POWERBOOST

DC Converter System 1.5:
Quick Start Guide

JMA Wireless World Headquarters
7645 Henry Clay Boulevard
Liverpool, NY 13088
USA
www.jmawireless.com
+1 888-201-6073

Latest revision of this document is available online here:

https://jmawireless.com/16995-01/

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Note:

- This information applies to product referred to as "PowerBoost 1.5," identifiable by Orion controller software version B8.97B01 or later.
    - Also has firmware version label on circuit board at rear of chassis indicating FW 1.5.0.
- For information about product "PowerBoost 1.0," identifiable by Orion controller software version (circa) B8.30B32 and circuit board at rear indicating FW 1.0.2, see other documents 16089-01 and 15525-01.
- To identify the Orion controller's software via touch screen:
    - Swipe right (or left) as needed to reach the main screen.
    - Touch the icon labeled **Controller** or **Device**.
    - Orion will reveal its installed software version, serial number, etc.
- Updated "PB 1.5" vs existing "PB 1.0":

- The use model of PB 1.5 is slightly different; users who are familiar with existing PB 1.0 please read this document fully before working with PB 1.5.
- Input power connections (from DC plant) are the same.
- Output power connections (to lower OVP) are the same, now with greater flexibility.

Definitions

OMM Output Management Module: uppermost 1U of PowerBoost, has 16 output circuit breakers

Orion Controller: In PowerBoost upper shelf at left side; has touch screen, has Ethernet GUI

OVP - **Over Voltage Protection**: generally refers to the Raycap units upper and lower. Note: the Raycap OVP units also provide a telemetry function that communicates upper channel Voltages. This is used by PowerBoost to regulate Voltage at load.

PB: PowerBoost product

PB-COM: Circuit board at rear of PowerBoost upper shelf; interface between Raycap RS485 data and Orion controller. Has heartbeat LED and other indicators.

RRH - Remote Radio Head: i.e., the load, typically connected near upper OVP unit)

SYS-8: Short-hand reference to PB-19-SYS-8

SYS-16: Short-hand reference to PB-19-SYS-16

General overview

JMA PowerBoost is a rack-mounted voltage boost unit that maintains acceptable voltage at the RRH by sensing system characteristics and adjusting its output voltage accordingly. PowerBoost makes use of telemetry data from suitably equipped Raycap OVP units as a reference point for maintaining RRH Voltage. The PowerBoost unit is comprised of the following:

- Rack frame (19 inch 1U high), holds an Orion controller and up to 4 boost modules (2 channels per module), referred to as "boost rack."
- Rack frame (19 inch, 1U high), holds 16 individual circuit breakers for boost outputs, referred to as OMM output management module.

Two variants of PowerBoost are available:

- PB-19-SYS-8 (total 2U high), consists of 1 OMM unit married with 1 boost rack (single Orion controller and 1 to 4 boost modules); supports up to 8 channels.
- PB-19-SYS-16 (total 3U high), consists of 1 OMM unit married with 2 boost racks (single Orion controller and 1 to 8 boost modules); supports up to 16 channels.

1. Pre-installation checklist

Space:

- ☐ System design performed; confirm equipment configuration.
- ☐ Documented wiring diagram with components and distances labeled.
- ☐ Rack space available for PowerBoost.
- ☐ DC plant has capacity and breaker space to feed PowerBoost inputs.
- ☐ Ground bus has sufficient location(s) available.
- ☐ Shelter/cabinet cooling system has capacity for added equipment.

Components:

- ☐ PowerBoost shelf and modules
- ☐ Circuit breakers and current lug adapters
- ☐ Compression lugs and heat shrink tubing
- ☐ Wire (typically Telcoflex II or Telcoflex IV, 6AWG for PowerBoost outputs. Input AWG per code and system design.)

Tools:

- ☐ Standard hand tools
- ☐ 7/16 deep socket and driver capable of calibrated torque to 65 lbf·in.
- ☐ Compression tool(s) for wire/lugs
- ☐ Label maker

2. Confirm OVP equipment and operation

- ☐ Verify that Raycap OVP network configuration is appropriate for use with PowerBoost (per system design). Lower Raycap OVP unit must have output port labeled "VBOOST OUTPUT." See table below:

Raycap Model	No. of circuits	RS485 board required	Description
RxxDC-2260-RM-48	6	Yes	6 Circuit rack
RxxDC-3315-PF-48	6	Yes	6 Circuit tower or base
RxxDC-4520-RM-48	12	No	12 Circuit rack
RxxDC-4520-RM-482	12	No	12 Circuit rack with (2) CPRI interface modules
RxxDC-6627-PF-48	12	No	12 Circuit tower or base

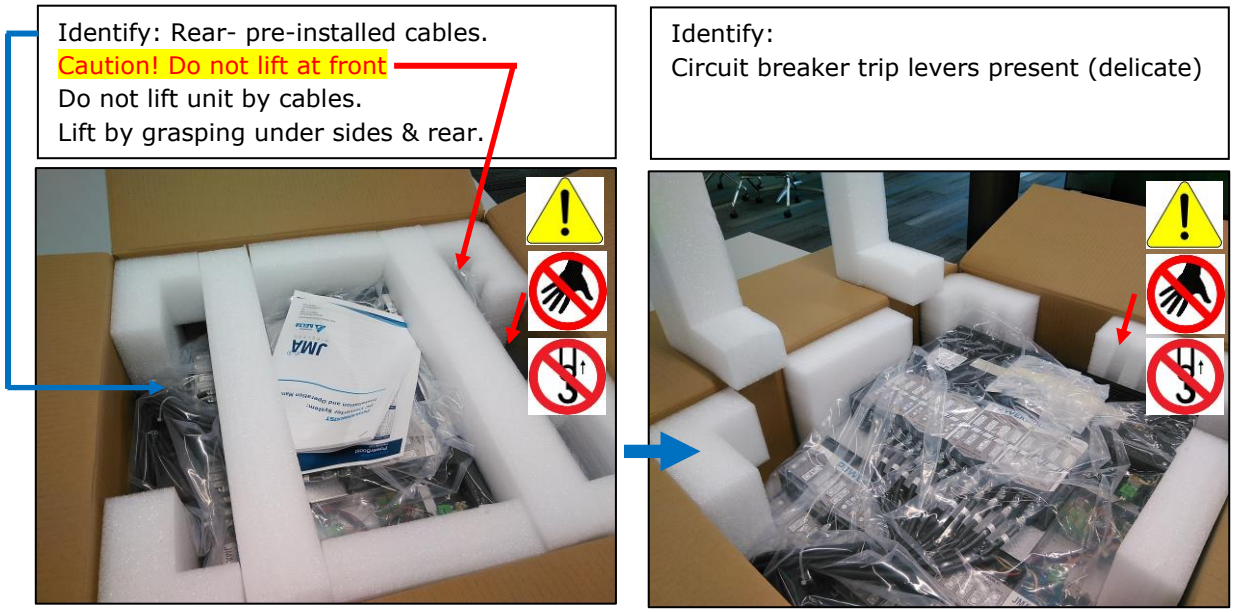
- ☐ Verify that Raycap OVP network telemetry is functioning correctly. (lower OVP is reading voltage at upper OVP, from correct channels)
- ☐ OVP: Conductors correct connection has been verified (no crossed channels or bridging/jumpering).
- ☐ Consult Raycap documents for troubleshooting OVP. See also general information later in this document.

Installation

3. Unbox, mount PowerBoost unit, connect ground

Caution! Wear a grounded ESD wrist strap when handling equipment or working with electrical connections.

3.1. Unbox.



3.2. Mount securely in rack.

Mounting hardware supplied in box under unit.

3.3. Attach ground cable 6AWG or larger

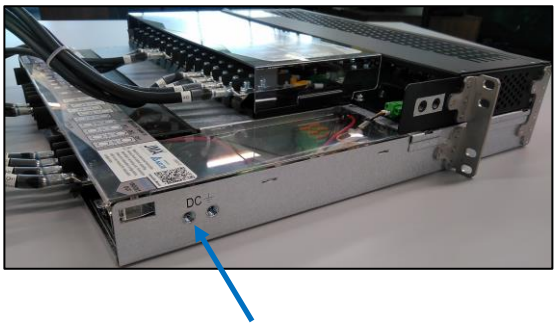
Compression lug for 6AWG (1/4” x 5/8” spacing) and bolts provided in hardware kit. (See photos below)

- Arrows show recommended point for ground lug. Typically, one ground cable per PowerBoost unit is acceptable, provided that the factory-supplied mounting brackets are present and secure.

- Ground wiring must be installed in accordance with all local and national electric codes and requirements.

Arrow shows recommended earth connection point on PB-19-SYS-16

Arrow shows recommended earth connection point on PB-19-SYS-8



3.4. How to insert and remove modules from boost rack

The following information explains how to insert and remove modules from the boost rack. The Orion controller comes pre-installed and is typically removed only for the purpose of re-setting the controller.

Insertion:

Simply slide the Orion controller and/or boost module into the appropriate bay and push it fully in. The module will automatically latch in place. For the Orion controller, push on the left side (not on the touch screen).

Removal:

Orion controller: Locate the unlocking slide lever at the upper left corner. Hold the slide lever in the "up" position and pull on the protrusion at the bottom to remove the controller. The Orion controller is hot-swappable; loads will remain powered, but will not be regulated until a controller is installed.

Boost module: Locate the unlocking lever at the right side. Hold the lever in the "up" position and pull on it to remove the boost module. Use only boost modules specified for use in PowerBoost.

During the installation process for a new rack, the Orion controller should be (remain) installed.

Important! No boost modules should be present; they are installed at a later step.

4. Connect -48VDC input power from DC plant

4.1. Circuit breakers & conductors – DC Plant

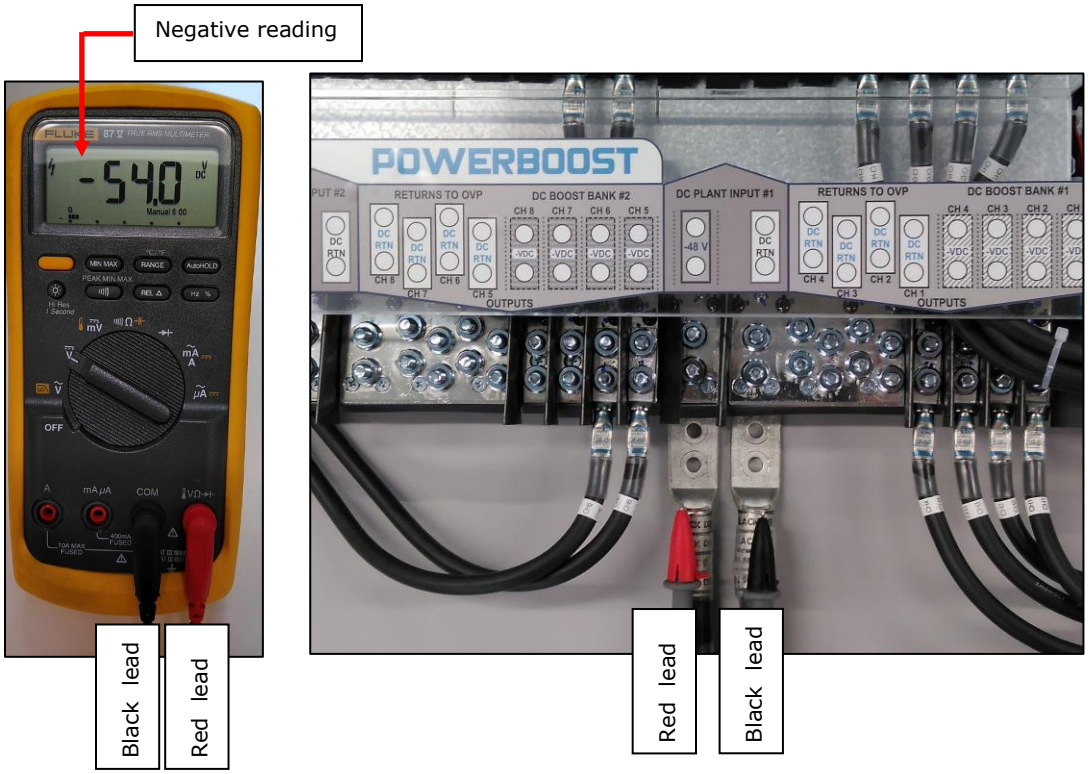
- Input wiring and overcurrent protection must be installed in accordance with all local and national electric codes and requirements.

Install circuit breakers and associated current combiner plates in DC plant to feed each PowerBoost input. Circuit breaker size is determined during system design. Use manufacturer recommended torque values. See Appendix A and Appendix B for reference information on lugs and circuit breakers.

Note that PB-19-SYS-8 utilizes up to 2 power inputs, and PB-19-SYS-16 utilizes up to 4 power inputs; a separate circuit breaker is needed for each input. See Appendix B for reference information on circuit breakers.

4.2. Power input connections at PowerBoost rack

- ☐ Run conductors of appropriate AWG (per code and system design) to rear of the PowerBoost rack.
- ☐ Before connecting input power to PowerBoost rack, verify polarity of each power feed as follows: Feed circuit breakers in DC plant OFF.
- ☐ Caution! PowerBoost equipment will be damaged if energized with reversed polarity.
- ☐ See images below. Insert probes into DMM as shown (black probe = COM)
  At PowerBoost rack, at least 1 power lug not landed and insulated from connection. Black lead from DMM to the "return" (RTN) feed. Orient the input power cables securely so they can be energized independent of the boost rack, for purpose of measuring voltage polarity.



- Turn circuit breaker ON. Verify that meter indicates negative polarity voltage reading equal to DC plant voltage. Turn circuit breaker OFF.
- If voltage reading is not negative, remedy the situation before connecting to PowerBoost inputs.

Images below show connection points for power feeds from DC plant to PowerBoost inputs. Torque value for all lugs on the PowerBoost unit is 65 lbf·in.

Photo below shows PB-19-SYS-8.

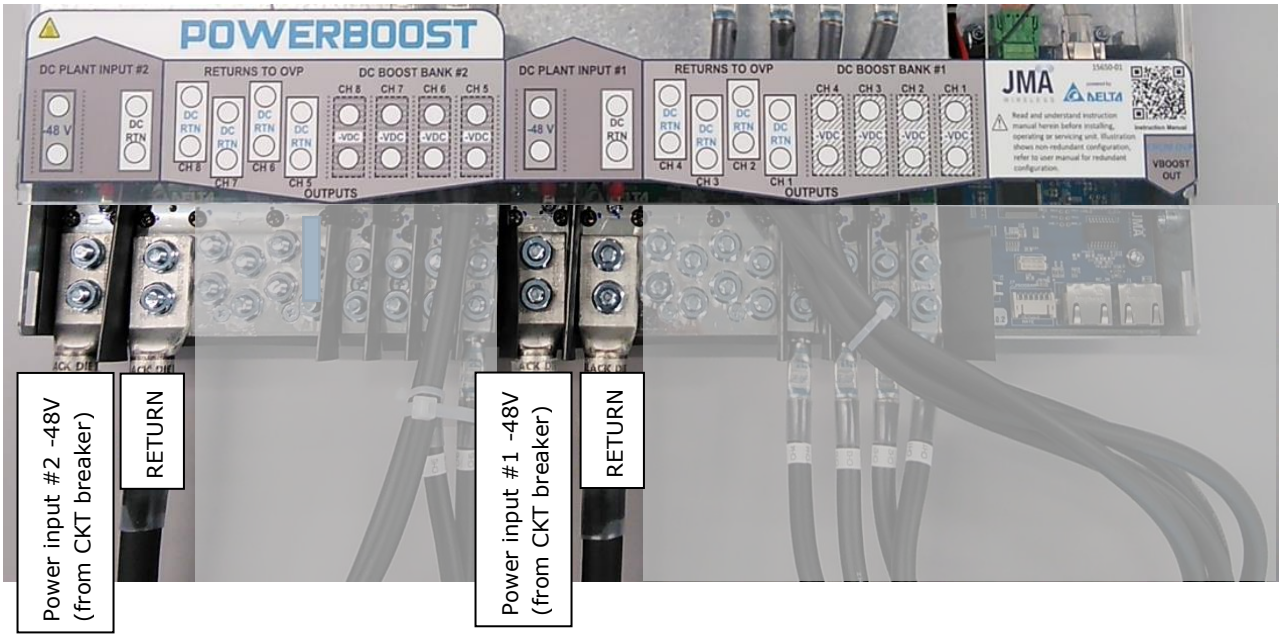
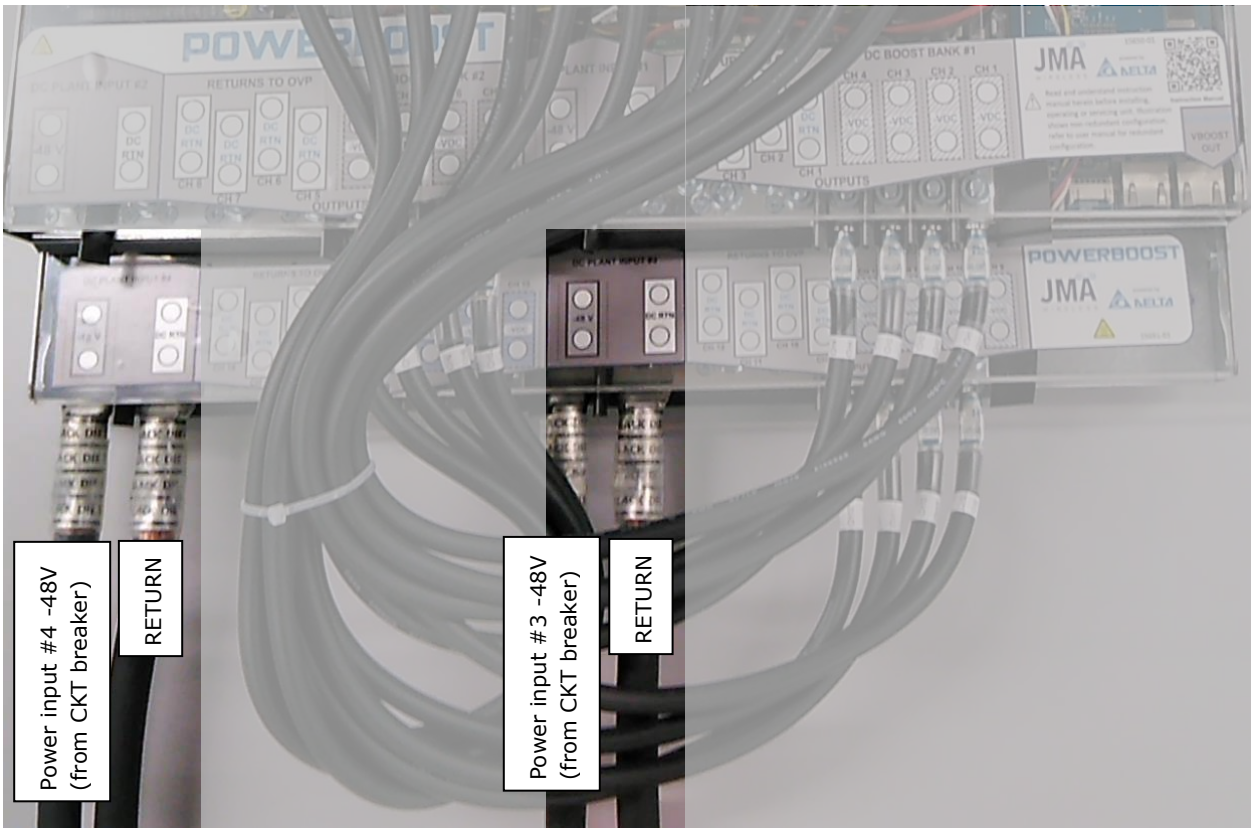


Photo below shows PB-19-SYS-16. Power inputs #1 and #2 are the same as shown in PB-19-SYS-8 above. PB-19-SYS-16 only: LOWER SHELF Power inputs #3 and #4.



4.3. Connect PowerBoost outputs to lower OVP

- Output wiring and overcurrent protection must be installed in accordance with all local and national electric codes and requirements.

Torque value for all lugs on the PowerBoost unit is 65 lbf·in. See labels on lug covers for further detail. See Appendix C for reference information connections to lower OVP rack.

Photo below shows PB-19-SYS-8

- -48V connection is made at upper "OMM" shelf.
- Return connection is made at lower "boost" shelf.

Note that -48V lug channel numbers progress as follows:

8 7 6 5 4 3 2 1

16 15 14 13 12 11 10 9

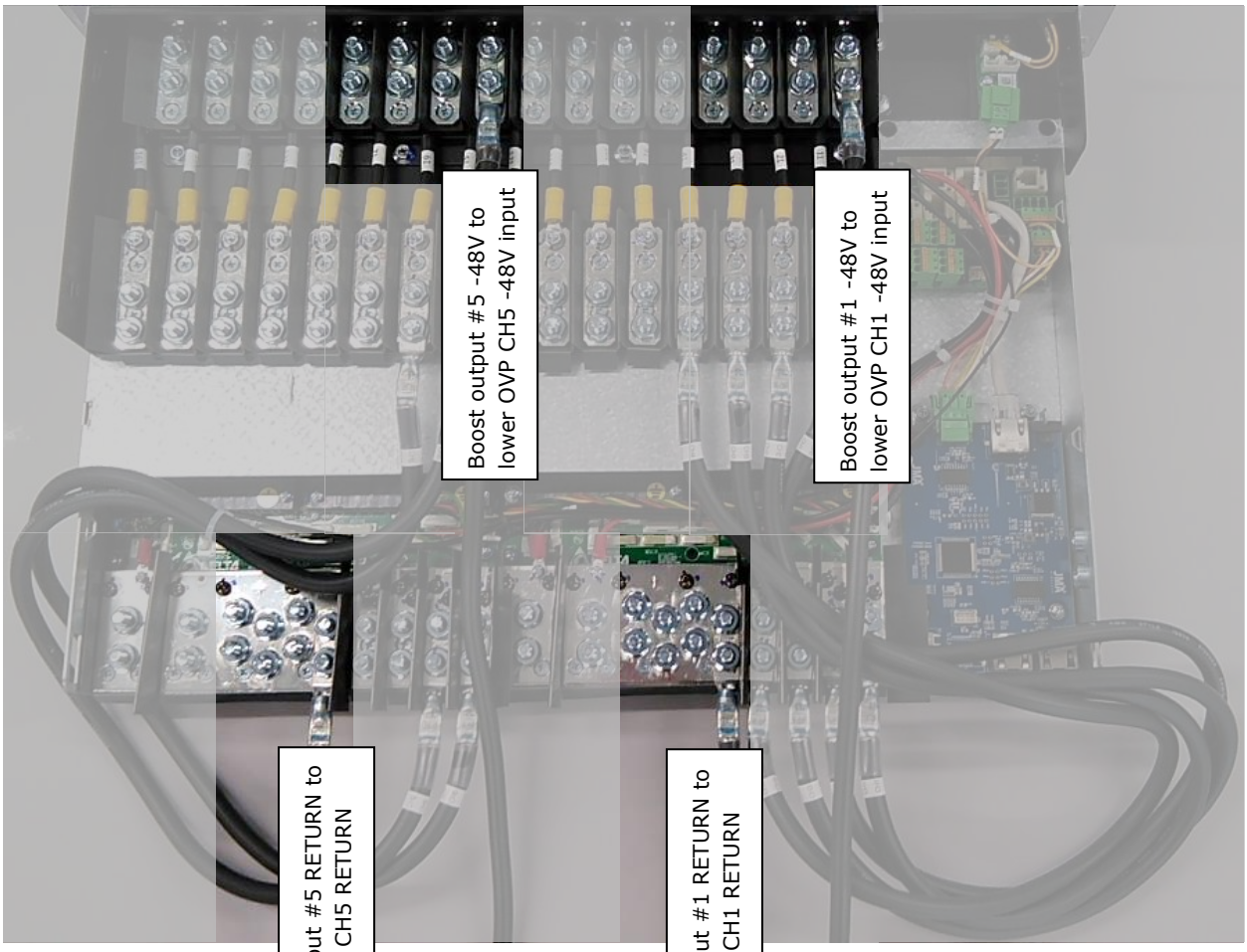


Photo below shows PB-19-SYS-16. For CH1-8, locations of -48V lugs and RETURN lugs are the same as PB-19-SYS-8 above. For CH9-16:

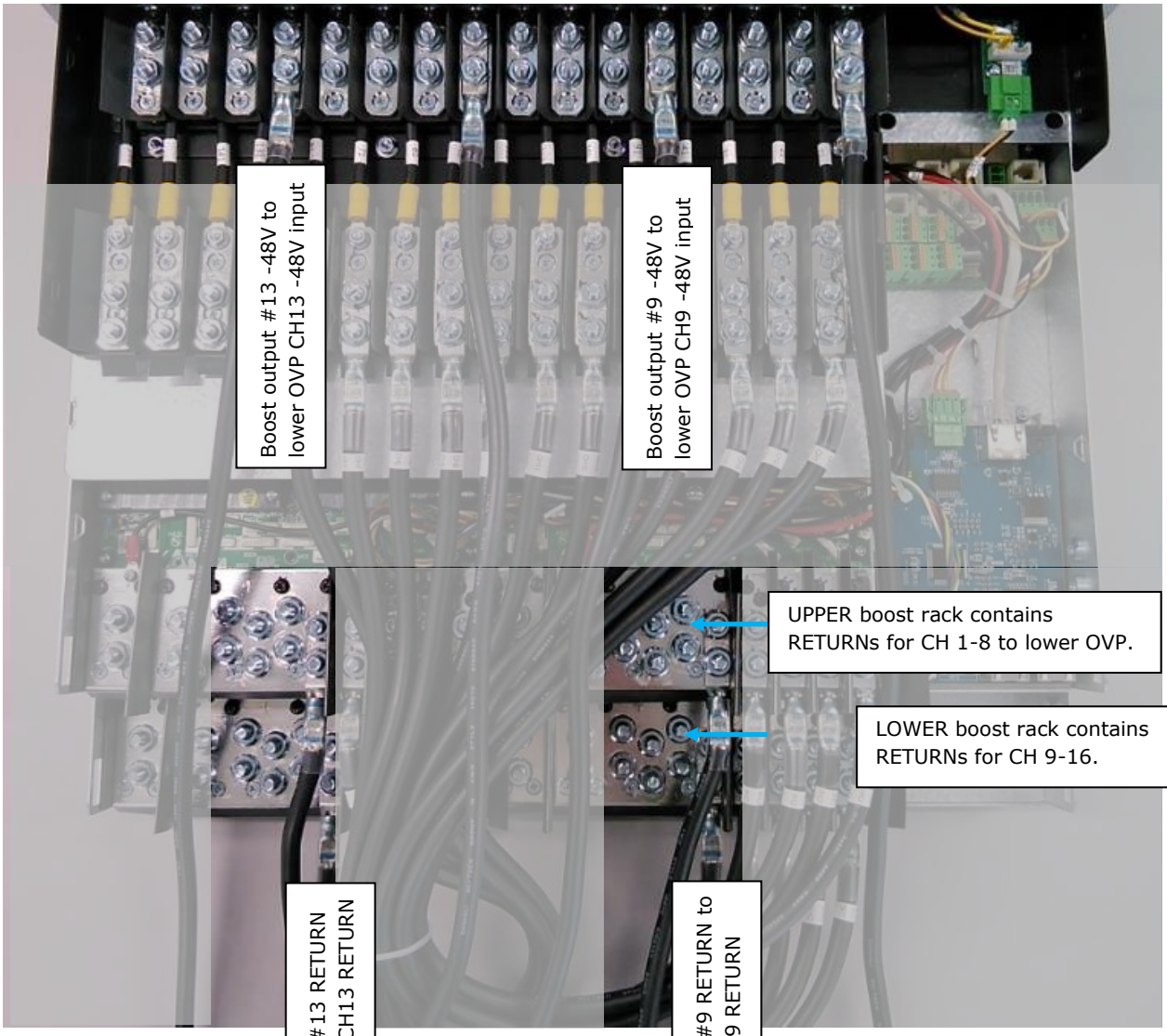
- -48V connections are made at upper "OMM" shelf at the locations illustrated below.
- Return connections are made in similar fashion as SYS-8, but connect to the lowest "boost" shelf.

Note: When connecting a SYS-16, tool access is often easier if the lower connections (CH9-16) are made first.

Note that -48V lug channel numbers progress as follows:

8 7 6 5 4 3 2 1

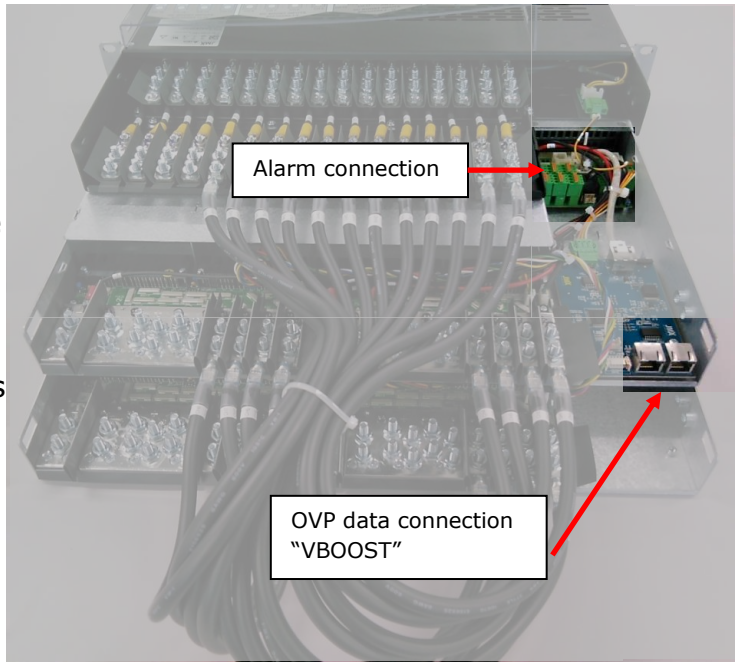
16 15 14 13 12 11 10 9



4.4. RS485 Data link and alarm connections

4.4.1. RS485 data

Alarm connections are made in the location shown. See further below for more information.



OVP data connection is made in the location shown. This is the PowerBoost "VBOOST IN" connection. The lower OVP "VBOOST OUT" connects here.

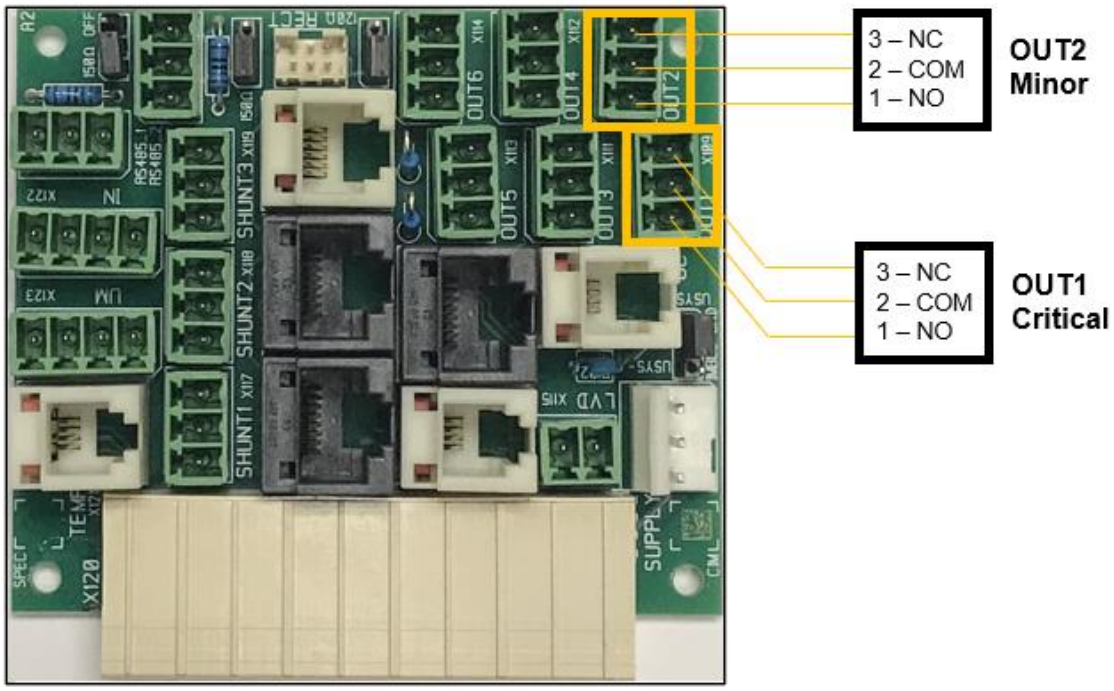
Note: If PowerBoost has 2 connectors (as shown in photo):

- Connection to either connector is acceptable.
- Only 1 cable connects tothis location; both connectors are never used at same time.

4.4.2. Alarm connections

For reference, summary information on alarm connections is shown below.
(See Appendix G for further information and alarm mapping.)

Relay name	Pin out
Critical	OUT1.1 – Normally open OUT1.2 – Common OUT1.3 – Normally closed
Minor	OUT2.1 – Normally open OUT2.2 – Common OUT2.3 – Normally closed



Board is on rear of rack behind Orion controller (interface connectors are included with unit).

5. Startup:

5.1. New system startup

Note: In order to select the proper configuration file later in this segment, it is necessary to have knowledge (and preferably a diagram) of the system wiring connections. The diagram should show:

- PowerBoost
- OVP lower and upper
- cable spans and
- RRH units
- Which PowerBoost channels are connected to which OVP channels and RRH units.

Before applying power, ensure the following:

- The Orion controller is present and fully inserted.
- No boost modules are inserted
- Power input feeds from DC plant have been checked for correct polarity before connecting to the lug lands. (See Section 4.2: Power input connections)

Turn on only the circuit breaker feeding power input for channels 1-4

- Note: the Orion controller can draw power from either of the bulk input feeds (ch 1-4 or ch 5-8) and can withstand application of reverse polarity without damage, facilitating its use to verify correct polarity. Boost modules will be damaged if they are energized with reverse polarity.
- Verify that the Orion controller touch screen lights up. (Typically it lights up, then shows "ORION," then progresses to the default display screen). Allow up to 30 seconds.
- Orion touch screen that lights up is an indication that the input power is connected with the correct polarity.
- If the Orion touch screen remains dark when the input power is turned on, this is typically a sign that polarity is reversed. Troubleshoot before proceeding.
- Once the Orion controller has been confirmed to properly light up, turn OFF the circuit breaker for channels 1-4.

If the system has a second power input feed for channels 5-8, turn on the circuit breaker feeding those channels.

- Using same approach as in preceeding step, verify that the Orion controller lights up as expected. Troubleshoot before proceeding.

If the system has 3rd and 4th power input feeds (i.e., PB-19-SYS-16 with 2nd boost shelf for channels 9-12 and 13-16): Note that the Orion controller does NOT draw power from these 2nd boost shelf inputs, so the Orion touch screen will remain dark when only those power feeds are energized. Correct polarity of the 3rd and 4th power feeds can be confirmed by ensuring that the polarity connections are the same as the feed supplying ch 1-4, which has been previously verified.

Final step in performing the polarity checks — finish with all circuit breakers OFF.

- All power feed breakers from DC plant to PowerBoost OFF
- All 16 circuit breakers on PowerBoost OMM OFF
- No boost bricks are inserted

Once polarity of the individual power feeds has been verified, proceed with actual power-up:

- Turn on all breakers in DC plant that feed the given PowerBoost rack.
- Allow 2-3 minutes for the Orion controller to boot.
- Proceed with configuration; see the following pages.

5.2. Orion controller access

General login information for reference:

- Orion touch screen default password is 0000 (four zeros)
- Orion GUI (Ethernet) default address from factory is set for static 192.168.100.100
- Default username: Admin; Password: orion

Note: The Orion controller GUI contains many menus/sub-menus. Only the parameters needed for the PowerBoost functions are covered here. Leave all other settings at their default values.

A note about configuration files: Think of the config. file in same general manner as a radio channel preset button. The config file is a convenience device that sets one or more (typically several) parameters within the Orion controller. Selecting and engaging a config. file saves time that would otherwise be spent navigating to and altering the various parameters.

Refer to Appendix E to identify the configuration file appropriate for the given application. Consult JMA tech support with any questions.

5.2.1. Select a config file via touch screen

To select a config file via the Orion touch screen (without using a laptop / without logging into the Orion Ethernet GUI):

Think of swipes horizontally on the Orion touch screen as flipping through pages in a book; repeated swipes to the right return toward "front of the book"; in other words, toward the Orion main screen.

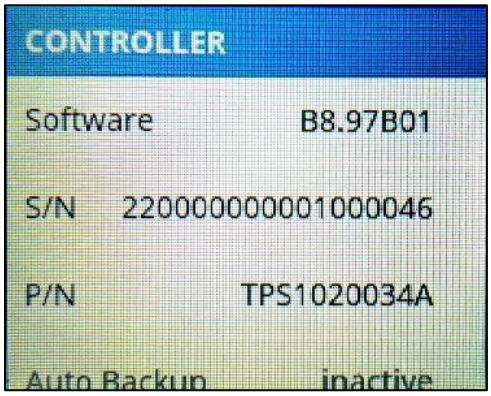
From the factory, default display page for the Orion controller is the "meter panel" page, which shows parameters for each channel. Scroll up and down to scroll through the channels. Rather than one long (vertical) string of all channels, the meter panel page is divided into segments of approximately 5 channels. To advance forward through the meter panel page segments, scroll down to the bottom of a given segment and choose "Next." To return through the segments, swipe right in a given segment.

To select a configuration file via the Orion touch screen: swipe right in order to reach the "Menu" screen. (show image main screen)

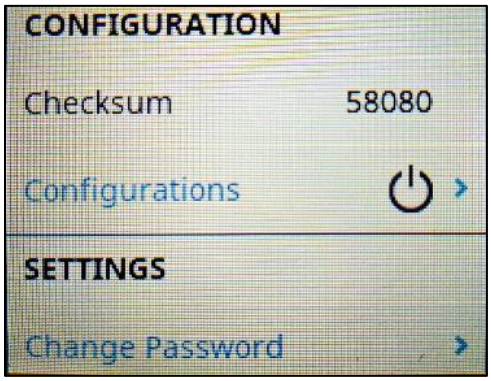
Screen order is: Main "Orion" page, "Menu" page, "Alarm" page, "Meter Panel" page.

Touch the icon **Controller**.

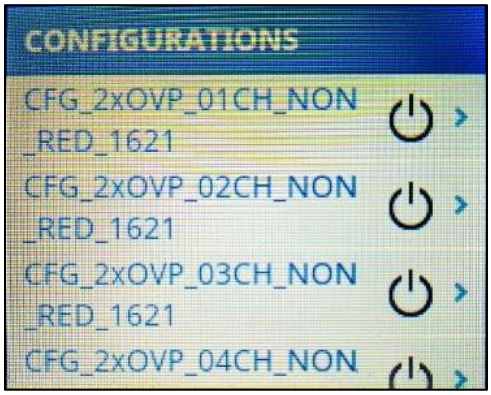
This reveals the Orion controller serial number and installed software version. Scroll down (swipe up) to reach the configurations section.



Touch **Configurations** to enter the configs menu.



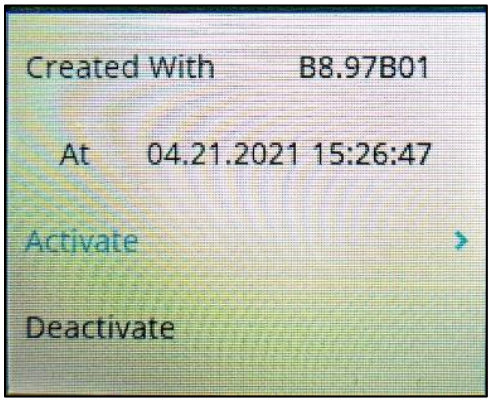
Touch on the desired configuration file (identified previously based on system design).



The example below illustrates selection of 2xOVP_01CH.

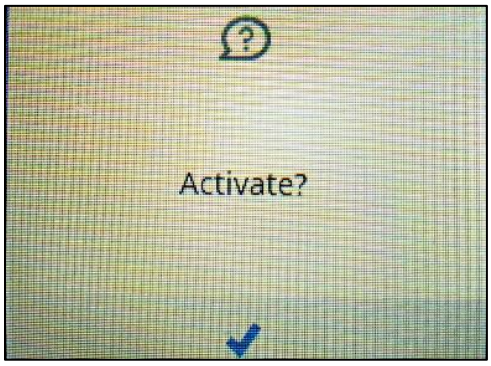
Note: The "CUSTOM" config file cannot be implemented via touch screen, but must be implemented via Orion Ethernet GUI access. See information later in this document.

For the given config file, scroll down slightly to expose the "Activate" menu. Select **Activate**.



If prompted for password, enter the default password 0000 and touch the **blue checkmark**.

Orion will present a confirmation screen; touch the **blue checkmark** at bottom.

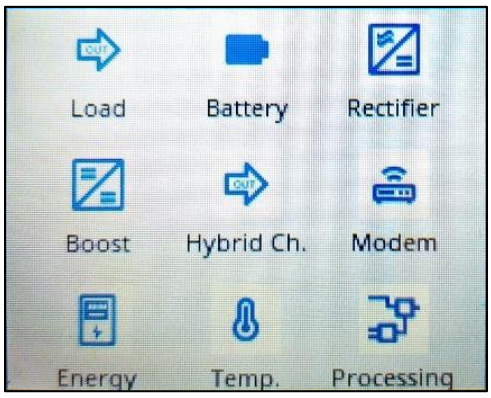


If using config file 2OVP, 3OVP, 4OVP: those files are fully defined and no further action is necessary.

If selecting the config file CFG_06OVP… or CFG_12OVP…, an extra step is necessary to enable the desired channels (because these two config files ship by default with no channels enabled). Channel enable can be performed from the Orion touch screen as follows:

Swipe the Orion touch screen as needed to reach the "Menu" screen:

Once on the "Menu" screen, swipe up (scroll down) to reveal more icon tiles. Touch on the **Hybrid Ch.** tile.

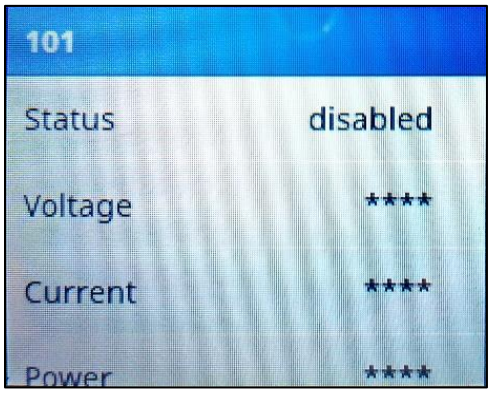


This brings the "HYBRID CHANNEL" menu.

Note: Do not change other existing entries in this menu; focus is only on the individual channels for enabling.

Within the "HYBRID CHANNEL" menu, scroll down (swipe up) as appropriate and touch on the desired mapped channel (101, 102… etc.).

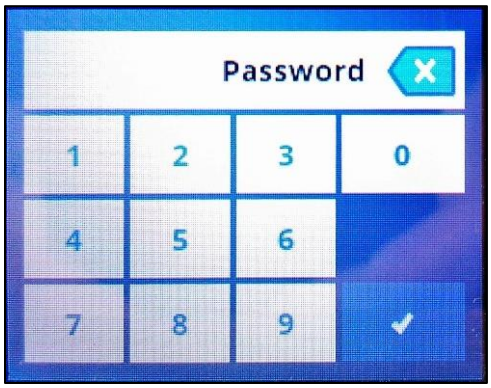
This opens the channel menu.



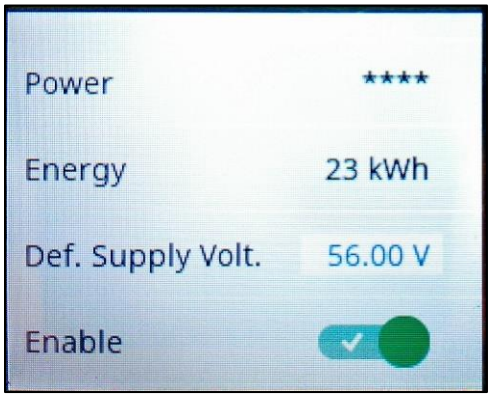
Once in the menu for the desired channel, scroll down (swipe up) to reach the line item for "Enable." Although the icon for "Enable" appears as a slider, it can be toggled on/off by simply touching.

If the Orion password hasn't already been entered for this session, a password prompt will appear.

Password is 0000 (four zeros).



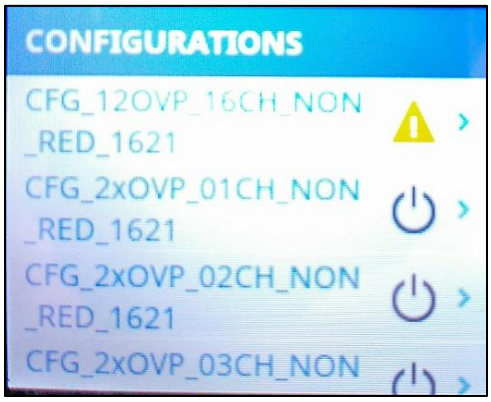
Result is the channel enabled.

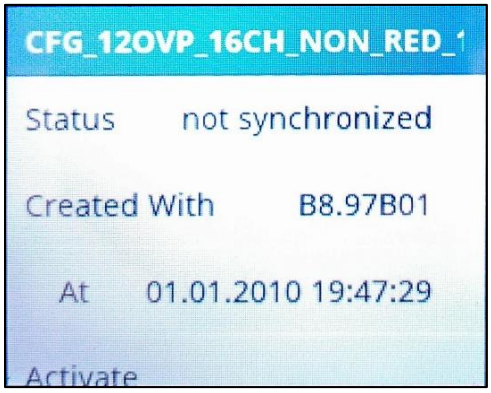


Swipe left as appropriate, and repeat the process to enable other channels as needed.

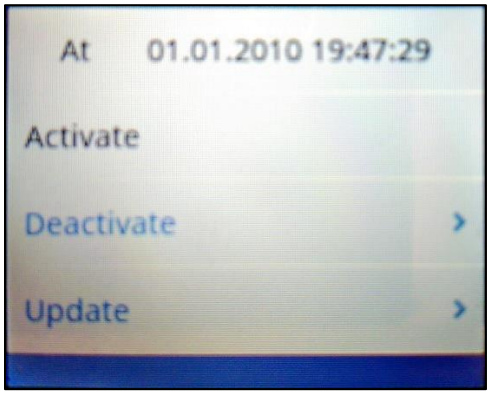
After enabling the desired channels, the config file must be synchronized.

Swipe (typically right or down) as appropriate to return to the "MENU" screen, and touch the **Controller** icon. Scroll down (swipe up) to reach the "Configurations" line. Touch the active configuration; status will indicate "not synchronized."

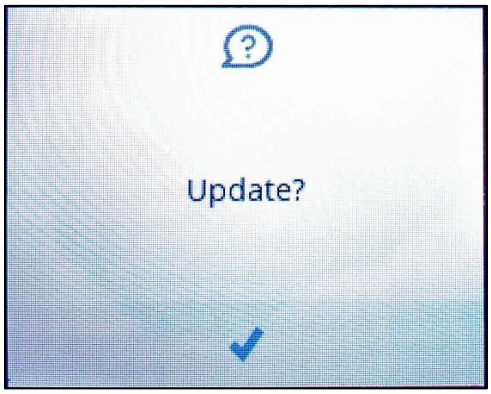




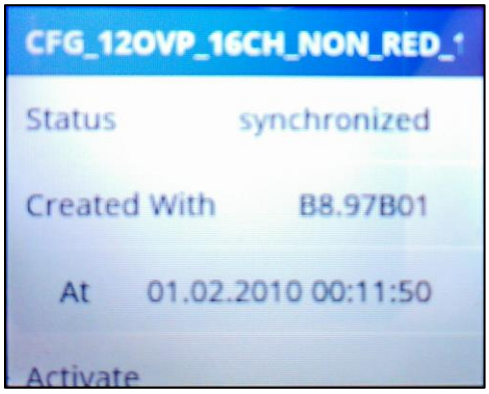
Scroll down to find and touch the line for **Update.**



Touch the **blue checkmark** to confirm.



Allow a few seconds for the change; config status will indicate "synchronized."



Once the configuration file is selected and implemented:

- With all OMM circuit breakers OFF, insert boost modules only for the channels that are enabled.
- It is recommended to turn on the OMM circuit breakers one at a time, and verify that the expected Raycap channel energizes.
- Confirm/troubleshoot as appropriate.
- Optional: once all channels are energized, one can proceed to Appendix I for closeout checklist.

5.2.2. Select a config file via Ethernet GUI

To select a config file via the Orion GUI (uses laptop and login via Ethernet connection on front):

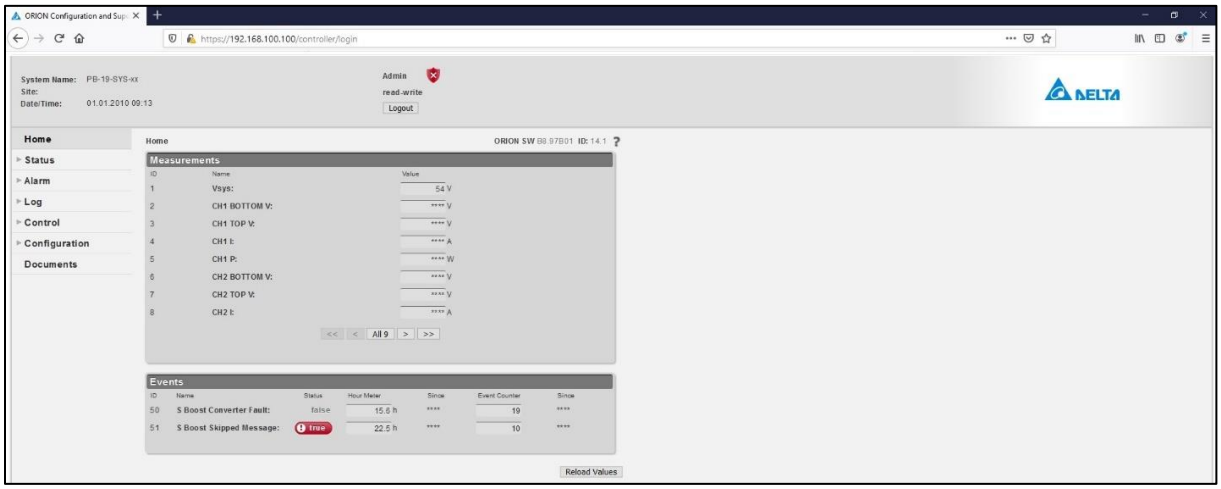
If accessing the Orion controller GUI via its front Ethernet port, refer to Appendix D for information to connect and log in.

Quick steps:

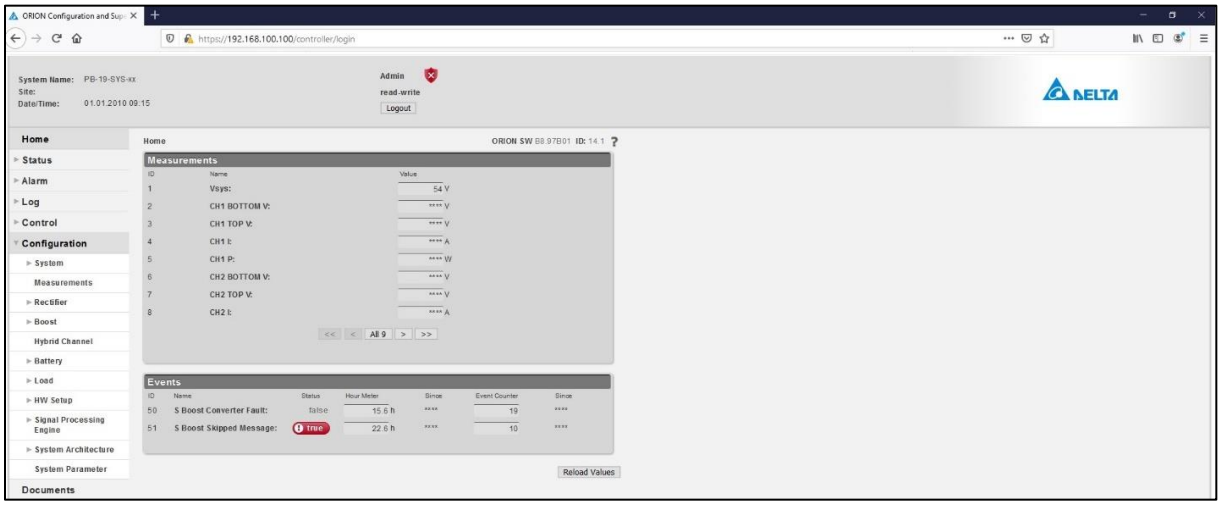
Configuration, System, Config Manager, Deactivate current config file, new file- Activate, OK, Update.

- Under **Configuration, System,** click **Configuration Manager**.
- Look through the list of configuration files; use arrow buttons at the bottom.
- In the Status column, the presently active configuration file will indicate "synchronized," and it will have a **Deactivate** button.
- In order to change the configuration file, first deactivate the presently active file, then select the new desired file in the list and click **Activate**.
- Next, an "are you sure?..." dialogue box will appear. Click **OK**.
- This will load the new configuration file, and Status will indicate "not synchronized."
- Click the **Update** button for the chosen configuration file. This will engage the file, and status will change to "synchronized."
    - If using config file 2OVP, 3OVP, 4OVP: those files are fully defined and no further action is necessary.
    - If using one of the last three config files (06OVP, 12OVP, or 16CH CUSTOM), an extra step is necessary. Please read the steps below.

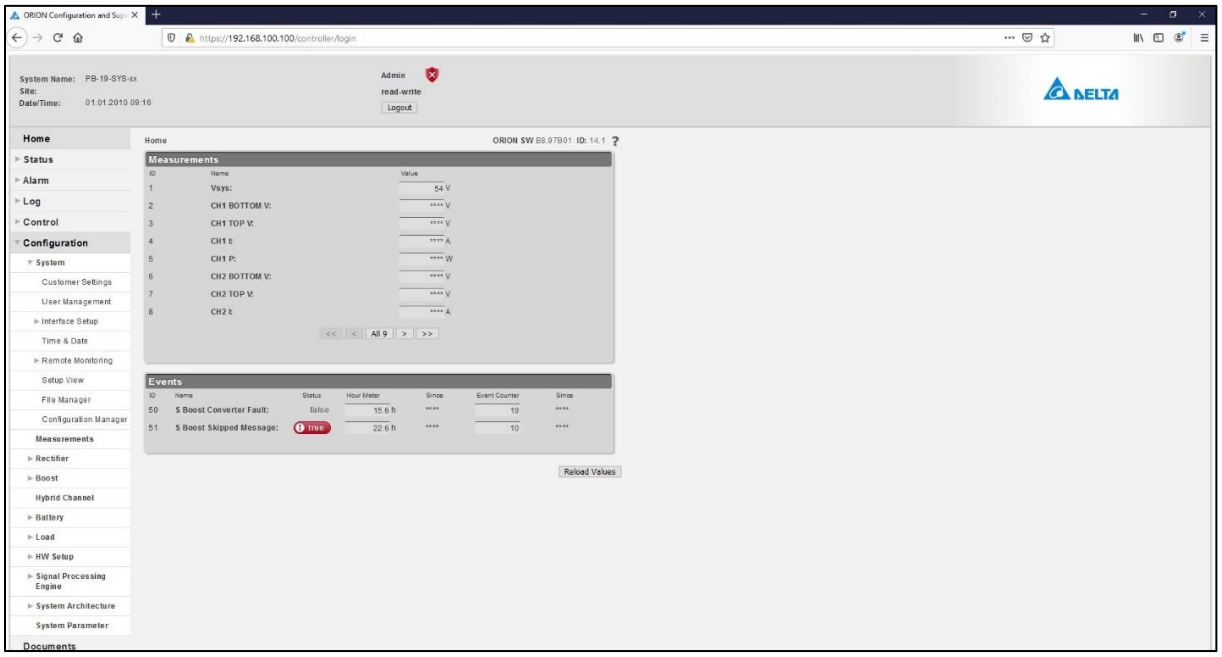
Below, find the Orion main screen after login. (Note: this image is displaying an "S Boost Skipped Message" alarm because the PowerBoost unit from which the screen was captured did not have connected Raycap telemetry at the time.)



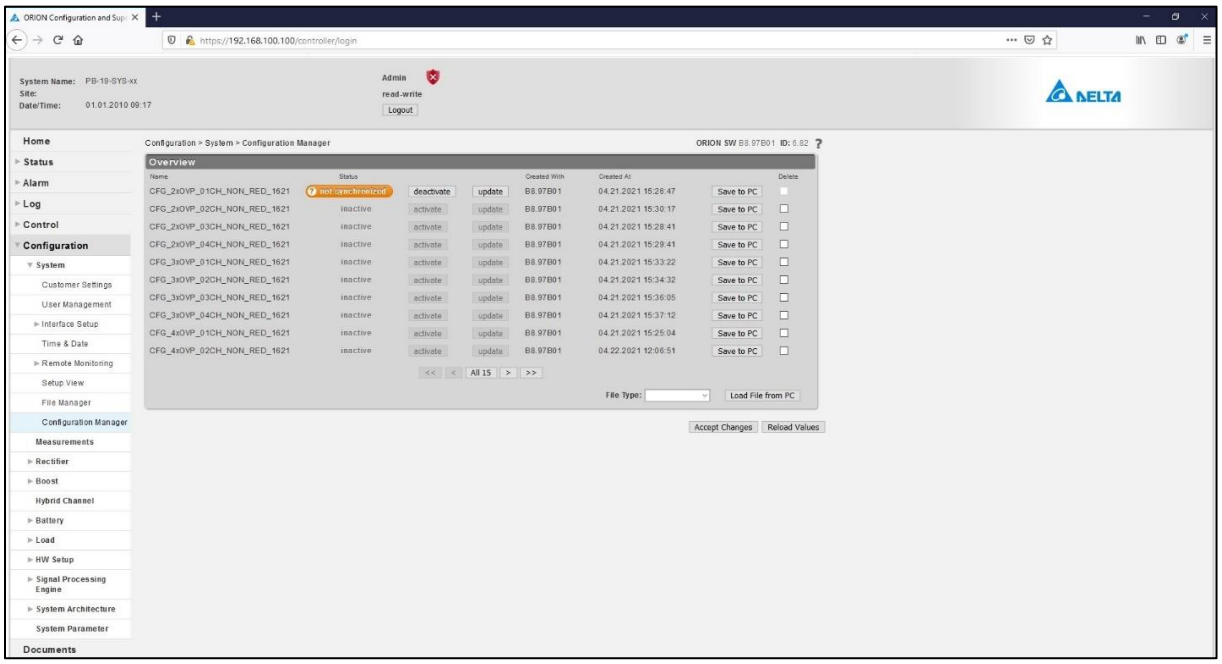
On the left side Menu, click **Configuration**.



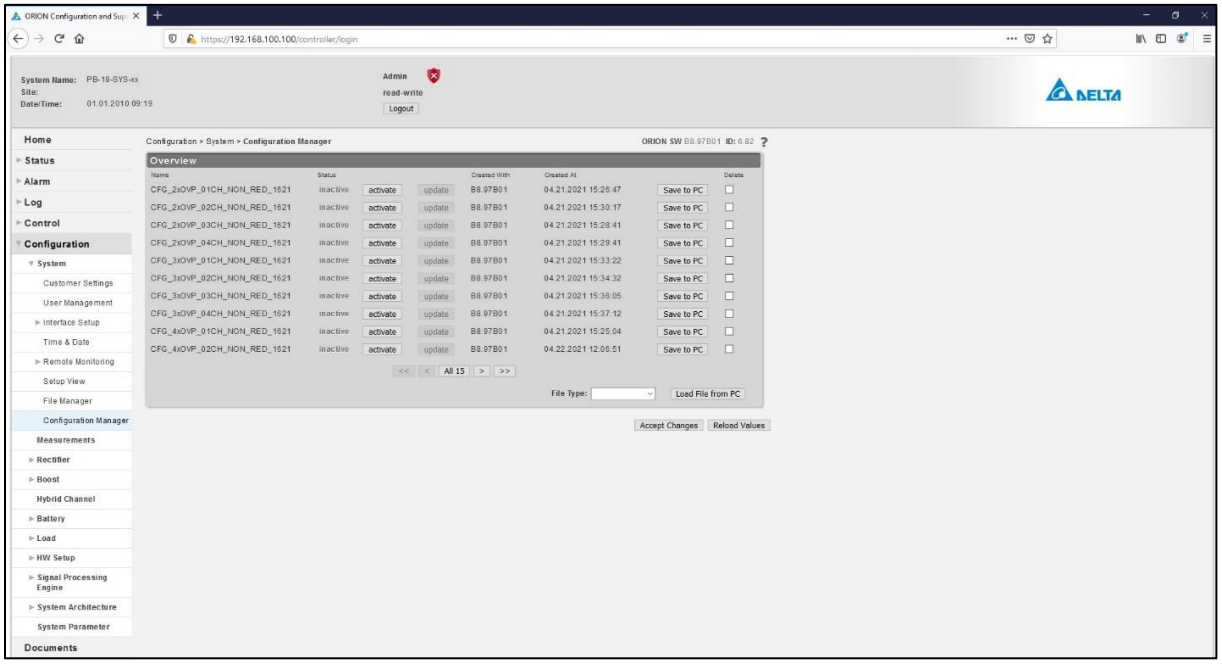
Under "Configuration," click **System.**



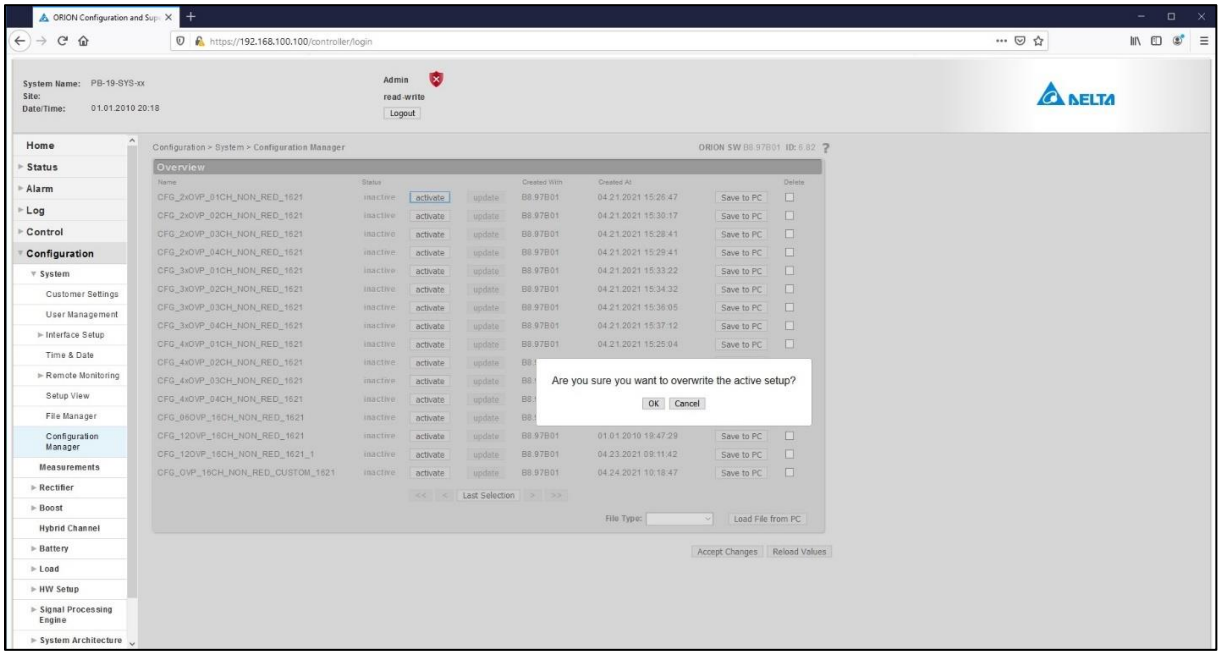
Under "System," click **Configuration Manager.**



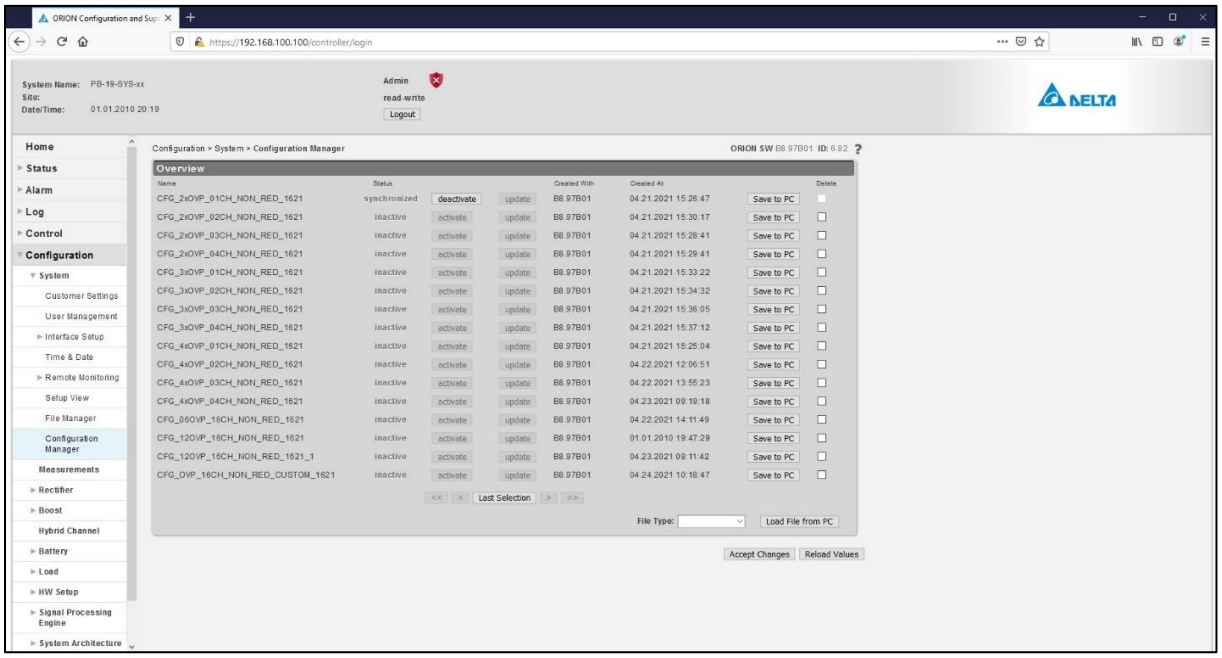
Deactivate the existing configuration file (if applicable). Select the desired configuration file and click **Activate.**



This will bring a confirmation dialogue box; click **OK**.



Allow a few seconds; Orion will activate the file, and the menu will appear as:

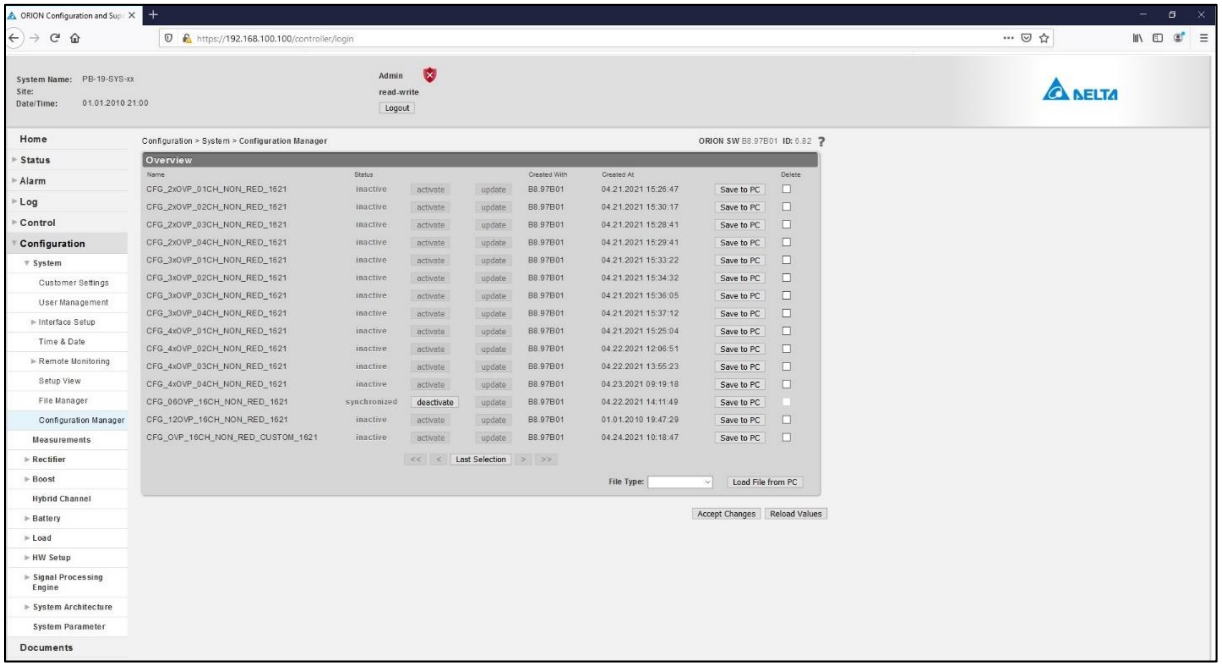


The first 12 config files (names CFG_2xOVP…, CFG_3xOVP…, CFG_4OVP…) are fully defined and no further action is necessary after following the steps above.

If using config file CFG_06VP… or CFG_12OVP…, go through the same steps as outlined above to select and activate the file.

These config files are shipped with all channels deactivated so the user can activate the desired channels. Channel activation is accomplished as follows:

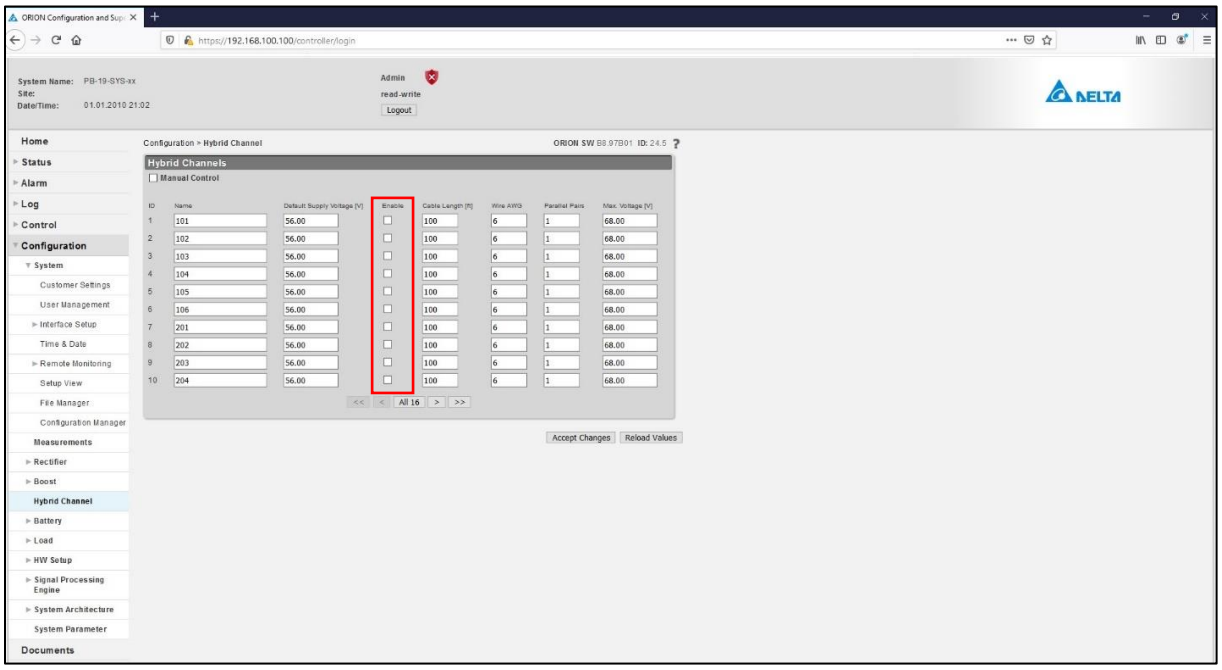
The image below shows example status after selecting and activating the "06OVP…" file per the preceding steps.



After activating the file CFG_06OVP… or CFG_12CHOVP, navigate menu path: **Configuration, System, Hybrid channel**. See image below. The purpose of navigating to this menu is to enable the desired channels.

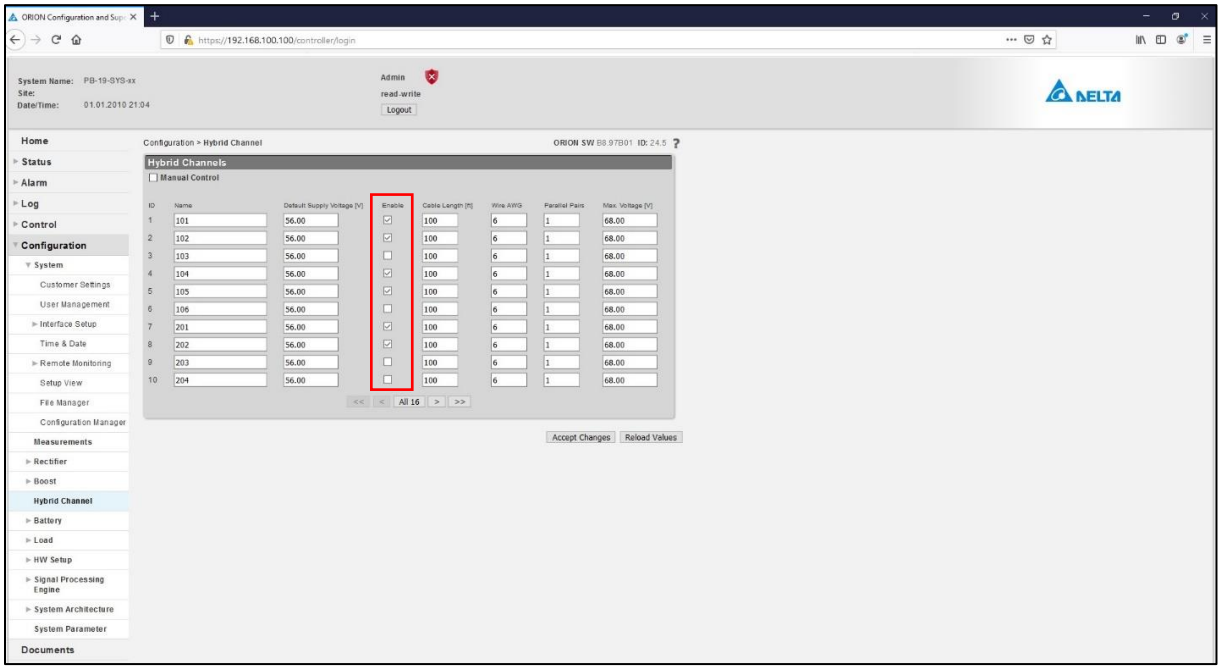
Note: Do not change other existing entries in this menu; focus is only on the "Enable" column.

See the "Enable" column, and note that none of the checkboxes are checked.

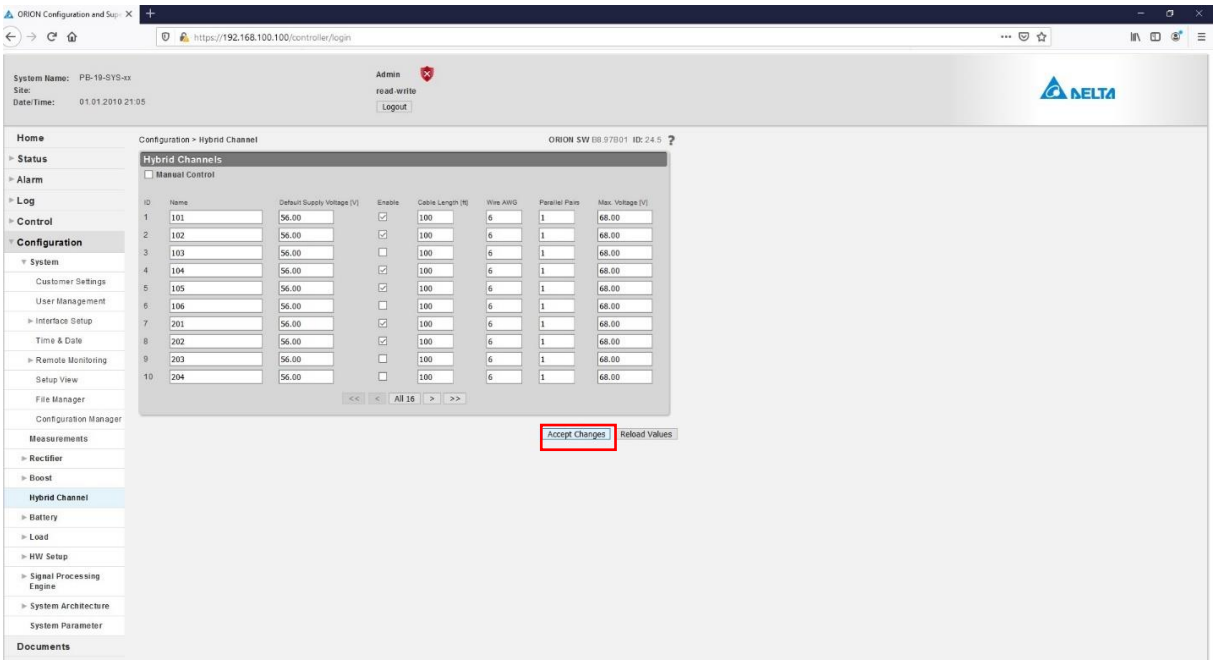


Place checks in the checkboxes for the channels desired to activate. See example image below: channels 1, 2, 4, 5, 7, 8 have been selected.

(Note: it is not necessary to use all channels in sequence. In this example, channels 3, 6, 9, 10 have not been enabled, as if the system design has left those channels and OVP positions unloaded for future build-out).

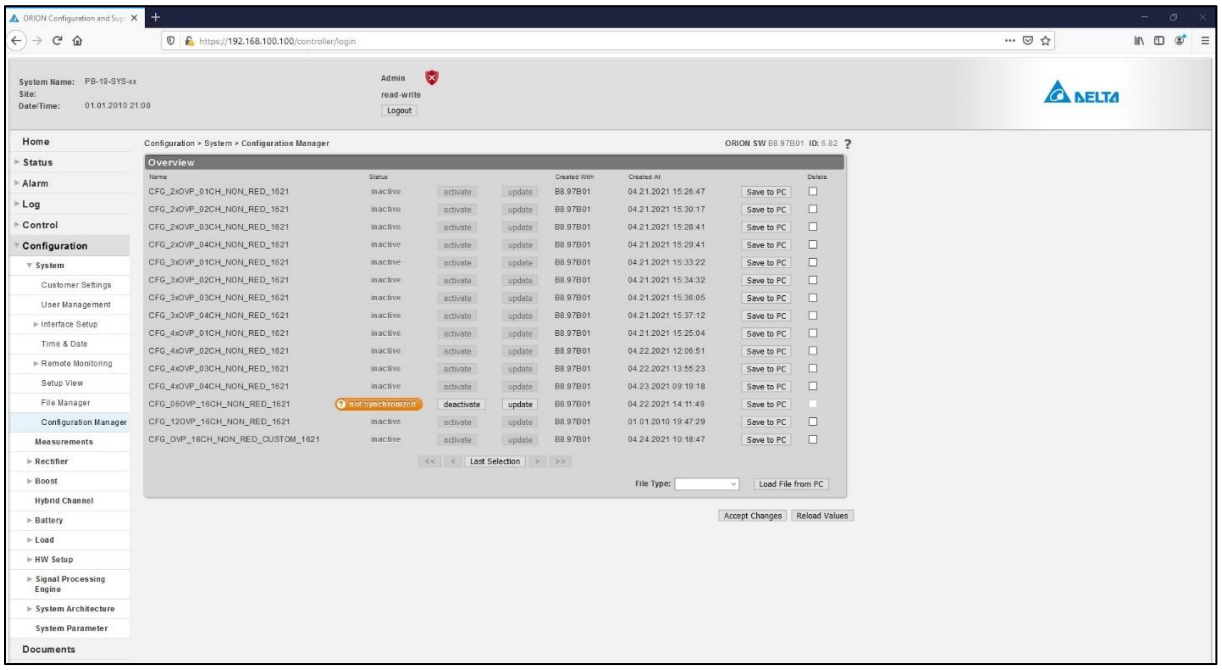


After selecting the "Enable" boxes for the desired channels, click **Accept Changes** at the bottom.

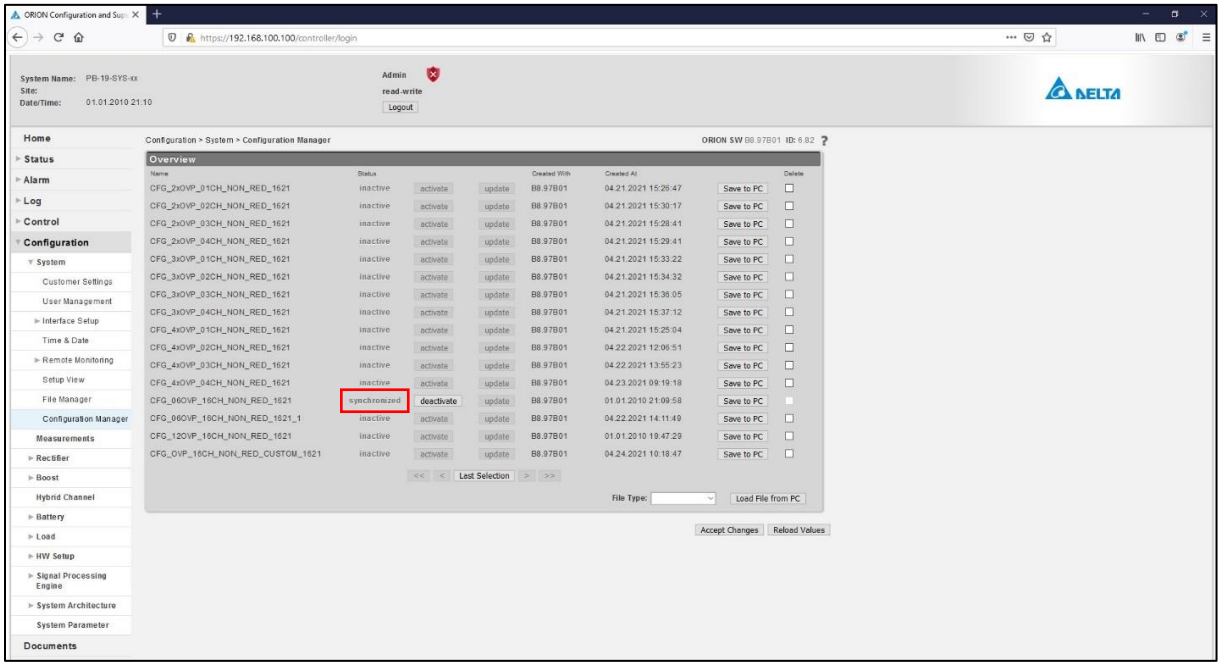


Important: after clicking **Accept Changes**, it is necessary to return to the menu **Configuration, System, Configuration Manager** to synchronize the config file.

Note that making the channel "Enable" changes in previous steps has resulted in config file status changing to "not synchronized."



Click the **Update** button associated with the config file. Allow a few seconds for Orion to process the update. See image below; the config file is now synchronized.



If using config file CFG_OVP_16CH CUSTOM…

The channels must be mapped, then enabled, then synchronize the file.

Note: engaging the "CUSTOM" file cannot be done via the Orion touch screen; access must be made via the Orion Ethernet GUI in order to perform the channel mapping entries.

First, select and activate the CUSTOM config file…

(**Configuration, System, Configuration Manager**: "Display all 15" config files as necessary.)

Deactivate an existing config file if necessary.

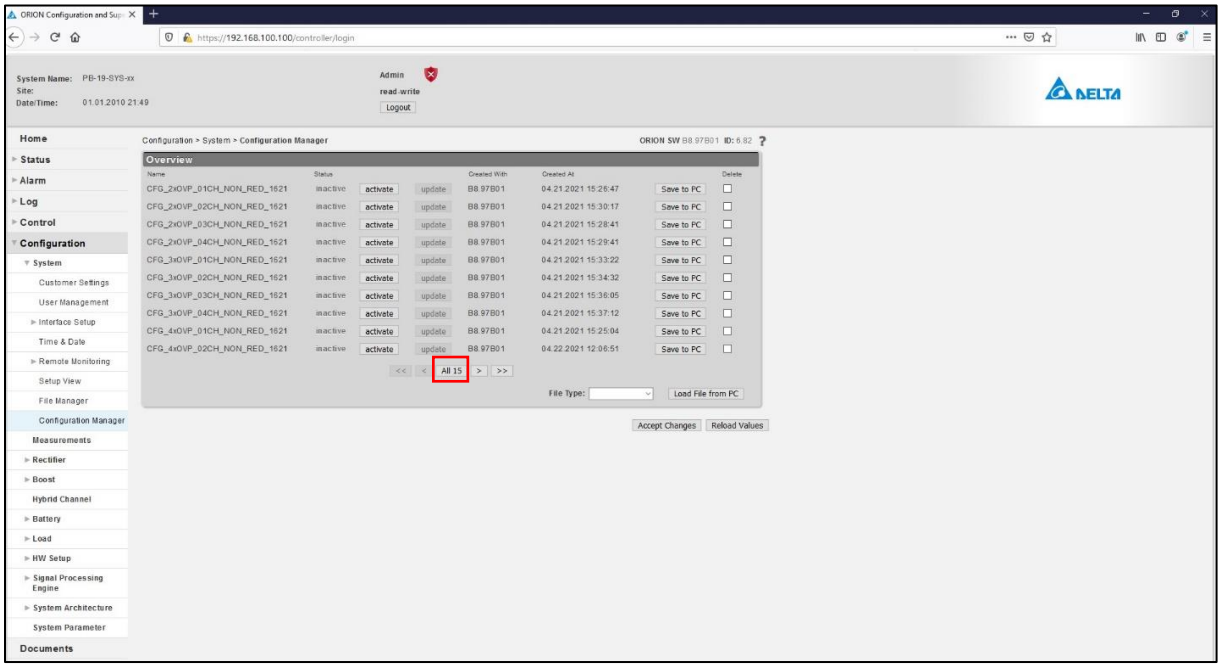
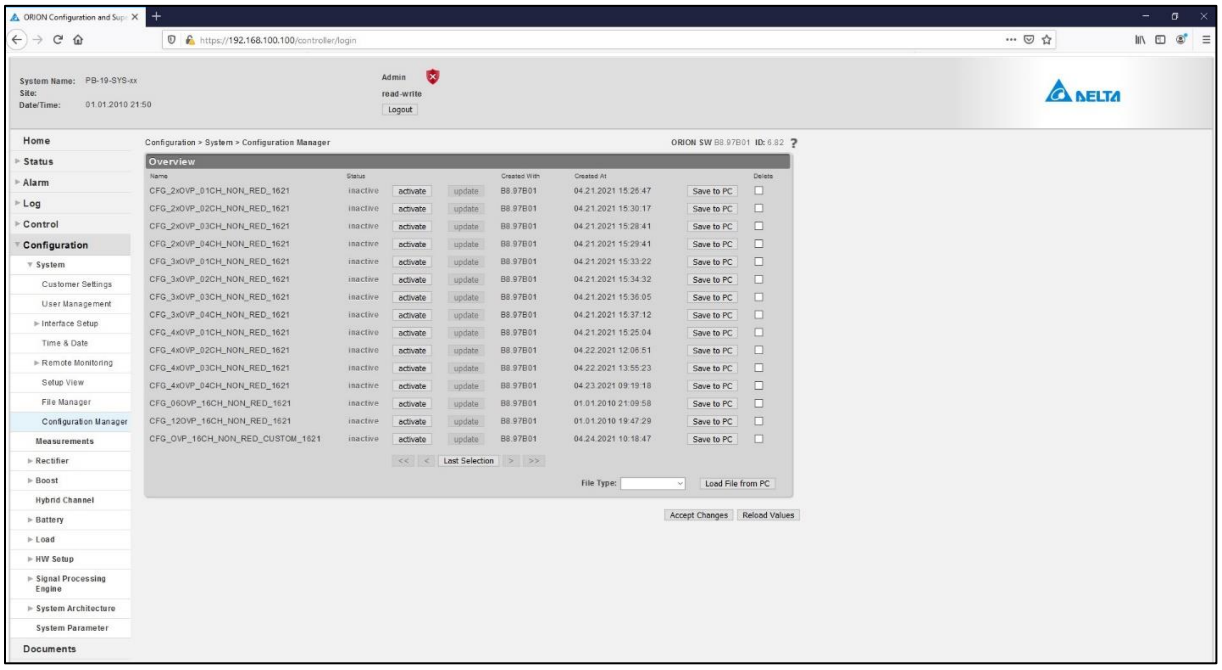
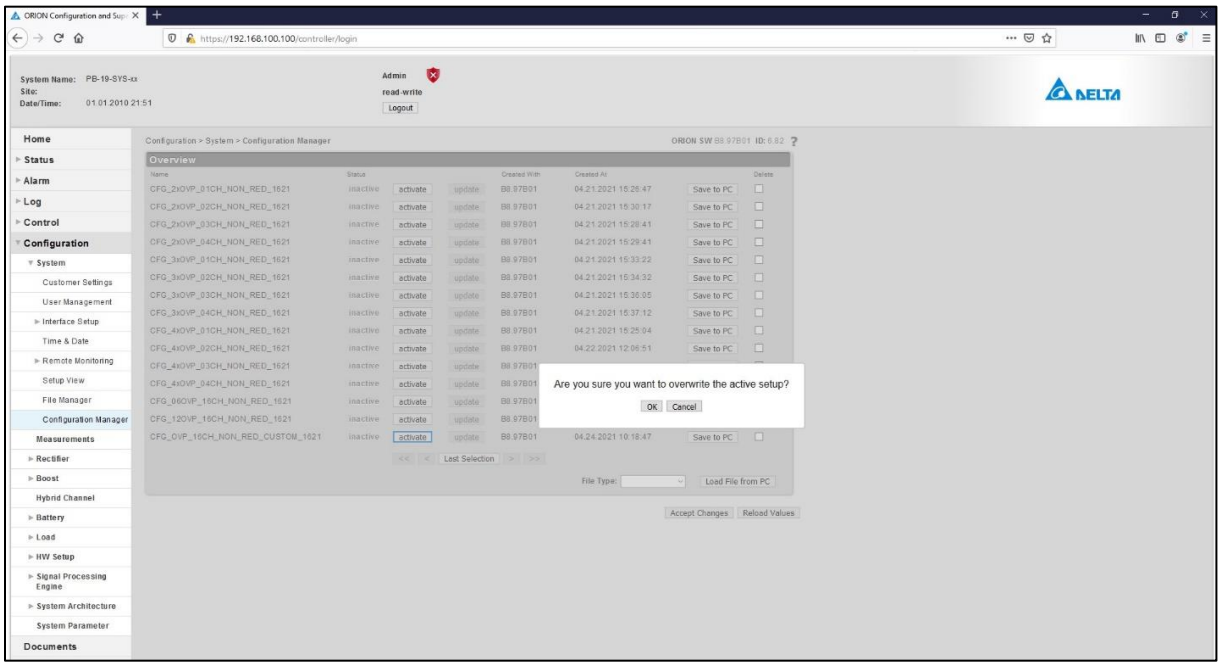


Image below shows the full config file list after clicking **All 15** button.



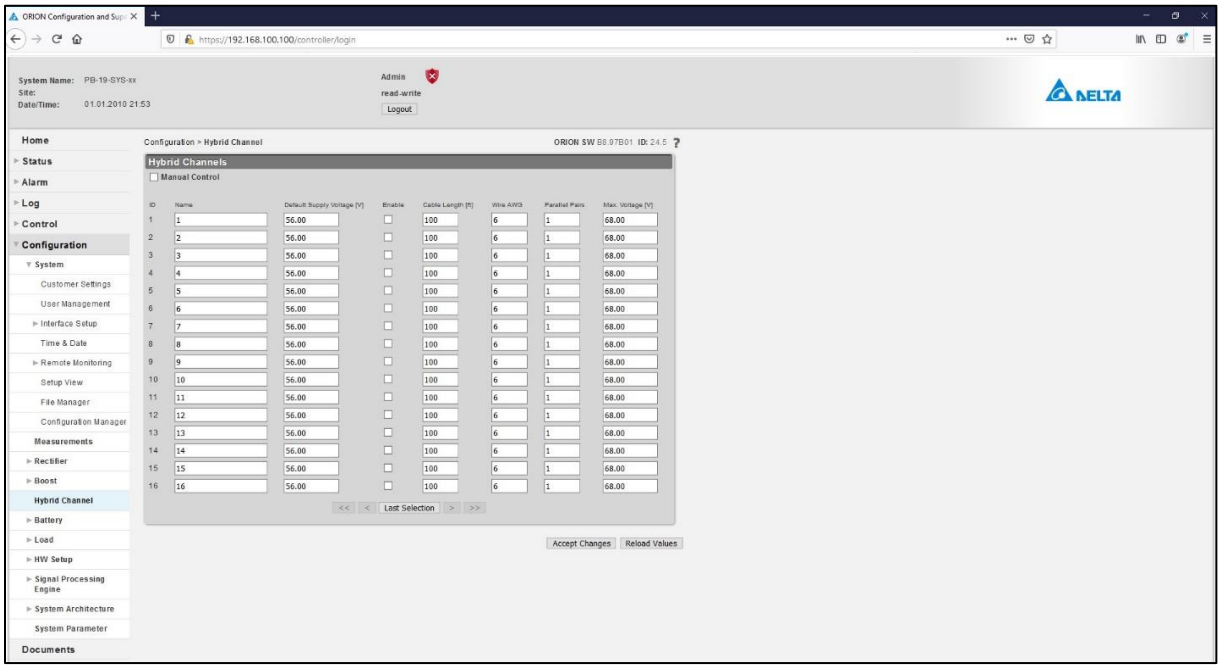
Select and activate the bottom file in the list CFG_OVP_16CH_NON_RED_CUSTOM…. Click **OK** to engage the file.



After activating the "CUSTOM" config file, navigate menu path: **Configuration, System, Hybrid channel**. See image below. The purpose of navigating to this menu is to do 2 things:

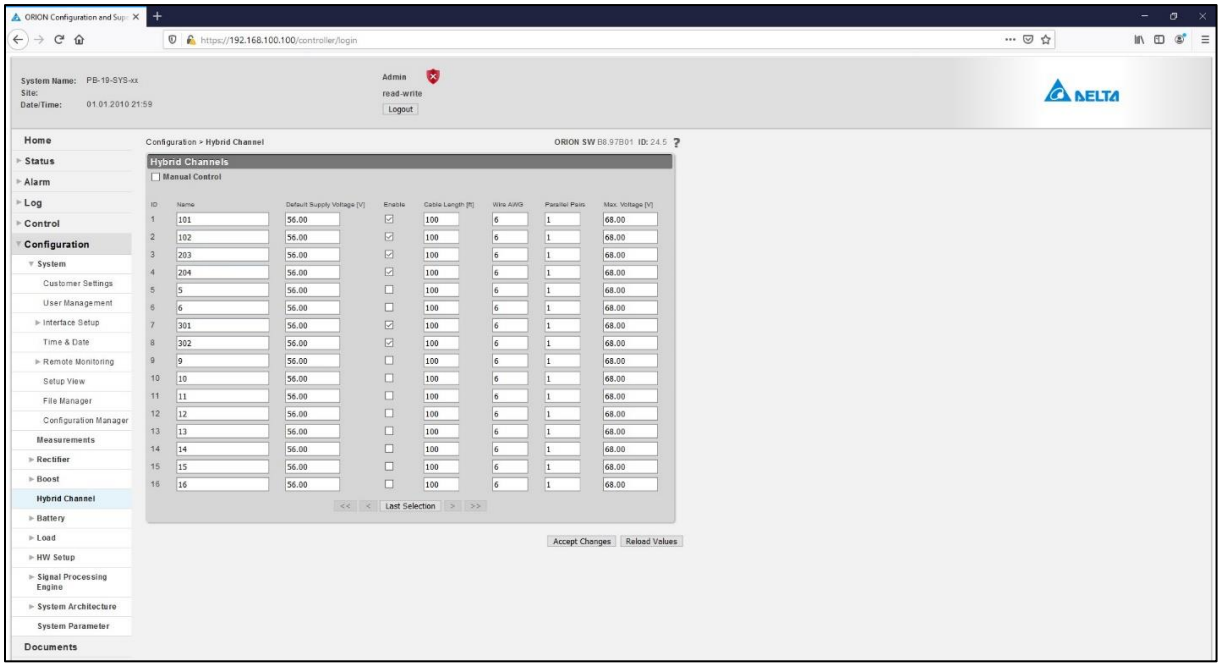
- Enter the desired channel mapping numbers in the "Name" column.
- Enable the desired channels.
- Enabled channels must have a valid OVP channel reference in their "Name" entry (ie. 101, 102, etc.). Enabling a channel that doesn't have a valid "Name" mapping entry will result in error message.

Note: Do not change other existing entries in this menu; focus is only on the "Name" and "Enable" columns.

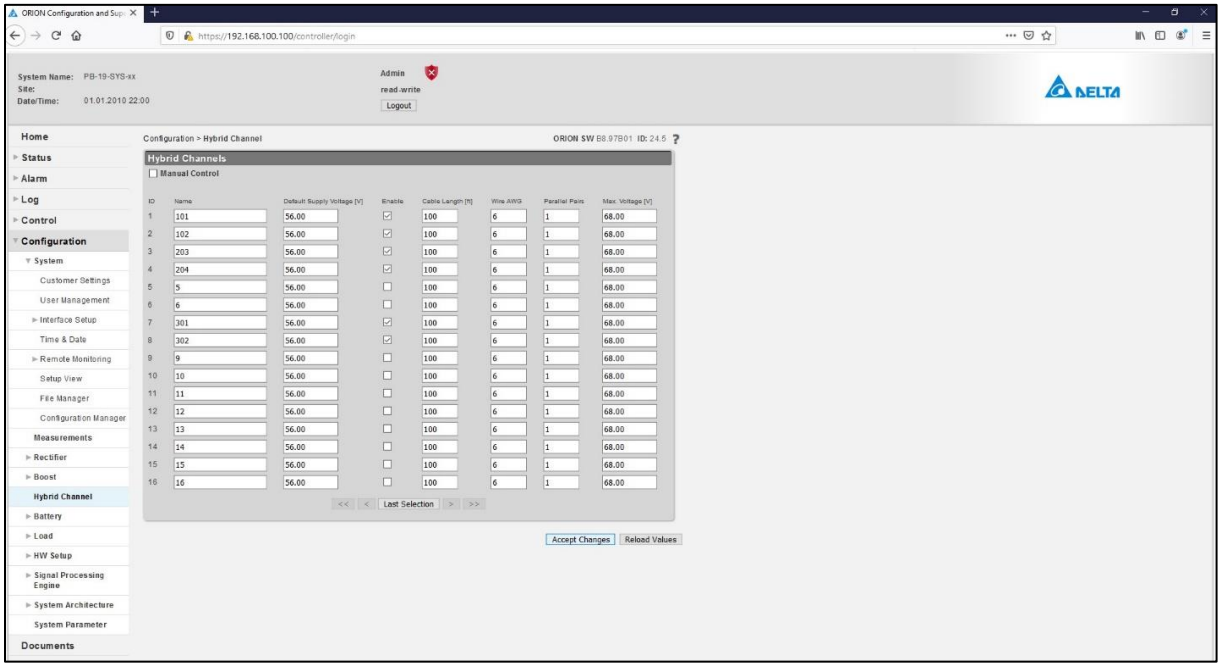


The example below shows the CUSTOM file configured such that:

- PB CH1 is mapped to OVP 101 (ie. first OVP set, CH1).
- PB CH2 is mapped to OVP 102 (ie. first OVP set, CH2).
- PB CH3 is mapped to OVP 203 (ie. second OVP set, CH3) (ie. skipped OVP ch 1&2).
- PB CH4 is mapped to OVP 204 (ie. second OVP set, CH4).
- PB CH7 is mapped to OVP 301 (ie. third OVP set, CH1) (ie. skipped PB ch 5&6).
- PB CH8 is mapped to OVP 302 (ie. third OVP set, CH2).



When finished making the "Name" and "Enable" entries, click **Accept Changes** at the bottom.



Important! After clicking **Accept changes**, the config file must be synchronized. Use the same procedure described on page 39 for the CFG_06OVP and CFG_12OVP files.

(Return to the menu **Configuration, System, Configuration Manager**, and click the **Update** button to synchronize the config file.)

Once the configuration file is selected and implemented:

- With all OMM circuit breakers OFF, insert boost modules only for the channels that are enabled.
- It is recommended to turn OMM circuit breakers on one at a time, and verify that the expected Raycap channel energizes.
- Confirm/troubleshoot as appropriate.
- Optional: once all channels are energized, one can proceed to Appendix I for closeout checklist.

Appendix A: Suggested lugs

Note: all input and output lug locations on the PowerBoost chassis, including ground bonding locations on the side, utilize 1/4” stud x 5/8” spacing.

The following crimp lug part numbers are provided for reference.

Wire size (AWG)	Recommended Burndy part number	Recommended Panduit part number
#8	YAZ8C2TC14FX	LCCX8-14A-L
#6	YAZV6C2TC14FX	LCCX6-14A-L
#4	YAZV4C2TC14FX	LCCX4-14A-L
#2	YAZV2C2TC14FX	LCCX2-14A-E
#1	YAZV1C2TC14FX	LCCX1-14A-X
1/0	YAZV252TC14FX	LCCX1/0-14A-X
2/0	YAZV262TC14FX	LCCX2/0-14A-X
4/0	YAZV282NT14FX	PennUnion BBLU4/0D2TC14 w/o inspection window via elecdirect.com

Appendix B: Circuit breakers for reference

Summary of circuit breakers and lug adapter kits for DC plant manufacturers Delta, GE, and Vertiv/Emerson.

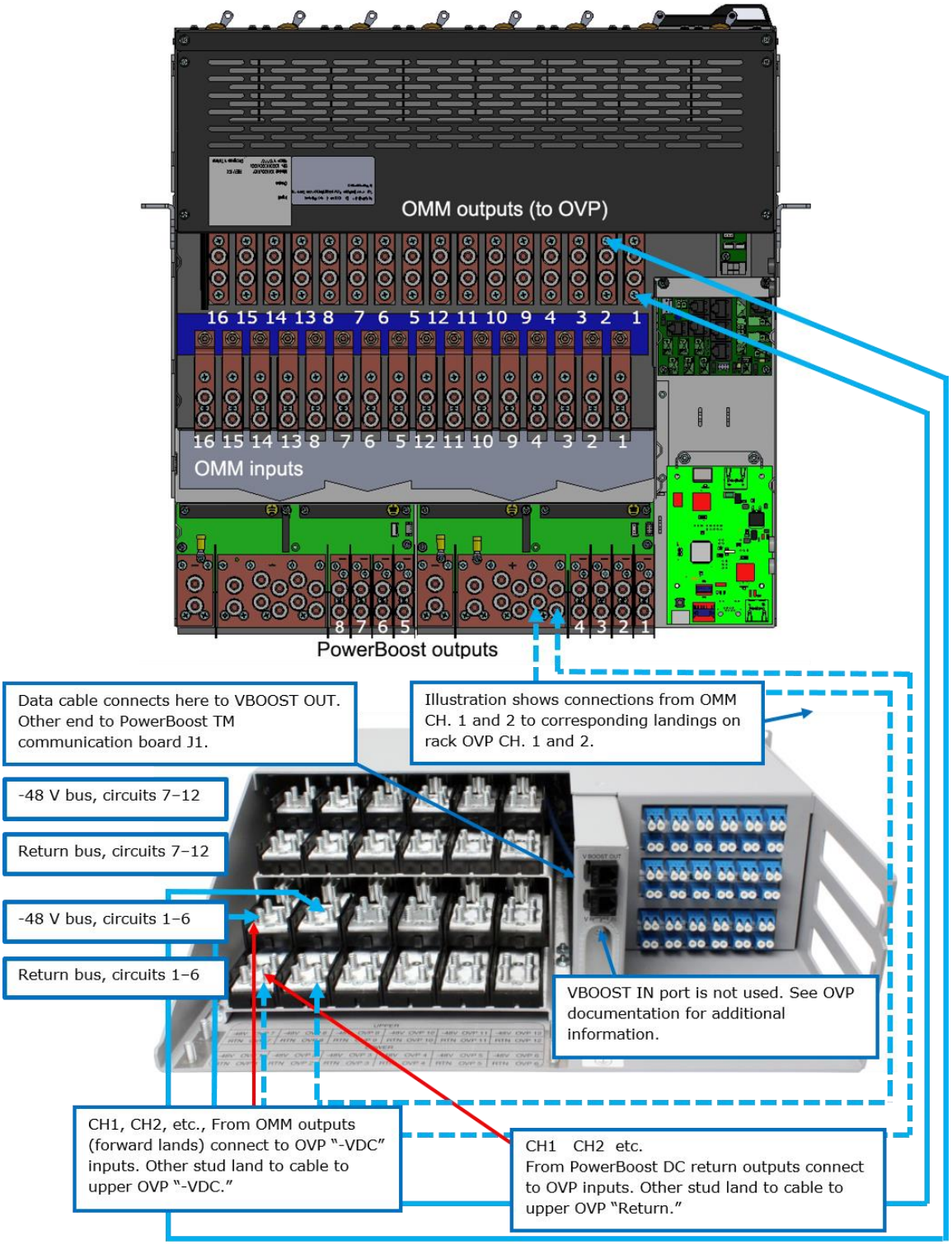
	Delta	GE	Vertiv/ Emerson
Circuit breaker 75A 1 pole	830692008	N/A	101609
Circuit breaker 80A 1 pole	830692108	407998251	121995
Circuit breaker 150A 2 pole	830734408	408185346	516839
Circuit breaker 200A 2 pole	830746508	408544076 (See Note 1)	121832
Circuit breaker 200A 3 pole	xx	408564941	xx
Circuit breaker 225A 3 pole	N/A	408573975	144886
Circuit breaker 250A 3 pole	830730008	408535752	121836
Note: 2-pole and 3-pole breakers require lug adapters. Info below:			
Lug adapter kit 2 pole (conn posts 3/8 x 1.0)	3799235700-S	850021775	534449
Lug adapter kit 2 pole (conn posts 1/4 x 5/8)		CC848756916	
Lug adapter kit 3 pole (conn posts 3/8 x 1.0)	3799236400-S	850021955	514714
Lug adapter kit 3 pole offset (conn posts 3/8 x 1.0)		CC848756924	

# of CH	Typ. Breaker (A) *
1	75 or 80
2	150
3	200 or 225
4	250
* For reference only. Consult local system design standards/requirements.	

Note 1: For GE/ABB plant:

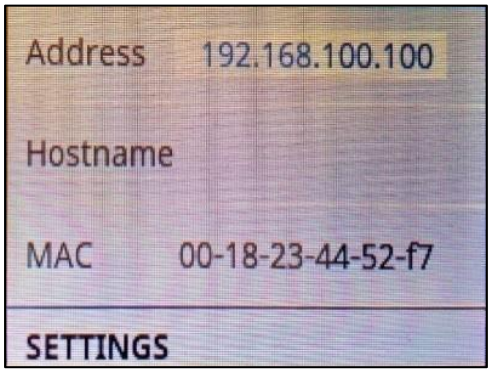
- 100A/pole buss to use 2-pole 200A breaker, and requires no spacing (modern 600A & 900A plants).
- 70A/pole buss requires a space between the next breaker when using a 2 pole; pre 2015.

Appendix C: Connections from PowerBoost output to rack mount "near" OVP input



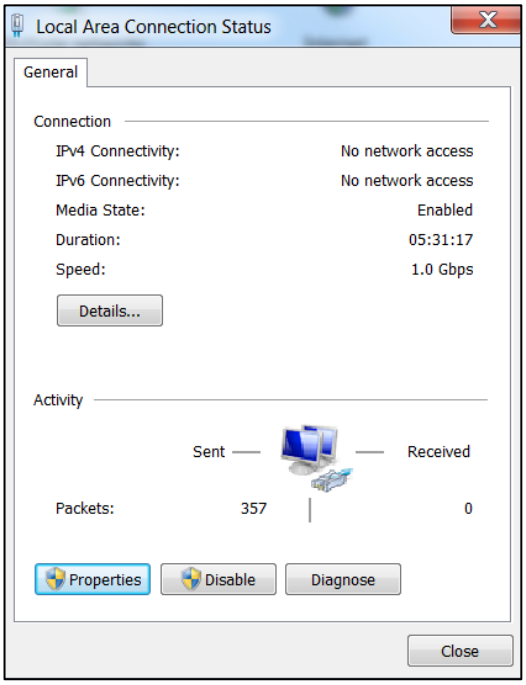
Appendix D: Orion GUI login

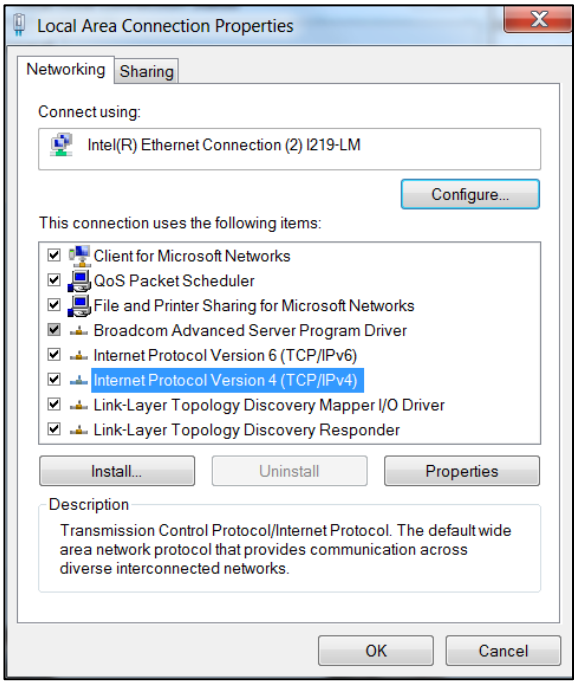
- Swipe through the menu options on the Orion controller screen and find the network option. Identify and remember the IP address on the controller.



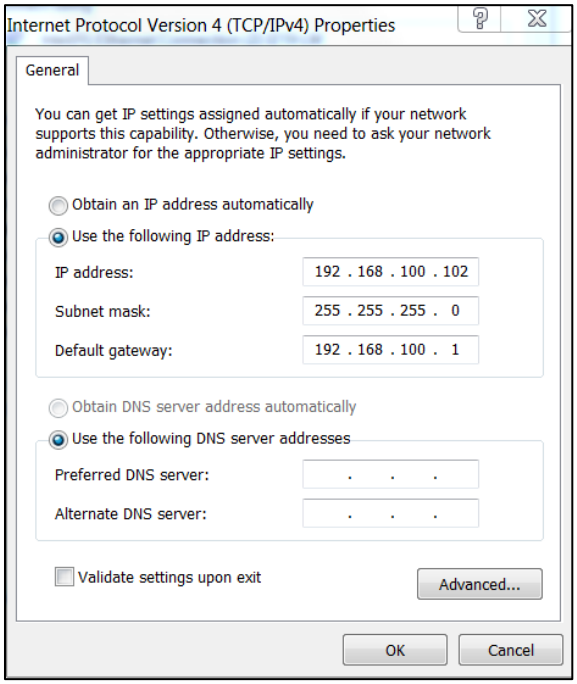
- Connect the Ethernet cable to the Orion controller and the other end of the cable to your laptop/PC.
- Go to **Control Panel** on your laptop → **Network Sharing center** → **Local Area connection**.

- Go to **Properties → Internet Protocol Version 4 (TCP/IPv4).**





- Change the properties to match the IP address identified in the first bullet and click **OK**.



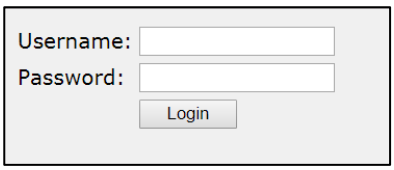
Note: You will only need to perform the above steps when you are connecting the first time or if you change the IP address settings to different properties.

Logging into the Orion:

- Open the webpage on your laptop/PC and type in the address https://192.168.100.100
- On entering the IP address on the webpage, it will direct you to a login page. Log in with the following credentials:

Username: Admin

Password: orion



Appendix E: OVP Configurations and channel mapping

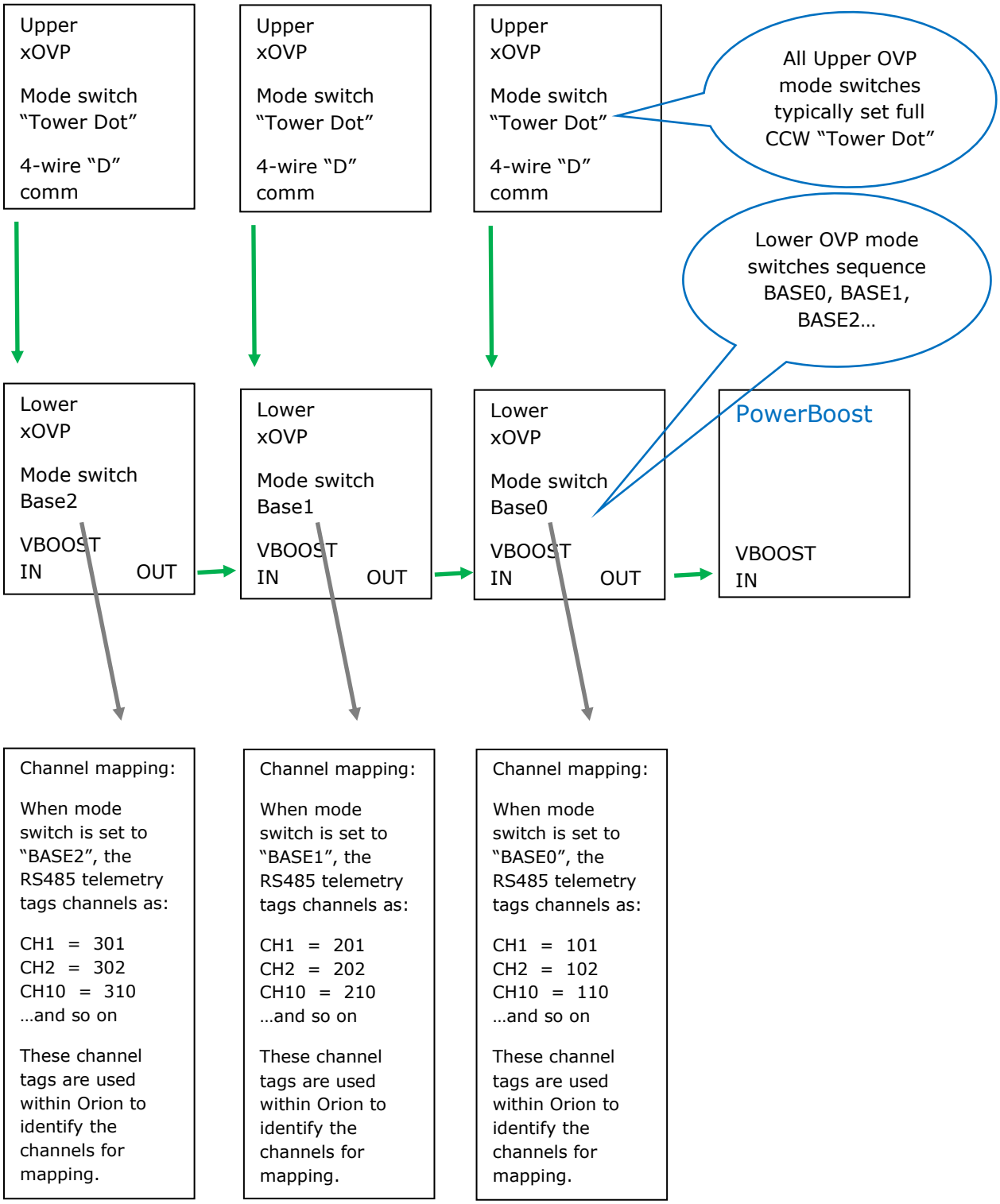
General overview of Raycap OVP telemetry connections for reference

This information is provided for general reference only; consult Raycap information for setup and troubleshooting. In the event of conflicting information, information from Raycap company or documentation should take precedence.

See diagram below. (Diagram shows only the RS485 "OVP telemetry" wiring, not the radio power cables.)

- OVP units are generally organized in pairs containing 1 upper and 1 lower OVP.
- Each OVP unit has a rotary mode switch selector that must be set correctly.
- Upper OVP units typically have their mode switches set same = "Tower Dot" (fully CCW).
- Each upper OVP unit has data wires that connect to its corresponding lower OVP unit. (Typically 4 wires connected at green & orange terminal blocks "TOWER COMM" ports.)
- Lower OVP units have their mode switch set to BASEx (where "x" is a number 0,1,2...)
    - If using just 1 pair of upper and lower OVPs, the lower OVP mode switch is set to BASE0.
        - VBOOST OUT from the lower OVP connects to VBOOST IN at PowerBoost.
    - If using 2 or more OVP pairs, the lower OVP mode switches are set in sequence BASE0, BASE1, BASE2, etc.
        - Lower OVP BASE0 VBOOST OUT connects to PowerBoost VBOOST IN.
        - Lower OVP BASE0 VBOOST IN comes from BASE1 VBOOST OUT.
        - Lower OVP BASE1 VBOOST IN comes from BASE2 VBOOST OUT and so on.
        - Note that only one OVP base unit connects to PowerBoost "VBOOST IN."
- Important! The power wiring conductors must connect to SAME channel number at upper and lower OVP. (Not shown in diagram)
- Diagram below shows general OVP configuration for introduction.

Note: Other configurations are supported; contact JMA technical support (888-201-6073) with any questions.



Explanation of channel mapping:

There exists PowerBoost channels 1-8 (for PB-19-SYS-8), or channels 1-16 (for PB-19-SYS-16).

Within the PowerBoost Orion GUI, OVP channels are tagged to the PowerBoost channels as described below.

As described in the diagram above, Raycap OVP channels are identified by the mode select switch on the lower OVP unit(s):

- For a single lower OVP unit, mode select is set to BASE0.
  - In that setting, the OVP channels are identified as 101 (OVP CH1), 102 (OVP CH2) etc. up through 106 or 112.
- When two lower OVP units are daisy-chained together, the first lower OVP unit mode select is set to BASE0, and the second lower OVP unit is set to BASE1.
  - In that setting, channels of the BASE0 OVP are identified as 101, 102, etc.
  - Channels of the BASE1 OVP are identified as 201, 202, etc.

The approach remains same for daisy-chaining more lower OVP together.

The third lower OVP mode select is set to BASE2, and its channels would be identified as 301, 302, etc.

A fourth lower OVP in daisy-chain would have its mode select set to BASE3, and its channels would be identified as 401, 402, etc.

These numbers 101, 102… 201, 202… are used by PowerBoost to map the given OVP channels to the PowerBoost channels 1-8 (SYS-8) or 1-16 (SYS-16).

A note about configuration files: Think of the config file in same general manner as a radio channel preset button. The config file is a convenience device that sets one or more (typically several) parameters within the Orion controller. Selecting and engaging a config file saves time that would otherwise be spent navigating to and altering the various parameters.

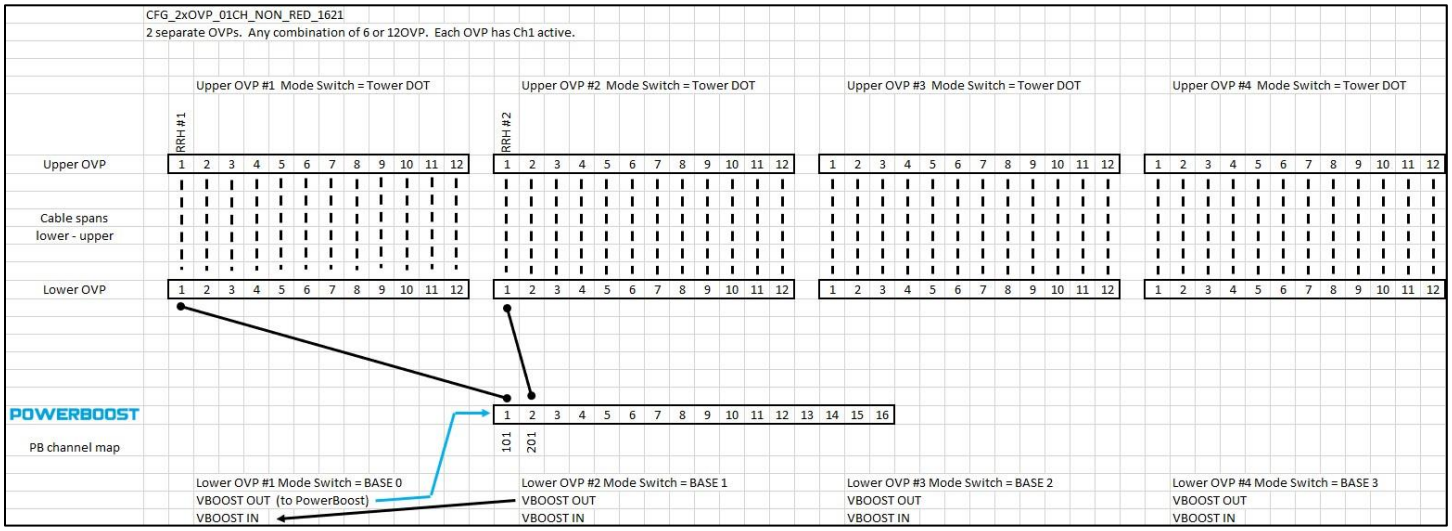
PowerBoost includes a set of pre-made configuration files which address the following:

- A group of config files which directly address the most common anticipated system designs. (Simply select the diagram that matches the system, and engage that config file.)
- A pair of config files which facilitate sequential channel use in 2 common variations. (Daisy-chained pair consisting of 6OVP + 12OVP, or 12OVP + 6OVP – simply select the appropriate config file, then enable the desired channels)
- A config file that allows the user to easily map channels as desired. (Select the "CUSTOM" config file, enter the desired channel mapping for each of the 8 or 16 PowerBoost channels, then enable the desired channels.)

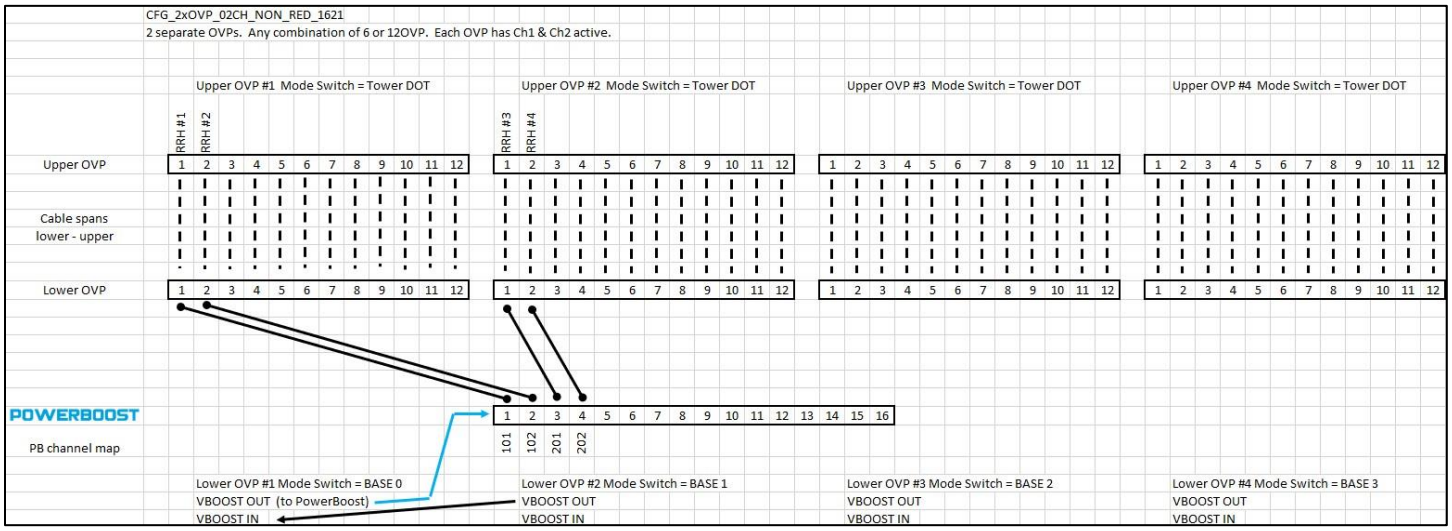
Image below shows the list of configuration files as seen in the Orion graphical user interface.

Next, for each configuration file, a basic diagram and notes are provided:

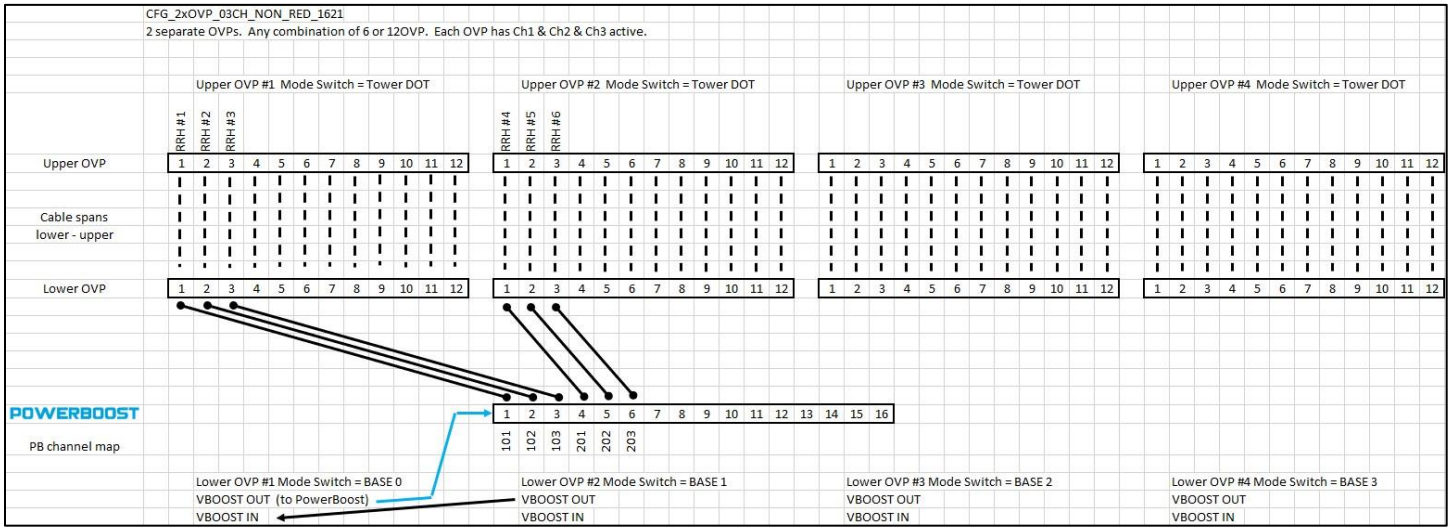
CFG_2xOVP_01CH_NON_RED_1621



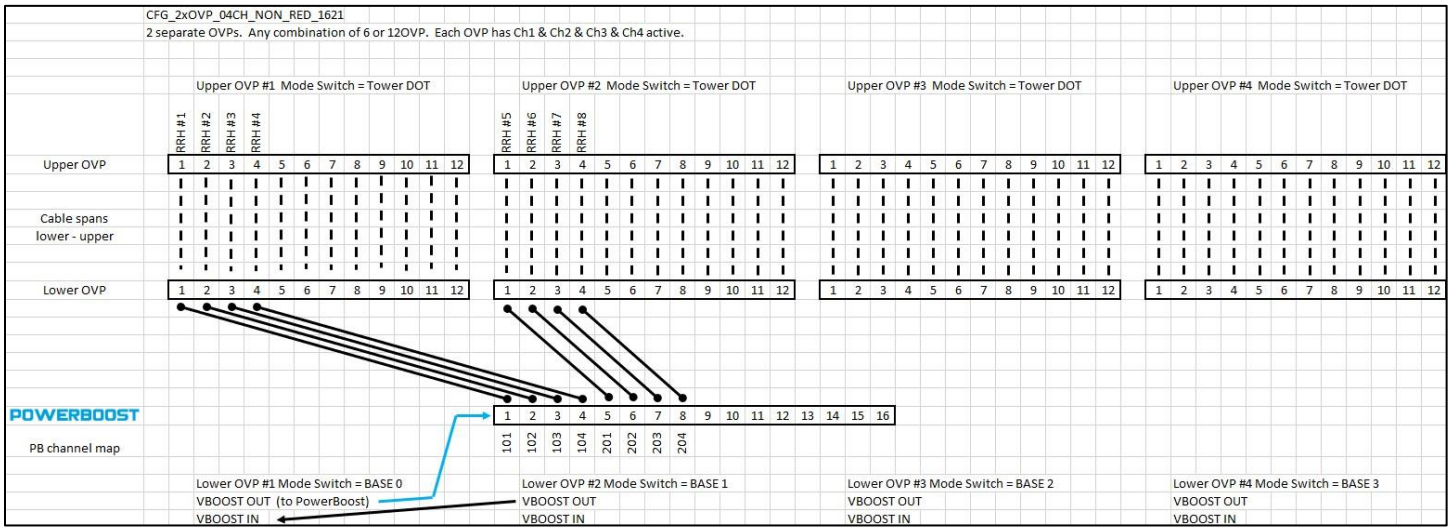
CFG_2xOVP_02CH_NON_RED_1621



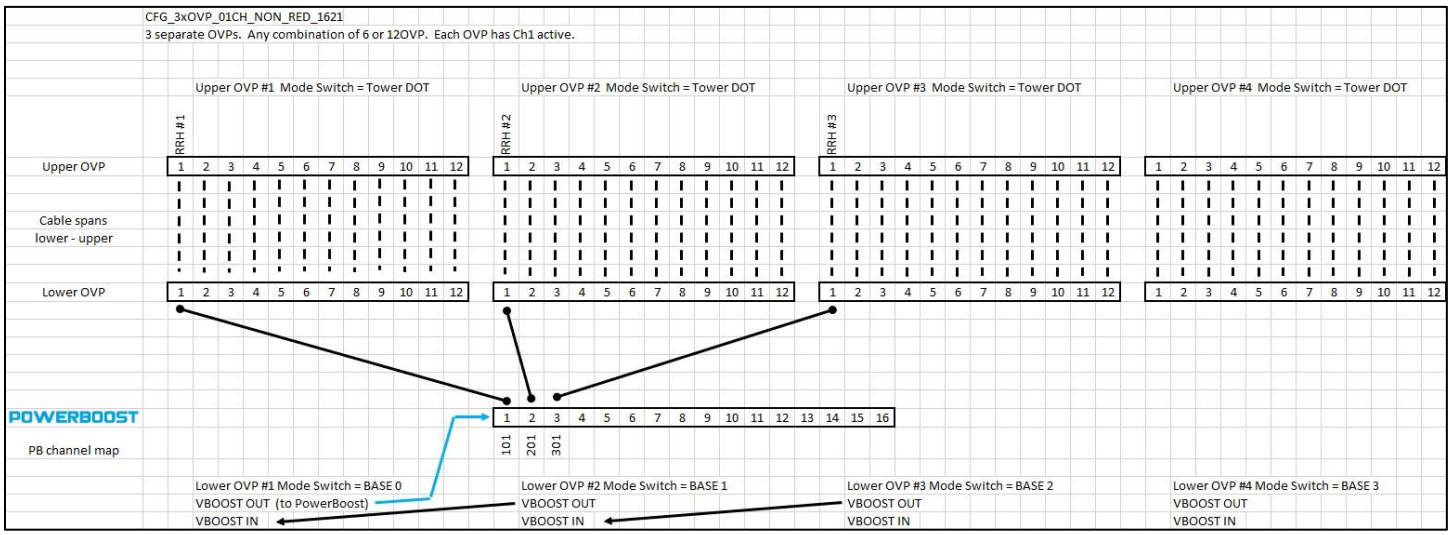
CFG_2xOVP_03CH_NON_RED_1621



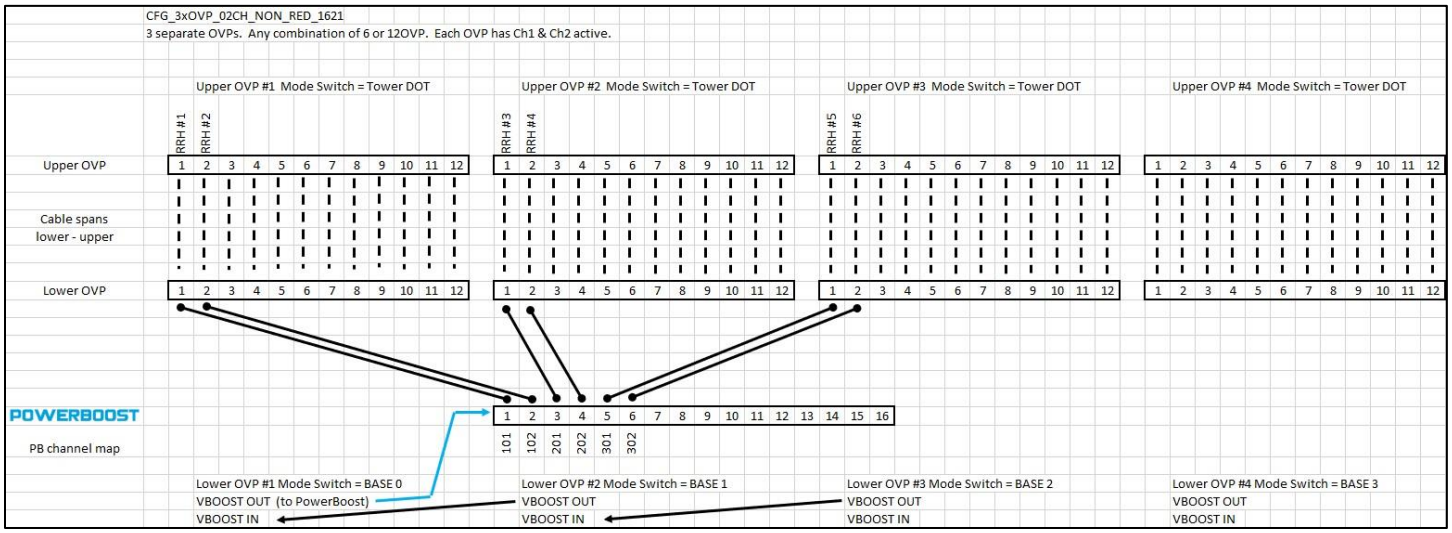
CFG_2xOVP_04CH_NON_RED_1621



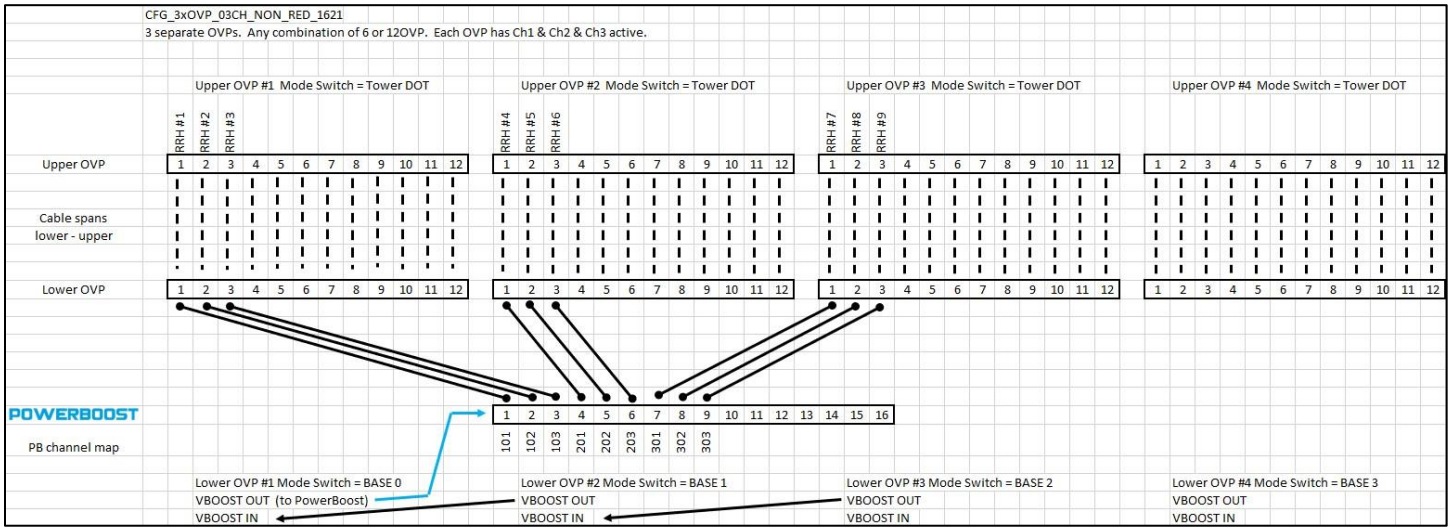
CFG_3xOVP_01CH_NON_RED_1621



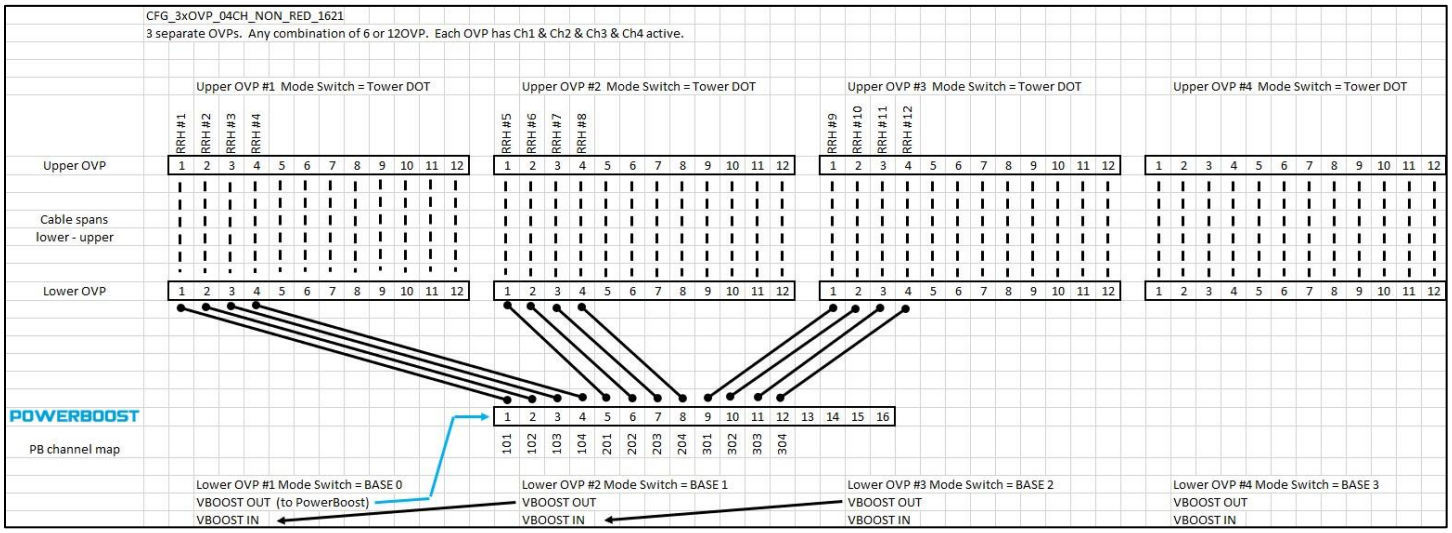
CFG_3xOVP_02CH_NON_RED_1621



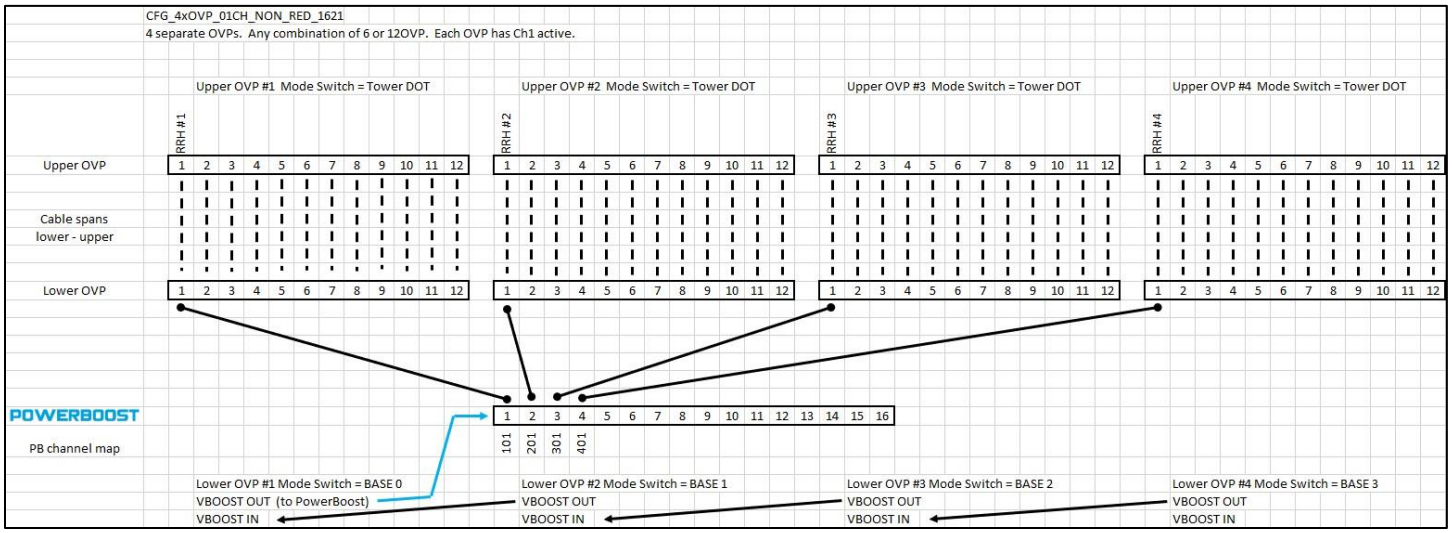
CFG_3xOVP_03CH_NON_RED_1621



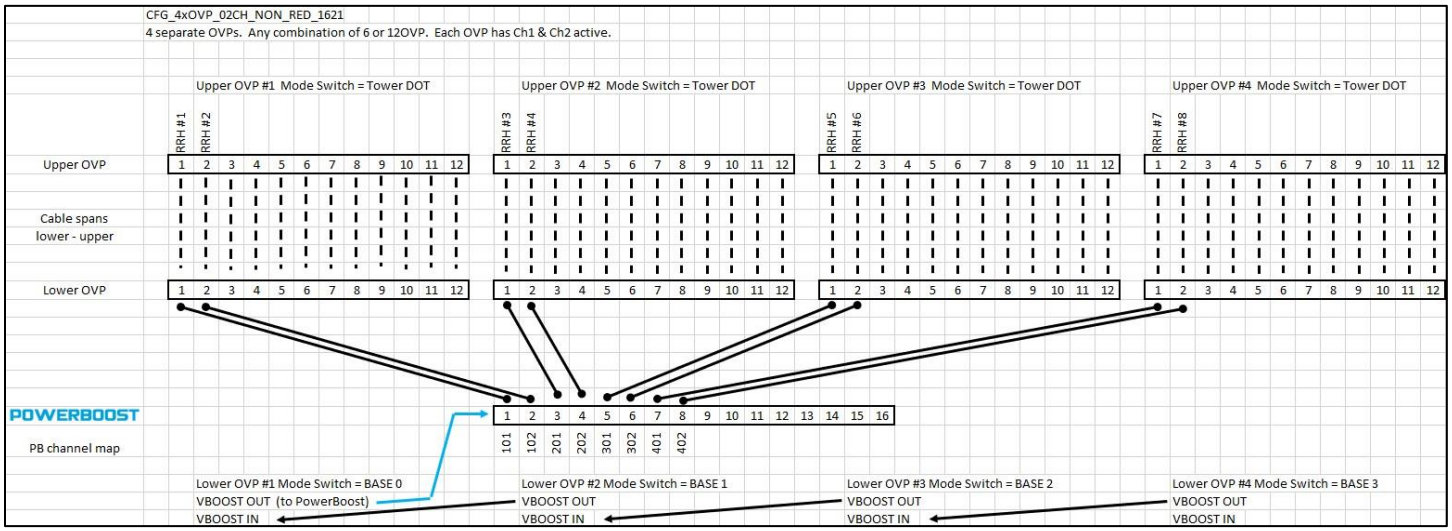
CFG_3xOVP_04CH_NON_RED_1621



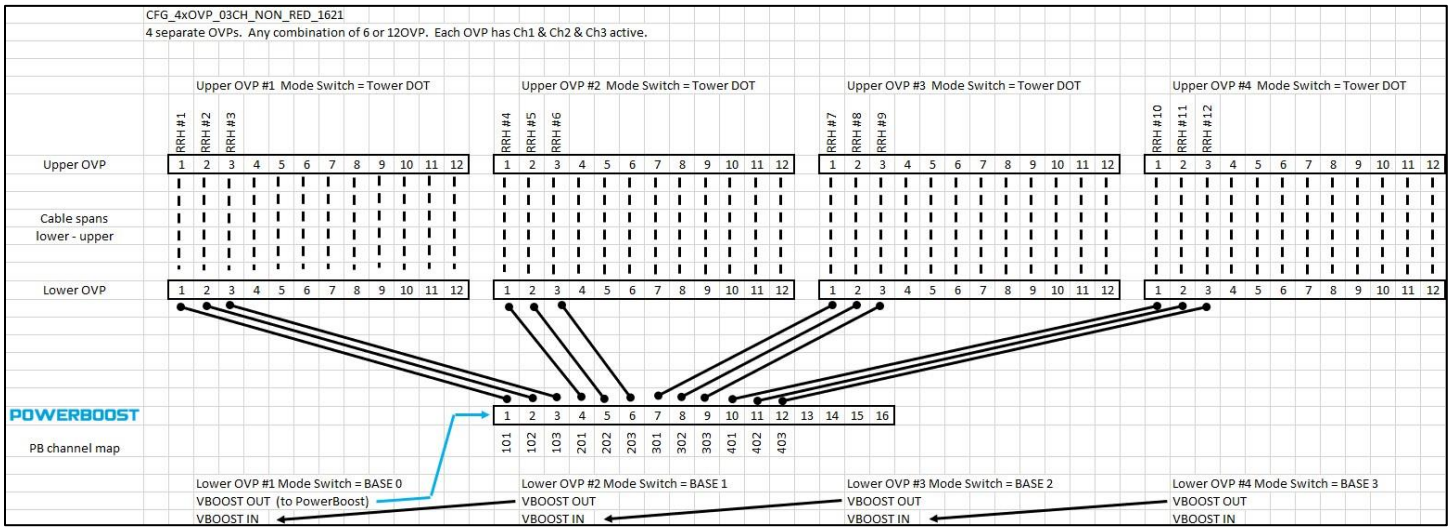
CFG_4xOVP_01CH_NON_RED_1621



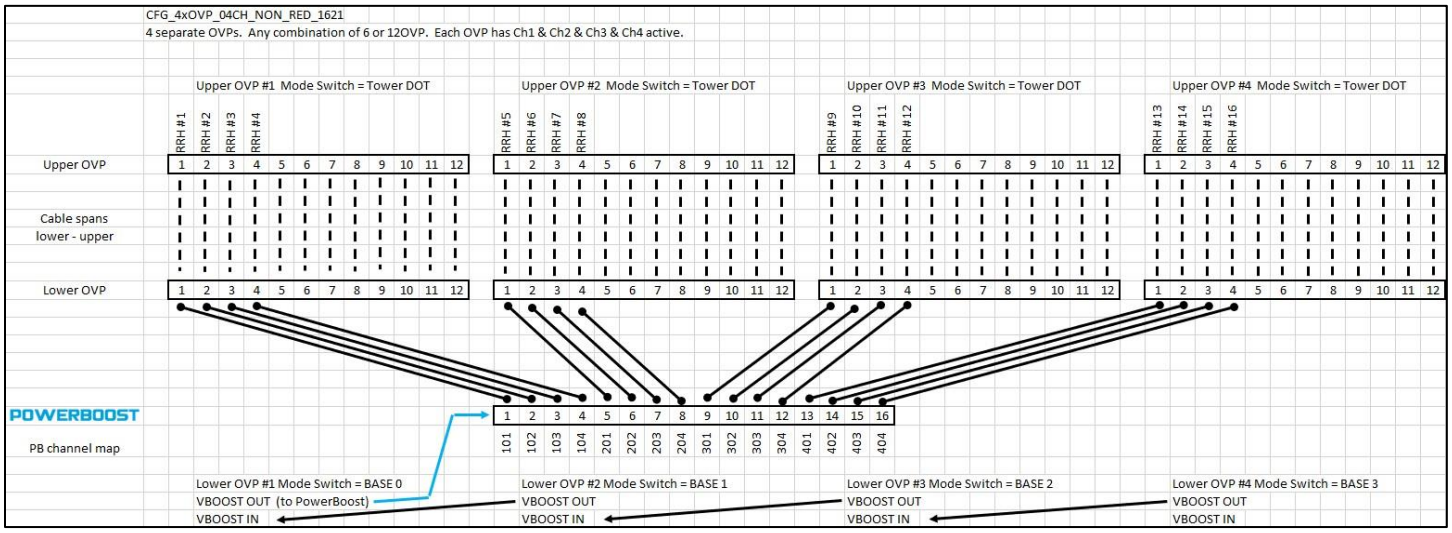
CFG_4xOVP_02CH_NON_RED_1621



CFG_4xOVP_03CH_NON_RED_1621



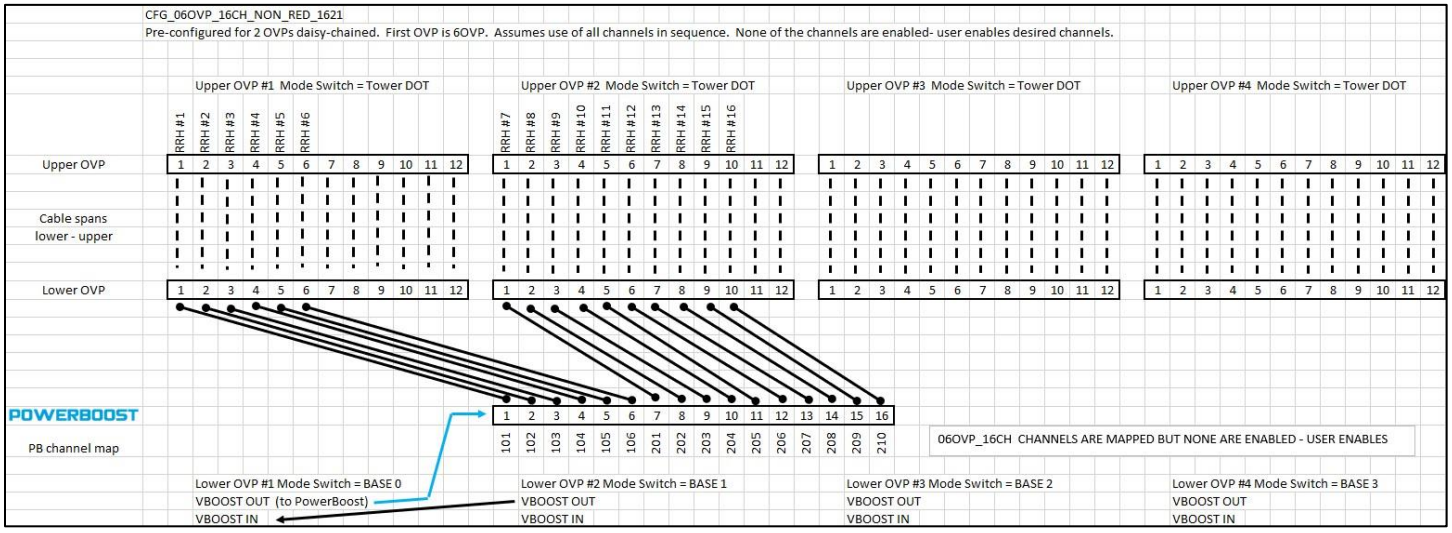
CFG_4xOVP_04CH_NON_RED_1621



CFG_06OVP_16CH_NON_RED_1621

This configuration file maps the channels as shown, but by default none of the channels are enabled.

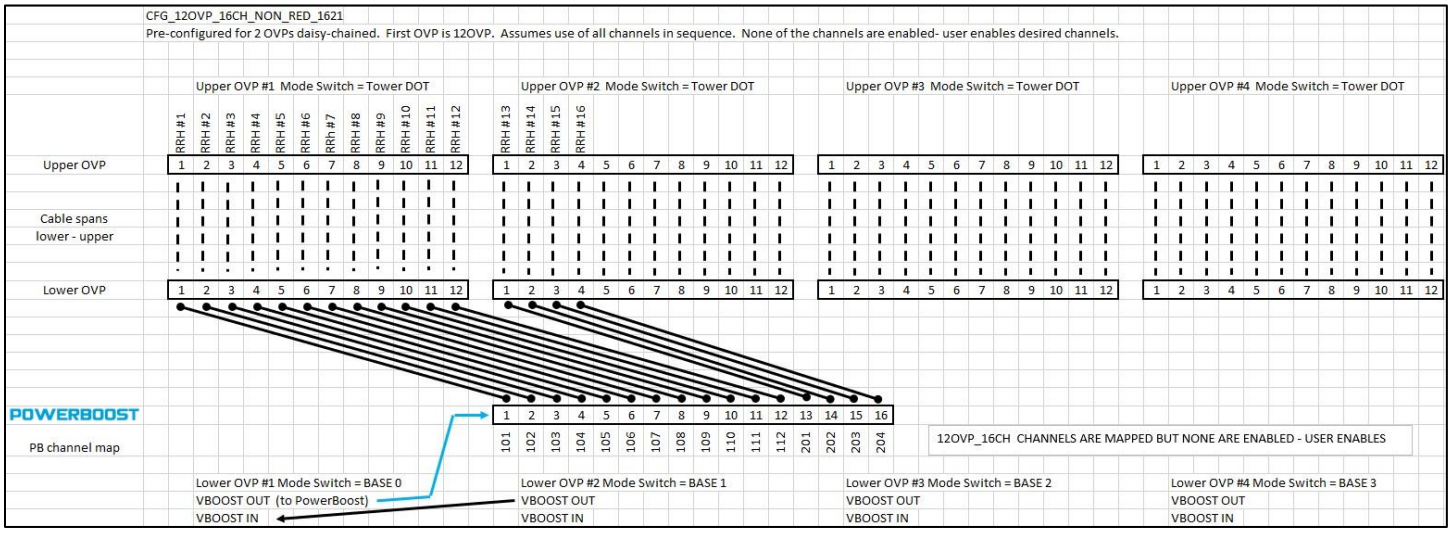
After activating this configuration file, an extra step is required to enable the desired channels then synchronize the file. See sync instructions, pg 39.



CFG_12OVP_16CH_NON_RED_1621

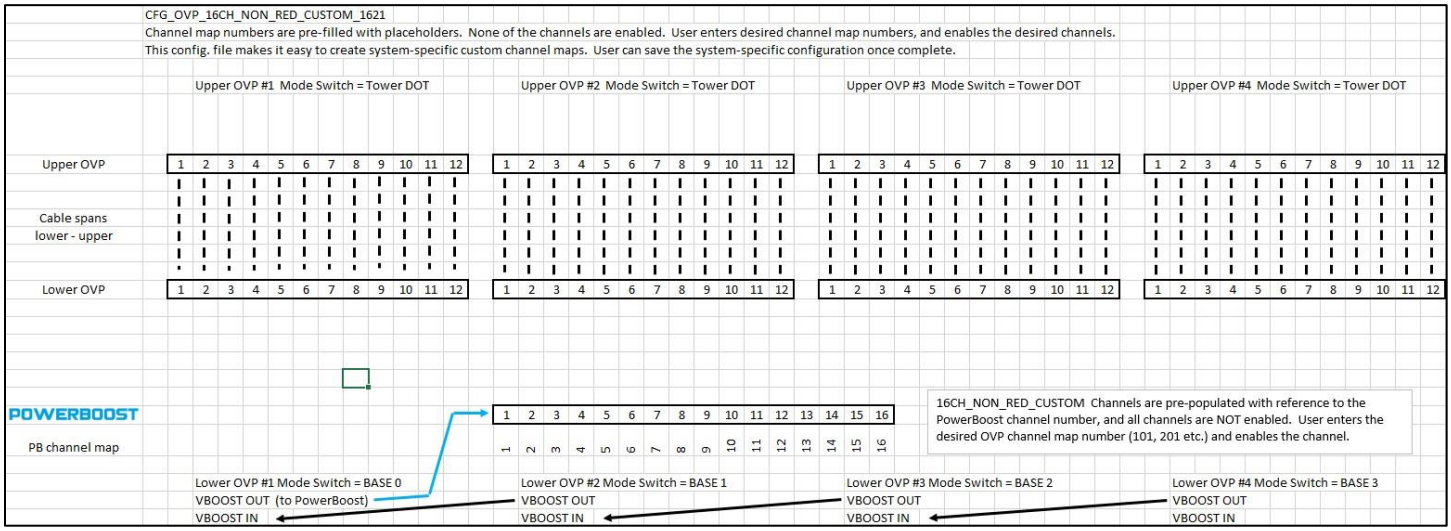
This configuration file maps the channels as shown, but by default none of the channels are enabled.

After activating this configuration file, an extra step is required to enable the desired channels then synchronize the file. See sync instructions, pg 39.

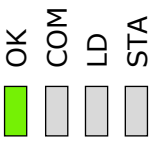
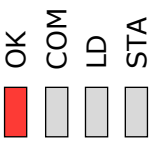
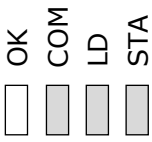
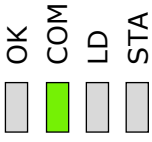


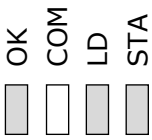
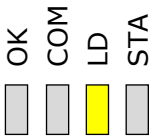
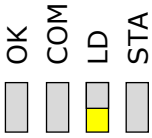
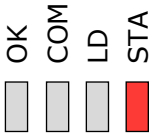
CFG_OVP_16CH_NON_RED_CUSTOM_1621

This configuration file is constructed with place-holders for the channel map numbers, and none of the channels are enabled. After activating this configuration file, the desired channel mapping entries are made, then an extra step is required to enable the desired channels then synchronize the file. See sync instructions, pg 39.



Appendix F: Converter status LEDs

LED	LED behavior	Description
	OK LED is solid green	• The converter is operating normally **Action** • N/A
	OK LED is solid red	• The converter is not operating due to input being out of the operating range (under-voltage or over-voltage) • The converter is not operating due to over-temperature protection (OTP) • The converter is not operating due to a fan failure • The converter is not operating due to a DC overvoltage protection (OVP) • The converter is not operating due to improper installation **Action** • View converter status on controller • Reseat converter • Test status of converter by inserting converter into different slot • Replace converter
	OK LED is off	• The converter is not working due to a loss of input power • The converter is not working due to a converter failure **Action** • View converter status on controller • Reseat converter • Test status of converter by inserting converter into different slot • Replace converter
	COM LED is solid green	• The converter is communicating with the controller (if applicable) **Action** • N/A

LED	LED behavior	Description
	COM LED is off	• The converter is not communicating with the controller (if applicable) **Action** • View converter status on controller • Reseat converter • Test status of converter by inserting converter into different slot • Replace converter
	LD LED is solid yellow	• The converter is operating at less than 5 percent load **Action** • N/A
	LD LED is blinking yellow	• The converter is operating in current limit mode • The DC output of the converter is short circuited **Action** • View converter status on controller • Reseat converter • Test status of converter by inserting converter into different slot • Replace converter
	STA LED is solid red	• The converter is shut down permanently (latched protection) due to an over-temperature or a DC over-voltage condition **Action** • Reseat converter • Replace converter

Appendix G: Alarm information

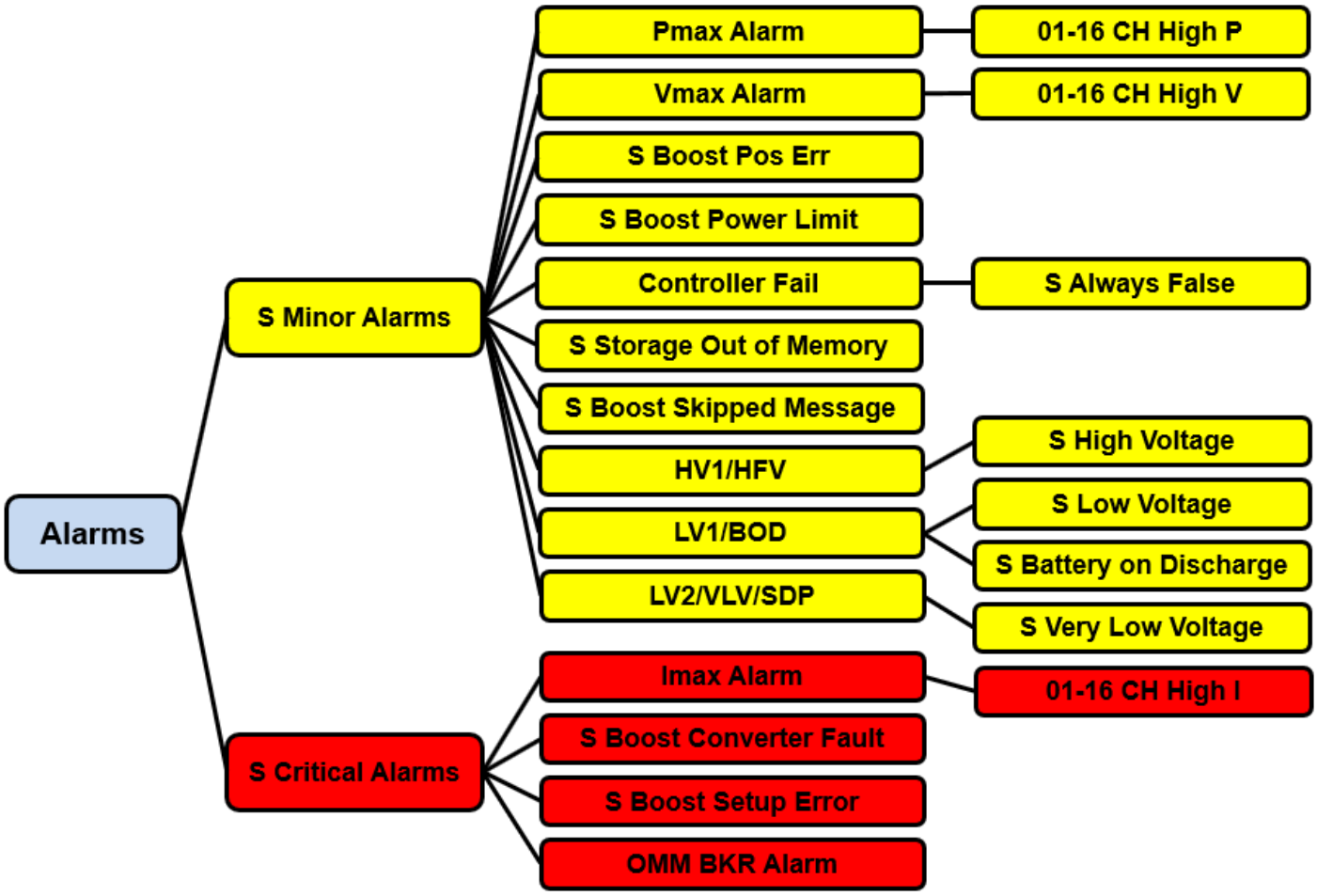
The Orion controller provides output alarm relays (see table below), local LCD display, and web access to alarm statuses. Alarms can be found on the controller display at **Main Menu > Alarm > Alarm List**.

- From the home screen, press the **Enter** button to enter the **Main Menu.**
- Highlight the **Alarm** menu and press **Enter.**
- Highlight the **Alarm List** menu and press **Enter.**

PowerBoost alarm matrix:

Alarm name	Critical	Minor	Alarm Description
Relay output:	**O/P#1**	**O/P#2**	
HV1/HFV		x	sys high voltage
LV1/BOD		x	sys low voltage or sys battery on discharge
LV2/VLV/SDP		x	sys very low voltage
S BOOST CONVERTOR FAULT	x		Event indicating that at least one of the configured boost converters is not running
S BOOST SETUP ERROR	x		The controller is not able to send a correct configuration to the convertor
OMM BKR Alarm	x		Results when a 50A breaker is tripped
CONTROLLER FAIL		x	This is the result of a failed controller
STORAGE OUT OF MEMORY		x	This is the result of not clearing device history
S BOOST SKIPPED MESSAGE		x	Event received by the JMA Modbus protocol. Indicated that there is an issue with the radio head communication.
Imax ALARM	x		Over current threshold alarm above 33A
Pmax ALARM		x	Overpower threshold alarm above 2200W
Vmax ALARM		x	Over voltage threshold alarm above 70V
S BOOST POS ERR		x	A positioning error occurred
S BOOST POWER LIMIT		x	Event indicating that at least one of the configured boost convertors is in power limit
S HIGH VOLTAGE			sys output voltage above 55.50 +/- 0.5
S LOW VOLTAGE			sys output voltage below 53 +/- 0.5

Alarm name	Critical	Minor	Alarm Description
S BATTERY ON DISCHARGE			Sys battery on discharge below 53 +/- 0.5
S VERY LOW VOLTAGE			sys output voltage below 46 +/- 0.5



Alarm details:

Converter fail

Converter fail alarms are due to the failure of one or more converters.

1. Identify the failed converter(s). See the Converter status LEDs table (Appendix F) for information on the converter LED status indicators.
2. Remove and reinsert the converter per the instructions in Section 3.4.
3. If the converter continues to shut down, replace the faulty converter.

LV1/BOD

PB input low voltage (below 53 +/- 0.5) /system battery on discharge alarm (PB input voltage below 53 +/- 0.5). (ie. the DC plant Voltage is low) Increase in voltage clears the alarm.

LV2/VLV/SDP

PB input very low voltage alarm (below 46V +/-0.5). (ie. the DC plant Voltage is low) Increase in voltage clears the alarm.

HV1/HFV/HVSD

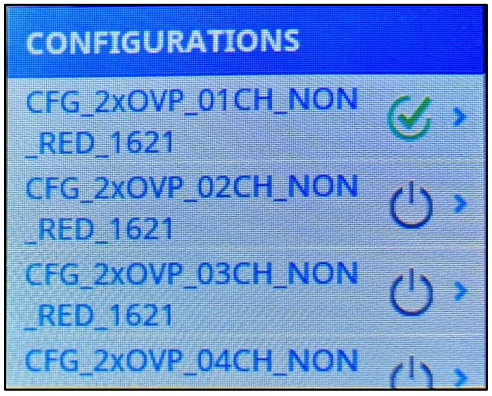
This alarm is the result of an input voltage being above the high voltage set point (55.50 +/- 0.5). Check the DC plant voltage.

"SBoost" Convertor Fault error

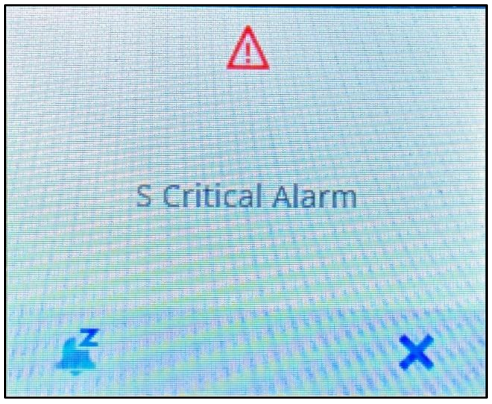
Event indicating that at least one of the configured boost converters is not running.

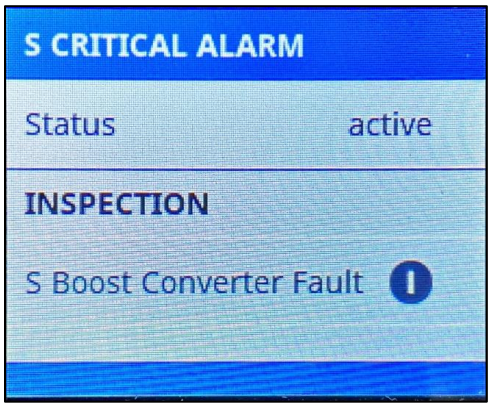
This error message can result in rare situations where operational channels are taken out of service and one or more boost modules are removed. To reset this, follow the steps below.

In the example below, the configuration file for 2xOVP_01CH is active. Associated brick is currently loaded.



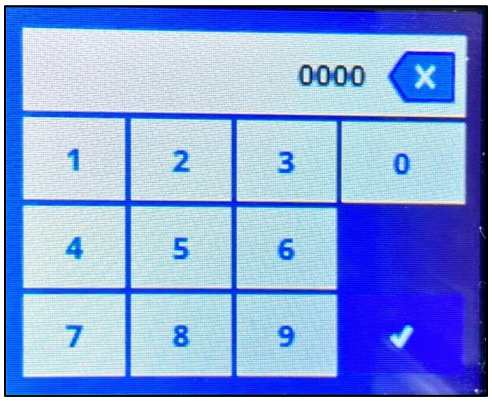
On withdrawal of brick 1, the S Critical Alarm → S Boost Convertor Fault alarm appears.



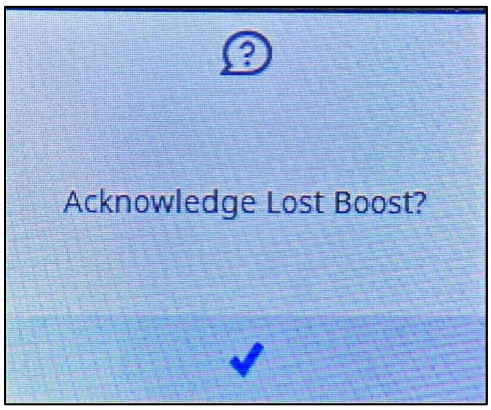


Touch **Boost** and view the status of the brick. The Orion system indicates it has lost an operating brick.

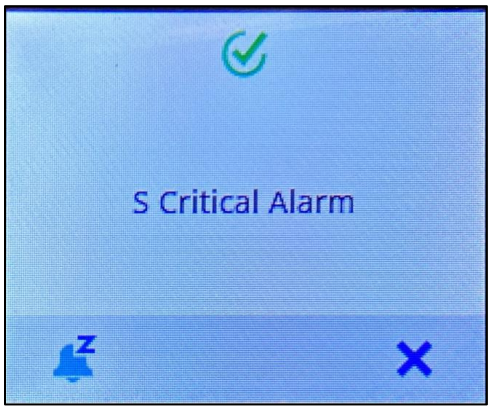
To reset this alarm: Click on the **Lost** option. It will ask you to enter the password (0000) for acknowledging the error.



Once you enter the password "0000," click on the check mark. An acknowledgement window will pop up.



Click on the check mark and wait till the alarm clears.



S Boost Setup Err

The controller is not able to send a correct configuration to the convertor. This alarm is triggered if you plug in a boost convertor that does not match the profile. Plug in the correct boost convertor (PB-PSU-162) to clear the alarm.

OMM BKR Alarm

When any of the Output management module 50A breakers trips, system will generate this alarm. Reset the breaker that was tripped to clear the alarm. There might be subsequent channel errors to investigate which channel triggered the alarm.

Imax Alarm

This alarm is raised when there is a current draw above 33A per channel. When operating under parallel or redundant mode, the alarm is raised when the current draw is above 66A per boost brick. Reduce the current to clear the alarm.

Pmax Alarm

This alarm is raised when there is power output over 2200W per channel. When operating under parallel or redundant mode, the alarm is raised when the power output is above 4400W per boost brick. Reduce the power load to clear the alarm.

Vmax Alarm

This alarm is raised when the output voltage is above 70V per module. Reduce the voltage to clear the alarm.

S Boost Pos Error

A positioning error occurred. If the configuration file uses less number of channels and an additional module is plugged in without updating the configuration, the system will flag this alarm. To reset the alarm, select the correct configuration file and reset the Orion controller by withdrawing it for a few seconds, then re-insterting.

S Boost Power Limit

Event indicating that at least one of the configured boost convertors is in power limit.

Orion controller fail (failure message or blank screen)

This is the result of a failed controller.

1. Remove the controller according to the steps in Section 3.4.
2. Reinsert the controller.
3. If the controller is still faulty, replace the controller.

Storage out of memory

Currently the device logs 10000 events per file up to 90 different files. If the device history is not cleared, the system will generate this alarm.

S Boost Skipped Message

- Indicates that there is an issue with the Raycap OVP telemetry (RS485) data reaching (or not reaching) the PB “VBOOST IN” port.
- PB-COM LED steady red indicates a fault or error in the message from the Raycap OVP or a bad connection to communication board.

- It also indicates that the telemetry between Raycap top and bottom is missing or damaged.
    - Check the RS485 cable on Raycap and to the PB-COM
    - Check telemetry wiring connection between Raycap base and the top
    - Reset PB-COM or power cycle the Orion controller
    - Check system installation for RS485 signals
- PB-COM LED green flashing at approximate one second interval indicates that it is receiving valid data from Raycap OVP telemetry.

Appendix H: Ordering guide

Part number	Details
PB-19-KIT6	POWERBOOST 6RRH KIT WOMM (2U) COMES W/ JUMPERS INSTALLED, BOOST MODULES INCL.
PB-19-KIT8	POWERBOOST 8RRH KIT WOMM (2U) COMES W/ JUMPERS INSTALLED, BOOST MODULES INCL.
PB-19-KIT9	POWERBOOST 9-10RRH KIT WOMM (3U) COMES W/ JUMPERS INSTALLED, BOOST MODULES INCL.
PB-19-KIT12	POWERBOOST 12RRH KIT WOMM (3U) COMES W/ JUMPERS INSTALLED, BOOST MODULES INCL.
PB-19-SYS-8	19IN 2RU DC BOOST SYSTEM 8CH WOMM JUMPERS, BOOST MODULES ORDERED SEPARATELY
PB-19-SYS-16	19IN 3RU DC BOOST SYSTEM 16CH WOMM JUMPERS, BOOST MODULES ORDERED SEPARATELY
PB-PSU-162	CPC1700B-24 DC Boost Module
PB-PASS	FRU, CPC1700B-24 Bypass Module
PB-PSU-COV	Slot Blank Cover, PSU
PB-OMM-CBL-KIT-2	OMM JUMPER CABLE KIT, CONTAINS 2 CABLES 26IN EA

Appendix I: Commissioning and closeout checklist

Definitions:

PB: PowerBoost

OVP: Raycap OVP equipment

OMM: PowerBoost Output Management Module, i.e., circuit breakers on PB unit

PowerBoost installation/commissioning

- ☐ Note: Commissioning of PowerBoost system assumes that the Raycap OVP system to which PowerBoost will be connected has previously been installed and verified for correct wiring connections and correct data communication upper to lower (i.e., the display on lower OVP correctly reports the upper OVP channel voltages).
- ☐ Prior to energizing PB, complete the next three steps:
  - System wiring must be complete.
  - Based on system design information (OVP configuration), identify the associated PB configuration file that will be selected during setup.
  - Verify correct polarity of all power feeds from the DC plant to the PB rack. Note that PB-19-SYS-8 contains two (2) input power feeds, and PB-19-SYS-16 contains four (4) input power feeds. Correct polarity of all power feeds must be verified before energizing. See pp. 9-12.
- ☐ Energize the system.
- ☐ Select and implement the PB config file for the given system configuration.
- ☐ With at least one PB channel energized, after at least 1 minute of operation, observe the PB-COM circuit board and verify the presence of an orange LED flashing at approximately 1 second intervals. This indicates the receipt of communication from the lower OVP to PB.
- ☐ For all PB channels used in the given system, sequentially energize channels at the PB OMM, adding 1 more channel at a time, and verify that the expected channel indicates voltage at the upper OVP (as read on the lower OVP display). Allow at least 30 seconds for a recently energized channel to indicate voltage on the OVP.
- ☐ Check for the absence of system alarms after PB has been operating for at least 3 minutes beyond the most recent change.

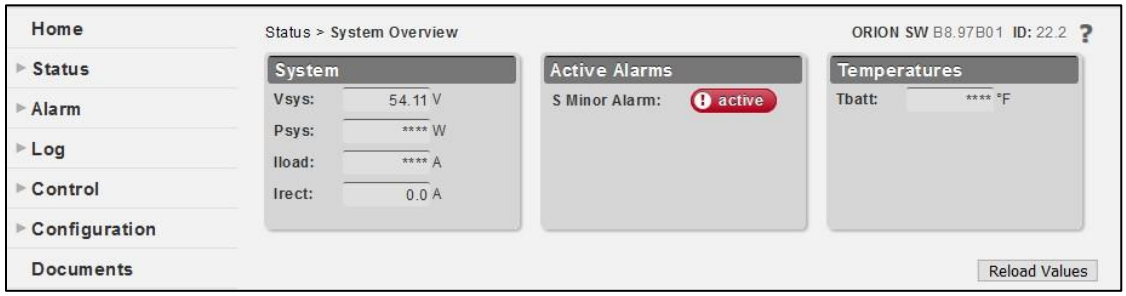
Option 1: Using Orion GUI

- After the installation is complete and verified, log into Orion GUI (refer to Appendix D: Orion GUI Login).
- Go to **Alarm → Status**

- The status "OK" on all the alarm events is a clear indication that there are no system alarms.

Option 2: Using Orion GUI (High Level Screen Capture)

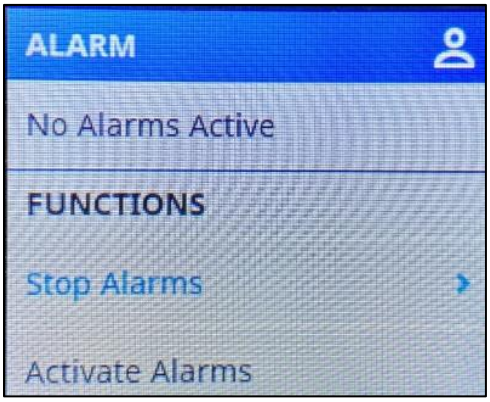
- After the installation is complete and verified, log into the Orion GUI (refer to Appendix A: Orion GUI Login).
- Go to **Home**; the status in the highlighted screen capture that there are no alarms is an indication that there are no system alarms.
- Note: the screen shot below is showing an active alarm for illustrative purposes.



Option 3: Using Orion touchscreen

- The clear screen with no alarm symbol is an indication that there are no system alarms.

(or) Swipe right twice on the Orion touchscreen:

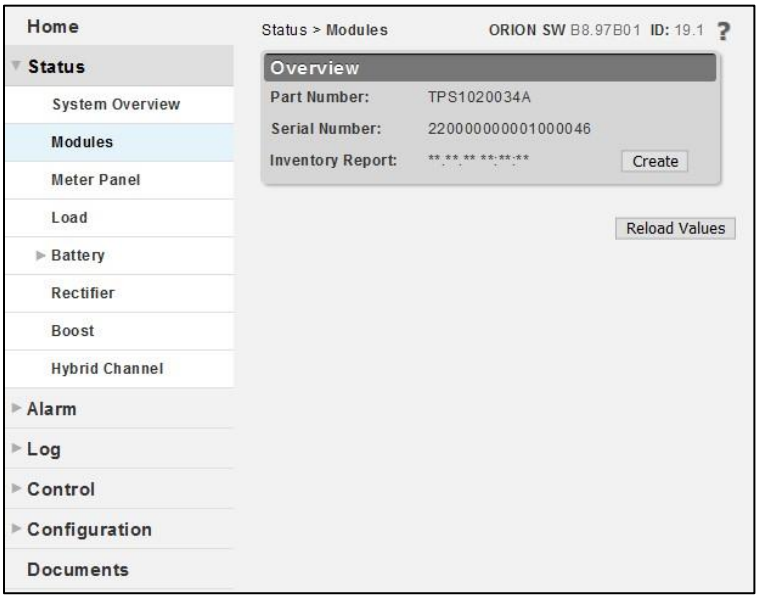


- Below is a screenshot of the Orion touchscreen with active alarms. Refer to the alarms section if there are any active alarms.

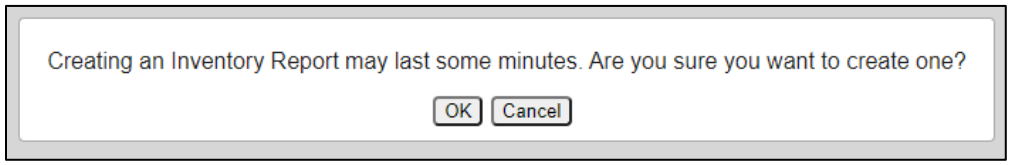
Capture the inventory report

Log into the PB GUI and record the following:

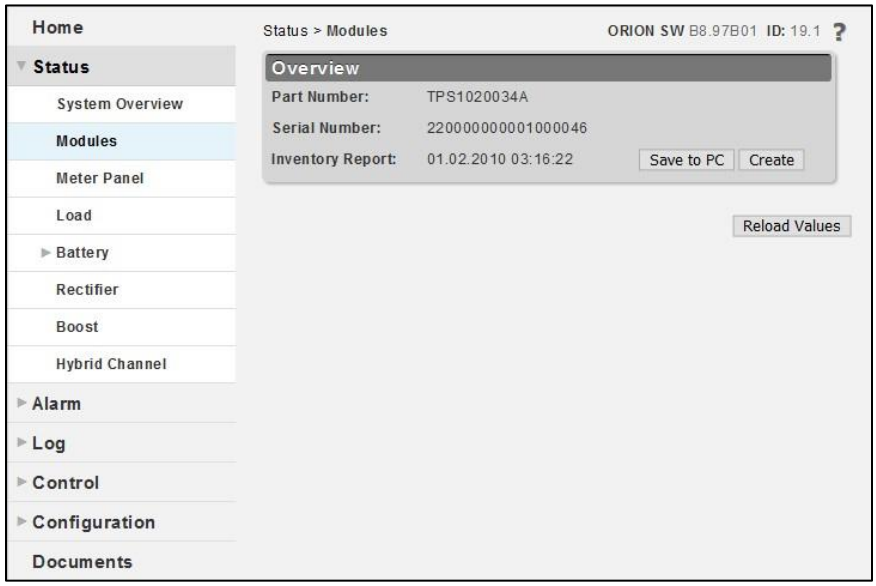
- After the installation is complete and verified, log into Orion GUI (refer to Appendix A: Orion GUI Login).
- Go to **Status** → **Modules**.



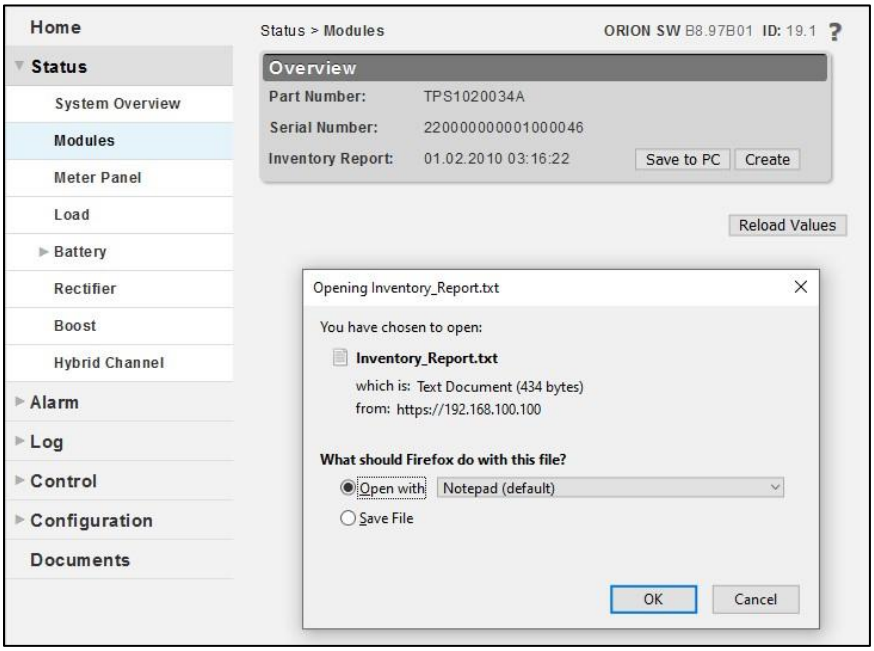
- Click on **Create**. You will see a pop-up window. Click **OK**. Do not log off or disconnect until the process is finished.



- Once the process is complete, you will see that an inventory report is generated and gives an option to save it to your PC. Click on **Save to PC** to download the file to your PC.



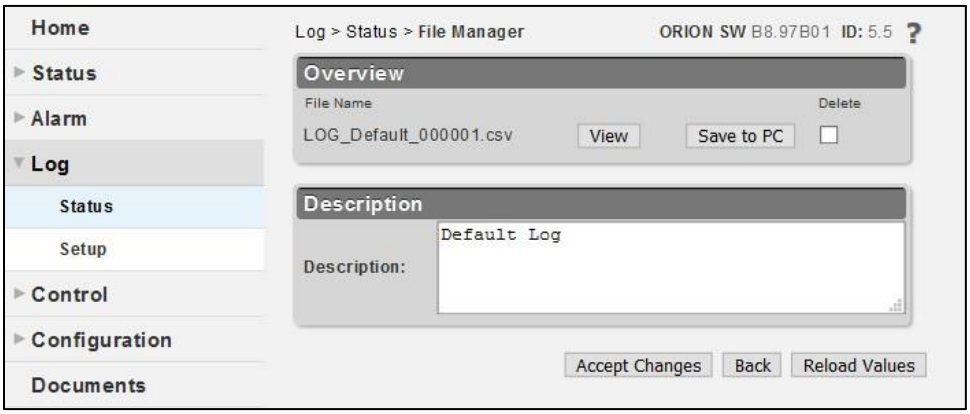
- An inventory report is generated/downloaded, as shown in the screenshot below.



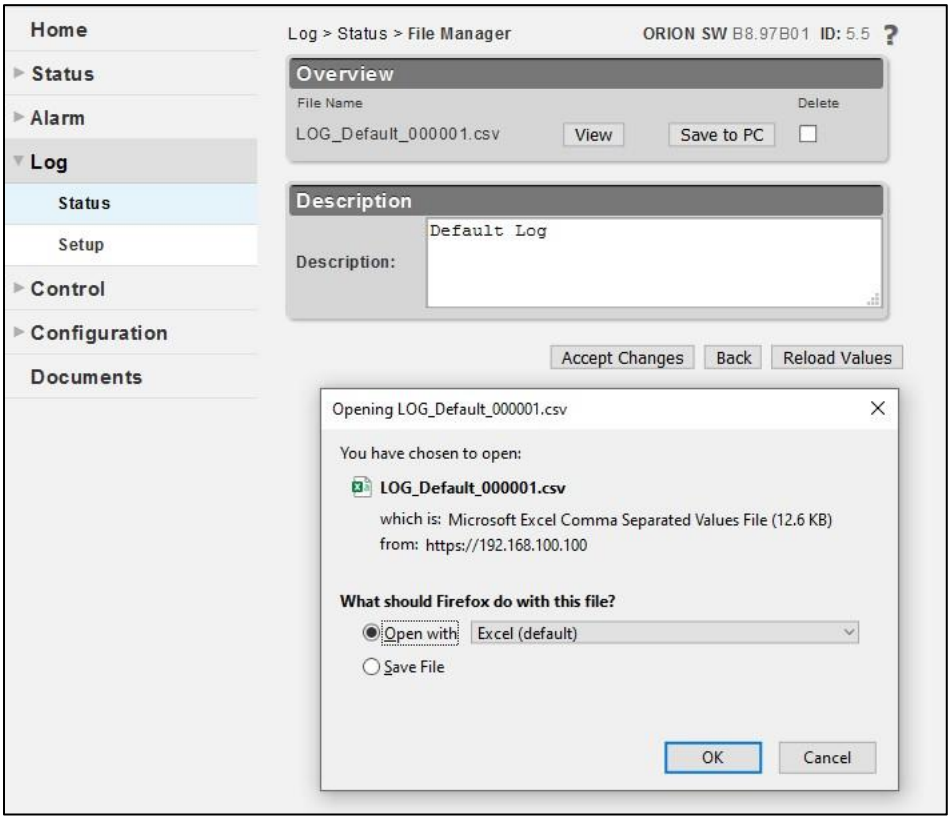
Capture the alarm history report

- After the installation process is complete and verified, log into the Orion GUI (refer to Appendix A: Orion GUI Login).
- Go to **Log → Status**

- Click on **Files**.
- Click on **Save to PC**; do not log off or disconnect until the process is finished.



- Once the process is complete, you will see that an event/alarm spreadsheet is generated/downloaded to your PC. An alarm report is generated at the bottom of the page in the screenshot below.



Capture the system map worksheet

PB CH #	RRU #	RRU Sector	Notes info	PB input breaker #	OVP base ID #	OVP base port #
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						

PowerBoost closeout

- ☐ Verify that the system map table is completely and correctly captured (see installation/commissioning section).
- ☐ Verify that the system inventory report is captured and accurate.
- ☐ Verify that the system alarm history report is captured.