmeter) of the voltage between the Return bus and the distribution input bus.
4	Verify wiring polarity at the input of the load equipment.
	Leave breaker switches in the OFF position until the load equipment is ready to be energized.

Bolt-In Breakers	
<p>Bolt-in breakers must be installed before load connection is made. Bolt-in Breakers can either be factory installed or field installed per the following kits:</p> <ul style="list-style-type: none"> • CC109127635 150A Single Pole Breaker • CC109127627 250A Single Pole Breaker • CC109127486 400A Two Pole Breaker 	

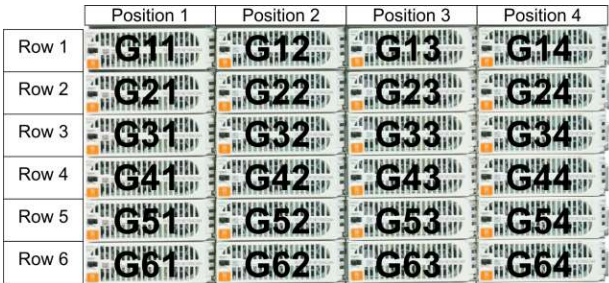
Bolt-In Breakers	
	<p style="text-align: center;">CC848801878 WIRESET DAISY CHAINS ALARM FROM BREAKER TO BREAKER: PLUG YELLOW WIRE TO PIN 8 (C) PLUG ORANGE WIRE TO PIN 9 (NO) SHUNT WIRES TO RPM's: PLUG BLACK WIRE TO PIN 12 PLUG WHITE WIRE TO PIN 13</p> <p style="text-align: center;">Figure 57 Bolt-In Breakers</p>
1	Assemble load bus bar to breaker using provided screws, nuts, and washers. Torque nuts to 240 in-lb – 9/16” socket.
2	Install alarm wire set. Alarm wire set daisy chains from Plant Wire Set through all bolt in breakers. <ol style="list-style-type: none"> 1. Connect wire set to breaker pins 8 & 9. 2. Connect wire set to plant wire set (if first bolt in breaker) or to previous breaker.
3	Install Bolt-in breakers into specified position using provided hardware. <ol style="list-style-type: none"> 3. Install standoffs - torque to 65 in-lb. 4. Secure load bus to standoffs with flat head screws - torque to 65 in-lb – 7/16” socket. 5. Secure breaker to load bus with hex screws and washers - torque to 240 in-lb – 9/16” socket.
4	Secure Load Cable connections with provided hardware (per cable): (2) 3/8-16 nut (2) 3/8-inch lock washer (2) 3/8-inch flat washer Torque to 240 in-lb - 9/16” socket.
5	Verify polarity (using a voltmeter) of the voltage between the Return bus and the distribution input bus.
6	Verify wiring polarity at the input of the load equipment.
	Leave breaker switches in the OFF position until the load equipment is ready to be energized.

Re-secure Retainer Cover	
1	Re-secure hinged retainer cover if removed.

Verify Installation

Perform the following verification checklist after installation of batteries and wiring:

Step	Action
1	Verify cabinet is properly grounded (using Digital Multimeter (DMM)).
2	Verify the AC equipment ground is properly connected.
3	Verify the correct ground cable gauge is used. Use the standard grounding principles for the office.

Step	Action
4	Verify the AC voltage supplied matches the AC input voltage of the rectifiers.
5	Verify all cables are properly installed for the distribution and labeled as 48 V or 24 V.
6	Examine to assure no sharp corners are in contact with dressed wires. Modify to correct any problems found.
7	Check for conductor clearance within the bay associated with high power.
8	Check that all breakers are OFF and all fuses not inserted.
9	Verify the battery contactors are open, if equipped. Manually operate them to the open position, if necessary, by pushing the contacts apart.
10	Verify the polarity of all battery cables (using DMM).
11	Verify no shorts are present between frame ground and the AC service. Measure resistance from each AC input line terminal block position to frame ground.
12	<p>Verify shelves and rectifier positions are properly identified. Label positions as necessary.</p> <p>Example is for 5-shelf (row) system (front view).</p>  <p style="text-align: center;">Front View</p> <p style="text-align: center;">Figure 58 Rectifier Positions</p>
13	Verify battery negative cables are connected to the appropriate bus bar.
14	Verify battery positive cables are connected to the appropriate bus bar.
15	Visually verify cables the RS485 cables are properly installed and that shelf ID settings at the rear of the frame are: [Shelf 1, Shelf 2, Shelf 3, etc.] from top to bottom.

Install Controller

Follow the procedures for the controller present in the system.



Install Pulsar Plus

Note: The controller is factory installed and connected to the *NE-M* equipment.
Connections to the controller made during installation are described here.

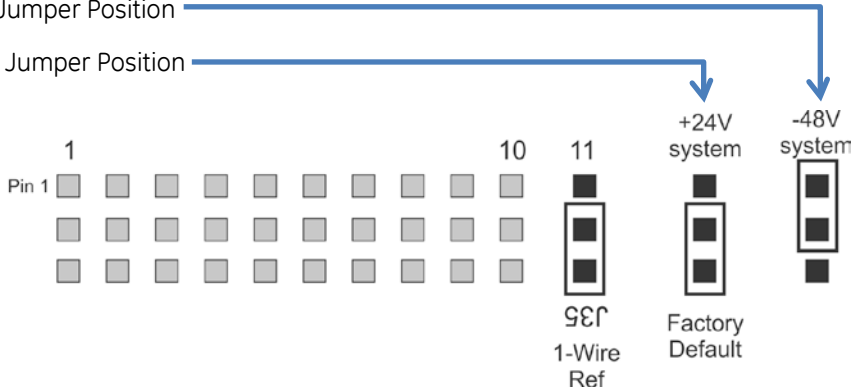
CAUTION: Equipment Damage

ESD NOTE: You must protect against ESD prior to configuring and installing the following circuit cards.

Step	Action – Pulsar Plus
	<p>Configuring Individual Alarm Output Contact Type – “Close” on or “Open” on alarm</p> <p>The factory default configuration for all alarm outputs is “Open On Alarm” on alarm. Is this acceptable?</p>
	<p>Yes – go to Step1.</p> <p>No – go to Step4.</p>

Step	Action – Pulsar Plus
1	<p>Attach an ESD wrist strap or equivalent to the ESD grounding connector on right hand side of the inside of the frame.</p> <div data-bbox="760 275 1333 548" style="text-align: center;">  <p>ESD Grounding Connector</p> </div> <p style="text-align: center;">Figure 59 ESD Grounding Connector</p>
2	<p>Locate configuration jumpers for alarm relays on the controller.</p> <p>Jumpers for each of the 10 output alarms are visible on the board of the door-mounted controller.</p> <div data-bbox="462 762 1193 999" style="text-align: center;">  <p>Alarm Relay Jumpers</p> </div> <p style="text-align: center;">Figure 60 Alarm Relay Jumpers – Pulsar Plus</p>

Step	Action – Pulsar Plus																																			
3	<p>Configure alarm relays to “Open On Alarm” or “Close On Alarm” as specified in site engineering instructions.</p> <p>Each Alarm Relay Jumper select “Open On Alarm” or “Closed On Alarm” for one alarm signal and each signal output can be configured independently.</p> <p>Carefully move each Alarm Relay Jumper to select “Open On Alarm” or “Close On Alarm” position as per site engineering instructions with an insulated tool.</p> <div data-bbox="516 415 1209 625" style="text-align: center;"> </div> <p style="text-align: center;">Figure 61 Alarm Relay Jumper Positions - Pulsar Plus</p>																																			
	<p>The following table contains the alarms along with the factory default alarm assignments to user relays R1-R7.</p> <p>Utilize the web interface to change any of the alarm user relay alarm assignments.</p> <div data-bbox="440 877 1263 1360" style="text-align: center; border: 1px solid black; margin: 10px auto; width: 80%;"> <table border="1"> <thead> <tr> <th colspan="3" style="background-color: #e1eef6;">Table 3 Alarm Defaults – Standard Pulsar Plus</th> </tr> <tr> <th>Jumper Number</th> <th>Signal Name</th> <th>Standard Defaults</th> </tr> </thead> <tbody> <tr><td>1</td><td>PCR</td><td>Power Critical Alarm severity indicator</td></tr> <tr><td>2</td><td>PMJ</td><td>Power Major Alarm severity indicator</td></tr> <tr><td>3</td><td>PMN</td><td>Power Minor Alarm severity indicator</td></tr> <tr><td>4</td><td>R1</td><td>BD - Battery on Discharge alarm</td></tr> <tr><td>5</td><td>R2</td><td>VLV - Very Low Voltage alarm</td></tr> <tr><td>6</td><td>R3</td><td>FAJ - External Fuse Major alarm</td></tr> <tr><td>7</td><td>R4</td><td>ACF – single rectifier input (AC or DC) Fail alarm</td></tr> <tr><td>8</td><td>R5</td><td>RFA - single Rectifier Fail alarm</td></tr> <tr><td>9</td><td>R6</td><td>MRFA - multiple Rectifier Fail alarm</td></tr> <tr><td>10</td><td>R7</td><td>HV - High Voltage shutdown alarm</td></tr> </tbody> </table> </div>	Table 3 Alarm Defaults – Standard Pulsar Plus			Jumper Number	Signal Name	Standard Defaults	1	PCR	Power Critical Alarm severity indicator	2	PMJ	Power Major Alarm severity indicator	3	PMN	Power Minor Alarm severity indicator	4	R1	BD - Battery on Discharge alarm	5	R2	VLV - Very Low Voltage alarm	6	R3	FAJ - External Fuse Major alarm	7	R4	ACF – single rectifier input (AC or DC) Fail alarm	8	R5	RFA - single Rectifier Fail alarm	9	R6	MRFA - multiple Rectifier Fail alarm	10	R7
Table 3 Alarm Defaults – Standard Pulsar Plus																																				
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4	<p style="text-align: center;">Using optional ES771 Mid-String Voltage Modules?</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; padding: 5px;">Yes – go to Step 4.</td> <td style="width: 50%; padding: 5px;">No – Go to Step 5.</td> </tr> </table>	Yes – go to Step 4.	No – Go to Step 5.																																	
Yes – go to Step 4.	No – Go to Step 5.																																			

Step	Action – Pulsar Plus
5	<p style="text-align: center;">Configure the 1-Wire serial bus reference</p> <p>The ES771 modules must be referenced to the most negative potential of the DC bus. This reference is achieved by the proper setting of Jumper 11 next to the relay configuration jumpers. Following are the appropriate settings for negative and positive power plants. The jumper is set in the factory for positive systems unless the controller is shipped with an assembled system that has a pre-determined primary output bus. It is suggested that an insulated tool be used to set the jumpers.</p> <p>-48V systems Jumper Position ↓</p> <p>+24V systems Jumper Position ↓</p> <div style="text-align: center;">  </div> <p style="text-align: center;">Figure 62 1-Wire Jumper - Pulsar Plus</p>

Connect Controller Wiring – Pulsar Plus

All connections to the controller are made through appropriate cable assemblies. The controller has been designed to separate outputs, inputs, communication, and plant specific items onto to individual connectors.

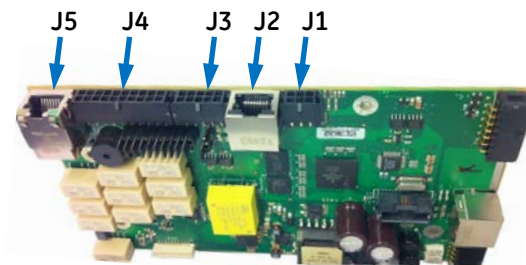


Figure 63 Controller Connections

Many systems are shipped with the appropriate controller connections wired by the factory. The following provides a brief description of how and what to connect to the controller. Use only those sections that apply to the system configuration.


Step	Action – Pulsar Plus																
1	<p style="text-align: center;">Analog Interface Connector</p> <p>Connect and wire to shunt and alarms.</p> <p>J1 is a 6-pin connector provided for analog interface to a plant shunt, distribution alarms, and open battery string alarms. Typically a factory installed plant wire harness plugs into this connector. This wire set has a purple wire with a Faston ® receptacle for connecting the Open String Alarm from field installed battery disconnect breakers.</p> <table border="1" data-bbox="326 443 1062 743" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th colspan="2" style="background-color: #e1eef6;">Table 4 Analog Interface Connector Signals – Pulsar Plus</th> </tr> <tr> <th style="background-color: #e1eef6;">Pin</th> <th style="background-color: #e1eef6;">Signal</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">1</td> <td>Shunt+</td> </tr> <tr> <td style="text-align: center;">2</td> <td>Shunt Reference</td> </tr> <tr> <td style="text-align: center;">3</td> <td>Shunt-</td> </tr> <tr> <td style="text-align: center;">4</td> <td>Fuse Alarm Major +24V</td> </tr> <tr> <td style="text-align: center;">5</td> <td>Open String</td> </tr> <tr> <td style="text-align: center;">6</td> <td>Fuse Alarm Major -48V</td> </tr> </tbody> </table>	Table 4 Analog Interface Connector Signals – Pulsar Plus		Pin	Signal	1	Shunt+	2	Shunt Reference	3	Shunt-	4	Fuse Alarm Major +24V	5	Open String	6	Fuse Alarm Major -48V
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2	Shunt Reference																
3	Shunt-																
4	Fuse Alarm Major +24V																
5	Open String																
6	Fuse Alarm Major -48V																
2	<p style="text-align: center;">1-Wire Peripheral Connector</p> <p>Connect and wire to VT-Probe, external ambient probe, or Remote Voltage Monitor.</p> <p>J2 is an RJ-45 receptacle for connecting to 1-Wire devices.</p>																

Step	Action – Pulsar Plus		
3	Auxiliary Input Connector		
	Connect and wire auxiliary inputs as required to Connector J3 . J3 is an auxiliary input connector. Utilize cable as necessary to obtain the desired connections to the inputs shown below. Input Alarm Cable comcodes for J3 are: 50 ft: CC848817651, 150 ft: CC848817668.		
	Table 5 Auxiliary Input Connector Signals - Pulsar Plus		
	Pin # Wire Color	Signal Name ¹⁷	Description ¹⁷
	1 (BK)	Aux Input 1 (Aux1)	Auxiliary input to monitor a contact closure or open to its respective return on pin 8, Auxiliary Input Return.
	2 (BR)	Aux Input 2 (Aux2)	Auxiliary input to monitor a contact closure or open to its respective return on pin 8, Auxiliary Input Return.
	3 (R)	Aux Power Major Input (AMJ)	Auxiliary input to monitor a contact closure to the non-grounded side of a dc bus ($\pm 24V/-48V$) to create the standard Auxiliary Power Major alarm. Generator Running in <i>Eco</i> applications.
	4 (O)	Plant Battery Test/ Group Standby/TR (GSTR)	Dedicated input to be monitored for a contact closure to its respective return on pin 9, Plant Battery Return. This signal is used for the Plant Battery Test and Group Standby Feature.
	5 (Y)	Emergency Power Off (EPO)	Dedicated EPO input to be monitored for a contact closure to its respective return on pin 10, Emergency Power Off Return.
	6 (G)	Aux Input 3 (Aux3)	Auxiliary input to monitor a contact closure or open to its respective return on pin 8.
	7 (BL)	Aux Input 4 (Aux4)	Auxiliary input to monitor a contact closure or open to its respective return on pin 8.
	8 (V)	Aux Input Return (Aux_R)	Return for Auxiliary Inputs 1-4.
9 (S)	Plant Battery Test/Group Standby/TR Ret.(GSTR_R)	Return for Plant Battery Test and Group Standby.	
10 (W)	Emergency Power Off Ret. (EPO_R)	Return for EPO input.	

¹⁷ Inputs are reconfigured for specific use for specific Eco applications.

Step	Action – Pulsar Plus																																																																										
4	Output Alarm Connector Connect and wire remote alarm output circuits to Connector J4 . J4 is output alarm connector. Utilize cable as necessary to obtain the desired connections to the outputs shown below. Output Alarm Cable comcodes for J4 are: 50ft: CC848817635, 150ft: CC848817643.																																																																										
	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th colspan="6" style="background-color: #d9e1f2;">Table 6 Alarm Signals - Pulsar Plus</th> </tr> <tr> <th rowspan="2">Pin # Wire Color</th> <th rowspan="2">Signal Name¹⁸</th> <th rowspan="2">Pin # Wire Color</th> <th rowspan="2">Signal Name¹⁸</th> <th colspan="2">Defaults</th> </tr> <tr> <th>Standard</th> <th>Eco</th> </tr> </thead> <tbody> <tr> <td>1 (BL)</td> <td>PCR</td> <td>11 (BL-BK)</td> <td>PCR_C</td> <td>PCR (Power Critical)</td> <td></td> </tr> <tr> <td>2 (O)</td> <td>PMJ</td> <td>12 (O-BK)</td> <td>PMJ_C</td> <td>PMJ (Power Major)</td> <td></td> </tr> <tr> <td>3 (G)</td> <td>PMN</td> <td>13 (G-BK)</td> <td>PMN_C</td> <td>PMN (Power Minor)</td> <td></td> </tr> <tr> <td>4 (W)</td> <td>UR1</td> <td>14 (W-BK)</td> <td>UR1_C</td> <td>BD (Battery on Discharge)</td> <td></td> </tr> <tr> <td>5 (BK)</td> <td>UR2</td> <td>15 (BK-W)</td> <td>UR2_C</td> <td>VLV (Very Low Voltage)</td> <td></td> </tr> <tr> <td>6 (BL-W)</td> <td>UR3</td> <td>16 (BL-R)</td> <td>UR3_C</td> <td>FAJ (External Fuse Major)</td> <td></td> </tr> <tr> <td>7 (O-R)</td> <td>UR4</td> <td>17 (R)</td> <td>UR4_C</td> <td>ACF (rectifier input AC or DC) Fail)</td> <td>Generator Start/Stop</td> </tr> <tr> <td>8 (G-W)</td> <td>UR5</td> <td>18 (R-G)</td> <td>UR5_C</td> <td>RFA (Rectifier Fail)</td> <td></td> </tr> <tr> <td>9 (W-R)</td> <td>UR6</td> <td>19 (R-W)</td> <td>UR6_C</td> <td>MRFA (Multi Rectifier Fail)</td> <td></td> </tr> <tr> <td>10 (BK-R)</td> <td>UR7</td> <td>20 (R-BK)</td> <td>UR7_C</td> <td>HV (High Voltage)</td> <td>Generator Maintenance</td> </tr> </tbody> </table>	Table 6 Alarm Signals - Pulsar Plus						Pin # Wire Color	Signal Name ¹⁸	Pin # Wire Color	Signal Name ¹⁸	Defaults		Standard	Eco	1 (BL)	PCR	11 (BL-BK)	PCR_C	PCR (Power Critical)		2 (O)	PMJ	12 (O-BK)	PMJ_C	PMJ (Power Major)		3 (G)	PMN	13 (G-BK)	PMN_C	PMN (Power Minor)		4 (W)	UR1	14 (W-BK)	UR1_C	BD (Battery on Discharge)		5 (BK)	UR2	15 (BK-W)	UR2_C	VLV (Very Low Voltage)		6 (BL-W)	UR3	16 (BL-R)	UR3_C	FAJ (External Fuse Major)		7 (O-R)	UR4	17 (R)	UR4_C	ACF (rectifier input AC or DC) Fail)	Generator Start/Stop	8 (G-W)	UR5	18 (R-G)	UR5_C	RFA (Rectifier Fail)		9 (W-R)	UR6	19 (R-W)	UR6_C	MRFA (Multi Rectifier Fail)		10 (BK-R)	UR7	20 (R-BK)	UR7_C	HV (High Voltage)	Generator Maintenance
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5	Network (LAN) Connection (Optional) Connect to network. The controller provides an Ethernet connection for a LAN and or Craft port connection. Connector J5 provides a standard RJ45 shielded receptacle connection for a standard Cat-5 connection to the controller’s 10/100Base-T port. This port has two main modes of operation: Server mode, LAN mode (Static and DHCP Client). In server mode the port can be used as a local Craft interface. In this mode, a local laptop can be connected through J5 and its standard web browser used to directly access the controller by typing in network address http://192.168.2.1 . A connection should never be made between the controller and LAN while the controller is in Server mode.																																																																										
	Is the controller equipped with the Modem Option?																																																																										
	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%;">Yes – go to Step 6.</td> <td style="width: 50%;">No – go to Step 7.</td> </tr> </table>	Yes – go to Step 6.	No – go to Step 7.																																																																								
Yes – go to Step 6.	No – go to Step 7.																																																																										


¹⁸ Relays are reconfigured for specific use for specific Eco applications.

Step	Action – Pulsar Plus	
6	<p>Telephone Line Connection (Optional).</p> <p>Door-mount MODEM option provide their own RJ11 connection for the telephone line.</p> <p>Use appropriate routing techniques to connect the controller respective RJ11 to the telephone line.</p>	<p>Modem is mounted on door above the controller.</p>
7	<p>Local RS232 Serial Port Connector</p> <p>Connect notebook computer, PC or external modem to RS232 port.</p> <p>The Local RS232 and future Craft Ethernet connectors are located inside the door on the front of the controller.</p> <p>RS-232 is DCE (Data Communication Equipment).</p>	 <p>Figure 64 Local Port - Pulsar Plus</p>

Install Millennium II

Note: The controller is factory installed connected to the *NE-M* equipment.
Connections to the controller made during installation are described here.

CAUTION: Equipment Damage
ESD NOTE: You must protect against ESD prior to configuring and installing the following circuit cards.

1	<p>Attach an ESD wrist strap or equivalent to the ESD grounding connector on right hand side of the inside of the frame.</p>  <p>Figure 65 ESD Grounding Connector</p>	
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Install Circuit Cards

CAUTION: Equipment Damage
ESD NOTE: You must protect against ESD prior to configuring and installing the following circuit cards.

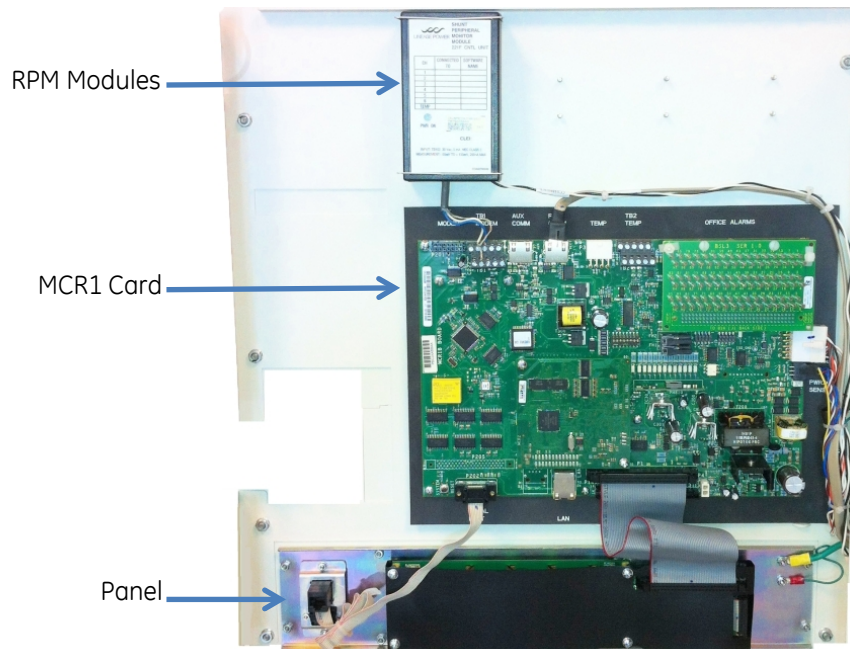


Figure 66 Millennium II Circuit Card - Field

BSL Alarm Termination Board

An insulation displacement (punch down) type alarm terminal board (BSL3, 848741711) is provided with the system. For a wire wrap type terminal board, order BSL4 (848749507) and perform the following steps:

Step	Action – Millennium II
1	In the upper right hand corner of the MCR1 board, find the alarm board already installed.
2	Remove the two screws holding the board at the top.
3	Holding the board on both sides, slowly, but firmly, remove the alarm board from the P8 connector.
4	Connect the new alarm board to P8 and press down firmly, until the board is seated.
5	Secure the alarm board at the top using the two screws removed earlier.

Connect Controller Wiring – Millennium II

All connections to the controller are made through appropriate cable assemblies. The controller has been designed to separate outputs, inputs, communication, and plant specific items onto to individual connectors.

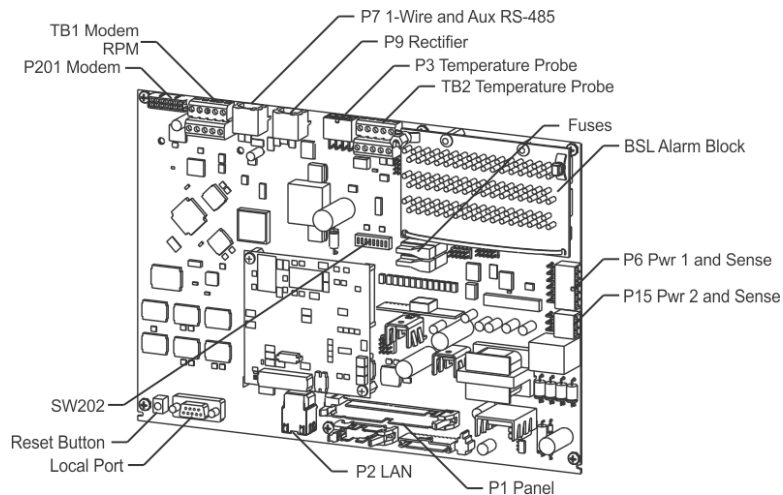


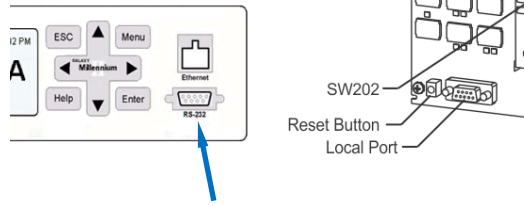
Figure 67 Controller Connections

Many systems are shipped with the appropriate controller connections wired by the factory. The following provides a brief description of how and what to connect to the controller. Use only those sections that apply to the system configuration.

Step	Action – Millennium II														
1	<p style="text-align: center;">Power and Sense Connector</p> <p>Connect and wire to shunt and alarms.</p> <p>P6 is a 6-pin connector provided for analog interface to a plant shunt, distribution alarms, and open battery string alarms. Typically a factory installed plant wire harness plugs into this connector. This wire set has a purple wire with a Faston ® receptacle for connecting the Open String Alarm from field installed battery disconnect breakers.</p> <table border="1" data-bbox="326 527 924 827"> <caption data-bbox="326 527 924 562">Table 7 Power and Sense Signals - Millennium II</caption> <thead> <tr> <th data-bbox="326 562 435 598">Pin</th> <th data-bbox="435 562 924 598">Signal</th> </tr> </thead> <tbody> <tr> <td data-bbox="326 598 435 634">1</td> <td data-bbox="435 598 924 634">Shunt+</td> </tr> <tr> <td data-bbox="326 634 435 669">2</td> <td data-bbox="435 634 924 669">Shunt Reference</td> </tr> <tr> <td data-bbox="326 669 435 705">3</td> <td data-bbox="435 669 924 705">Shunt-</td> </tr> <tr> <td data-bbox="326 705 435 741">4</td> <td data-bbox="435 705 924 741">Fuse Alarm Major +24V</td> </tr> <tr> <td data-bbox="326 741 435 777">5</td> <td data-bbox="435 741 924 777">Open String</td> </tr> <tr> <td data-bbox="326 777 435 812">6</td> <td data-bbox="435 777 924 812">Fuse Alarm Major -48V</td> </tr> </tbody> </table>	Pin	Signal	1	Shunt+	2	Shunt Reference	3	Shunt-	4	Fuse Alarm Major +24V	5	Open String	6	Fuse Alarm Major -48V
Pin	Signal														
1	Shunt+														
2	Shunt Reference														
3	Shunt-														
4	Fuse Alarm Major +24V														
5	Open String														
6	Fuse Alarm Major -48V														
2	<p style="text-align: center;">1-Wire Peripheral Connector</p> <p>Connect and wire to VT-Probe, external ambient probe, or Remote Voltage Monitor.</p> <p>P7 is an RJ-45 receptacle for connecting to 1-Wire devices.</p>														

Step	Action – Millennium II	
3	Alarm and Control Connections	
	<p>Connect and wire alarm and control signals to the BSL card as specified in site engineering instructions.</p> <p>Refer to <i>Galaxy Millennium II Installation and User's Guide</i> alarm and control connection details.</p> <div data-bbox="509 338 1175 735" style="text-align: center;"> </div> <p style="text-align: center;">Figure 68 Alarm Connections Millennium II</p> <p>NOTE: Wire Wrap Use 24 to 30 AWG wire. Strip approximately 1 inch of insulation from wire. Use a standard wire wrap tool to connect each wire to its terminal.</p> <p> Punch Down Use 18 to 22AWG (if less than 18AWG, use multi-conductor cable for mechanical integrity). Secure wires to terminals using a punch down tool or Phillips #1 or #2 screwdriver inserted into a punch down insulating cap¹⁹.</p>	
4	Network (LAN) Connection (Optional)	
	<p>Connect to network.</p> <p>The controller provides an Ethernet connection for a LAN and or Craft port connection. Connector P2 provides a standard RJ45 shielded receptacle connection for a standard Cat-5 connection to the controller's 10/100Base-T port. This port has two main modes of operation: Server mode, LAN mode (Static and DHCP Client). In server mode the port can be used as a local Craft interface. In this mode, a local laptop can be connected through J5 and its standard web browser used to directly access the controller by typing in network address http://192.168.2.1. A connection should never be made between the controller and LAN while the controller is in Server mode.</p>	
	Is the controller equipped with the Modem Option?	
	Yes – go to Step 6.	No – go to Step 7.
5	Telephone Line Connection (Optional).	
	<p>Door-mount MODEM option provide their own RJ11 connection for the telephone line.</p> <p>Use appropriate routing techniques to connect the controller respective RJ11 to the telephone line.</p>	<p>Modem is mounted on door near the controller.</p>

¹⁹ Punch down caps are furnished with the controller.

Step	Action – Millennium II	
6	<p align="center">Local RS232 Serial Port Connector</p> <p>Connect notebook computer, PC or external modem to RS232 port.</p> <p>The Local Port connector is at the lower left of the controller card. This connector is factory cabled to the Local Port connector on front right of the front panel, for convenient local connection of a laptop PC.</p> <p>If connecting to a modem or other device which is connected permanently, use the Local Port connector on the controller card.</p> <p>Connect to the RS-232 connector as Data Circuit-terminating Equipment (DCE).</p>	 <p align="center">Figure 69 LAN Connection - Millennium II</p>

Install BSM6 Modem

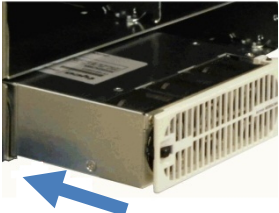
The optional BSM6 Modem is field installed. Instructions accompany the modem.

Install Optional Controller Peripherals

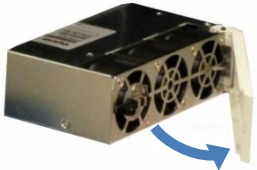
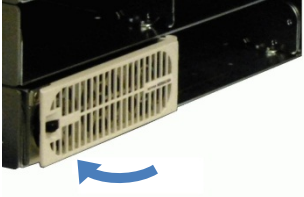
Optional Controller Peripherals are field installed. See the controller manual and instructions accompany the options.

Install Rectifiers/Converters

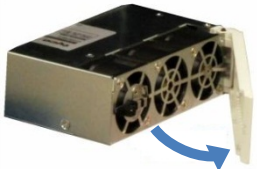
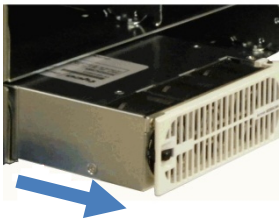
Rectifier/Converter Installation Procedure

Step	Action	
<p>CAUTION: Improper Operation Install only <i>Eco</i> rectifiers in <i>Eco</i> system DC (PV or solar) powered positions.²⁰ Eco systems require <i>Eco</i> rectifiers in all DC powered positions. Eco rectifiers have unique badge symbols - Table 1.</p>		
<p>CAUTION: Equipment Damage Do not install rectifiers before battery bus voltage and polarity has been verified. Rectifiers and system damage will result from incorrect battery bus polarity. The damage may not be immediately evident.</p>		
1	Is this a DC (PV or solar) powered rectifier position in an <i>Eco</i> system?	
	Yes – Proceed	No – go to Step 2.
2	Verify rectifier is Eco type by examining the rectifier type badge - Table 1	
3	Verify rectifier Output Voltage by examining the rectifier type badge - Table 1	
4	Slide the rectifier/converter part way into a slot.	 <p align="center">Figure 70 Insert Rectifier</p>

²⁰ Non-Eco rectifiers may be installed in AC powered position – **NOT RECOMMENDED**.

Step	Action	
5	Open the faceplate by sliding the black latch to the left to release the faceplate.	 <p data-bbox="1019 359 1365 390">Figure 71 Open Rectifier Door</p>
6	Push the unit firmly into the shelf until seated.	
7	Install an air filter by placing it inside the faceplate.	
8	Swing the faceplate closed until it is secured by the latch.	 <p data-bbox="1019 709 1365 741">Figure 72 Close Rectifier Door</p>
9	Verify green LED and only green LED is on. If this isn't the case, see the Troubleshooting section.	

Rectifier/Converter Removal Procedure

Step	Action	
1	Open the faceplate to disengage the rectifier/converter.	 <p data-bbox="1019 1165 1365 1197">Figure 73 Open Rectifier Door</p>
2	Remove the unit from the shelf.	 <p data-bbox="1036 1501 1349 1533">Figure 74 Remove Rectifier</p>

Install Rectifiers

- Refer to the controller manual for details of controller operations.
- Use the above rectifier/converter installation and removal procedures as needed in the following steps.

Step	Action
	CAUTION: Improper Operation Install only <i>NE Eco</i> rectifiers in <i>Eco</i> systems DC (PV or solar) powered positions. ²¹ Eco systems require <i>Eco</i> rectifiers in all DC powered positions. Eco rectifiers have unique badge symbols - Table 1.
	CAUTION: Equipment Damage Do not install rectifiers before battery bus voltage and polarity has been verified. Rectifiers and system damage will result from incorrect battery bus polarity. The damage may not be immediately evident.
1	Turn on input power circuit breakers ²² to apply power to the system rectifier positions.
2	Install a rectifier in an available rectifier position.
3	Wait until the rectifier establishes communications with the controller (the red Fail LED stops flashing).
4	Verify rectifier green Norm LED is lit.
5	Apply 10 amperes of load to the system.
6	Verify the contactor closes and connects the battery strings (if equipped).
7	If an audible alarm is present, press the ENTER key to MUTE the audible alarm.
8	Verify all LEDs are green on the controller and the display is visible with the proper voltage shown.
9	Increase the system load current to 20 amperes.
10	Install rectifier in the next position.
11	Wait until the rectifier establishes communications with the controller (the red Fail LED stops flashing).
12	Verify green rectifier Norm LED is lit.
13	Verify that each rectifier is present and verify the rectifier output currents by using the controller front panel (Menu > Status > Rectifiers > Rectifier Currents).
14	Repeat from Step 10 for to install each rectifier.
	Continue after installing all rectifiers.
15	Increase the system load current to 50 amperes.
16	Verify the rectifiers share the load and the voltage regulation is correct. Rectifiers should load share after 2 minutes to within 2% of the total average output.
17	Verify front panel display voltage is within 0.5% of the Float Setpoint.
18	Remove a rectifier and ignore the request to remove missing equipment.
19	Verify the controller identifies the rectifier as missing to verify that the Minor Communication Fail alarm is operational.
20	Re-install the rectifier and verify that the alarm clears.













²¹ Non-Eco rectifiers may be installed in AC powered positions of Eco systems – **NOT RECOMMENDED**.
 Use of non-Eco rectifiers in Eco systems increases the risk of improperly filling system rectifier positions.

²² AC and PV input power circuit breakers for Eco systems.

Verify Rectifier Positions

Refer to site engineering instructions for rectifier type per position.

Step	Action
1	Verify that proper rectifiers are installed in all powered rectifier positions.
2	Verify that rectifiers in all DC powered positions have Eco type badges ²³ - Table 1 .
3	Verify that rectifiers in all DC powered positions are displayed with the Eco leaf in the ECO Support column on the controller web Inventory report screen – Figure 75.
4	Verify that rectifiers in all DC powered positions are displayed with the “Eco leaf” in the controller web main screen ²⁴ – Figure 76.

Rectifier	Type	Serial Number	Capacity	Run Time	ECO Support	Part Number
G41	NE050ECO48ATEZ	LBLNPW12KZ20009050	50.0 A	804 Hours		150025074
G42	NE050ECO48ATEZ	LBLNPW12KZ20009032	50.0 A	837 Hours		150025074
G43	NE050ECO48ATEZ	LBLNPW12KZ20009078	50.0 A	493 Hours		150025074
G44	NE050ECO48ATEZ	LBLNPW12KZ20009084	50.0 A	485 Hours		150025074
G51	NE050ECO48ATEZ	LBLNPW12KZ20009088	50.0 A	830 Hours		150025074
G52	NE050ECO48ATEZ	LBLNPW12KZ20009047	50.0 A	805 Hours		150025074
G53	NE050ECO48ATEZ	LBLNPW12KZ20009045	50.0 A	477 Hours		150025074
G54	NE050ECO48ATEZ	LBLNPW12KZ20009102	50.0 A	489 Hours		150025074
G81	NE050ECO48ATEZ	LBLNPW12KZ20009043	50.0 A	293 Hours		150025074
G82	NE050ECO48ATEZ	LBLNPW12KZ20009053	50.0 A	838 Hours		150025074
G83	NE050ECO48ATEZ	LBLNPW12KZ20009088	50.0 A	489 Hours		150025074
G84	NE050ECO48ATEZ	LBLNPW12KZ20009070	50.0 A	470 Hours		150025074


Eco type rectifiers display the Eco leaf 

Figure 75 Inventory Screen

²³ **RECOMMENDED** – Eco rectifiers in all Eco system rectifier positions (AC and DC powered).

NOT RECOMMENDED – Non-Eco rectifiers may be installed in AC powered positions of Eco systems.

Use of non-Eco rectifiers in Eco systems increases the risk of improperly filling system rectifier positions.

²⁴ The “Eco leaf” displays for rectifier positions after being DC powered while connected to the controller.

All populated rectifier positions are reported as AC powered until DC input is applied.

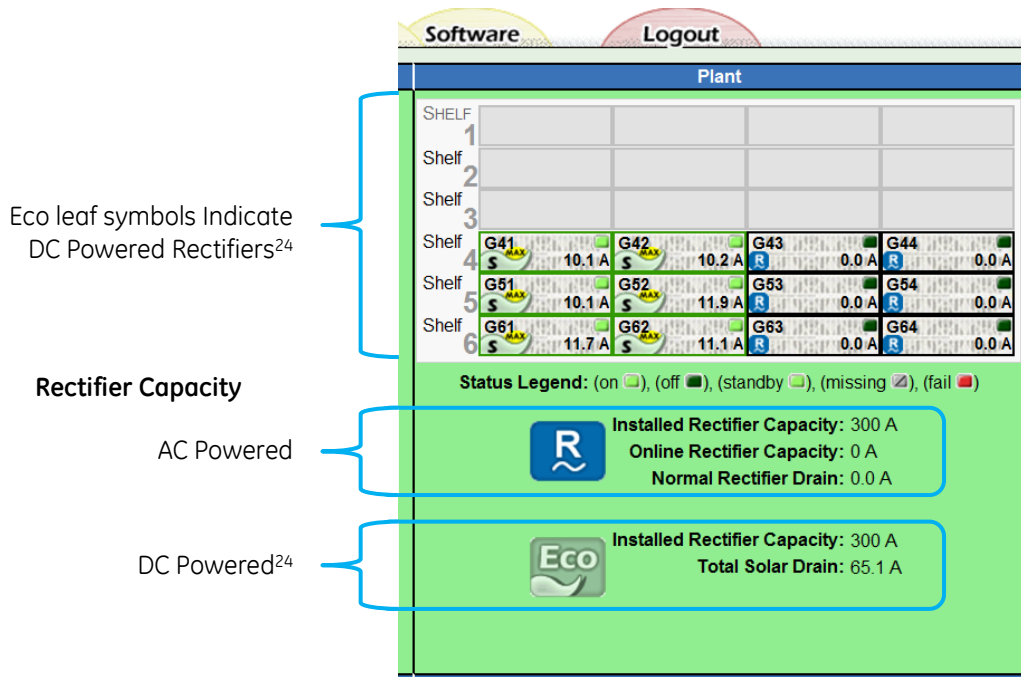


Figure 76 Main Screen - web

Install Converters

Repeat the above steps for converters; use converter-only slots first if provided. These are the lowest mounted shelves and labeled "Converter Only".

For more information on rectifiers and converters, see the Troubleshooting section.

Install Battery Voltage Temp (VT)-Probes



QS873A VT Probes can be used with or without mid-string voltage monitoring. Only one probe is required to allow the battery slope thermal compensation function to be utilized.

Refer to the *Galaxy Pulsar Plus Family Product Manual* for installation instructions.

Install Aux Display (NE830A) Alarm Cable (Optional)

The optional NE830 Aux Display, when ordered separately, will require field installation. To do so, perform the following steps:

Step	Action
	Is the NE830A factory installed?
	No – go to Step1. Yes – go to Step4.
1	Connect and wire to field installed NE830A.
2	Install wiring per NEC and local rules for Class 3 circuits. Note: Cable supplied with NE830A is suitable for Class 3 circuits.

Step	Action															
3	Apply appropriate terminals (if necessary) to the cable after removing the supplied had 1/4 inch Faston ® terminals:															
	Table 8 Power Connections - NE830															
	<table border="1"> <thead> <tr> <th>Pin # Wire Color</th> <th>Signal Name</th> <th>Connect to:</th> </tr> </thead> <tbody> <tr> <td>1 (Green)</td> <td>Earth Ground</td> <td>Frame Ground</td> </tr> <tr> <td>2 (White)</td> <td>24V+/-</td> <td>24V point to be monitored (+24V or -24V)</td> </tr> <tr> <td>3 (Red)</td> <td>48V-</td> <td>-48V point to be monitored (-48V only)</td> </tr> <tr> <td>4 (Black)</td> <td>Common Return</td> <td>Return for signals on pins 2 & 3</td> </tr> </tbody> </table>	Pin # Wire Color	Signal Name	Connect to:	1 (Green)	Earth Ground	Frame Ground	2 (White)	24V+/-	24V point to be monitored (+24V or -24V)	3 (Red)	48V-	-48V point to be monitored (-48V only)	4 (Black)	Common Return	Return for signals on pins 2 & 3
	Pin # Wire Color	Signal Name	Connect to:													
	1 (Green)	Earth Ground	Frame Ground													
2 (White)	24V+/-	24V point to be monitored (+24V or -24V)														
3 (Red)	48V-	-48V point to be monitored (-48V only)														
4 (Black)	Common Return	Return for signals on pins 2 & 3														
<table border="1"> <tbody> <tr> <td>1 (Green)</td> <td>Earth Ground</td> <td>Frame Ground</td> </tr> </tbody> </table>	1 (Green)	Earth Ground	Frame Ground													
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<table border="1"> <tbody> <tr> <td>2 (White)</td> <td>24V+/-</td> <td>24V point to be monitored (+24V or -24V)</td> </tr> </tbody> </table>	2 (White)	24V+/-	24V point to be monitored (+24V or -24V)													
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<table border="1"> <tbody> <tr> <td>3 (Red)</td> <td>48V-</td> <td>-48V point to be monitored (-48V only)</td> </tr> </tbody> </table>	3 (Red)	48V-	-48V point to be monitored (-48V only)													
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<table border="1"> <tbody> <tr> <td>4 (Black)</td> <td>Common Return</td> <td>Return for signals on pins 2 & 3</td> </tr> </tbody> </table>	4 (Black)	Common Return	Return for signals on pins 2 & 3													
4 (Black)	Common Return	Return for signals on pins 2 & 3														
4	Connect and wire connection to NE830A. Alarm cable comcodes are 15ft: CC847922101, 150 ft: CC848804765.															
	<table border="1"> <thead> <tr> <th colspan="2">Table 9 Alarm Connections - NE830</th> </tr> <tr> <th>Pin # Wire Color</th> <th>Signal Name</th> </tr> </thead> <tbody> <tr> <td>1 Black</td> <td>Common</td> </tr> <tr> <td>2 Brown</td> <td>Open on Alarm</td> </tr> <tr> <td>3 Bare</td> <td>Close on Alarm</td> </tr> </tbody> </table>	Table 9 Alarm Connections - NE830		Pin # Wire Color	Signal Name	1 Black	Common	2 Brown	Open on Alarm	3 Bare	Close on Alarm					
	Table 9 Alarm Connections - NE830															
Pin # Wire Color	Signal Name															
1 Black	Common															
2 Brown	Open on Alarm															
3 Bare	Close on Alarm															
<div style="display: flex; align-items: center;"> <div style="margin-right: 20px;"> <p>Alarm Cable Connector</p>  </div>  </div>																
<p>Figure 77 NE830 Alarm Cable Connector</p>																

Configure Controller – Minimum

This section covers the basic operations that must be performed so that the controller is minimally configured. See the controller manual for further detail.

Configure Pulsar Controller

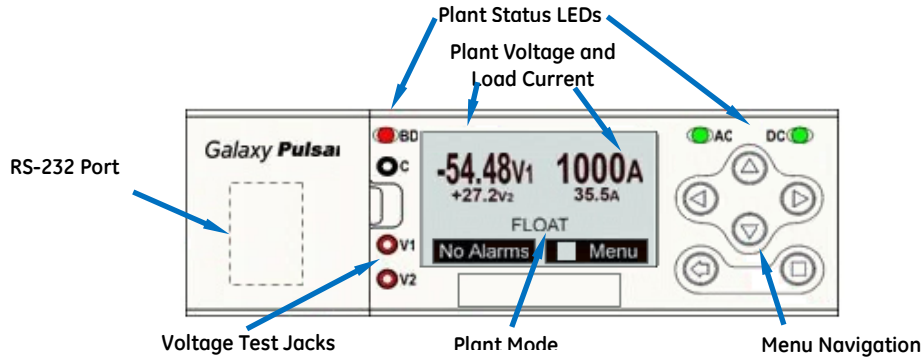


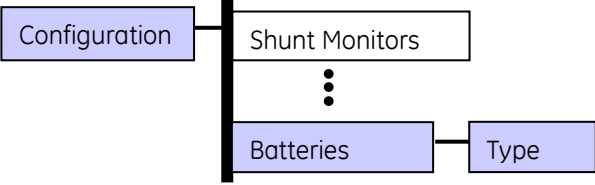
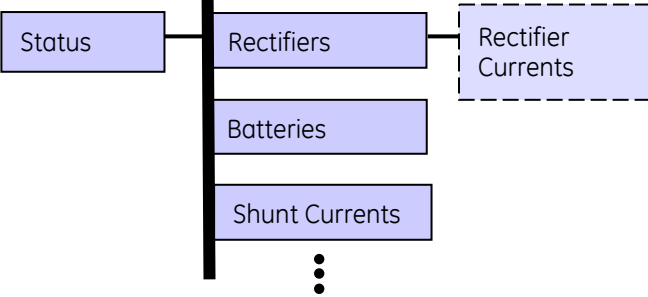
Figure 78 Front Panel - Pulsar Plus Controller

This display shows the front panel display for a system with both rectifiers and converters. The display (V1 versus V2) correlates with test jacks. The large font indicates the “Primary” or rectifier dc bus; the smaller font shows the “Secondary” or converter dc bus.

Menu Navigation Buttons

	Parameter Change	Increase or decrease the value of the selected parameter.
	Navigate	Navigate menus – move to different selected menu item.
	Enter Button	Enter a sub-menu or confirms a parameter change. Go to the Main Menu from the Normal display.
	ESC Button	Go up one menu level or exits a parameter change without saving.

Step	Configuration Attribute to Change	Menu Path/Action - Pulsar
1	Date	
	Format	This field allows you to select one of the following date formats: MM/DD/YY, DD/MM/YY, YY/MM/DD, MM/DD/YYYY, DD/MM/YYYY, YYYY/MM/DD. Use the <+> or <-> key to select the desired format and press <ENTER> to save the change.
	Month	Use this field to change the month; the possible value is from 1 to 12.
	Day	Use this field to change the day of the month; the possible value is from 1 to 31.
	Year	Use this field to change the year; the possible value is from 1992 and up.
	Note: The system will validate the entries before the system date is modified.	
2	Time	

Step	Configuration Attribute to Change	Menu Path/Action - Pulsar
	Format	This field allows you to select one of the following time display formats: 12 or 24 hour. Use the <+> or <-> key to select the desired format and press <ENTER> to save the change.
	Time	Allows you to change/set the time.
3	Daylight	Enables or Disables Daylight Savings per the new standards created by the <i>Energy Policy Act of 2001</i> . (Started in 2007.)
	Batteries	 <pre> graph LR Config[Configuration] --- Shunt[Shunt Monitors] Shunt --- Dots1[...] Dots1 --- Batteries[Batteries] Batteries --- Type[Type] </pre>
4	Type	The configuration of this field selects the battery type, Flooded or Valve Regulated (sealed). This parameter is used in reserve time prediction and enhanced battery test features. Move the cursor to the field and use the <+> or <-> key to adjust the threshold value. Press <ENTER> to save the change.
5	Confirm Equipment Installed	<p>Use the STATUS menu to confirm the equipment installed:</p> <p>Rectifiers: Menu > Status > Rectifiers Distribution Modules: Menu > Status > Shunt Currents Thermal Probes: Menu > Status > Batteries</p>  <pre> graph LR Status[Status] --- Rectifiers[Rectifiers] Rectifiers --- RectifierCurrents[Rectifier Currents] Rectifiers --- Batteries[Batteries] Rectifiers --- ShuntCurrents[Shunt Currents] ShuntCurrents --- Dots2[...] </pre>

Configure Millennium II Controller

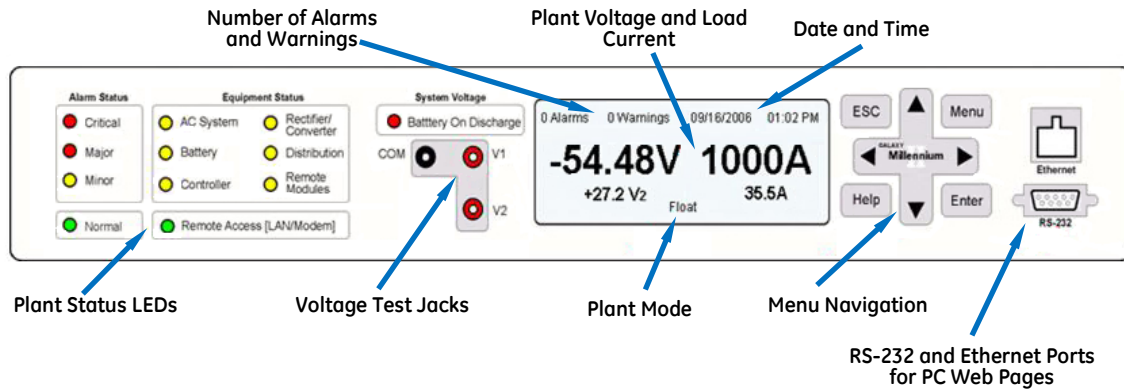


Figure 79 Front Panel - Millennium II Controller

Table 10 Push Buttons - Millennium II

Button	Function	Action
▲	Display Contrast	Increase or decrease the display contrast (in Main Display).
▼	Parameter Change	Increase or decrease the value of the selected parameter.
◀ ▶ ▲ ▼	Navigate	Navigate menus – move to different selected menu item.
Enter	Enter	Enter a sub-menu or confirms a parameter change.
ESC	Escape	Go up one menu level or exits a parameter change without saving.
Menu	Menu	Go to the Main Menu.
Help	Help	Display available Help information.

The Millennium II controller’s primary user interface is the front panel, which includes a backlit LCD, and an array of pushbutton controls. SW202-8 must be set to ENABLED for changes to be made from the front panel. This section covers the basic operations that must be performed so that the controller is minimally configured.

Step	Configuration Attribute to Change	Menu Path/Action = Millennium II
1	DATE/TIME	<div style="border: 1px solid black; padding: 5px; display: inline-block;">Configuration</div> <ul style="list-style-type: none"> Plant Shunt Float Settings Plant Rectifiers Batteries Contactors Alarm Test System Settings <div style="margin-left: 100px;"> <div style="border: 1px solid black; padding: 2px 10px;">Date</div> <div style="border: 1px solid black; padding: 2px 10px;">Time</div> </div>

Step	Configuration Attribute to Change	Menu Path/Action = Millennium II
	Format	This field allows you to select one of the following date formats: MM/DD/YY, DD/MM/YY, YY/MM/DD, MM/DD/YYYY, DD/MM/YYYY, YYYY/MM/DD. Use the <+> or <-> key to select the desired format and press <ENTER> to save the change.
	Month	Use this field to change the month; the possible value is from 1 to 12.
	Day	Use this field to change the day of the month; the possible value is from 1 to 31.
	Year	Use this field to change the year; the possible value is from 1992 and up.
NOTE	Please note that the system will validate the entries before the system date is modified.	
2	TIME	
	Format	This field allows you to select one of the following time display formats: 12 or 24 hour. Use the <+> or <-> key to select the desired format and press <ENTER> to save the change.
	Time	Allows you to change/set the time.
	Daylight	Enables or Disables Daylight Savings per the new standards created by the Energy Policy Act of 2005. (Started in 2007.)
3	Batteries	
	Model	The configuration of this field selects the installed battery type from a list of pre-defined battery types used in reserve time prediction and enhanced battery test features. Move the cursor to the field and use the <+> or <-> key to adjust the threshold value. Press <ENTER> to save the change.
	Strings	The configuration of this field selects the number of battery strings in the system. This parameter is used in reserve time prediction and enhanced battery test features. Move the cursor to the field and use the <+> or <-> key to adjust the threshold value. Press <ENTER> to save the change.
	Cells/String	The configuration of this field selects the number of installed cells in the battery strings. This parameter is used in reserve time prediction and enhanced battery test features. Move the cursor to the field and use the <+> or <-> key to adjust the threshold value. Press <ENTER> to save the change.
	Type	The configuration of this field selects the battery type, Flooded or Valve Regulated (sealed). This parameter is used in reserve time prediction and enhanced battery test features. Move the cursor to the field and use the <+> or <-> key to adjust the threshold value. Press <ENTER> to save the change.

Acceptance Testing

NOTE: The controller may report a limited recharge alarm during these tests.

NOTE: At any time you encounter difficulty with these steps, refer to the **Troubleshooting** Section.

Communication with Rectifiers and Converters

Step	Action
1	Place external battery disconnect switches in the ON (connected) position if equipped.
2	Turn on all circuit breakers supplying rectifiers.
3	Adjust the contrast (if needed) for the site's ambient condition (Menu > Configuration > System Settings > Display Contrast). Millennium II only: use the up and down arrow keys at the Main Menu.
	Wait 30 seconds. Are all lit LEDs on all components including rectifiers, the controller, LVD control boards, and Aux Displays green?
	Yes – Go to Step 7. No – go to Step 4.
4	Initiate the Clear Events and Uninstall Equipment operations (in Menu > Control / Operations). Non-existent alarm conditions should clear. Refer to the controller manual as needed.
5	If the controller appears not to be powered or not responsive, remove and reseal the controller.
6	If all lit LEDs still aren't green, review the installation procedure or refer to the Troubleshooting section in this manual. The controller display should indicate "NO ALARMS". The system float voltage, total load current, and system operating mode should be observable as indicated and the controller's back-light shall be illuminated green for no alarms and the system rectifier voltage should be displayed.
7	If Slope Thermal Compensation (STC) is active disable STC: (Menu > Configuration > Batteries > Batt Temp Management > Temperature Comp)
8	Check the voltage readings on the controller display. The controller is factory configured with a rectifier Float voltage set-point of -54.50V for -48V rectifier systems and $\pm 27.25V$ for $\pm 24V$ rectifier systems. If converters are present, the display shows their voltage and current in smaller font. The controller is factory configured with a converter output voltage set-point of -54.50V for -48V converters and +27.25V for +24V converters. Note: If Slope Thermal Compensation (STC) is active or if the connected batteries are not fully charged, the bus voltage may be different than the set-point. If possible, open the external battery disconnect prior to making measurements to eliminate these effects. If QS873 VT probes are installed in the system. STC may be active. This will be indicated by the Plant Mode "FLOAT – TEMP COMP".
9	Enable Slope Thermal Compensation (STC) if it was disabled in Step 7: (Menu > Configuration > Batteries > Batt Temp Management > Temperature Comp)
Remove and Replace Rectifier and Verify Results:	
10	Remove a rectifier from its slot.
11	Verify the controller LED and display are light amber which indicates a missing rectifier condition.
12	When the controller prompts to remove equipment press enter ■ .
13	Verify the controller LED and display are light green.
14	Replace the removed rectifier in its original slot.
15	Verify the controller LED and displays remain green.
	Repeat Steps 9-14 for converters, if equipped.

Miscellaneous Alarms

(Batteries must be connected)

Distribution Alarms

Step	Action
1	Manually connect a piece of wire from the circuit breaker feed bus to the distribution alarm strip.
2	Verify an FAJ – Fuse Alarm Major is reported by the controller.
3	Remove the wire. Verify the alarm clears.
	Repeat test for each distribution panel or sub-system.

ac Fail Alarms²⁵

Step	Action
1	Turn off AC circuit breaker feeding a single rectifier. ²⁶
2	Verify ACF – AC Fail Minor is reported for the correct rectifier ID.
3	Restore input and verify alarms clear and the controller returns to Normal.
4	Remove input from two or more rectifiers.
5	Verify MACF – Multiple AC Fail Major is reported for the correct rectifier IDs.
6	Turn on input circuit breaker turned off in Step 1 and verify alarms clear and the controller returns to Normal.

Battery On Discharge Alarms²⁷

Step	Action
1	Change BD alarm to 2 volts below float voltage (Menu > Configuration > Float Settings > Voltage Alarms > BD).
2	Adjust the load to 50 amperes.
3	Verify the BD alarm occurs when the system voltage decreases to BD threshold.
4	Verify the BD alarm clears once the voltage has exceeded 0.5V above the BD alarm threshold.
5	Restore the BD alarm threshold to its previous setting.

High Voltage Alarms

Step	Action
1	Confirm the HV alarm threshold (Menu > Configuration > Float Settings > Voltage Alarms > High Minor).
2	Adjust the float voltage to a value greater than this threshold (Menu > Configuration > Float Settings > Set Point).
3	Verify an HV alarm is reported by the controller.
4	Restore the float voltage back to its original setting.
5	Restore the HV setting back to its original setting.
6	Verify the alarms clear and the controller returns to Normal.

²⁵ **Rectifier Input Fail Controller Alarms:** is displayed and labeled “ACF” and “MACF”.

Input Fail Rectifier LED: non-Eco rectifiers LED is labeled “ACF”. Eco rectifiers LED is labeled “INF” (Input Fail).

²⁶ DC fed Eco rectifiers do not report a failure (INF) when DC input is removed.

²⁷ Eco systems do not alarm for battery discharges and may have BD thresholds settings different than non-Eco systems.

Manual Contactor Control and Alarms²⁸


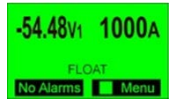




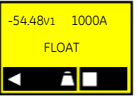







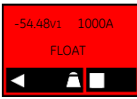






Step	Action
1	Open the contactor by controller command (Menu > Control / Operations > Disconnects).
2	Verify the controller reports a Contactor Open alarm. ²⁹
3	Close the contactor by controller command.
4	Verify the alarms clear and the controller returns to Normal.

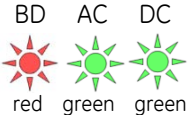
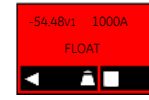









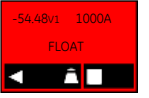






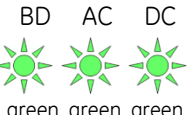
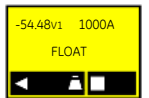





²⁸ Skip if contactors are not present.

²⁹ Contactor Open Alarm may be delayed by imminent LVD Alarm delay if enabled and configured.

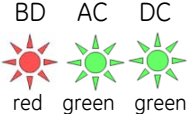
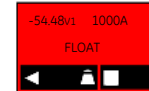






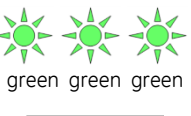





Troubleshooting

System




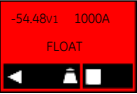







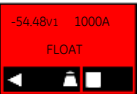







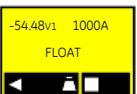




Pulsar Controller Status Display	Millennium Controller Status Display	Rect/Conv LEDs	Dist. Module LED	Possible Problem(s)	Possible Solution(s)
<p>No Alarms</p> <p>BD AC DC</p>  <p>green green green</p>  <p>Display green</p>	 <p>Normal green</p>	 <p>Norm green</p>	 <p>green</p>	Normal Operation	
<p>MIN AC Fail</p> <p>BD AC DC</p>  <p>green amber green</p>  <p>Display Amber</p>	 <p>Minor amber</p>  <p>AC System amber</p>	 <p>NF amber (one Rect)</p>	 <p>green</p>	<ul style="list-style-type: none"> • Single rectifier not receiving AC power. • ac input circuit breaker has opened. • ac input voltage is out of range. 	<ol style="list-style-type: none"> 1. Verify rectifier input circuit breaker is closed. 2. Verify AC power to rectifier is available and in range. 3. If problem not corrected, replace rectifier.
		 <p>Norm green</p>	 <p>green</p>	A rectifier has been removed from the system while it is unpowered.	Issue the Menu > Control / Operations > Uninstall Equipment command for any rectifier that was removed while unpowered.
<p>MAJ Multiple AC Fail</p> <p>BD AC DC</p>  <p>green red green</p>  <p>Display Red</p>	 <p>Minor red</p>  <p>AC System amber</p>	 <p>INF amber (Multiple Rect)</p>	 <p>green</p>	<ul style="list-style-type: none"> • Multiple rectifiers not receiving AC power. • ac input circuit breakers have opened. • ac input voltage is out of range. 	<ol style="list-style-type: none"> 1. Verify rectifier input circuit breakers are closed. 2. Verify AC power to rectifiers is available and in range. 3. If problem not corrected, replace rectifiers.
		 <p>Norm green</p>	 <p>green</p>	One or more rectifiers have been removed from the system while it is unpowered.	Issue the Menu > Control / Operations > Uninstall Equipment command for any rectifier that was removed while unpowered.


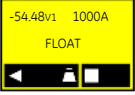





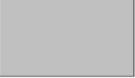
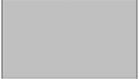



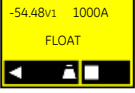





Pulsar Controller Status Display	Millennium Controller Status Display	Rect/Conv LEDs	Dist. Module LED	Possible Problem(s)	Possible Solution(s)
<p>MAJ Battery on Discharge</p> <p>BD AC DC  red green green</p>  <p>Display Red</p>	<p>  Major red  Battery on Discharge red  Major red  Battery on Discharge red </p>	<p>  Norm green  Norm amber </p>	<p>  green  green </p>	<p>System voltage has fallen below the battery on discharge threshold set by the user.</p> <p>Rectifier is in current limit.</p>	<ol style="list-style-type: none"> Investigate other alarms that may be present such as rectifier related problems. If AC power is present but the system voltage remains low, call your local field representative.
<p>MAJ Battery on Discharge and AC Fail</p> <p>BD AC DC  red amber green</p>  <p>Display Red</p>	<p>  Major red  AC Sys amber  Battery on Discharge red  INF amber </p>	<p>  INF amber </p>	<p>  green </p>	<ul style="list-style-type: none"> Rectifier not receiving ac power. ac input voltage is out of range. 	
<p>MIN Rectifier Fail</p> <p>BD AC DC  green green green</p>  <p>Display Amber</p>	<p>  Minor amber  Rectifier/Converter amber  Fail red (one Rect) </p>	<p>  Fail red (one Rect) </p>	<p>  green </p>	<ul style="list-style-type: none"> Rectifier output has dropped below 18V (36V), rectifier has shut down³⁰. Excessive ambient temperature, rectifier has shut down. A rectifier or rectifier fan has failed. A rectifier high voltage shut down³⁰. 	


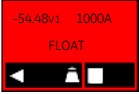




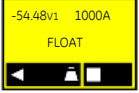




³⁰ When a rectifier or converter senses an over- or under-voltage condition it will shutdown, wait 4 seconds, and then attempt to restart. If the over- or under-voltage condition remains it will cycle again. If the over- or under-voltage condition remains after 3 restart attempts the unit will lock out, and user intervention is required to restart.


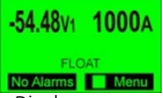



Pulsar Controller Status Display	Millennium Controller Status Display	Rect/Conv LEDs	Dist. Module LED	Possible Problem(s)	Possible Solution(s)
<p>MAJ Multiple Rectifier Fail, MAJ Battery on Discharge</p> <p>BD AC DC  red green green</p>  Display Red	<p>  Minor red  Rectifier/Converter amber </p>	<p>  Fail red (multiple Rect) </p>	<p>  green </p>	<p>Multiple rectifier outputs have dropped below 18V (36V); rectifiers have shut down³¹.</p>	<ol style="list-style-type: none"> Reset the rectifiers by removing the rectifiers, waiting approximately 30 seconds, and replacing the rectifiers. If problem not corrected, replace rectifiers.
		<p>  Fail red (all Rect) </p>	<p>  green </p>	<ul style="list-style-type: none"> Excessive ambient temperature; multiple rectifiers have shut down³¹. Multiple rectifiers have failed. 	<ol style="list-style-type: none"> Verify that there is no obstruction of the vertical airflow path and fans are turning. Reset rectifies by removing them, waiting approximately 30 seconds, and replacing them. If problem persists, replace the rectifiers. If problem still persists, call your local field representative.
<p>MAJ High Voltage</p> <p>BD AC DC  green green green</p>  Display Red	<p>  Minor red  Rectifier/Converter amber </p>	<p>  Fail red (multiple Rect) </p>	<p>  green </p>	<ul style="list-style-type: none"> All rectifier outputs have dropped below 18V (36V); all rectifiers have shut down³¹. Defective controller. 	<ol style="list-style-type: none"> Remove controller and reset the rectifiers by removing the rectifiers, waiting approximately 30 seconds, and replacing the rectifiers. If output voltage does not go to set-point previously set by user, call your local field representative.
		<ul style="list-style-type: none"> High output voltage from rectifier(s). Rectifier(s) high voltage shut down³¹. Internal rectifier(s) failure. VHV threshold set below float set point. 	<ol style="list-style-type: none"> Check and adjust VLV threshold to above float set point. Reset the rectifier(s) by removing the rectifier(s), waiting approximately 30 seconds, and replacing the rectifier(s). If problem persists, replace rectifier(s). If problem still persists, call your local field representative. 		

³¹ When a power unit senses an over- or under-voltage condition it will shutdown, wait 10 seconds, and then attempt to restart. If the over- or under-voltage condition remains it will cycle again. If the over- or under-voltage condition remains after 3 restart attempts the power unit will lock out, and user intervention is required to restart.

Pulsar Controller Status Display	Millennium Controller Status Display	Rect/Conv LEDs	Dist. Module LED	Possible Problem(s)	Possible Solution(s)
<p>MAJ Fuse Major</p> <p>BD AC DC</p> <p>  </p> <p>green green red</p>  <p>Display Red</p>	<p> </p> <p>Minor red Distribution amber</p>	<p> </p> <p>Norm green red</p>	<p>One or more output circuit breakers or fuses have opened.</p>	<ol style="list-style-type: none"> 1. Clear circuit fault(s). 2. Reset circuit breaker(s) or replace fuse(s). 	
<p>MAJ Contactor Open</p> <p>BD AC DC</p> <p>  </p> <p>green green red</p>  <p>Display Red</p>	<p> </p> <p>Minor red Battery amber</p>	<p> </p> <p>Norm green Red</p>	<p>One or more LVD contactors are manually forced open.</p>	<p>Place disconnect switch(s) in ON position.</p>	
<p>MIN Battery High Temperature</p> <p>BD AC DC</p> <p>  </p> <p>green green green</p>  <p>Display Amber</p>	<p> </p> <p>Minor amber Battery amber</p>	<p> </p> <p>Norm green green</p>	<p>Batteries have exceeded temperature threshold set by user.</p>	<ol style="list-style-type: none"> 1. Check the threshold setting. 2. Call your local field representative. 	

Pulsar Controller Status Display	Millennium Controller Status Display	Rect/Conv LEDs	Dist. Module LED	Possible Problem(s)	Possible Solution(s)
<p>MIN Thermal Probe Fail</p> <p>BD AC DC  green green green</p>  <p>Display Amber</p>	<p>  Minor amber Battery amber</p>	<p>  Norm green green</p>	<p>Battery thermal probe failed.</p>	<ol style="list-style-type: none"> 1. Ensure thermal probe is properly connected to thermal probe cable. 2. Ensure cable is properly connected to the rear of the Distribution Module. 3. If problem persists, replace thermal probe. 4. If problem still persists, call your local field representative. 	
<p>No response</p> <p>BD AC DC  off off off</p>  <p>Display blank</p>	<p> Display blank</p>	<p> Fail red blink</p>	<p> red blink</p>	<p>Controller failure, all devices on the communication bus reporting loss of communication with controller.</p>	<ol style="list-style-type: none"> 1. Check controller to ensure it is properly inserted into its slot. If so, perform the following steps: 2. Remove the controller input power connector for 1 minute and then reset. 3. If problem persists, replace controller with new controller board. 4. If problem still persists, call your local field representative.
<p>MIN Minor Communication Fail</p> <p>BD AC DC  green green green</p>  <p>Display Amber</p>	<p> Minor amber</p>	<p> Fail red blink (one rect)</p>	<p> green</p>	<p>Rectifier lost communication with controller.</p>	<ol style="list-style-type: none"> 1. Reset the rectifier by removing the rectifier, waiting approximately 30 seconds, and replacing. 2. If problem persists, replace the rectifier. 3. If problem still persists, call your local field representative.
<p>Display Amber</p>		<p>  Norm green green</p>	<p>Rectifier removed from a running system, but not uninstalled.</p>	<p>Issue the Menu > Control / Operations > Uninstall Equipment command for any rectifier that was removed.</p>	

Pulsar Controller Status Display	Millennium Controller Status Display	Rect/Conv LEDs	Dist. Module LED	Possible Problem(s)	Possible Solution(s)
<p>MAJ Major Communication Fail</p> <p>BD AC DC</p>  <p>green green green</p>  <p>Display Red</p>	 <p>Major Red</p>	 <p>Norm green</p>	 <p>red blink</p>	<ul style="list-style-type: none"> • LVD Board lost communication with the controller. • Multiple devices no longer communicating with the controller. 	<ol style="list-style-type: none"> 1. Clear blinking red LEDs on all devices. See other conditions with blinking red LEDs. 2. Correct communication with each device. 3. Issue the Menu > Control / Operations > Uninstall Equipment command. (This only removes this alarm for unconnected devices.) 4. Replace Distribution Module Board. 5. If problem persists, call your local field representative.
<p>MIN Clock Battery Low</p> <p>BD AC DC</p>  <p>green green green</p>  <p>Display Amber</p>	 <p>Minor amber</p>  <p>Controller amber</p>	 <p>Norm green</p>	 <p>green</p>	<p>Internal Lithium Battery Is Low.</p>	<ol style="list-style-type: none"> 1. The battery is not field replaceable. The controller unit must be replaced. 2. Off-load all desired information such as alarm history, statistics, and any field configuration that is different than the standard. 3. Replace controller, and upload any non-standard configuration.

Pulsar Controller Status Display	Millennium Controller Status Display	Rect/Conv LEDs	Dist. Module LED	Possible Problem(s)	Possible Solution(s)
<p>No Alarm, but individual Shunt Currents are displayed at or above their maximum display values ($\geq 600A$ for loads, $\geq 800A$ for battery)</p> <p>BD AC DC  green green green</p>  Display green	 Normal green	 Norm green	 green	<p>One or both of the QS871A shunt inputs is open-circuit.</p>	<ol style="list-style-type: none"> 1. Verify that the respective shunt has its green and yellow wire connections attached used for the current measurements. 2. Verify the shunt connection to the QS871A is good by verifying the green and yellow wire connections from the shunt follows through to the 10-pin connector at the respective QS871A.

Rectifiers/Converters

Status of a rectifiers and converters is provided by LEDs on their faces, and by extensive real time data, alarm and event history accessible through the system controller.

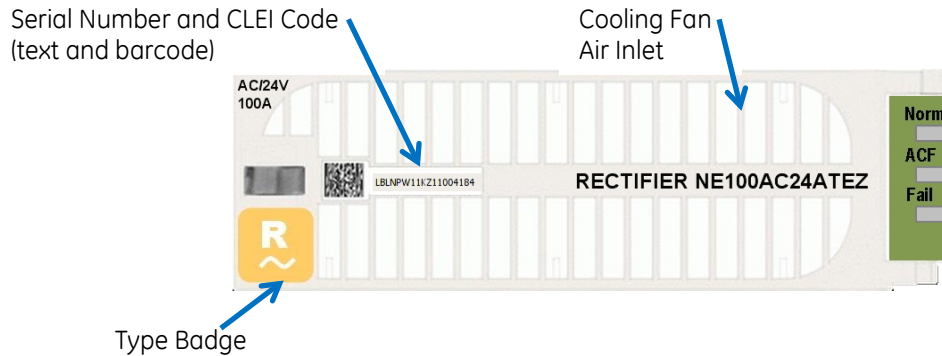


Figure 80 Rectifier Face Plate

Non-Eco rectifiers powered by PV (solar) panels will not operate properly.













- Under some conditions their LEDs may indicate normally operation: Norm LED ON.
- Various other LED conditions and rectifier status (observed via the controller) may occur with variations in DC input and load.

Rectifier/Converter Troubleshooting

1. Verify rectifier positions per the procedure in the **Verify Rectifier Positions** section.
2. Observe and compare Rectifier/Converter Status LEDs with Controller Status information.
3. Use the table below as a troubleshooting guide.

Rectifier/Converter LEDs

Table 11 Rectifier/Converter LEDs	
LEDs	Condition
Norm <input checked="" type="checkbox"/> green ACF <input type="checkbox"/> off Fail <input type="checkbox"/> off	Normal operation: No alarms, inputs and outputs are in their normal range, communicating with the system controller.
Norm <input type="checkbox"/> off ACF <input type="checkbox"/> off Fail <input type="checkbox"/> off	Unpowered: No input or output voltage present. <ol style="list-style-type: none"> 1. Remove and reinsert unit. 2. Check input voltage with a voltmeter; if input voltage is present, replace unit. 3. Check output bus voltage with a voltmeter; if output bus voltage is present, replace unit.
Norm <input checked="" type="checkbox"/> green blink ACF <input type="checkbox"/> off Fail <input type="checkbox"/> off	Standby: The unit is okay, but has been placed in Standby by the controller and is not delivering power. Note: If a unit in standby loses communications with the controller it will exit Standby mode and deliver power

Table 11 Rectifier/Converter LEDs	
Norm  amber ACF  off Fail  off or red blink	<p>Output Limit: The unit is okay and delivering maximum output:</p> <ul style="list-style-type: none"> • At max rated output • At configured current limit • At thermal limit <ol style="list-style-type: none"> 1. If rectifiers/converters are equipped with optional air filters and reporting thermal limiting, check air filters. Clean or replace all filters if necessary. 2. View rectifier currents: Status > Rectifiers > Rectifier Currents.
Norm  off ACF  amber Fail  off or red blink	<p>ac Fail: Rectifier input is missing or out of range. Correct AC fault.</p> <p>Input Fail: Converter input is out of range. Correct converter input fault.</p>
Norm  off ACF  off or amber Fail  red	<p>Shutdown³²: The unit cannot deliver output.</p> <ul style="list-style-type: none"> • High Voltage Shutdown • Thermal Shutdown • Under Voltage Protect • Component failure <ol style="list-style-type: none"> 1. Check rectifier or converter status on controller display to determine cause of shutdown 2. Correct system output short, high temp, etc. 3. Remove and reinsert unit. If fault remains and other units are functioning correctly, replace unit.
Norm  any ACF  off or amber Fail  red blink	<p>Communication Fail: Blinks to indicate the rectifier is not communicating with a system controller. Remove and reinsert unit. If fault remains and other units are communicating correctly, replace unit.</p>

Voltage Temp (VT)-Probes

Checking for Defective VT-Probes

(If a Voltage Channel Failure and/or Thermal Probe Failure alarm occurs)

Step	Action
1	Disconnect the first probe from its RJ-45 terminal block.
2	Run the command: Menu > Control / Operations > Uninstall Equipment.
	Is the system controller green Normal LED lit?
3	Yes – Install new probe. Finished. No – Reinstall the removed probe. go to Step 4.
4	Remove the next probe.
5	Go to Step 2. Repeat steps for all probes.

³² When a rectifier or converter senses an over- or under-voltage condition, it will shutdown, wait 4 seconds, and then attempt to restart. If the over- or under-voltage condition remains it will cycle again. If the over- or under-voltage condition remains after 3 restart attempts the unit will lock out, and user intervention is required to restart.

Specifications and Application

- Specifications and ordering information are in the *Infinity M Product Line Brochure* available at www.gecriticalpower.com
- External Surge Protective Device (SPD) is required on all AC inputs.
- Equipment and subassembly ports:
 1. are suitable for connection to intra-building or unexposed wiring or cabling;
 2. can be connected to shielded intra-building cabling grounded at both ends.
- Grounding / Bonding Network – Connect to an Isolated Ground Plane (Isolated Bonding Network) or an Integrated Ground Plane (Mesh-Bonding Network or Common Bonding Network).
- Installation Environment - Install in Network Telecommunication Facilities, OSP, or where NEC applies.
- Battery return may be either Isolated DC return (DC-I) or Common DC return (DC-C).

Safety

Safety Statements

See equipment specifications for installation and environmental limitations.

- Do not install this equipment over combustible surfaces.
- Follow all national and local rules and regulations when making field connections.
- Compression Connectors
 - For installations in the U. S. or Canada, use Listed/Certified compression connectors to terminate Listed/Certified field-wire conductors where required.
 - For all installations, apply the appropriate connector to the correct size conductor as specified by the connector manufacturer, using only the connector manufacturer's recommended or approved tooling for that connector.
- Torque electrical connections to the values specified on labels or in the product documentation.
- Dress cables to avoid damage to the conductors and undue stress on the connectors.
- Field-wired Conductors - Follow all National Electric Code (NEC) and local rules and regulations.
 - Size field-wired conductors based on listed recommendations, National Electric Code (NEC) and/or local codes based on 70°C ampacity.
 - Insulation rating: 90°C minimum; 105°C (minimum) if internal to enclosed equipment cabinets.
- Size protectors (fuses or circuit breakers) as required by the National Electric Code (NEC) and/or local codes.
- Provide accessible AC and DC disconnect/protection devices to remove input power from the equipment in the event of an emergency.
- Provide external current limiting protection for alarm contacts. Rating 60V, 0.5A unless otherwise noted.
- Grounding - Connect the equipment chassis directly to ground. In enclosed equipment cabinets connect to the cabinet ac service ground bus. In huts, vaults, and central offices connect to the system bonding network.
- Use only specified fuses and circuit breakers.
- Use only GMT fuses provided with safety caps.
- Leave unused protector positions per UL report layout restrictions:

Protector	Rating	Unused Position – 1 Side	Unused Position – 2 Sides
Bullet Breaker – 1 pole ³³	70A and larger		X

³³ 2-pole and 3-pole breakers do not require adjacent vacant positions.

Precautions

- Install, service, and operate equipment only by professional, 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.
- Disconnect batteries from outputs and/or follow safety procedures while working on equipment. Batteries may be connected in parallel with the output of the rectifiers. Turning off the rectifiers will not necessarily remove power from the bus.
- Do not disconnect permanent bonding connections unless all power inputs are disconnected.
- Verify that equipment is properly safety earth grounded before connecting power. High leakage currents may be possible.
- Exercise care and follow all safety warnings and practices when servicing this equipment. Hazardous energy and voltages are present in the unit and on the interface cables that can shock or cause serious injury. When equipped with ringer modules, hazardous voltages will be present on the ringer output connectors.
- Use the following precautions in addition to proper job training and safety procedures:
 - Use only properly insulated tools.
 - Remove all metallic objects (key chains, glasses, rings, watches, or other jewelry).
 - Follow Lock Out Tag Out (LOTO) procedures: customer specified, site specific, or general as appropriate. Disconnect all power input before servicing the equipment. Check for multiple power inputs.
 - Wear safety glasses.
 - Follow Personal Protective Equipment requirements: customer specified, site specific, or general as appropriate.
 - Test circuits before touching.
 - Be aware of potential hazards before servicing equipment.
 - Identify exposed hazardous electrical potentials on connectors, wiring, etc.
 - Avoid contacting circuits when removing or replacing covers;.
 - Use a personal ESD strap when accessing or removing electronic components.
 - Follow procedures for working at heights more than 4ft above the floor: customer specified, site specific, or general as appropriate.
- Personnel with electronic medical devices need to be aware that proximity to DC power and distribution systems, including batteries and cables, typically found in telecommunications utility rooms, can affect medical electronic devices, such as pacemakers. Effects decrease with distance.

Special Installation Notes

Deutsch

Installationsanleitung

Eingangsspannung (Voltage) :+24, -48

Eingangsstrom (Current) : Max 1200A

Eingangsleistung (Watts) :

Nennfrequenz (Frequency) : 50 / 60 Hz

Seriennummer (Assembly No.):--

Modellnummer (Model No.) : Infinity *NE*

Abmessungen sind nur zur Referenz : 660mm x 533.4mm x 2133.6mm

(Dimensions are for reference only)

Max. Umgebungstemperatur : max. 45 deg. C

(Max. Operation temperature)

Achtung: Für kontinuierlichen Feuerschutz sollte die Sicherung nur mit einer des gleichen Types ersetzt werden.

Sicherungswert:

(Warning: For continued protection against fire replace with same type and rating of fuse)

Das System ist ein Gerät der Schutzklasse I / Überspannungs Kategorie II
(Power Supply is a Class I equipment / overvoltage category II)

Ausgangsspannungen und -ströme: DC 58 V / SELV
(Output Voltage and Current)

--Das Gerät darf nur in Räumen mit beschränktem Zutritt aufgestellt werden.
(Install only in limited access rooms)
(Nur ausgebildetes Personal)

--Nur für Aufstellung auf Boden oder einer anderen brennbaren Oberfläche geeignet.

--Das Gerät hat keinen eigenen Ausschalter, es muß daher mit einem Ein- und Ausschalter im Versorgungskreis versehen sein.

--Das Gerät ist für den Einbau in IT- Geräte in einem Rahmen bestimmt (siehe weitere Anleitung)

--Beim Einbau des Gerätes ist darauf zu achten das alle Anforderungen gemäß EN60950 eingehalten werden.

ACHTUNG: HOHER ABLEITSTROM

VOR ANSCHLUSS AN DEN VERSORGUNGSSTROMKREIS

UNBEDINGT ERDUNGSVERBINDUNG HERSTELLEN

Español

Notas especiales para instalaciones en países que hablan español.

- Instrucciones de instalación
(Installation Instructions)
- Voltaje (Voltage):
+24, -48
- Corriente (Current):
Max 1200 A
- Frecuencia (Frequency):
50/60Hz
- Voltaje y corriente de salida (Output Voltage and Current):

- Temperatura máxima de operación (Maximum Operation Temperature):
45°C (113°F)
- Sin cabina contra incendios, suelo no combustible
(No fire enclosure, non-combustible floor)
- Evaluado en EN60950
(Evaluated to EN60950)

Revision History

Issue	Date	Comment
1	2007 April	Initial release
2	2007 May	Enhanced the Menu Diagrams, minor corrections.
3	2008 Jan.	Rebranded
4	2008 May	Removed <i>NE-S</i> references
5	2009 Aug.	Added <i>NE-S</i>
6	2013 May	Removed <i>NE-S</i> ; merged manual to cover both controllers, Pulsar Plus and Millennium II); removed Pulsar Plus appendices; Added <i>NE-M Eco</i> systems; added Battery voltage and polarity verification; rebranded, re-formatted; corrected alarm cable colors, updated Safety section
7	2014	Removed DRAFT watermark on landscape pages.