

# PowerShift® V2

## Manual Resistance

### Installation Instructions

(Rev C)

---



<b><i>Controller Software Version</i></b>	<b>4.6.29, 4.6.30, 4.6.33</b>
---	-------------------------------

**DISCLAIMER:**

This document has been developed by CommScope and is intended for the use of its customers and customer support personnel. The information in this document is subject to change without notice. While every effort has been made to eliminate errors, CommScope disclaims liability for any difficulties arising from the interpretation of the information contained herein. The information contained herein does not claim to cover all details or variations in equipment, nor to provide for every possible incident to be met in connection with installation, operation, or maintenance. This document describes the performance of the product under the defined operational conditions and does not cover the performance under adverse or disturbed conditions. Should further information be desired, or should particular problems arise which are not covered sufficiently for the purchaser's purposes, contact CommScope.

CommScope reserves the right to change all hardware and software characteristics without notice.

**COPYRIGHT:**

© Copyright 2018 CommScope Inc. All Rights Reserved.

This document is protected by copyright. No part of this document may be reproduced, stored in a retrieval system, or transmitted, in any form or by any means, electronic, mechanical photocopying, recording, or otherwise without the prior written permission of CommScope.

[www.commscope.com](http://www.commscope.com)

**TRADEMARKS**

All trademarks identified by ® or ™ are registered trademarks or trademarks, respectively, of CommScope. Names of products mentioned herein are used for identification purposes only and may be trademarks and / or registered trademarks of their respective companies.

CommScope, Inc. of North Carolina, December-2018

**TABLE OF CONTENTS**

<b>1. GENERAL</b>	<b>5</b>
<b>2. INTRODUCTION</b>	<b>5</b>
2.1. SCOPE	5
2.2. POWERSHIFT TECHNICAL SUPPORT	5
2.3. PRODUCT DESCRIPTION	5
2.4. SYSTEM BLOCK DIAGRAM	7
2.5. SYSTEM COMPONENT SUMMARY	7
2.6. COMPONENT PART NUMBERS	8
<b>3. GENERAL SPECIFICATIONS</b>	<b>9</b>
<b>4. REQUIRED MATERIAL</b>	<b>9</b>
<b>5. INSTALLATION CHECKLIST</b>	<b>10</b>
<b>6. CONFIGURATION EXAMPLES</b>	<b>11</b>
6.1. TOWER TOP, 12 RRUS	11
6.2. ROOF TOP, 6 OR 12 RRUS (12 RRUS SHOWN)	11
<b>7. MODULE POPULATION OPTIONS</b>	<b>12</b>
7.1. 1:1 REDUNDANT CONFIGURATION	12
7.2. NON-REDUNDANT CONFIGURATION	12
<b>8. CIRCUIT MAP WORKSHEET</b>	<b>13</b>
<b>9. INSTALL SHELF &amp; CONTROLLER CARD</b>	<b>14</b>
<b>10. WIRE THE SHELF</b>	<b>15</b>
10.1. ALARM RELAY (DRY-CONTACT) WIRING	15
10.2. POWER INPUT AND OUTPUT	16
10.3. DUAL-HOLE LUG PREPARATION	16
10.4. SHELF WIRING SEQUENCE	17
<b>11. POWER UP PROCEDURE</b>	<b>18</b>
11.1. APPLY INPUT POWER	18
11.2. CONNECT TO THE GUI WITH LAPTOP PC	19
11.3. ENTER SITE ID AND SET SYSTEM TIME	20
11.4. INSTALL FIRST BOOST MODULE AND APPLY POWER	21
11.5. SET THE MANUAL RESISTANCE	24
11.6. CHECK ALARM STATUS	27
11.7. CONFIRM RADIO INPUT VOLTAGE (OPTIONAL)	27
11.8. INSERT REDUNDANT MODULE (OPTIONAL)	28
11.9. REPEAT INSTALLATION FOR REMAINING CIRCUITS	30
11.10. DISABLE UNUSED CIRCUIT	31
11.11. UNINSTALL A MODULE	31
11.12. CONFIRM GUI ALARM NOTIFICATIONS	32
<b>12. CLOSEOUT PACKAGE</b>	<b>34</b>
<b>13. POWERSHIFT ALARMS AND TROUBLESHOOTING</b>	<b>35</b>



## **1. General**

### **About CommScope**

CommScope is the foremost supplier of one-stop, end-to-end radio frequency (RF) solutions. Part of the CommScope portfolio are complete solutions for wireless infrastructure from top-of-the-tower base station antennas to cable systems and cabinets, RF site solutions, signal distribution, and network optimization. For patents related to this, and other CommScope products, see [www.cs-pat.com](http://www.cs-pat.com).

CommScope has global engineering and manufacturing facilities. In addition, it maintains field service engineering offices throughout the world.

The declaration of conformity for our products is available upon request from the local sales offices or directly from CommScope [www.commscope.com](http://www.commscope.com).

## **2. Introduction**

### **2.1. Scope**

This document provides the procedure to configure the PowerShift V2 to operate with manual line resistance, using the GUI with software version v4.5.11. This procedure is intended for customers that do not use a tower-top voltmeter. In order to configure the product for manual line resistance, the installer must know the length and gauge of the cable that supplies power to each remote radio.

### **2.2. PowerShift Technical Support**

For technical assistance and support, please contact the PowerShift® technical support team.

**Website:** <https://www.commscope.com/wisupport/>

**Phone:** 1-888-297-6433 (technical support) or 1-888-235-5732 (main number)

### **2.3. Product Description**

The PowerShift system continuously regulates the supply output voltage in order to maintain a consistent input voltage where it is needed: at the input to the remote radio unit (RRU).



PowerShift is installed between the output of the DC rectifier plant and the input to the trunk cables that provide power to the remote radio units. PowerShift provides a regulated voltage boost of DC power in order to overcome the voltage drop across the trunk cables. The voltage boost is applied independently for each individual radio and is dynamically adjusted in response to variations in the radio load conditions.

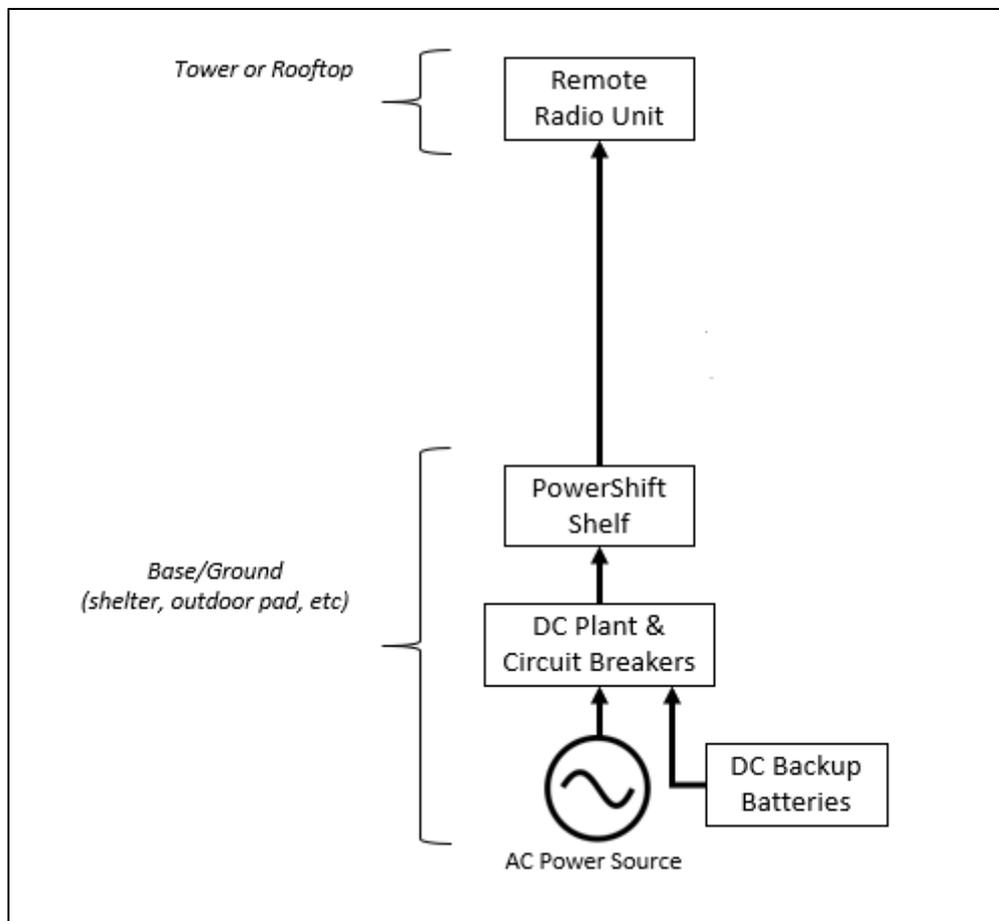
### **Benefits**

The PowerShift system provides the following benefits:

- **Lower operating costs:** The superior accuracy of the PowerShift system allows the radio input voltage to run closer to the maximum, thereby lowering radio load current demand, minimizing power loss and mitigating voltage drop across the trunk cables.
- **Lower capital equipment costs:** Smaller gauge cables can be used for the same radio power requirement.
- **Increased backup battery uptime:** Higher radio input voltage and lower current demand results in optimal utilization of battery capacity and extended runtime.
- **Future proof:** Increase in radio power requirements may not require larger or additional power cables to be installed.

## 2.4. System Block Diagram

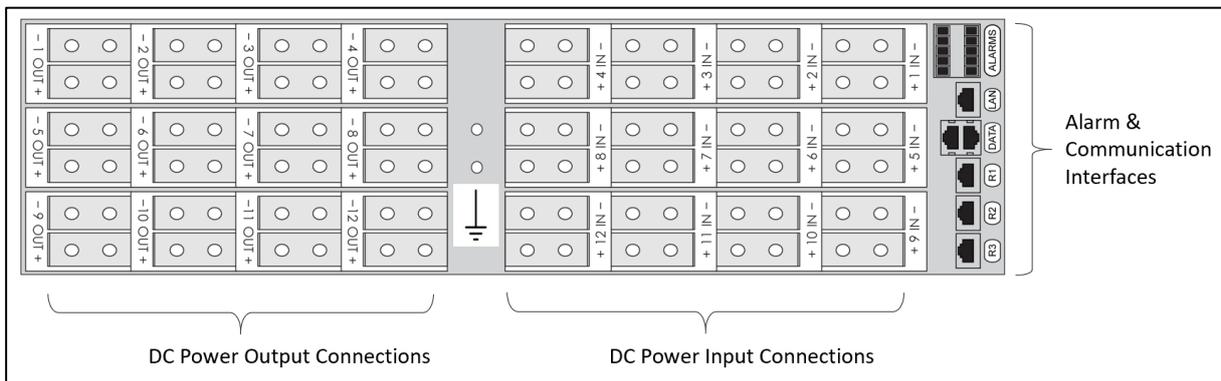
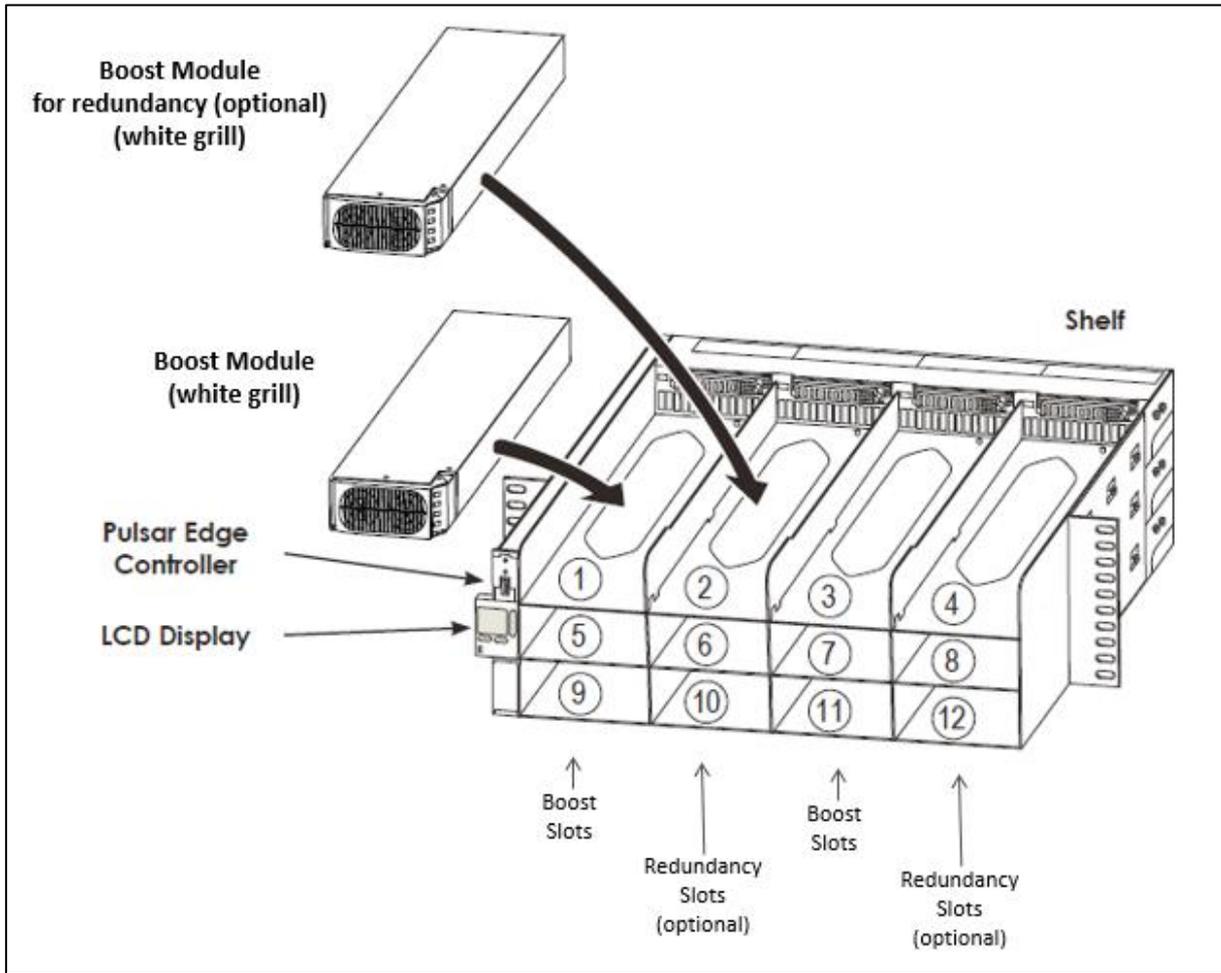
The diagram below shows the relative location and power connections of the PowerShift components and the cell site infrastructure.



## 2.5. System Component Summary

The PowerShift System Consists of the following major components (see figures below):

- **Shelf & LCD:** Standard 19-inch width, 3-RU height; 12 slots for power & bypass modules; rear power connections. The LCD provides on-site local display of system status and alarms
- **Boost Module:** Primary power source (2 circuits per module)
- **Redundancy Module:** Optional; install boost modules into adjacent slots to provide failure redundancy
- **Controller Card:** System monitoring, status and alarms; graphical user interface (GUI) for system configuration and for remote access



## 2.6. Component Part Numbers

The PowerShift shelf and component part numbers are shown in the table below:

Component	Part Number	Quantity
Shelf & Controller Card	PS-R-CNTRL	1
Boost Module	PS-1600-73	1 or more

### 3. General Specifications

Electrical <sup>1</sup>	Typical	Range
Input Voltage <sup>2</sup>	-54VDC	Cut-off: -38VDC Turn-on: -43VDC <sup>3</sup> Maximum: -58VDC
Input Current <sup>2</sup>	10A	0-57 A @ -38 VDC
Efficiency	> 97%	> 93%
PS Output Voltage <sup>2</sup>	-60 VDC	-48 to -65 VDC
PS Output Current <sup>2</sup>	15 A	0-30 A (power module) 0-40 A (bypass module)
Output Voltage Ripple		400 mV rms
Total Power output <sup>4</sup>		2000 W
Programmable RRU Voltage <sup>5</sup>		-53.5V +/- 3V
Gauge Range		0-6 AWG
Length Range <sup>6</sup>		150-650 ft (using 6AWG low inductance cable)

1. Per circuit; 2 circuits per module
2. Input/output voltage and current range are guaranteed values, actual operating values will typically exceed these up to 10%
3. Turn-on voltage is higher than cut-off voltage in order to provide hysteresis protection
4. Total power = power consumed by radio + power loss in trunk cable
5. RRU input voltage set-point is factory programmed (not user settable). Other voltage set-points are possible, contact CommScope
6. 650 ft of 6AWG  $\approx$  0.54 Ohms loop resistance. Longer cable lengths are possible, contact CommScope for more information

### 4. Required Material

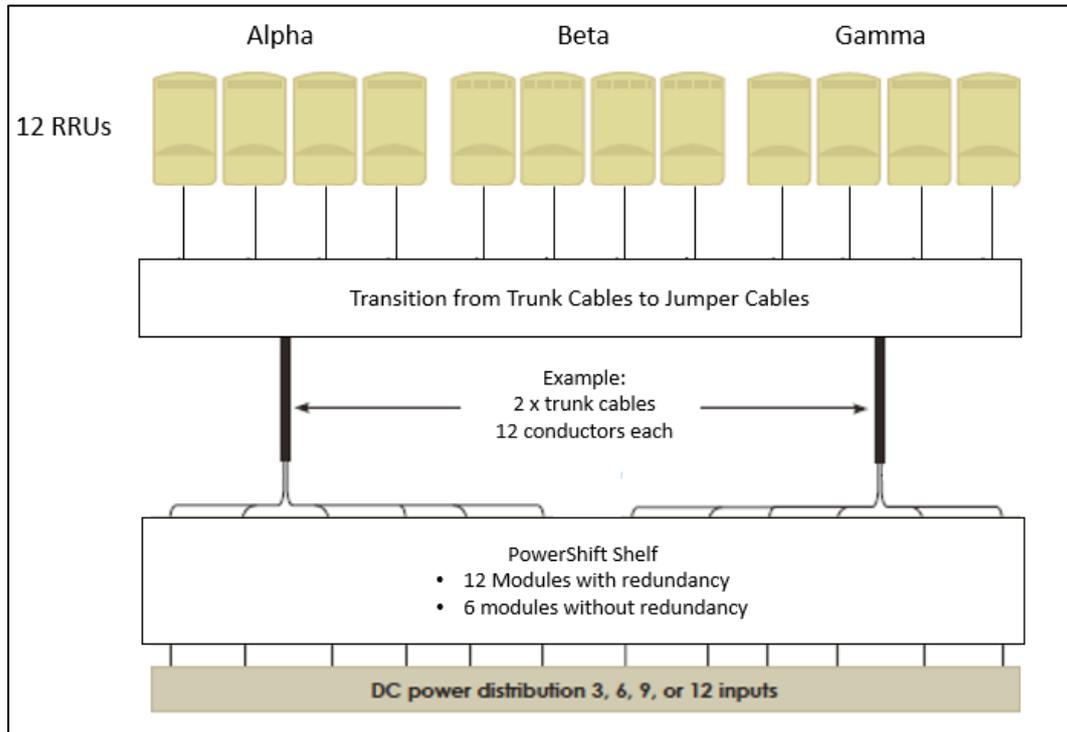
- 1) A laptop Window PC (Windows 7 or 10) with Chrome Web Browser
- 2) A standard Ethernet patch cable with RJ45 male connectors on either end (recommend a minimum length of 10-feet to ensure ease of reaching the LAN port on the back of the shelf)
- 3) Print out a copy of the Circuit Map Worksheet (see Section 8) prior to coming on site

## 5. Installation Checklist

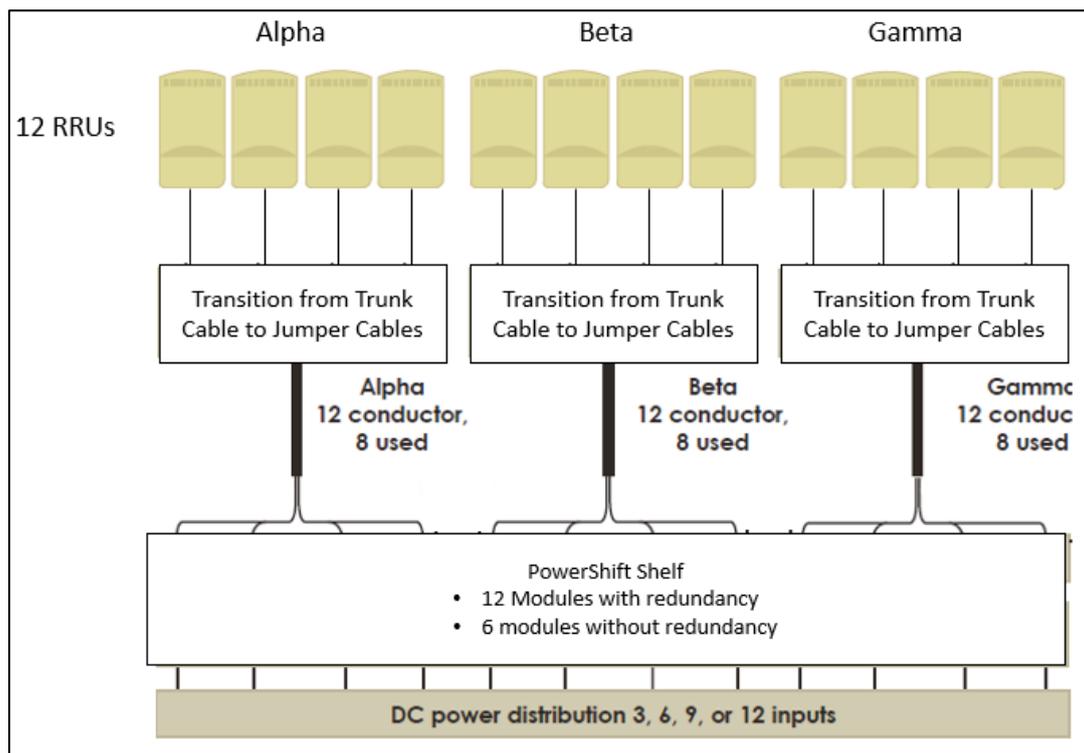
- Install PowerShift Shelf
- Wire the dry-contact alarm block and connect an Ethernet cable to the shelf LAN port (it's easier to do these steps before installing all the power cables)
- Install power cables from base up to the tower/roof top (e.g., using CommScope hybrid trunk cable)
- On the tower/roof top, connect jumper cables or another suitable termination method to connect power cables to remote radio units
- At the base, label the power cables as needed, terminate them with dual-hole lugs, and connect them to PowerShift shelf output terminals
- At the base, install power cables between the DC plant circuit breakers and the PowerShift shelf, terminate them with dual-hole lugs, and connect to the PowerShift shelf input terminals
- Confirm hardware jumper setting on PowerShift Controller card; install the card into PowerShift Shelf if needed
- Complete all the steps in Section 11: Power Up and Configuration Procedure
- Enter the site information and all radio circuit information into the PowerShift GUI
- Confirm all the required data has been captured to your PC for inclusion in the installation closeout package
- Confirm there are no active alarms on the GUI
- Confirm the Circuit Map Worksheet is filled out and is left at the site
- If possible, bring the radios to full operational state (user traffic) and confirm proper operation

## 6. Configuration Examples

### 6.1. Tower Top, 12 RRUs



### 6.2. Roof Top, 6 or 12 RRUs (12 RRUs shown)

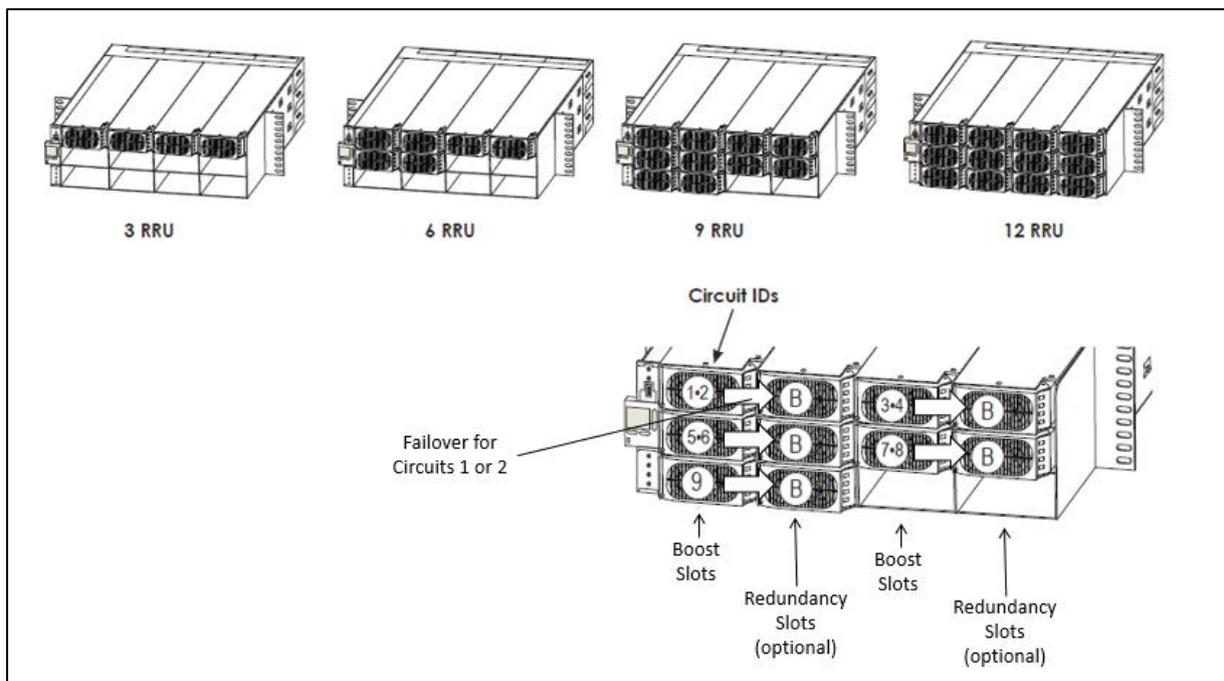


## 7. Module Population Options

The PowerShift shelf can be deployed in a redundant (fault tolerant) or non-redundant configuration. The input and output wiring of the shelf is done in the exact same manner regardless of which option is deployed (the fault-tolerant redundancy switching takes place inside the shelf via the backplane).

### 7.1. 1:1 Redundant Configuration

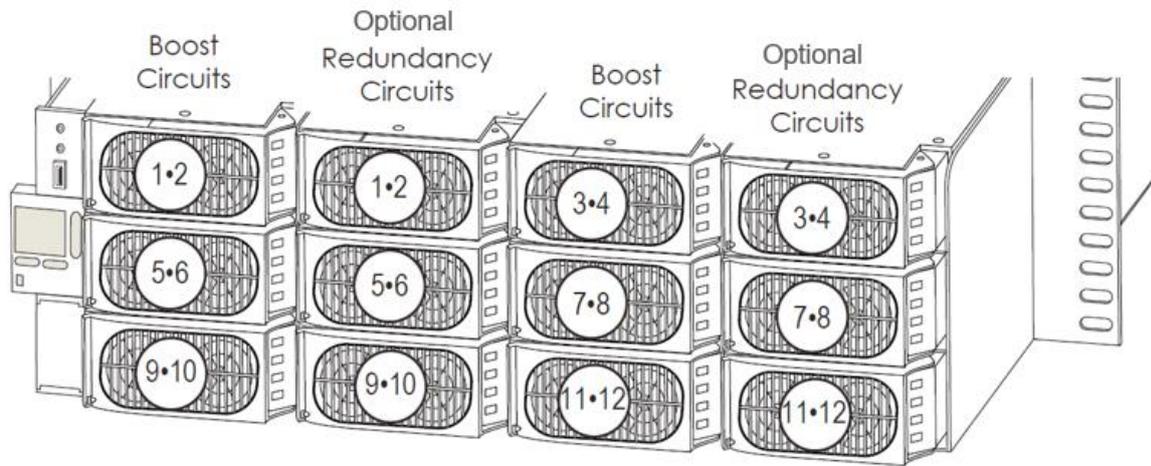
As shown below, additional boost modules can be installed in the adjacent redundancy slot to provide 1:1, single-fault tolerance for each circuit. If either circuit in a boost module fails, the circuit will automatically switch over to the redundant boost module located in the adjacent slot. Redundant operation is automatically enabled when a boost module is inserted into a redundancy slot; the PowerShift software automatically detects the insertion and automatically configures both circuits for redundant operation.



### 7.2. Non-Redundant Configuration

For non-redundant configuration (no fault tolerance), only the boost modules are installed. No other changes are required to the system, the PowerShift software will automatically detect that no redundant modules have been installed; no additional action is required by the installer.

8. Circuit Map Worksheet (leave on-site)



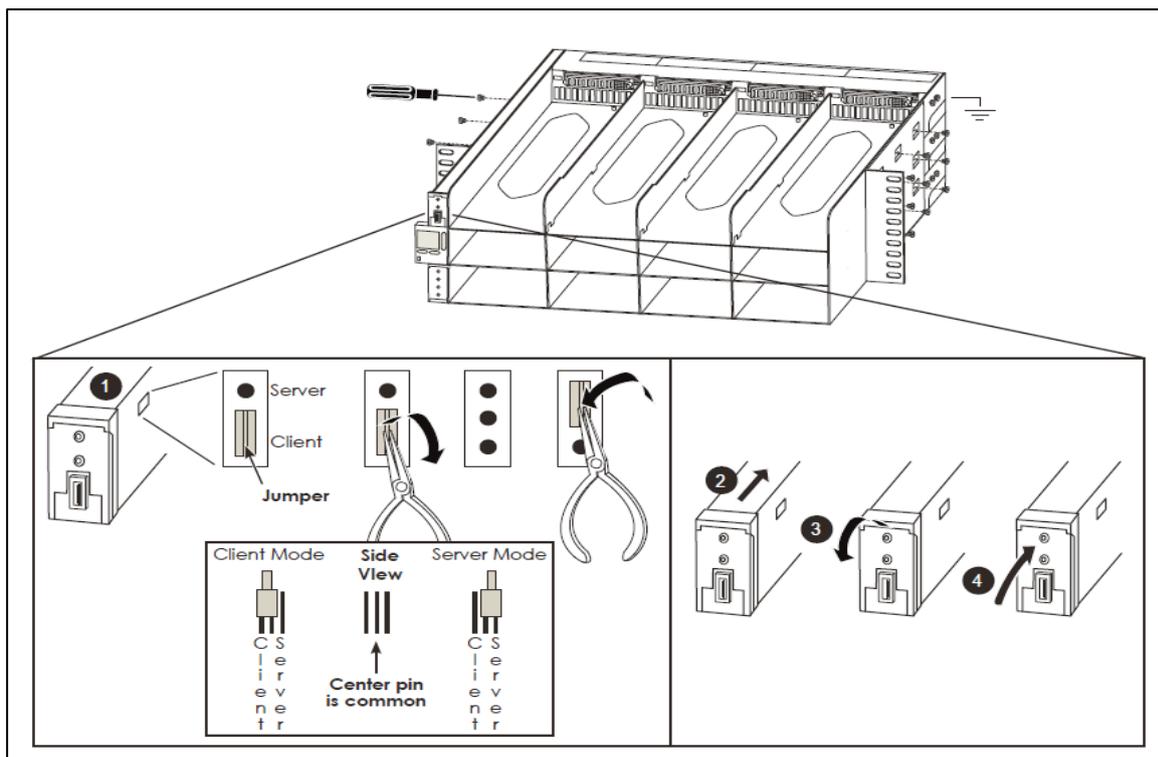
PowerShift Circuit #	RRU #	Sector ID	RRU Technology	Circuit Breaker #	Comments
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					

Date: \_\_\_\_\_

Contractor: \_\_\_\_\_

## 9. Install Shelf & Controller Card

- 1) Determine the installation depth required for the shelf unit, attach the side flanges in the appropriate location. 9 screws are required per side.
- 2) Mount the shelf in a standard 19" rack near DC power (plant) output breaker box.
- 3) Ground the shelf by installing a 6AWG ground wire at the back of the shelf between the input and output terminals.
- 4) If the controller is already installed in the shelf, unseat it as shown below and pull it out far enough from the shelf to confirm the hardware jumper is set to the "SERVER" position; if the controller is in a factory shipping box then install it using the following procedure:



- a) Unbox the Controller but do not remove it from the anti-static bag
- b) Using an ESD protective wrist strap, ground yourself to the PowerShift chassis
- c) Remove the Controller from the anti-static bag, locate the jumper on the side of card ❶ and confirm it is set to "Server"; if needed, use needle nose pliers to pull and re-insert the jumper in the Server position

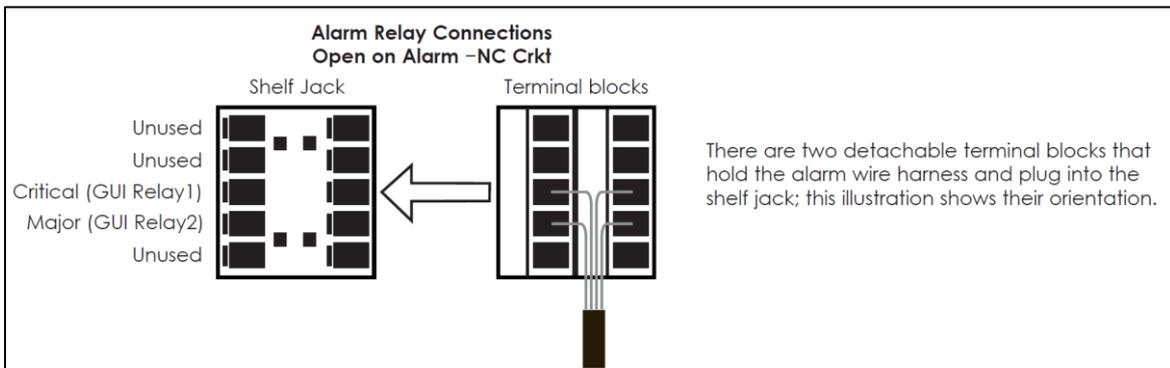
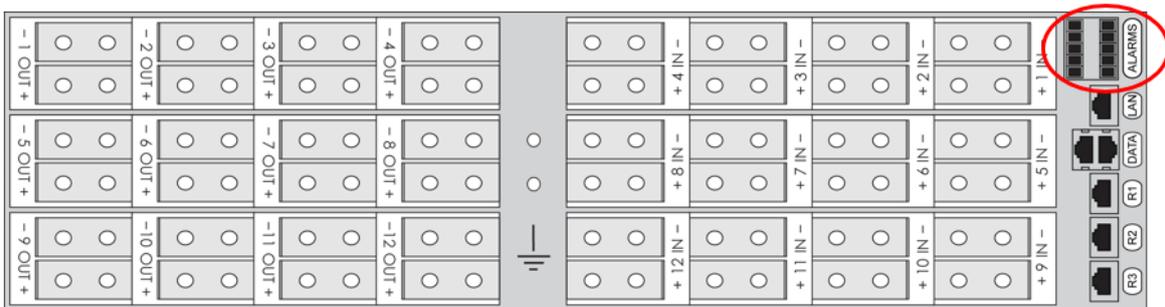
**⚠ Warning:** Do not allow the center of the controller circuit board to flex or bend when removing or inserting the jumper; hold the edges of board, near the center to give it proper support

- d) Slide the controller card halfway into the slot ❷, open the front latch ❸, then slide the controller all the way in until you feel contact with the backplane; gently seat the connector fully and close the latch ❹.

## 10. Wire the Shelf

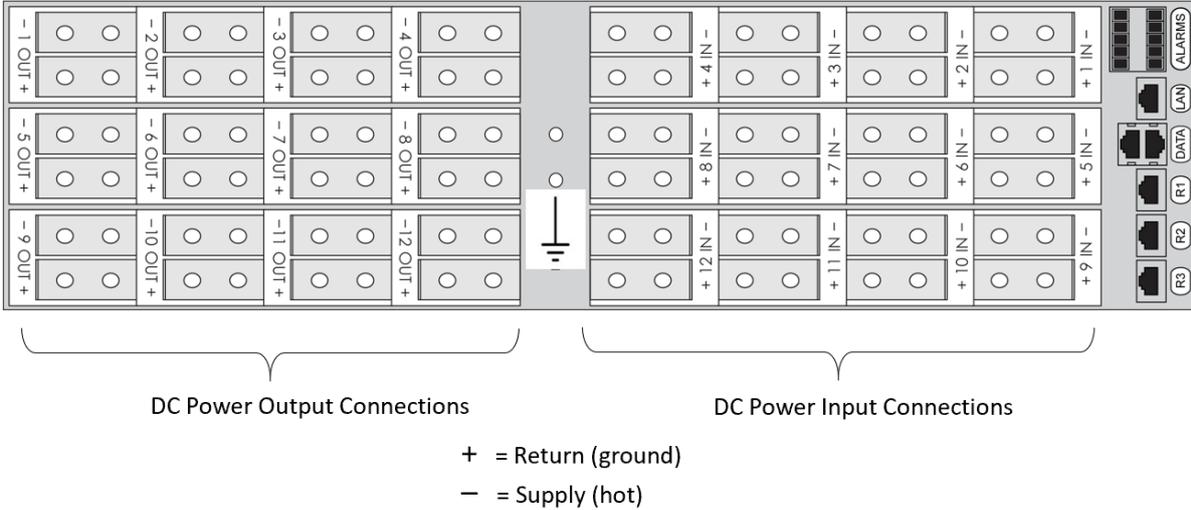
### 10.1. Alarm Relay (Dry-Contact) Wiring

- 1) The PowerShift alarm relay terminal block is located on the back of the shelf. The relays are Open On Alarm (Normally Closed).
- 2) If required, integrate the PowerShift Critical and Major alarms into the cell site alarm system (e.g., 66-block) using the wiring positions shown below

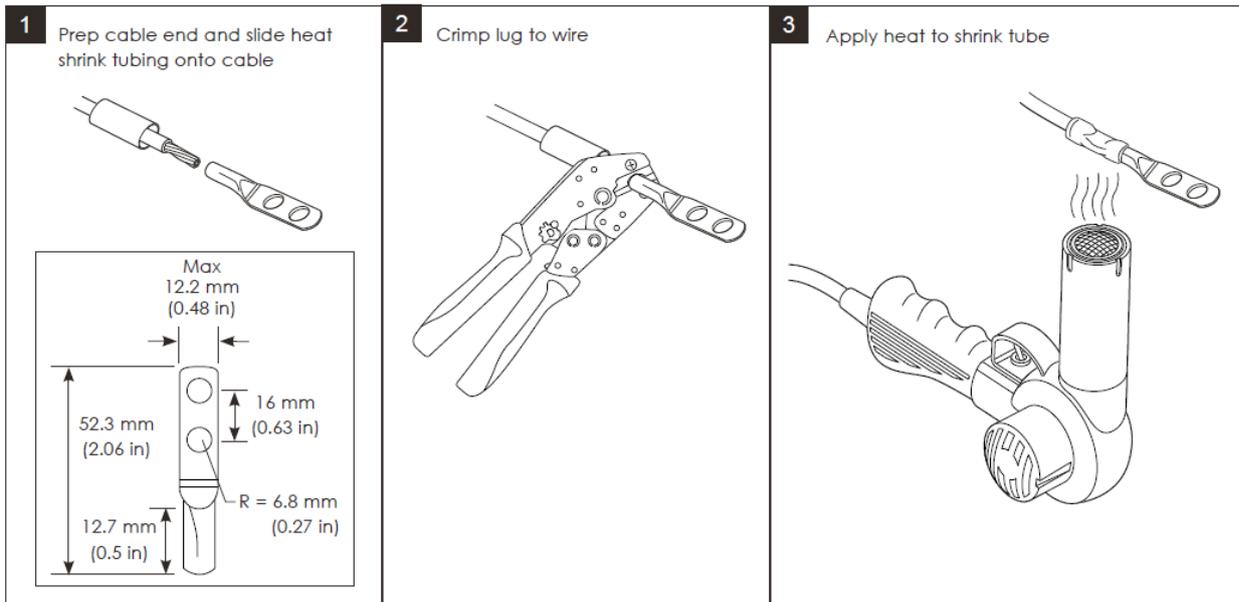


### 10.2. Power Input and Output

- 1) The rear of the shelf is divided into 24 individual circuits each containing a two wire DC input and a two wire DC output. There is a positive and negative terminal strip with dual-hole studs for each DC input and out.



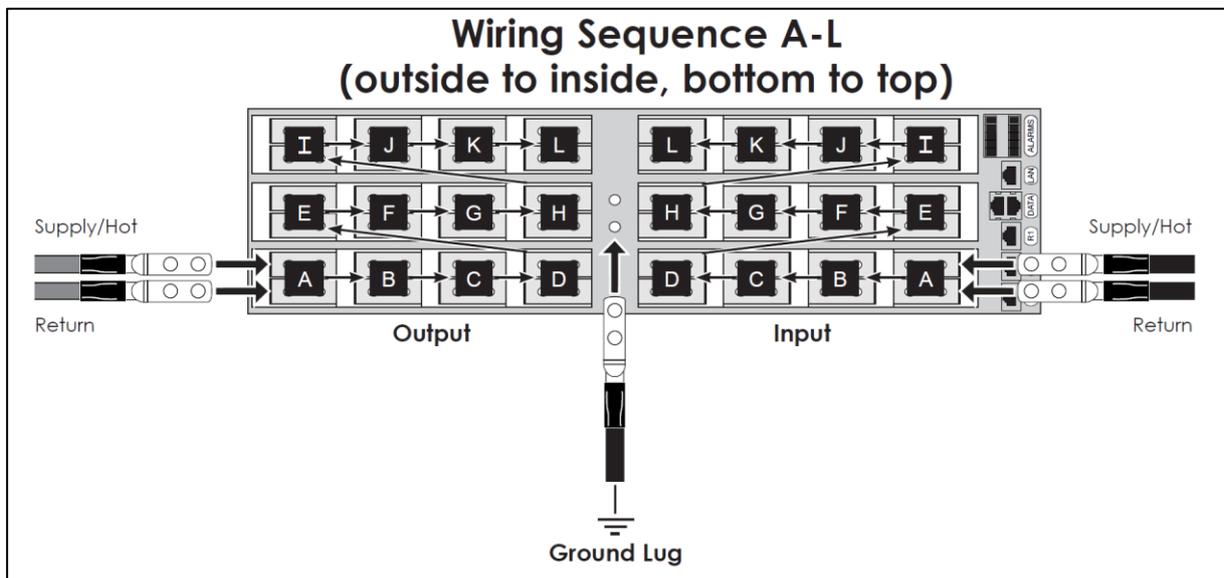
### 10.3. Dual-hole Lug Preparation



### 10.4. Shelf Wiring Sequence

**Note:** The Controller and LCD Display obtain power from the Shelf input terminals for circuits 1, 2, 5, 6, 9 or 10; at least one of these circuits must be wired for input power.

- 1) Attach power cables from the DC plant circuit breakers to the back of the PowerShift shelf.
- 2) It is recommended to wire all 12 input and 12 output cable pairs into the shelf during installation, even if 12 modules are not being installed; this will ease future installation of additional radios.
- 3) The recommended wiring sequence is shown below (outside to inside, bottom to top); this is the recommended sequence based on the typical route of power cables into a rack (i.e., cables usually run from the top of the rack downward to the PowerShift shelf).



## 11. Power Up Procedure

**Note:** In order to configure the system for manual resistance operation, you must know the length and gauge of each cable pair supplying power to the remote radios

### 11.1. Apply Input Power

- 1) The DC Plant circuit breakers should all be open such that there is no input power to any of the shelf input terminals
- 2) Turn on (close) the DC plant circuit breaker for PowerShift Circuit 01, confirm activation of the Controller and the LCD Display

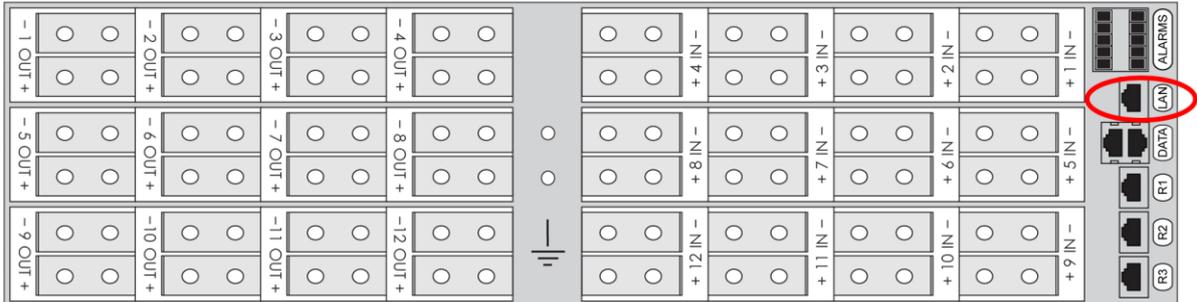
**Note:** The Controller and LCD Display card obtain power from the Shelf input terminals for circuits 1, 2, 5, 6, 9 or 10; at least one of these circuits must be powered. A power module does not need to be installed in the Shelf slot to power the Controller and LCD Display (the power is obtained from the input terminals, not from the power module)

- 3) The Controller LEDs should cycle off and on, the LCD display backlight should illuminate
- 4) After 10-30 seconds:
  - a) The Controller card SYS LED should illuminate solid green or red
  - b) The LCD Display should show the text "U" in the center/left of the screen (the backlight will be green initially and then change to red)



### 11.2. Connect to the GUI with Laptop PC

- 1) Use a Windows PC and web browser (Chrome is preferred) to connect to the LAN port on the back of the PowerShift Shelf



- a) Connect a standard Ethernet patch cable between the PC and the Shelf LAN port; the PC Ethernet port LED should illuminate
- b) The PC must be configured for DHCP operation on its Ethernet port

**Note:** In a prior step the Controller hardware jumper should have been confirmed to be set for “Server” operation

- 2) Open web browser on the PC and enter URL: 192.168.2.1, the GUI login page appears:

**Note:** When the Controller is powered up it may take 2-3 minutes before the web browser can connect, and then it may take an additional 2 minute for the login page to appear

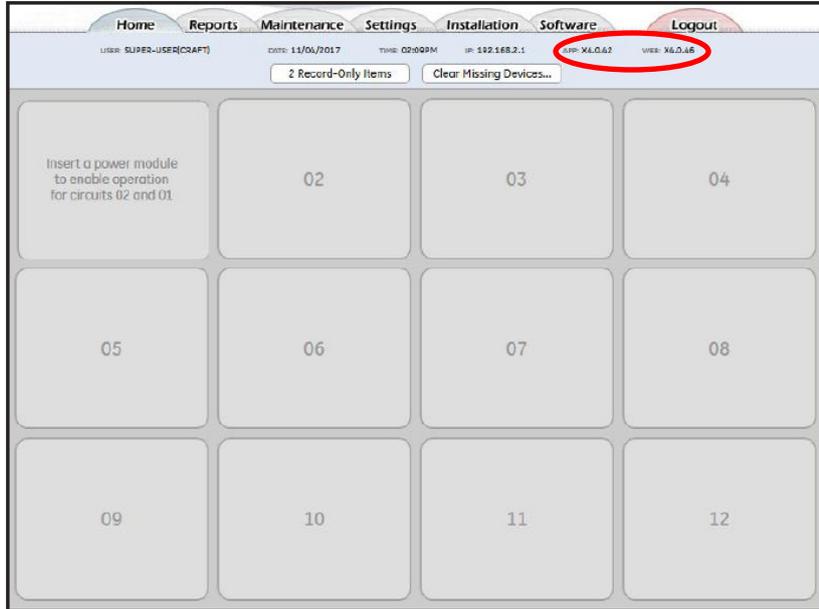


**Troubleshooting:** If the login page does not appear, open a command prompt (cmd) in Windows and use the following ping command to confirm a good connection to the controller: ping http://192.168.2.1

- 3) Enter the password: **super-user** (lower case, no spaces)

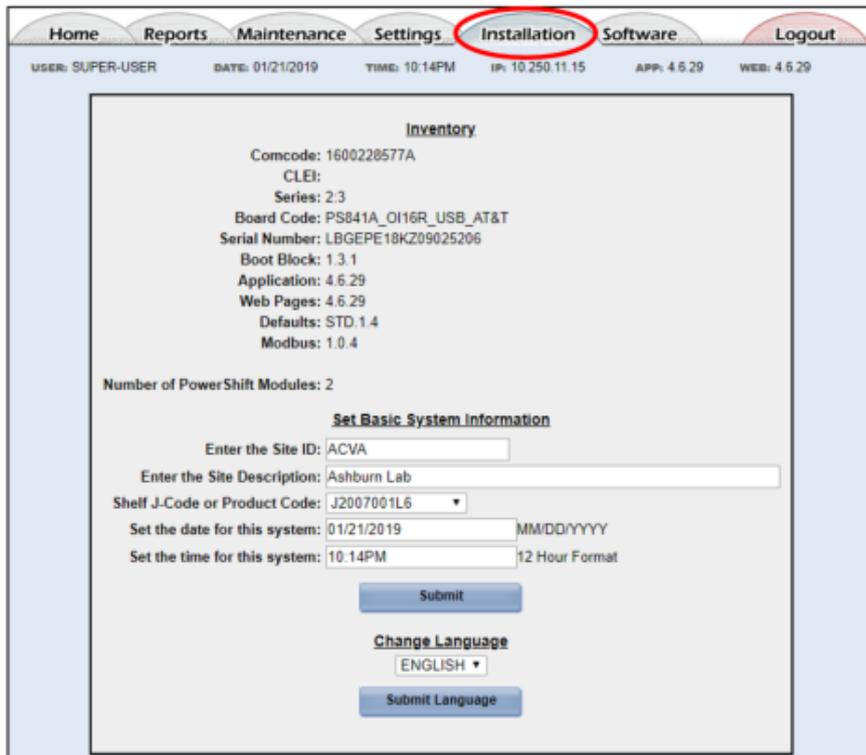
**Note:** The default login does not require a user name, only a password; if a user name prompt does appear, the user name is also **super-user**

- 4) Click Submit, the GUI Home page appears
- 5) Confirm the APP and WEB version numbers are 4.6.29, 4.6.30, or 4.6.33



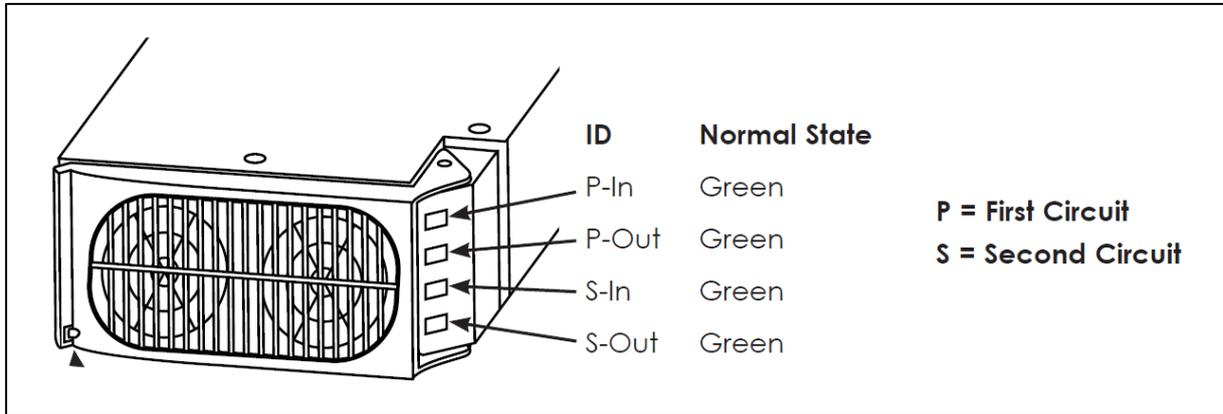
### 11.3. Enter Site ID and Set System Time

- 1) Click on the Installation tab, enter the Site ID, description (e.g., street address) and set the system date and time as needed

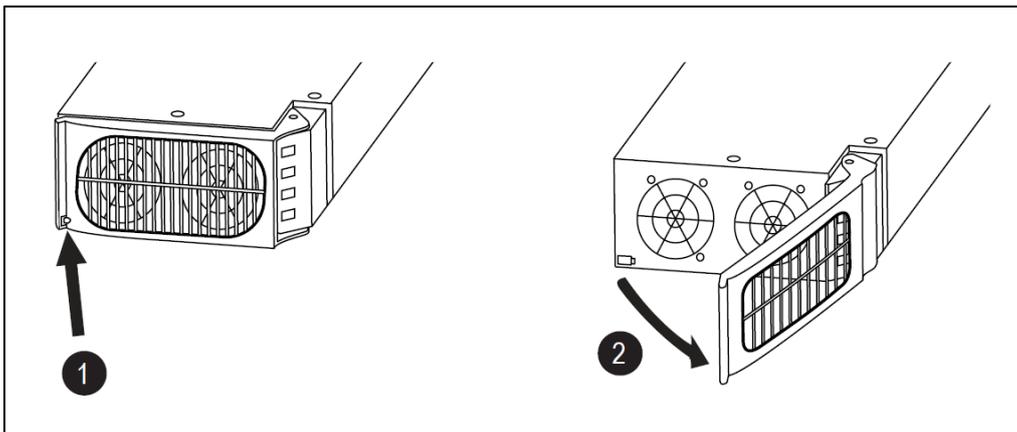


#### 11.4. Install First Boost Module and Apply Power

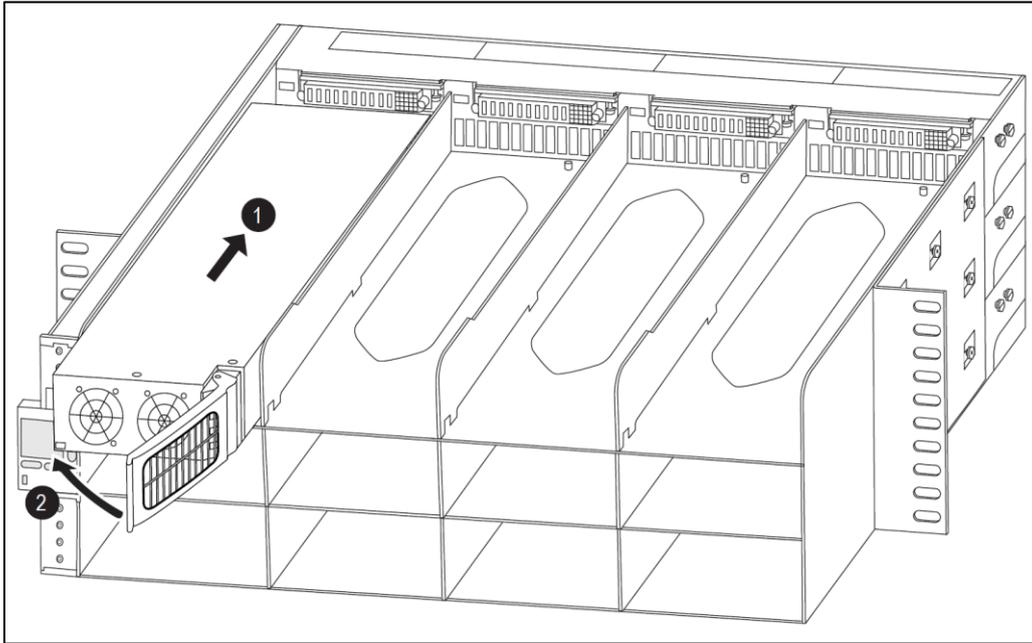
- 1) Note the following functions of the LEDs on the boost module; the top two LEDs provide power input and output status for the first circuit, and the bottom two LEDs provide status for the second circuit.



- 2) At this point, power should only be applied to the first circuit; DC Plant circuit breakers should be open (off) for all other circuits
- 3) On the front of the module, push in spring clip ❶, and swing open the front grill ❷



- 4) Slide the module into the shelf until it stops ❶
- 5) Close the front cover on the module to make connection and lock it into place ❷

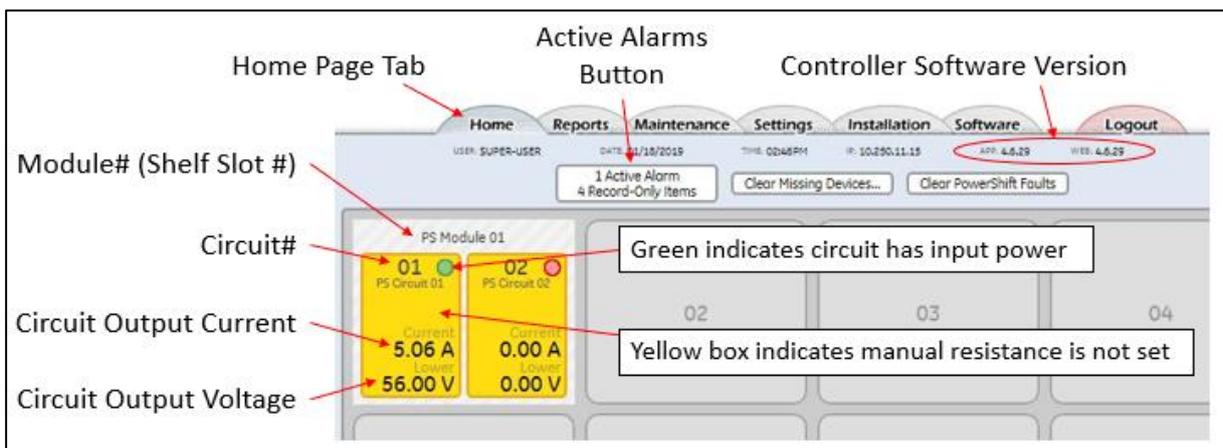


- 6) The following module LED behavior should occur:
  - a) The first circuit LED on the Module (P-In) blinks amber and the output LED (P-Out) blinks red
  - b) After 10-30 seconds both P-In and P-out LEDs change to solid green; this is the normal state and indicates output power is now active

**Note:** Output power on the circuit is now active, the circuit is using a default resistance and a safe default output voltage; if a radio is connected it will power on



- 7) The GUI Home page will update to show the module is installed:
  - a) In the example below, a boost module is installed in the first shelf slot (PS Module 01), Circuit 01 has input power, Circuit 02 has no input power
  - b) Circuit 01 output current indicates a radio is connected and powered up
  - c) The circuit box is amber until the manual resistance has been configured in the upcoming steps
  - d) Confirm the controller software version is correct; if needed perform a controller software upgrade (covered in a separate document)



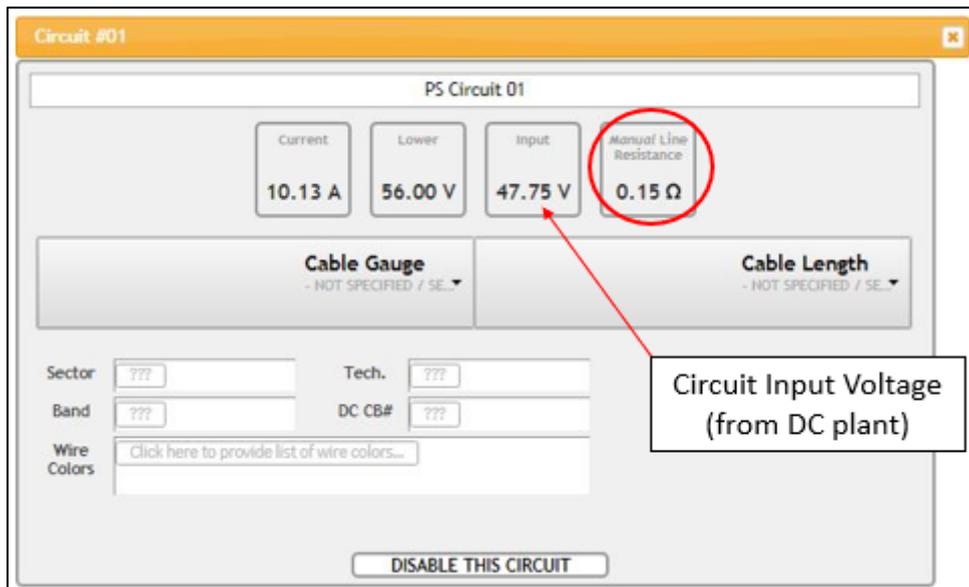
11.5. Set the Manual Resistance

1) Click anywhere inside the Circuit 01 box

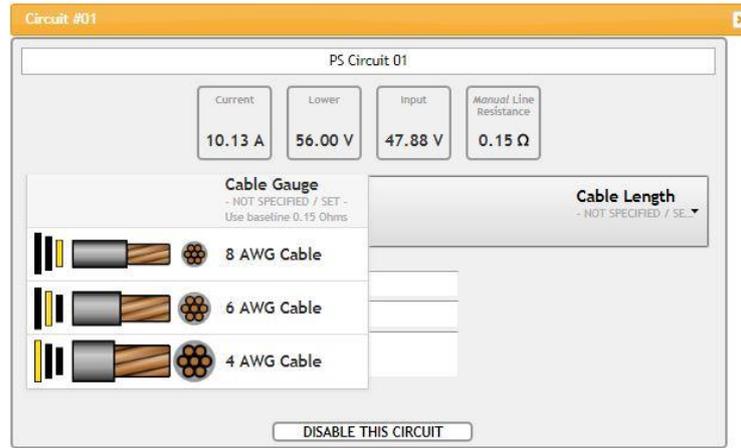


2) A pop-up box with circuit details is displayed:

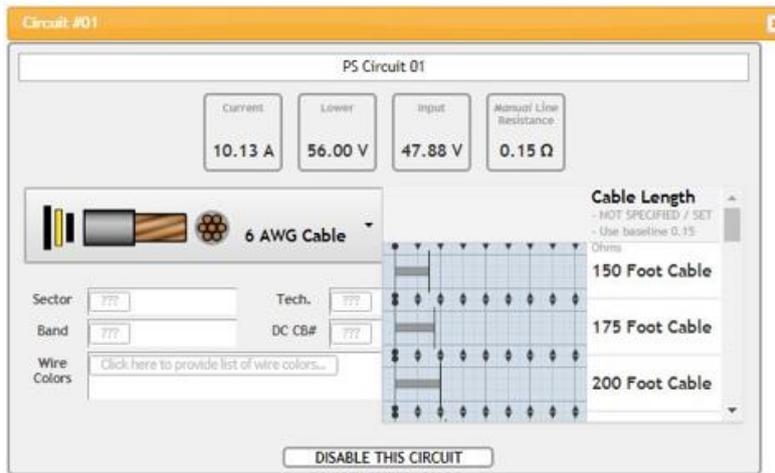
- The circuit output current and voltage are again displayed
- The input voltage (from the cell site DC plant) is displayed
- Note that the system starts with a default line resistance of 0.15 Ohms



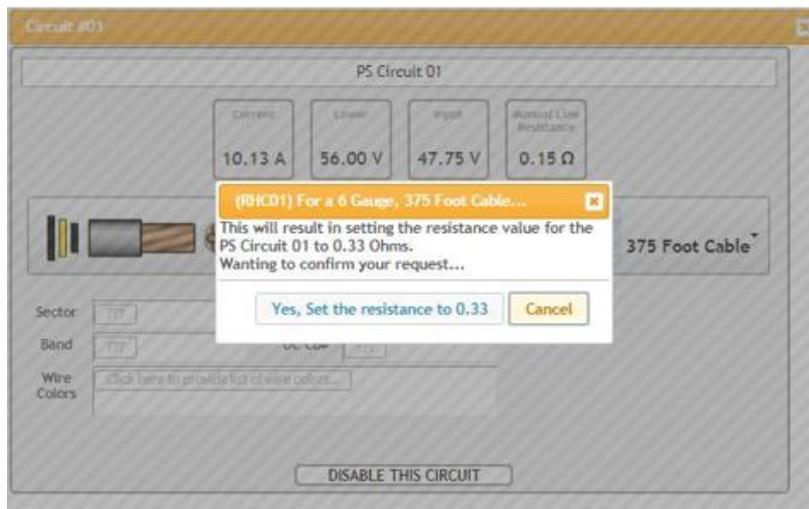
- Click the Cable Gauge drop-down list, select the applicable gauge for the cable installed for that circuit



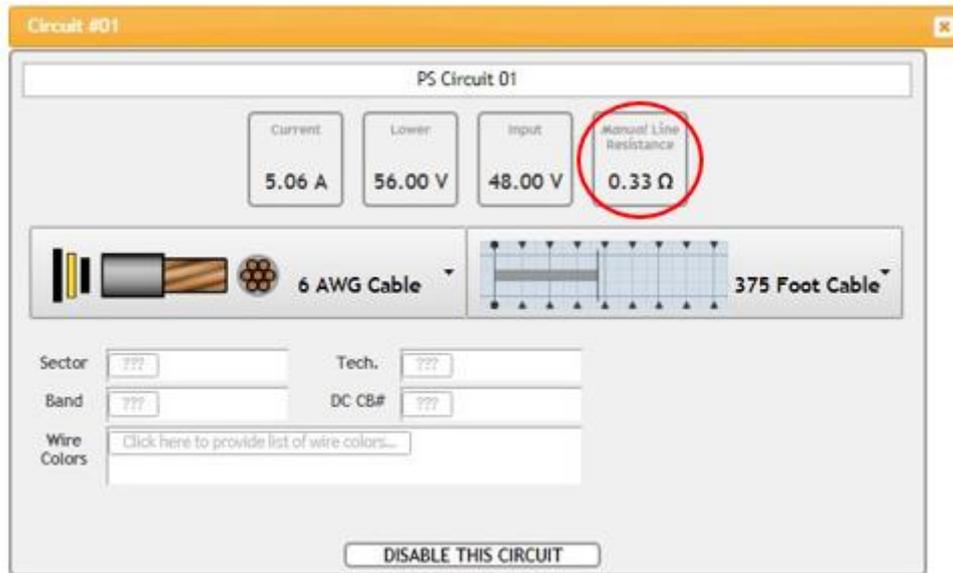
- Click the Cable Length drop-down list, select the applicable length for the cable installed for that circuit



- The calculated cable resistance is displayed, click Yes to accept the value



- 6) The cable line resistance is now set to the calculated value; the output voltage is adjusted based on the new cable resistance value



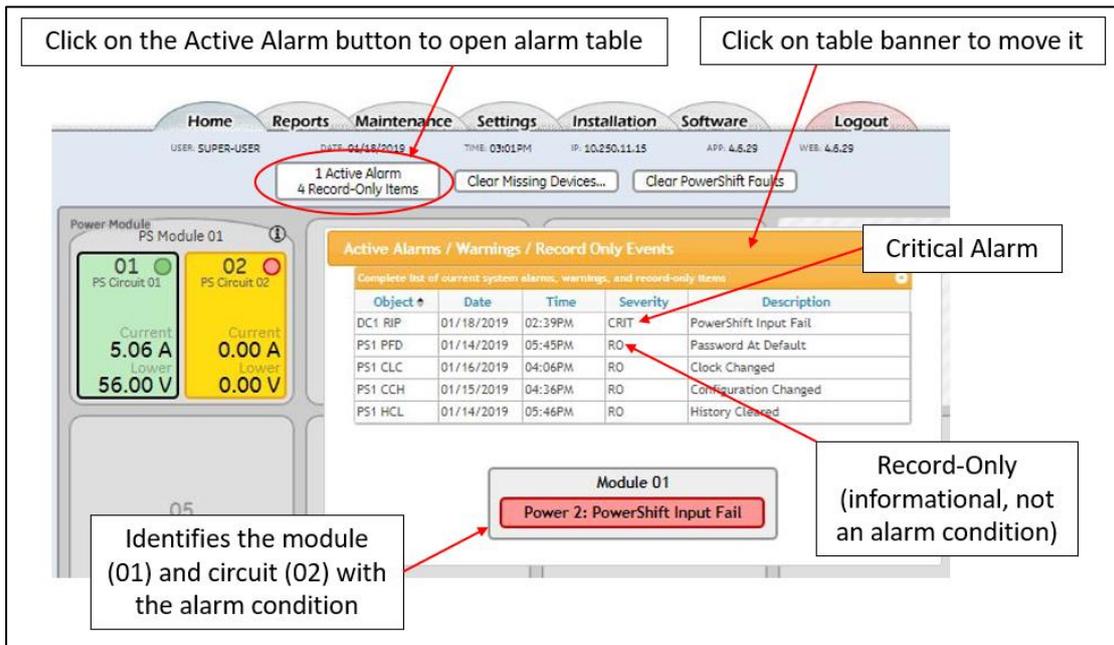
- 7) Enter additional information to identify the sector, radio technology, wire color code, etc

Enter text into each field, save it using Enter on keyboard or by clicking outside the field

After each entry, bottom of page should show green bar with "Updated"

**11.6. Check Alarm Status**

- 1) Click on Active Alarm button to open pop-up box with alarm table
  - Click and hold on the pop-up box banner to reposition it on the page; click on the box corners to adjust height and width
  - The table shows any alarm conditions and also shows record-only information
  - In this example Circuit 02 has no input power (e.g., the DC plant circuit breaker is open) therefore an “Input Fail” alarm is raised (the alarm will be cleared in upcoming steps when the circuit input power is applied, or when the circuit is disabled)



**11.7. Confirm Radio Input Voltage (Optional)**

- 1) If possible, measure the input voltage at the input to the remote radio (e.g., with a handheld voltmeter) and use the following guideline to confirm it is correct:

Load Current	Typical RRU Input Voltage
0 amps load current (e.g., radio disconnected)	55VDC to 56VDC
5 amps or less of load current (e.g., radio idle)	54VDC to 55VDC
10 amps or more of load current	53VDC to 54VDC

- 2) A radio input voltage less than 52VDC or greater than 56VDC most likely indicates an issue:
  - a) A lower than expected input voltage indicates the actual line resistance is higher than the line resistance calculation; reconfirm the cable length and

gauge, and confirm there are no physical issues with the cable and its connection points

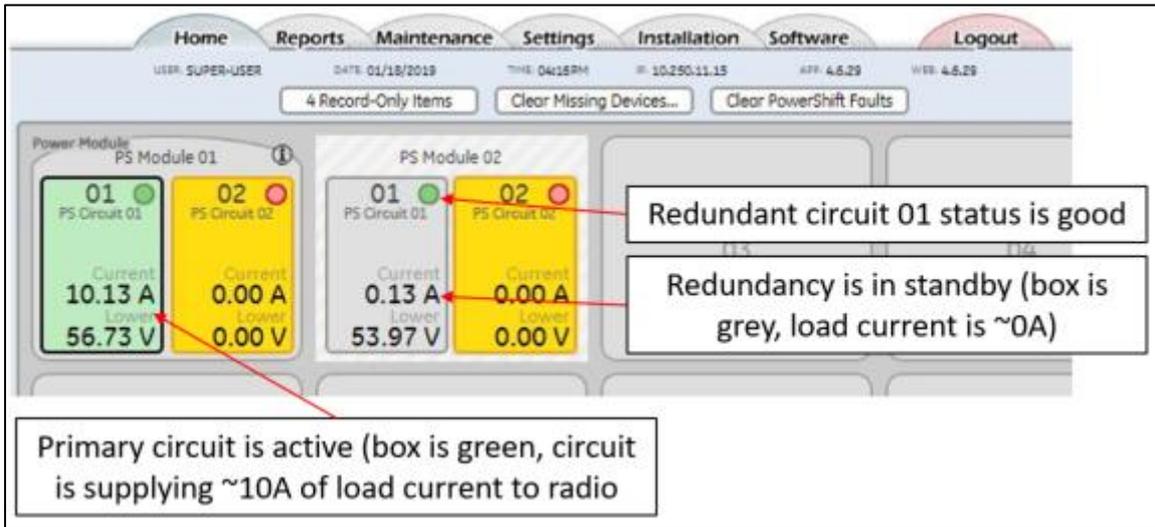
- b) A higher than expected input voltage indicates the actual line resistance is less than the line resistance calculation; reconfirm the cable length and gauge

### **11.8. Insert Redundant Module (Optional)**

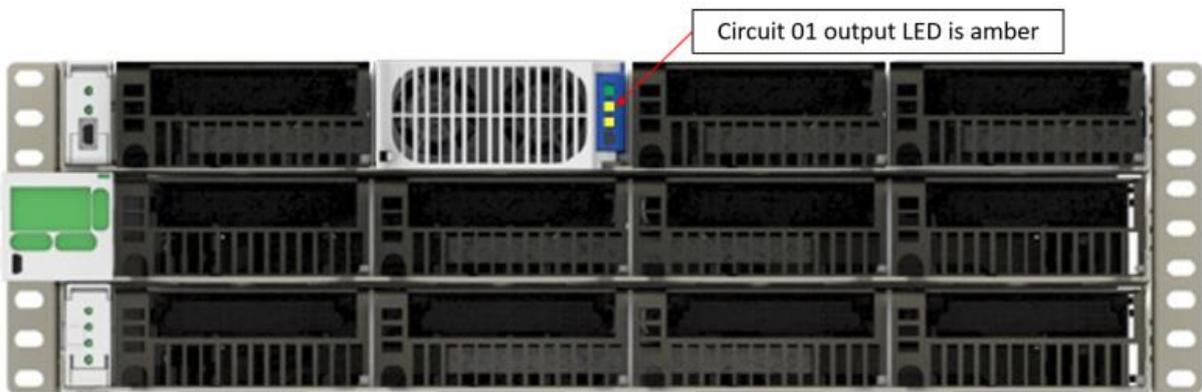
- 1) If redundant operation is required, insert a boost module into the adjacent slot (Slot 02 in this example)
- 2) The following LED behavior should occur:
  - a) Redundant module input LED (P-In) blinks amber and output LED (P-Out) blinks red
  - b) After 10-30 seconds both LEDs change to solid green; this the normal state and indicates the redundant circuit is functional and available, but is not currently engaged
  - c) Confirm the primary boost module input LED (P-In) and output LED (P-Out) remain solid green



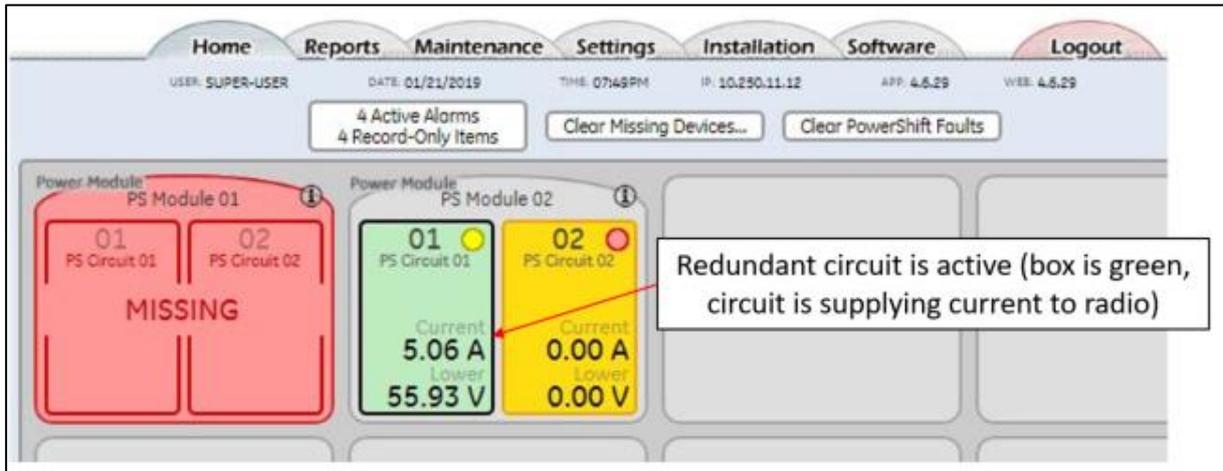
- 3) The GUI shows the redundant module is installed in Slot 02 (PS Module 02). The redundant circuit 01 status is good (green circle icon)



- 4) Test the redundancy function is working properly by unseating the primary boost module in shelf slot 01 as follows:
  - a) Press the metal tab on lower left of Boost module front bezel, the latch will flip outward
  - b) Lever the latch outward until the Boost module unseats and its LEDs go dark
  - c) On the redundant module, confirm the input LED (P-In) remains solid green, and confirm the output LED (P-Out) changes to solid amber; this indicates the redundant circuit is now active



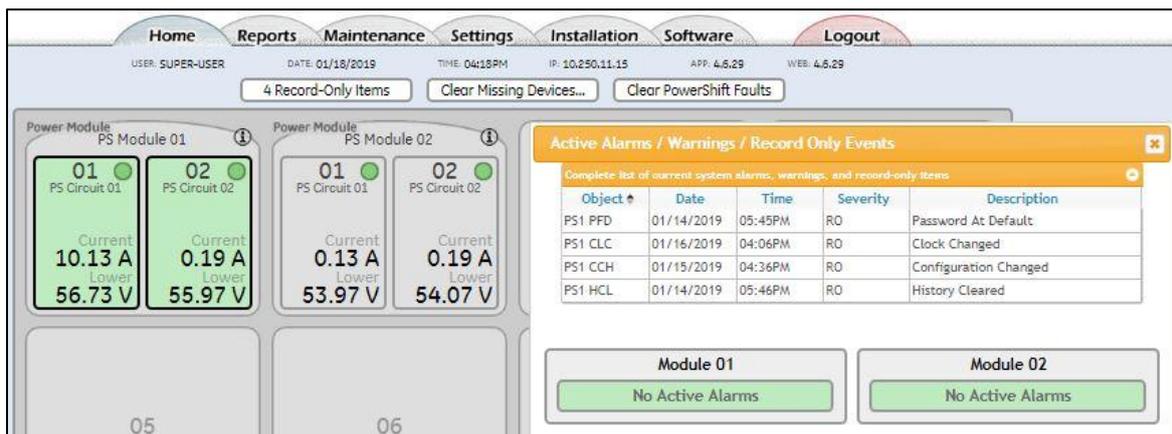
- d) Output voltage to the radio should not be interrupted
- e) The GUI will show the boost module is removed (MISSING) from Slot 01 and the redundant circuit active and providing current to the radio



- 5) Insert the primary boost module back into Slot 01, the circuit should automatically switch from the redundant module back to the primary module; the following behavior should occur:
  - a) The primary boost module and the redundant module input and output LEDs should return to the normal state, solid green
  - b) Output voltage at the radio should not be interrupted
  - c) The GUI will show the boost module is again installed in Slot 01 and the primary circuit is again providing the load current to the radio

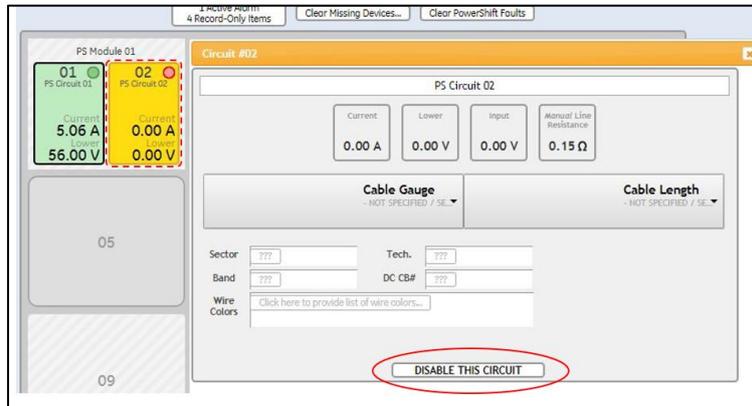
**11.9. Repeat Installation for Remaining Circuits**

- 1) Repeat the previous steps for the second circuit; close the circuit breaker to apply input power and follow the above steps to confirm the boost module LED status and configure the cable gauge and length
- 2) Repeat for all remaining circuits, installing additional boost modules as needed
- 3) The following example shows the results after applying input power to Circuit 02 and configuring the cable gauge and length; the Active Alarm table shows there are no critical or major alarms

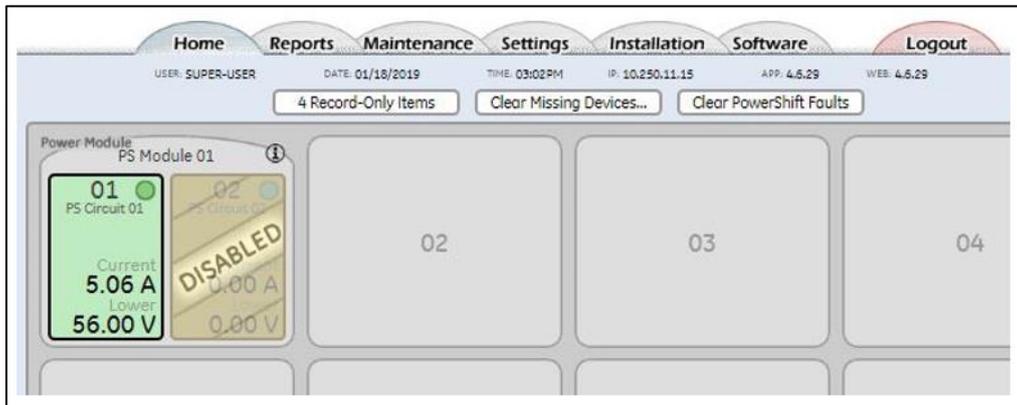


### 11.10. Disable Unused Circuit

- 1) If a circuit is not used (e.g., a total of 6 radios are installed at the site, therefore Circuit 07 is not used) the unused circuit must be disabled to suppress alarms
- 2) In this example, Circuit 02 is unused and has no input power; click inside the circuit box to open the pop-up box, then click on “Disable This Circuit” button

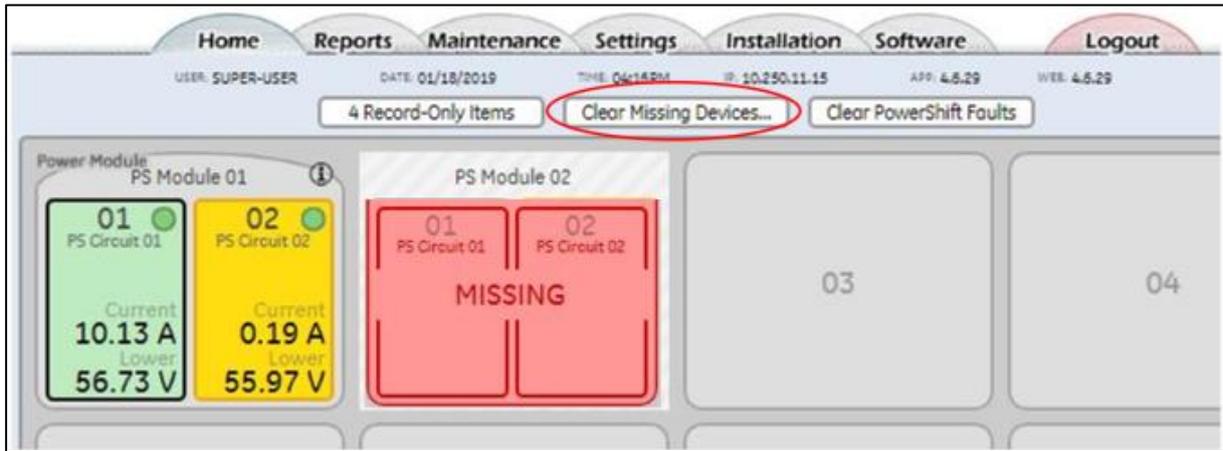


- 3) Circuit 02 is now disabled, and the Input Fail alarm is cleared



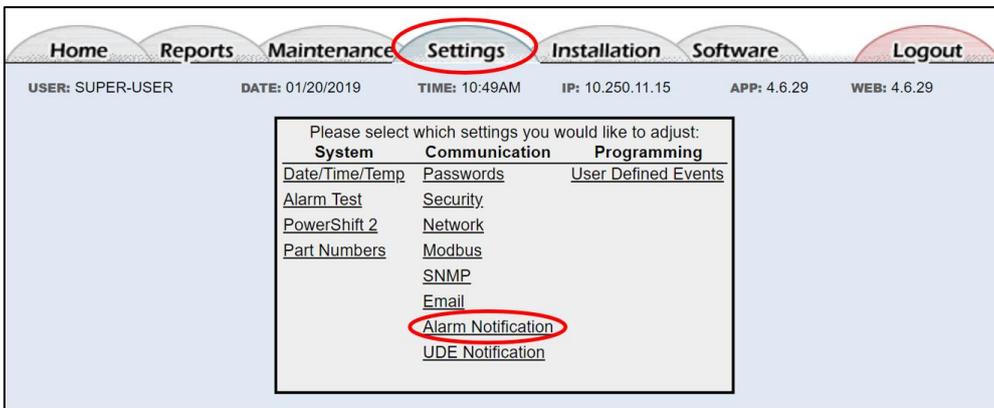
### 11.11. Uninstall a Module

- 1) Once a boost module has been installed into shelf slot and it is displayed in the GUI Home page, if the module is then subsequently removed from the shelf it will be flagged as “MISSING” in the GUI
- 2) To clear the “MISSING” flag, click on the “Clear Missing Devices” button



11.12. Confirm GUI Alarm Notifications

1) In the GUI, click on the Settings tab, then click on the Alarm Notification link



2) In the Alarm Notification page, confirm the severity (“Sev.”) and Relay columns are configured for each alarm section as shown in the screen captures below

Home Reports Maintenance Settings Installation Software Logout

USER: SUPER-USER DATE: 01/20/2019 TIME: 11:03AM IP: 10.250.11.12 APP: 4.6.29 WEB: 4.6.29

### Notify Settings

System Alarms	ID	Sev.	Relay	LED	EMAIL				SNMP				PHONE				Delay
					1	2	3	4	1	2	3	4	1	2	3	4	
<a href="#">High Ambient Temperature</a>	AMTH1	MAJ	R2	<input type="checkbox"/>	0s												
<a href="#">Low Ambient Temperature</a>	AMTL1	MAJ	R2	<input type="checkbox"/>	0s												
<a href="#">Config Reboot Required</a>	CRT1	CRIT	R1	<input type="checkbox"/>	0s												
<a href="#">Auxiliary Major</a>	AMJ1	CRIT	R1	<input type="checkbox"/>	0s												
<a href="#">Alarm Test Active</a>	ATA1	RO		<input type="checkbox"/>	0s												
<a href="#">Alarm Test Aborted</a>	ATB1	RO		<input type="checkbox"/>	0s												
<a href="#">Real Time Clock Battery Low</a>	BBL1	WRN		<input type="checkbox"/>	0s												
<a href="#">Configuration Changed</a>	CCH1	RO		<input type="checkbox"/>	0s												
<a href="#">Clock Changed</a>	CLC1	RO		<input type="checkbox"/>	0s												
<a href="#">ID Conflict</a>	DID1	CRIT	R1	<input type="checkbox"/>	0s												
<a href="#">Excessive Login Attempts</a>	EXL1	WRN		<input type="checkbox"/>	0s												
<a href="#">History Cleared</a>	HCL1	RO		<input type="checkbox"/>	0s												
<a href="#">Password At Default</a>	PDF1	RO		<input type="checkbox"/>	0s												
<a href="#">Processor Halt</a>	PHT1	RO		<input type="checkbox"/>	0s												
<a href="#">Self Test Failed</a>	STF1	MAJ	R2	<input type="checkbox"/>	0s												
<a href="#">ID Not Configured</a>	ZID1	CRIT	R1	<input type="checkbox"/>	0s												

Communication Alarms	ID	Sev.	Relay	LED	EMAIL				SNMP				PHONE				Delay
					1	2	3	4	1	2	3	4	1	2	3	4	
<a href="#">Minor Communication Fail Alarm</a>	CMA1	MAJ	R2	<input type="checkbox"/>	0s												
<a href="#">Queue Overflow</a>	COF1	WRN		<input type="checkbox"/>	0s												
<a href="#">No Call-Out Response</a>	COR1	WRN		<input type="checkbox"/>	0s												
<a href="#">Major Communication Fail Alarm</a>	MCM1	CRIT	R1	<input type="checkbox"/>	0s												
<a href="#">Unconfigured Alarm Destination</a>	NNC1	WRN		<input type="checkbox"/>	0s												
<a href="#">No Dial-Out Response</a>	POR1	WRN		<input type="checkbox"/>	0s												
<a href="#">External Password Reset</a>	EPR1	WRN		<input type="checkbox"/>	0s												

Power Shift Alarms	ID	Sev.	Relay	LED	EMAIL				SNMP				PHONE				Delay
					1	2	3	4	1	2	3	4	1	2	3	4	
<a href="#">Incompatible PowerShift</a>	ICLD1	CRIT	R1	<input type="checkbox"/>	0s												
<a href="#">OVP System H2O</a>	TH2O1	CRIT	R1	<input type="checkbox"/>	0s												
<a href="#">OVP System Intrusion</a>	TINT1	CRIT	R1	<input type="checkbox"/>	0s												
<a href="#">OVP System Power</a>	LTP1	CRIT	R1	<input type="checkbox"/>	0s												
<a href="#">OVP Upper Voltage Out of Range</a>	LUV1	CRIT	R1	<input type="checkbox"/>	0s												
<a href="#">OVP Upper to Lower Comm</a>	TBC1	CRIT	R1	<input type="checkbox"/>	0s												
<a href="#">PowerShift AutoResistance Fail</a>	ARF1	MAJ	R2	<input type="checkbox"/>	0s												
<a href="#">PowerShift Boost Over Temp</a>	RCO1	CRIT	R1	<input type="checkbox"/>	0s												
<a href="#">PowerShift Disabled Cct Power</a>	LDCP1	RO		<input type="checkbox"/>	0s												
<a href="#">PowerShift Fuse Fail</a>	RFF1	CRIT	R1	<input type="checkbox"/>	0s												
<a href="#">PowerShift ID Conflict</a>	RRID1	MAJ	R2	<input type="checkbox"/>	0s												
<a href="#">PowerShift Input Fail</a>	RIP1	CRIT	R1	<input type="checkbox"/>	0s												
<a href="#">PowerShift Interlock Open</a>	RIO1	CRIT	R1	<input type="checkbox"/>	0s												
<a href="#">PowerShift Module Mismatch</a>	LMIS1	CRIT	R1	<input type="checkbox"/>	0s												
<a href="#">PowerShift Module Over Temp</a>	RMT1	CRIT	R1	<input type="checkbox"/>	0s												
<a href="#">PowerShift Multiple Fan Fail</a>	RMF1	CRIT	R1	<input type="checkbox"/>	0s												
<a href="#">PowerShift Output V Out of Rng</a>	ROV1	MAJ	R2	<input type="checkbox"/>	0s												
<a href="#">PowerShift Overload</a>	ROL1	CRIT	R1	<input type="checkbox"/>	0s												
<a href="#">PowerShift Primary Fault</a>	LPRI1	CRIT	R1	<input type="checkbox"/>	0s												
<a href="#">PowerShift Redundancy Loss</a>	LRLS1	CRIT	R1	<input type="checkbox"/>	0s												
<a href="#">PowerShift Resistance</a>	LRES1	CRIT	R1	<input type="checkbox"/>	0s												
<a href="#">PowerShift Single Fan Fail</a>	RSF1	MAJ	R2	<input type="checkbox"/>	0s												
<a href="#">PowerShift Translator Timeout</a>	TPT1	CRIT	R1	<input type="checkbox"/>	0s												
<a href="#">PowerShift Upper Voltage Low</a>	PUVL1	MAJ	R2	<input type="checkbox"/>	0s												
<a href="#">PowerShift Voltage Not Linked</a>	LVNL1	CRIT	R1	<input type="checkbox"/>	0s												

Click buttons to change

## 12. Closeout Package

Once the installation is complete and all alarms are cleared, use the following steps to capture information for inclusion in the site installation closeout package

### 1) Capture the Circuit Map Worksheet

- Fill out the Circuit Map Worksheet (located in Section 8)
- Obtain a photo of the completed worksheet and save it as a jpg file to your Windows PC

### 2) Capture Alarm History Report

- In the GUI, click the Maintenance tab and clear the alarm history using the “clear alarm” button (the pull-down list underneath it should be set to “Alarm”)
- Click the Reports tab, then click the Alarm History hotlink
- Click the Print Event History button to generate a pdf file, save it to your Windows PC

### 3) Capture Inventory Report

- In the GUI, click the Reports tab, then click the Inventory Report tab; it may take a minute for the report to generate
- To generate a pdf file, click the small printer icon in the upper right corner of the Inventory banner
- Important: Set the Layout to Landscape, save the pdf file to your Windows PC

### 4) Capture Home Page

- In the GUI, click on the Home tab
- Obtain a screen capture of the Home page, save it as a jpg file to your PC

### 5) Capture Circuit Pop-up Boxes

- In the GUI Home page, click on each boost module circuit to open the pop-up box
- Note that multiple pop-up boxes can be opened at the same time, they can be moved around on the page and resized as needed; this allows you to arrange at least four circuits on the page before obtaining a screen shot
- Obtain multiple screen shots as needed to capture all the boost module circuits, save them as jpg files to your Windows PC

## 13. PowerShift Alarms and Troubleshooting

### Boost Module LEDs

There are four status indicators on each Boost module: P-In, P-Out, S-In, S-Out:

- 1) P-In and P-Out represent the status of the input and output circuits (respectively) of the first circuit in a boost module.
- 2) S-In and S-Out represent the status of the input and output circuits (respectively) of the second circuit in a boost module.

The following table provides a summary of LED status and the corresponding operational status of the hardware.

P-In LED	P-Out LED	S-In LED	S-Out LED	Condition
Off	Off	Off	Off	No Input Power
Yellow Solid	Red Blink	Yellow Solid	Red Blink	Initial Power On (~30 seconds duration)
Green Solid	Green Solid	Green Solid	Green Solid	Normal Operating State <sup>1</sup>
Green Solid	Green Solid	Yellow Solid	Off	Input Power to Only One Circuit <sup>2</sup> (e.g. no power to second circuit)
Green Solid	Yellow Solid	Green Solid	Yellow Solid	Redundant Circuit Active <sup>3</sup>
Green Solid	Yellow Blink	Green Solid	Yellow Blink	Short-Circuit or Overload On Output Circuit
Yellow Solid	Off	Yellow Solid	Off	Input Voltage Out of Range (<38VDC or >58VDC)
Green Solid	Red Blink	Green Solid	Red Blink	Circuit is Over-Temperature (output power is disabled)
Green Solid	Green Blink	Green Solid	Green Blink	Circuit was Over-Temperature but has recovered (output power is enabled)

1. Normal operating state for primary and redundant modules
2. If only one module circuit has input power, the other circuit will show yellow solid on the Input LED; the alarm condition can be cleared by disabling the unpowered circuit in the GUI
3. If a primary module circuit has failed or if the primary module has been removed from the shelf, the redundant module will show green solid on its input LED and yellow solid on its output LED

## GUI Alarms

The following table lists all of the PowerShift alarms generated in the GUI; active alarms are viewable in the GUI Home page, and the Reports tab provides an Alarm History report.

GUI Alarm Description	Severity	Relay #	Description [Troubleshooting]
-----------------------	----------	---------	-------------------------------

<b>**System Alarms**</b>			
High Ambient Temperature	Major	2	Shelter/cabinet air temperature is above acceptable range
Low Ambient Temperature	Major	2	Shelter/cabinet air temperature is below acceptable range
Config Reboot Required	Critical	1	Controller must be rebooted due to a configuration change [Reseat the controller to power cycle it]
<i>Auxiliary Major</i>	<i>Critical</i>	<i>1</i>	<i>N/A for PowerShift</i>
Alarm Test Active	Record Only		Indicates user has initiated test of the alarm relays. True while test is active
Alarm Test Aborted	Record Only		User alarm test was aborted due to an actual alarm condition
Real Time Clock Battery Low	Warning		The lithium battery in the controller RTC should be replaced
Configuration Changed	Record Only		User has changed the system configuration
Clock Changed	Record Only		User has changed the system time/date
ID Conflict	Critical	1	Indicates a problem with one or more boost or bypass modules
Excessive Login Attempts	Warning		User has tried to login with an invalid password - three failed attempts
History Cleared	Record Only		User has cleared history logs for alarm history or other history logs
Password At Default	Record Only		The login passwords are at factory default
Processor Halt	Record Only		The controller processor has stopped; controller was unseated in the shelf or power is otherwise removed from the controller. Entry is written during boot up based on RTC flag
<i>Self Test Failed</i>	<i>Major</i>	<i>2</i>	<i>N/A for PowerShift</i>
ID Not Configured	Critical	1	Boost or bypass module has an ID that is outside valid range

<b>***Communication Alarms***</b>			
Minor Communication Fail Alarm	Major	2	Controller has lost communication with one boost or one bypass module
<i>Queue Overflow</i>	<i>Warning</i>		<i>N/A for PowerShift; applies only when a modem is used</i>
No Call-Out Response	Warning		N/A for PowerShift; applies only when a modem is used
Major Communication Fail Alarm	Critical	1	Controller has lost communication with multiple boost modules

Unconfigured Alarm Destination	Warning		Alarm is configured to alert via dial-out or SNMP, but no destination has been defined
<i>No Dial-Out Response</i>	<i>Warning</i>		<i>N/A for PowerShift; applies only when a modem is used</i>
<i>External Password Reset</i>	<i>Warning</i>		<i>N/A for PowerShift</i>

<b>***PowerShift Alarms***</b>			
Incompatible PowerShift	Critical	1	The controller has detected PowerShift V1 boost modules installed in the shelf; only V2 modules may be used with PowerShift V2 shelf
<i>OVP System H20</i>	<i>Critical</i>	<i>1</i>	<i>N/A for manual resistance system</i>
<i>OVP System Intrusion</i>	<i>Critical</i>	<i>1</i>	<i>N/A for manual resistance system</i>
<i>OVP System Power</i>	<i>Critical</i>	<i>1</i>	<i>N/A for manual resistance system</i>
<i>OVP Upper Voltage Out of Range</i>	<i>Critical</i>	<i>1</i>	<i>N/A for manual resistance system</i>
<i>OVP Upper to Lower Comm</i>	<i>Critical</i>	<i>1</i>	<i>N/A for manual resistance system</i>
PowerShift Auto Resistance Fail	Major	2	PowerShift was unable to complete a line resistance calculation for a circuit
PowerShift Boost Over Temp	Critical	1	The PowerShift boost module has exceeded its operating temperature [Check for failed fan alarm on module; check the shelter or cabinet cooling system]
PowerShift Disabled Cct Power	Record Only		One or more circuits have been disabled
PowerShift Fuse Fail	Critical	1	The PowerShift boost converter module has a failed internal fuse; replace the module
PowerShift ID Conflict	Major	2	Possible issue with the PowerShift shelf unit
PowerShift Input Fail	Critical	1	PowerShift has lost input power to a circuit; a boost and/or a bypass module is installed for the circuit, but there is no input power. [Check the input circuit breaker; measure the voltage at the shelf input terminals]
PowerShift Interlock Open	Critical	1	Boost module is improperly seated in the shelf, or the module backplane is damaged, or the shelf backplane is damaged [Reseat modules; inspect backplane of modules for any obvious damage]
PowerShift Module Over Temp	Critical	1	The air inlet temperature to the module is above threshold temperature setpoint [Check shelter or cabinet cooling system]
PowerShift Multiple Fan Fail	Critical	1	Both fans in a PowerShift boost or bypass module have failed; replace the module
PowerShift Output V Out of Rng	Major	2	PowerShift boost module output voltage has exceeded the maximum output voltage of 73V [Should not occur unless module is faulted; replace the module]

PowerShift Overload	Critical	1	The output current on a PowerShift circuit has exceeded the specified maximum value of 30A, the module has turned off its output; if circuit over-current condition clears within 20 minutes, then module will re-enable output [Check for short-circuit on cable or radio; check for radio drawing excessive current]
PowerShift Primary Fault	Critical	1	A primary and redundant module pair are simultaneously trying to supply load current to a circuit [Unseat redundant module then reseal, if problem persists then swap in a different boost module to determine which module is faulted]
PowerShift Redundancy Loss	Critical	1	One or more PowerShift circuits have lost redundant backup power on a circuit; this can be due failure of a boost module, removal of a boost module for maintenance purposes, loss of input power to the circuit, etc.
PowerShift Resistance	Critical	1	The line resistance calculated by PowerShift has a value exceeding 1 Ohms; this indicates a problem condition with the line or misapplication of the product
PowerShift Single Fan Fail	Major	2	One fan in a PowerShift boost or bypass module has failed; replace the module
<i>PowerShift Translator Timeout</i>	<i>Critical</i>	<i>1</i>	<i>N/A for manual resistance system</i>
<i>PowerShift Upper Voltage Low</i>	<i>Major</i>	<i>2</i>	<i>N/A for manual resistance system</i>
<i>PowerShift Voltage Not Linked</i>	<i>Critical</i>	<i>1</i>	<i>N/A for manual resistance system</i>

### PowerShift Output Overload Protection

The boost module is designed to shut off its output circuit in the event the load demand exceeds the circuit maximum output capacity of 30 amps, which corresponds to 2000W total power (radio demand + power loss in the trunk cable).

Under normal circumstance an output overload should not occur; the proper design and installation of the PowerShift system ensures the maximum radio load demand and the trunk cable length do not exceed the circuit capacity. However, off-nominal events such as a short in the trunk cable or a malfunctioning radio could cause the load demand to exceed the module output capacity. In this event the module functions as follows:

- When circuit capacity is exceeded the module will shut off its output
- The module then checks the condition of the circuit periodically (about every 5 seconds) to determine if the overload condition remains or if it has cleared
- If the overload condition clears, the module will re-enable output on the circuit
- If the overload condition has not cleared, the module will continue to keep the circuit output shut off and will continue to check the circuit condition about every 5 seconds

- After 20 minutes, if the circuit overload condition has not cleared, the module will latch the circuit output off and will discontinue checking the circuit condition
- Once the circuit is latched off, the user must intervene to re-enable it; the overload condition must be cleared and the circuit can then be re-enabled by cycling the input power breaker or by using the GUI to disable/enable the circuit

