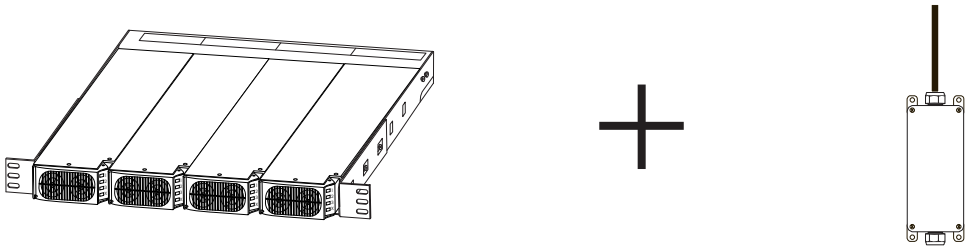
PowerShift® V1 Installation Instructions, Rev D

GUI v1.4 – Power Module Series 1:1 and newer (firmware v1.9 and newer)

The patent pending PowerShift system is designed to optimize electrical draw by adjusting voltage dynamically to match your exact RRU power requirements.



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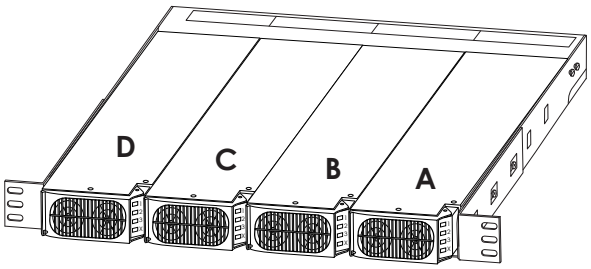
Section 1: PowerShift V1 System Components

The PowerShift V1 System Consists of two components: the Base Unit and Capacitive Jumpers.

The Base Unit is used in conjunction with the existing DC power plant at the installation site.

1. The modules are plug-and-play for easy installation and site maintenance.
2. The base unit has capacity for four modules.
3. Each module has DC input and DC output for three Remote Radio Units (RRU), for a total capacity of 12 RRU sectors per PowerShift base unit.
4. Each module unit is also provided with diagnostic indicators, explained in section 12.



Rack Part Number: PS-R-1

Module Part Number: PS-1-73

Note: The PowerShift base unit will not operate without the corresponding Capacitive Jumper. Each module requires three Capacitive Jumpers (one per circuit)

Electrical[1]	Typical	Range
Input Voltage[2]	-54VDC	Cut-off: -42VDC Turn-on: -43VDC[3] Maximum: -59.5VDC
Input Current[2]	5A	0-36 A
Efficiency	> 97%	> 95%
PS Output Voltage[2]	-60 VDC	-48 to -73 VDC
PS Output Current[2]	4 A	0-20 A
Output Voltage Ripple	400 mV rms	
Total Power output[4]	1460 W	
Programmable RRU Voltage[5]	-53.5V +/- 3V	
Gauge Range	14 to 6 AWG (2 to 16mm^2)	
Length Range[6]	Cable loop resistance from 0.2Ω to 1.8Ω: 2200 ft of 6-AWG (≈ 1.8Ω) 1350 ft of 8-AWG (≈ 1.8Ω) 850 ft of 10-AWG (≈ 1.8Ω) 540 ft of 12-AWG (≈ 1.8Ω) 40 ft of 14-AWG (≈ 0.2Ω)	

[1] Per circuit; 3 circuits per module

[2] Input/output voltage and current range are guaranteed values, typical operating values will exceed these by about 10%; examples:

Typical input cutoff (minimum) voltage: 42V x 0.9 ≈ 38V

Typical output maximum current: 20A x 1.1 ≈ 22A

[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-point are possible, contact CommScope

[6] For cable lengths outside these ranges, contact CommScope for more information

Section 2: Capacitive Jumper

The Capacitive Jumper is a circuit at the radio input to provide the PowerShift base unit with information regarding actual line impedance. Additionally it compensates for DC inductance of the power line further reducing power loss.

General Specifications

Type	Power-only Capacitive Jumper
Brand	HELIAX® FiberFeed®
Conductor Gauge, singles	6-12 AWG (10 AWG typical)
Conductors, quantity	2
Enclosure Color	Grey
Jacket Color	Black

Environmental Specifications

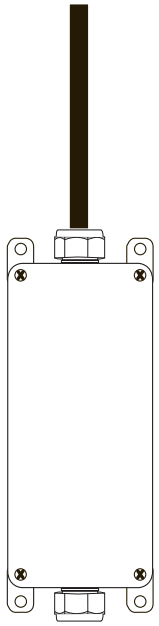
Environmental Space	UV resistant for outdoor and/or direct burial installations
Operating Temperature	Maximum value based on a standard condition of 20 °C (68 °F)
Safety Voltage Rating	600 V

Dimensions

Weight	1.1 kg | 2.5 lb
Diameter Over Jacket	12.395 mm | 0.488 in
Enclosure	304.8 mm | 12 in (length, including cable gland nuts)
	76.2 mm | 3 in (width)
	76.2 mm | 3 in (depth)

General

Mount	Tabs included



Section 3: Recommended Interconnect Power Cables (coordinate with a CommScope representative to determine popper gauge/length)

PWRT-208-S

Construction Materials:	
Construction Type	Non-armored
Conductor Material	Tinned copper
Dielectric Material	PVC
Drain Wire Material	Tinned copper
Filler Material	Polypropylene
Ground Wire Material	Tinned copper
Insulation Material, singles	PVC
Jacket Material	PVC
Outer Shield (Braid) Coverage	65 %
Outer Shield (Braid) Gauge	36 AWG
Outer Shield (Braid) Material	Tinned copper
Outer Shield (Tape) Material	Aluminum/Poly, nonbonded

Dimensions	
Cable Weight	0.43 kg/m | 0.29 lb/ft
Diameter Over Conductor, singles	3.9878 mm per 168 strand 0.1570 in per 168 strand
Diameter Over Dielectric	6.1468 mm | 0.2420 in
Diameter Over Drain Wire	2.5700 mm per 7 strand 0.1012 in per 7 strand
Diameter Over Ground Wire	3.200 mm | 0.126 in
Diameter Over Jacket	14.224 mm | 0.560 in
Diameter Over Shield (Braid)	11.938 mm | 0.470 in
Jacket Thickness	1.143 mm | 0.045 in

Electrical Specifications	
Conductor dc Resistance	0.67 ohms/kft | 2.21 ohms/km
Conductor dc Resistance Note	Maximum value based on a standard condition of 20 °C (68 °F)
Safety Voltage Rating	600 V

Environmental Specifications	
Environmental Space	UV resistant for outdoor and/or direct burial installations
Operating Temperature	-40°C to +90 °C (-40°F to +194 °F)
Safety Standard	NEC Article 336 (Type TC)

General Specifications	
Application	Industrial
Cable Type	Power
Jacket Color	Black
Conductor Gauge, singles	8 AWG
Conductor Type, singles	Stranded
Conductors, quantity	2
Construction Type	Discrete power cable
Drain Wire Gauge	12 AWG
Ground Wire Gauge	10 AWG
Ground Wire Type	Stranded
Jacket Color, singles	Black | Red

PWRT-210-S

Construction Materials: PWRT-210-S	
Construction Type	Non-armored
Conductor Material	Tinned copper
Dielectric Material	PVC
Drain Wire Material	Tinned copper
Filler Material	Polypropylene
Ground Wire Material	Tinned copper
Insulation Material, singles	PVC
Jacket Material	PVC
Outer Shield (Braid) Coverage	65 %
Outer Shield (Braid) Gauge	36 AWG
Outer Shield (Braid) Material	Tinned copper
Outer Shield (Tape) Material	Aluminum/Poly, nonbonded

Dimensions	
Cable Weight	0.30 kg/m | 0.20 lb/ft
Diameter Over Conductor, singles	3.2004 mm per 105 strand 0.1260 in per 105 strand
Diameter Over Dielectric	4.7244 mm | 0.1860 in
Diameter Over Drain Wire	1.8800 mm per 7 strand 0.0740 in per 7 strand
Diameter Over Ground Wire	3.200 mm | 0.126 in
Diameter Over Jacket	12.395 mm | 0.488 in
Diameter Over Shield (Braid)	10.109 mm | 0.398 in
Jacket Thickness	1.143 mm | 0.045 in

Electrical Specifications	
Conductor dc Resistance	1.06 ohms/kft | 3.47 ohms/km
Conductor dc Resistance Note	Maximum value based on a standard condition of 20 °C (68 °F)
Safety Voltage Rating	600 V

Environmental Specifications	
Environmental Space	UV resistant for outdoor and/or direct burial installations
Operating Temperature	-40°C to +90 °C (-40°F to +194 °F)
Safety Standard	NEC Article 336 (Type TC)

General Specifications	
Application	Industrial
Cable Type	Power
Jacket Color	Black
Conductor Gauge, singles	8 AWG
Conductor Type, singles	Stranded
Conductors, quantity	2
Construction Type	Discrete power cable
Drain Wire Gauge	12 AWG
Ground Wire Gauge	10 AWG
Ground Wire Type	Stranded
Jacket Color, singles	Black | Red

PWRT-606-S

Construction Materials

Construction Type	Non-amored
Conductor Material	Tinned copper
Dielectric Material	PVC
Drain Wire Material	Tinned copper
Filler Material	Polypropylene
Ground Wire Material	Tinned copper
Insulation Material, singles	PVC
Jacket Material	PVC
Outer Shield (Braid) Coverage	65 %
Outer Shield (Braid) Gauge	34 AWG
Outer Shield (Braid) Material	Tinned copper
Outer Shield (Tape) Material	Aluminum/Poly, nonbonded

Dimensions

Cable Weight	0.40 kg/m | 0.89 lb/ft
Diameter Over Conductor, singles	4.5466 mm per 19 strand 0.1790 in per 19 strand
Diameter Over Dielectric	6.3246 mm | 0.2490 in
Diameter Over Drain Wire	2.5700 mm per 7 strand 0.1012 in per 7 strand
Diameter Over Ground Wire	3.759 mm | 0.148 in
Diameter Over Jacket	23.368 mm | 0.920 in
Diameter Over Shield (Braid)	19.177 mm | 0.755 in
Jacket Thickness	2.032 mm | 0.080 in

Electrical Specifications

Conductor dc Resistance	0.44 ohms/kft | 1.43 ohms/km
Conductor dc Resistance Note	Maximum value based on a standard condition of 20 °C (68 °F)
Safety Voltage Rating	600 V

Environmental Specifications

Environmental Space	UV resistant for outdoor and/or direct burial installations
Operating Temperature	-40°C to +90 °C (-40°F to +194 °F)
Safety Standard	NEC Article 336 (Type TC)

General Specifications

Application	Industrial
Cable Type	Power
Jacket Color	Black
Conductor Gauge, singles	6 AWG
Conductor Type, singles	Stranded
Conductors, quantity	6
Construction Type	Discrete power cable
Drain Wire Gauge	12 AWG
Ground Wire Gauge	8 AWG
Ground Wire Type	Stranded
Jacket Color, singles	Black with coextruded blue stripe | Black with coextruded green stripe | Black with coextruded orange stripe | Red with coextruded blue stripe | Red with coextruded green stripe | Red with coextruded orange stripe

PWRT-608-S

Construction Materials

Construction Type	Non-armored
Conductor Material	Tinned copper
Dielectric Material	PVC
Drain Wire Material	Tinned copper
Filler Material	Polypropylene
Ground Wire Material	Tinned copper
Insulation Material, singles	PVC
Jacket Material	PVC
Outer Shield (Braid) Coverage	65 %
Outer Shield (Braid) Gauge	36 AWG
Outer Shield (Braid) Material	Tinned copper
Outer Shield (Tape) Material	Aluminum/Poly, nonbonded

Dimensions

Cable Weight	0.93 kg/m | 0.62 lb/ft
Diameter Over Conductor, singles	3.8608 mm per 19 strand 0.1520 in per 19 strand
Diameter Over Dielectric	6.1468 mm | 0.2420 in
Diameter Over Drain Wire	2.5700 mm per 7 strand 0.1012 in per 7 strand
Diameter Over Ground Wire	2.921 mm | 0.115 in
Diameter Over Jacket	20.828 mm | 0.820 in
Diameter Over Shield (Braid)	18.542 mm | 0.730 in
Jacket Thickness	1.524 mm | 0.060 in

Electrical Specifications

Conductor dc Resistance	0.67 ohms/kft | 2.21 ohms/km
Conductor dc Resistance Note	Maximum value based on a standard condition of 20 °C (68 °F)
Safety Voltage Rating	600 V

Environmental Specifications

Environmental Space	UV resistant for outdoor and/or direct burial installations
Operating Temperature	-40°C to +90 °C (-40°F to +194 °F)
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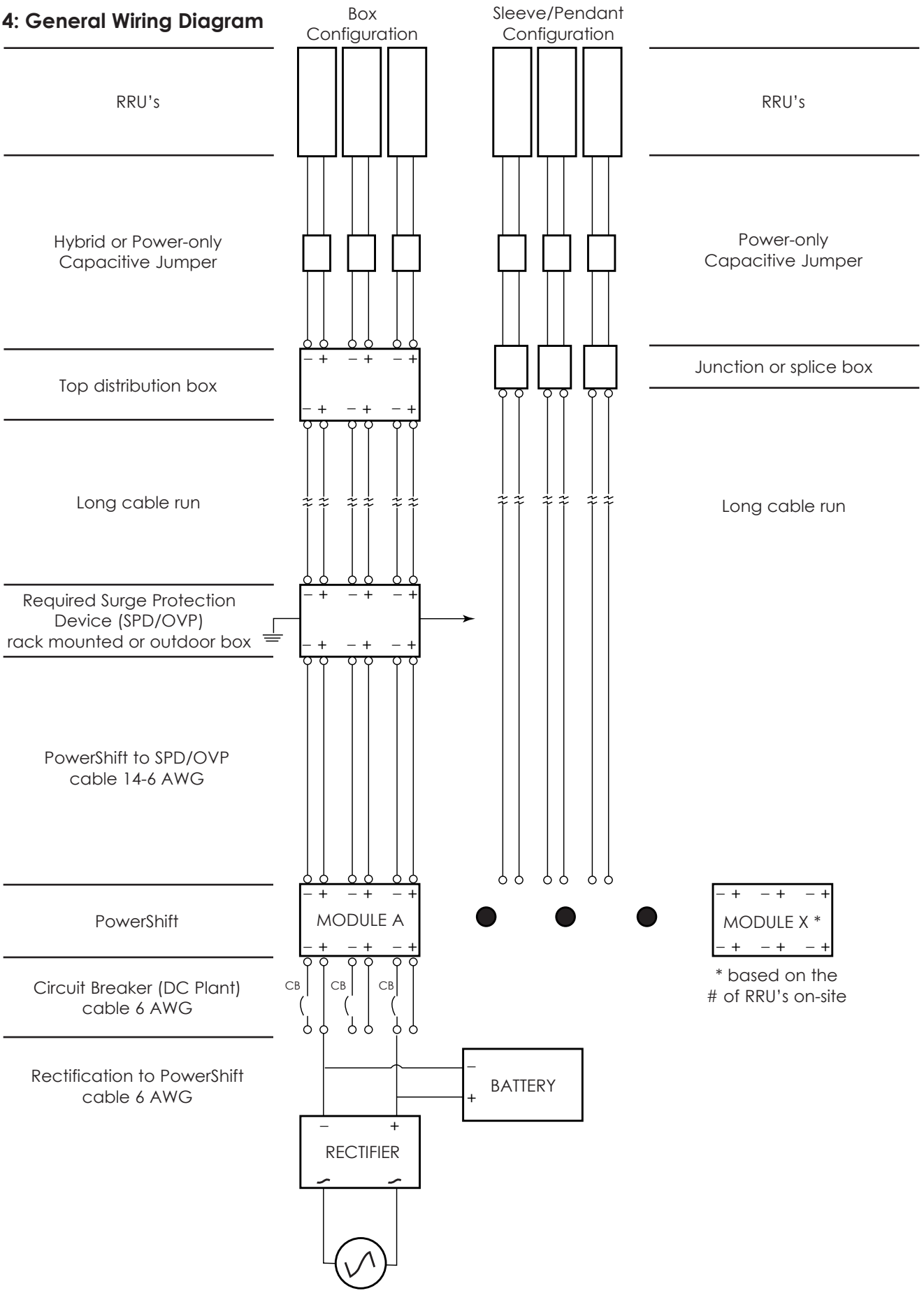
General Specifications

Application	Industrial
Cable Type	Power
Jacket Color	Black
Conductor Gauge, singles	8 AWG
Conductor Type, singles	Stranded
Conductors, quantity	6
Construction Type	Discrete power cable
Drain Wire Gauge	12 AWG
Ground Wire Gauge	10 AWG
Ground Wire Type	Stranded
Jacket Color, singles	Black with coextruded blue stripe | Black with coextruded green stripe | Black with coextruded orange stripe | Red with coextruded blue stripe | Red with coextruded green stripe | Red with coextruded orange stripe

Section 4: General Wiring Diagram

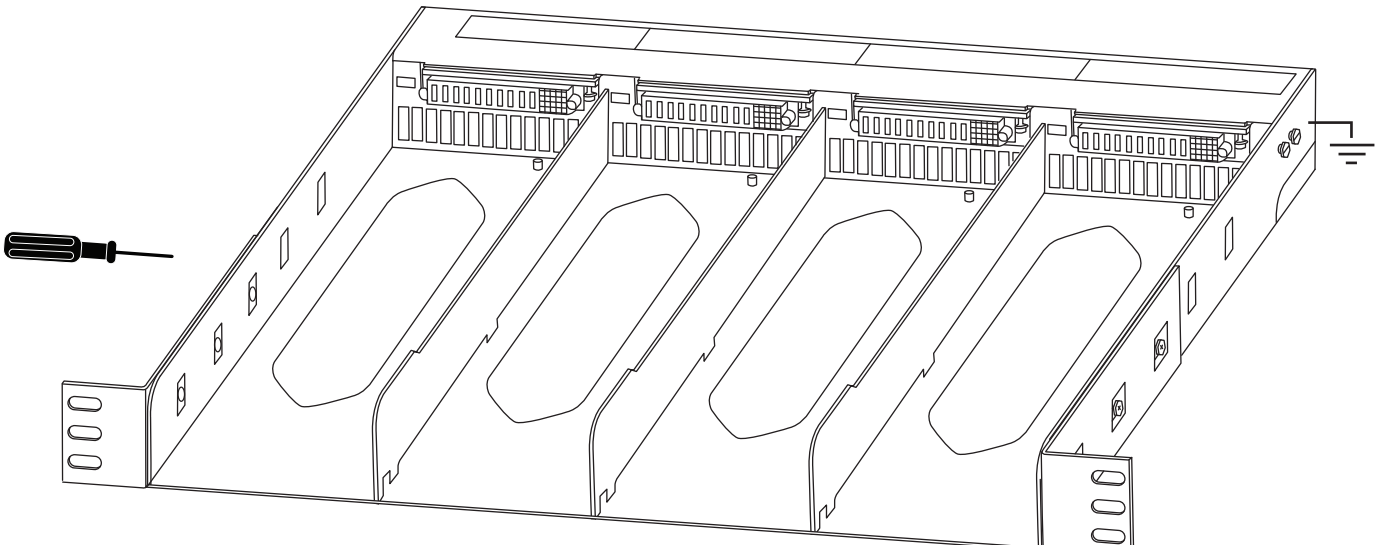


Section 5: Rack Installation

Determine the installation depth required for the base unit, attach the side flanges in the appropriate location. 3 screws are required per side.

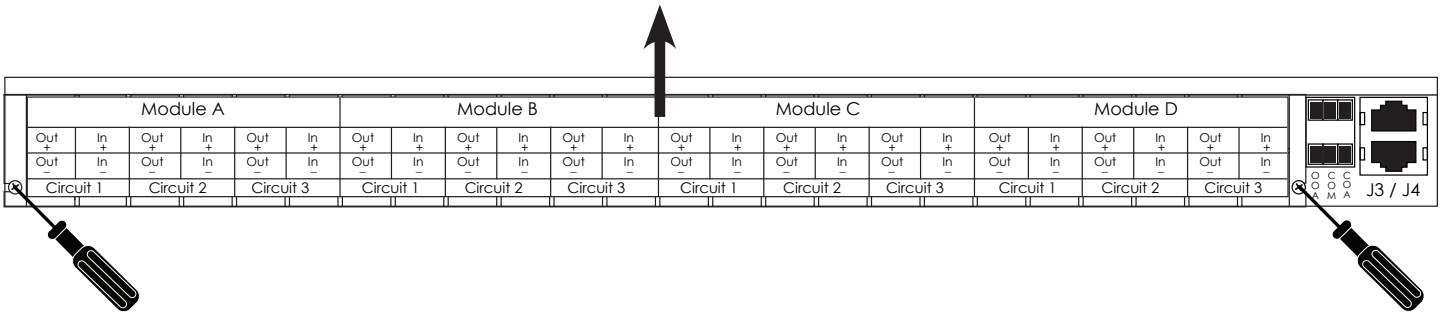
Mount the unit in a standard 19" rack near the current DC power output breaker box.

Ground the unit by installing a ground wire at the base of the unit.

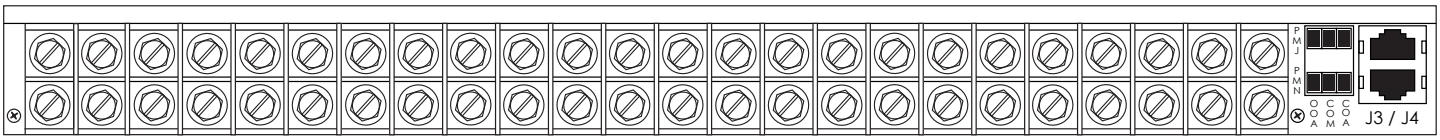


Section 6: Wiring of the Rack

Remove 2 small screws on the back of the unit and remove the back cover to expose the terminal screws. (replace screws to keep them with the unit)



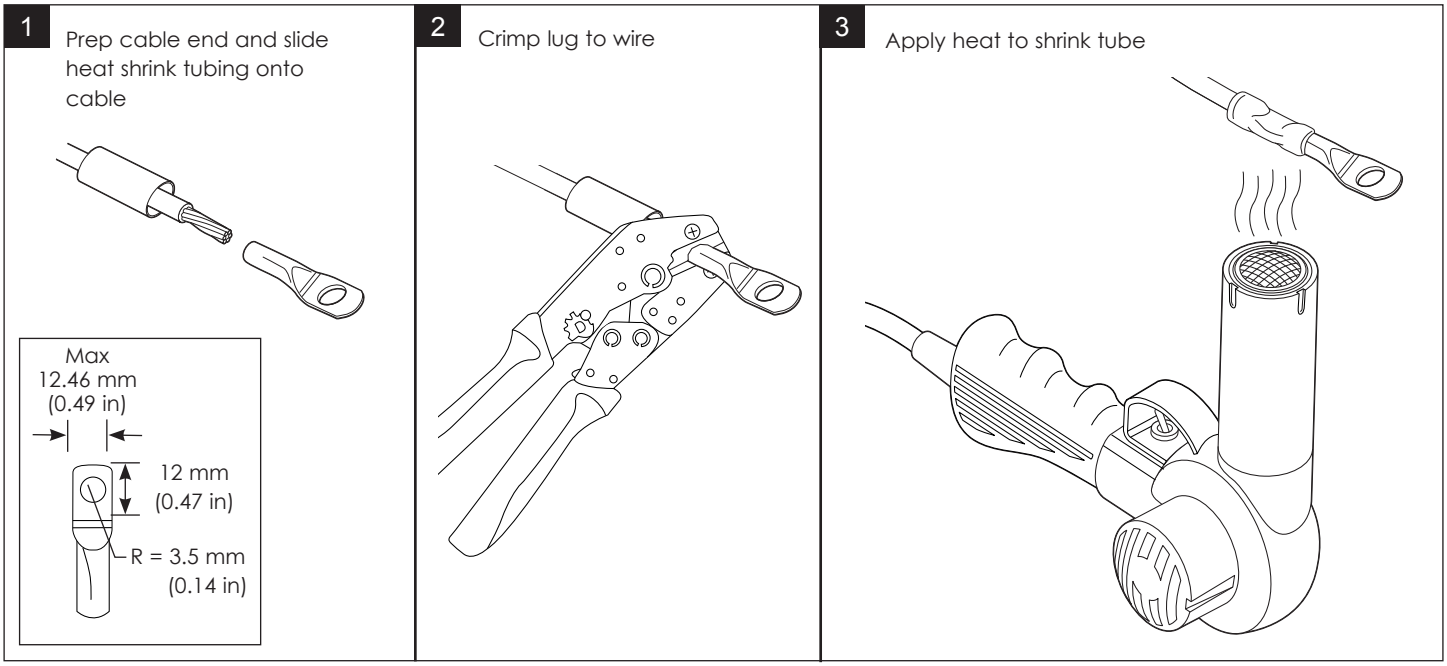
The rear of the shelf is divided into 12 individual circuits each containing a DC input and a DC output. There is a positive and negative terminal strip connection for each DC input and out. The right side pair is for the DC input and the left side pair is for the DC output. The most positive leg is located at the top and the most negative leg is on the bottom. Cables should be routed downward.



Unit will accommodate 14 - 6 AWG lugs (provided by the installation crew). 6 AWG conductors are recommended for future proofing of the installation.

If using 6 AWG conductors, lug - GE 450050820 or Panduit LCAX6-10-L is required. (one-hole, flex lug, #6 AWG wire, #10 stud hole, straight)

Ensure that the exposed wires and barrel of lug are protected by insulation such as shrink tubing to prevent any possible arcing or shorting.



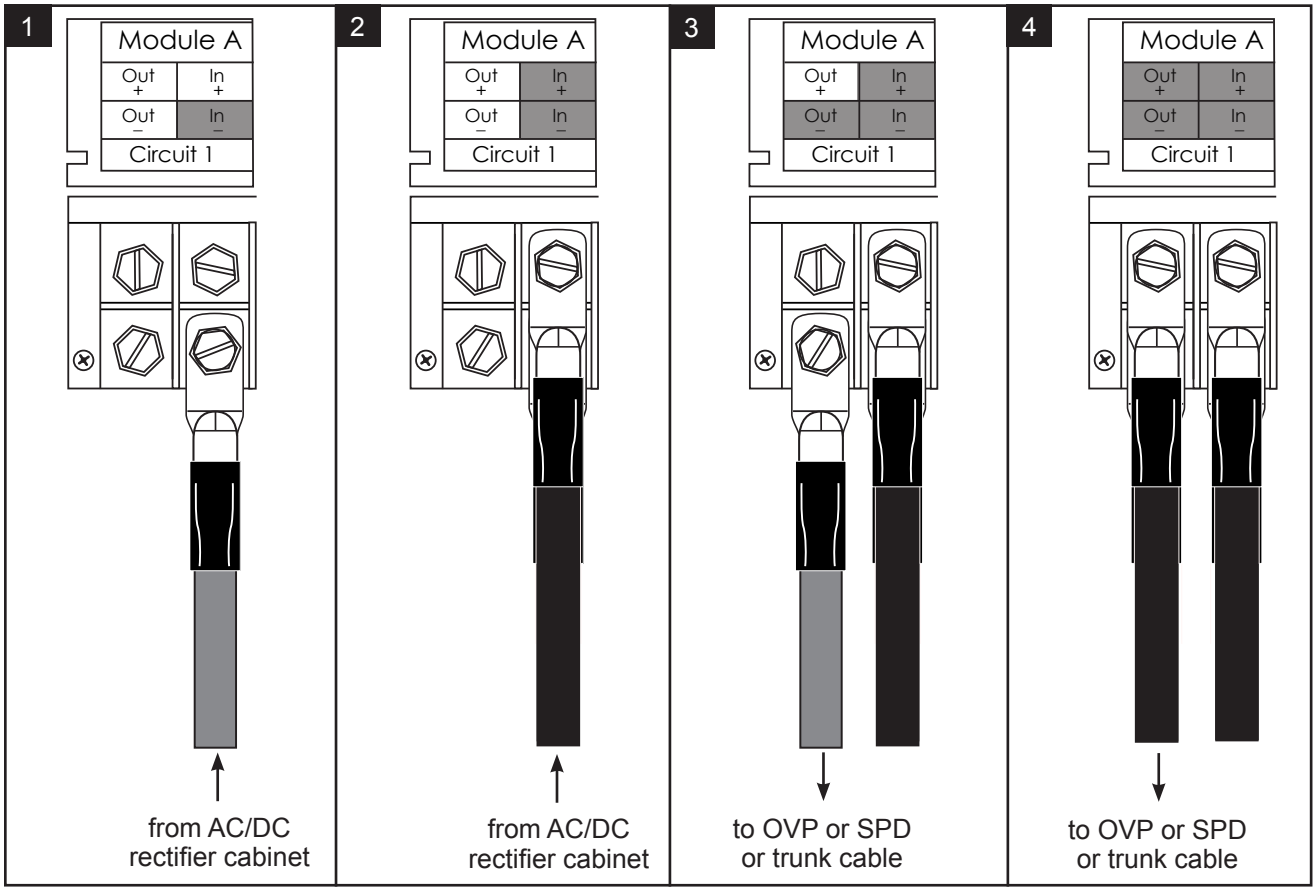
Attach the site output DC power supply lines from the breaker box to the PowerShift Base Unit Input screws.

Run cables from the Base Unit Output screws to the baseband Surge Protection Device / Over Voltage Protection (SPD / OVP) input if installed. Then attach the SPD / OVP outputs to the trunk cable that runs to the RRUs.

If no SPD/OVP is installed, then connect the trunk cable directly to the Base Unit Output screws.

Repeat for each circuit

Re-install the back cover of the unit when complete.



Section 7: Capacitive Jumper Installation

Mount the capacitive jumper following installation procedure in Section 8 of this document.

Once the capacitive jumper is installed the trunk power cable will need to be connected to the capacitive jumper. Follow the installation procedure in Section 9 of this document to connect the power trunk cable.

Perform a cable integrity check using one of the following methods:

IMPORTANT: When performing this check the PowerShift module must be unseated/removed from the applicable Base Unit slot, and the output of the capacitive jumper must be disconnected from the radio.

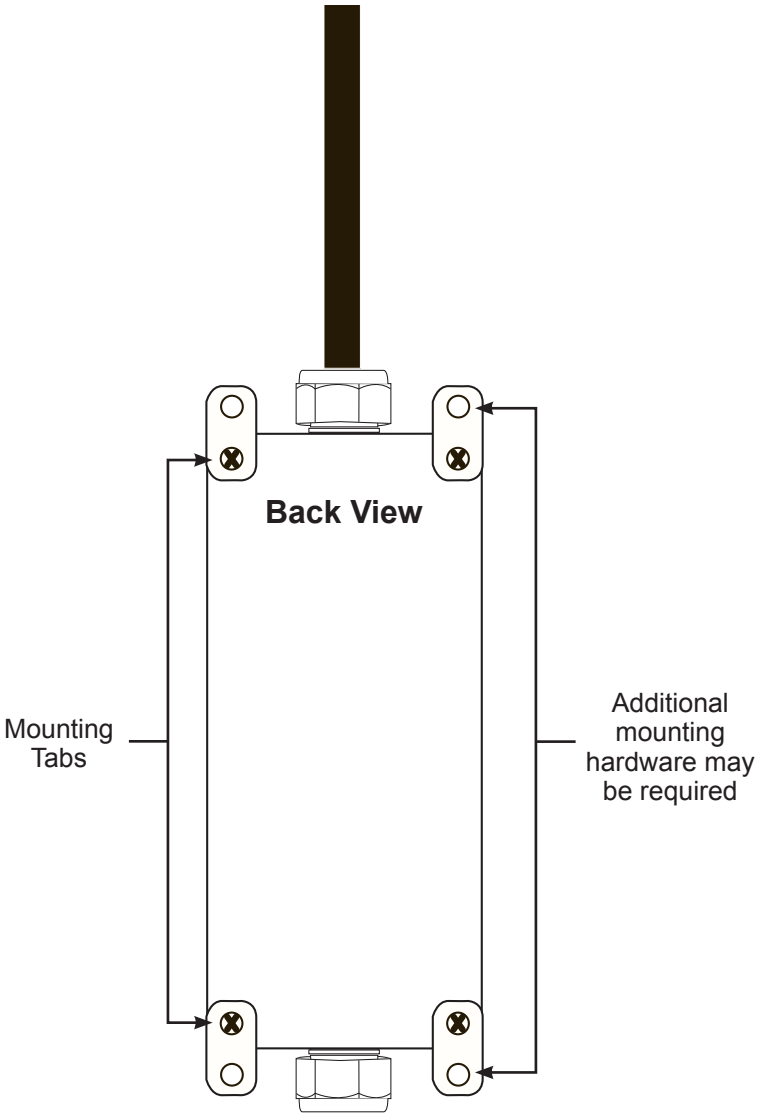
Method 1 (preferred): Take a capacitance measurement across the Base Unit Output screws using a suitable multi-meter; the expected value in micro-Farads (µF) is 1100µF +/- 25% (i.e. 825 to 1375µF). If an open or short condition is detected then there is likely a fault in the trunk cable or in the capacitive jumper.

Method 2: Using a multi-meter, take a resistance measurement across the Base Unit Output screws. First, take a resistance measurement to confirm the circuit is open. Second, temporarily connect (short) the two conductors together at the capacitive jumper (i.e. at the end of the capacitive jumper cable) and take a resistance measurement; the value should be less than 3 Ohms (it is dependent on the trunk cable gauge and length).

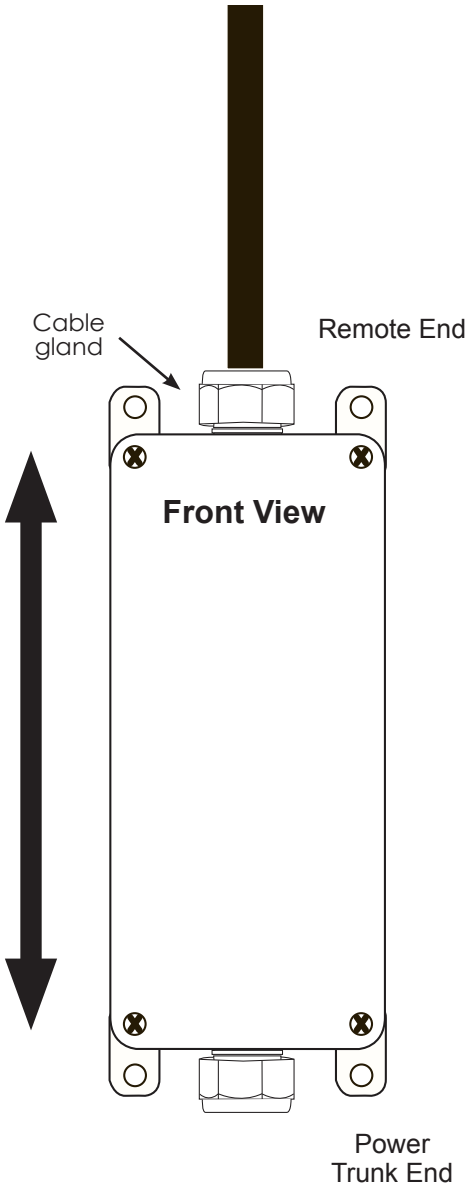
Connect the other end of the capacitive jumper to the Remote Radio Unit. See section 10 for connector installation instructions.

Section 8: Capacitive Jumper Mounting

1 Install mounting tabs to back of enclosure with provided hardware.

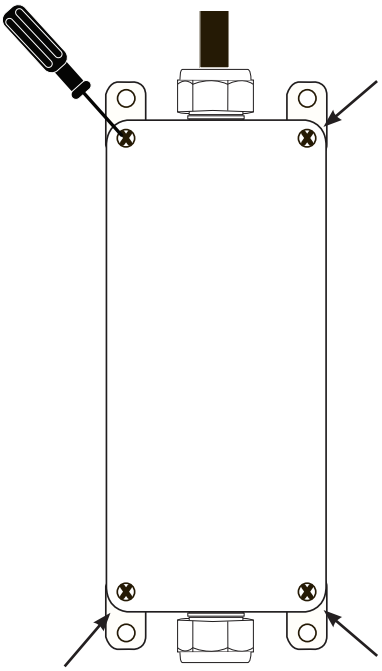


2 Mount enclosure vertically. Support power cable 152 mm (6 in) from cable gland.

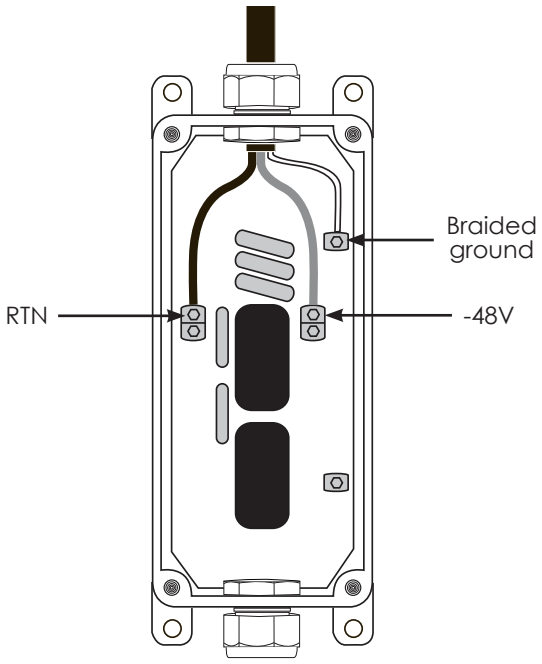


Section 9: Splicing Capacitive Jumper to power

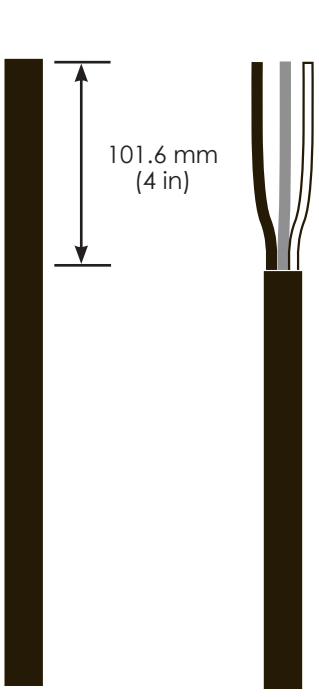
1 Loosen 4 screws to remove the cover. Screws are ARE captive to the lid but can be removed if required.

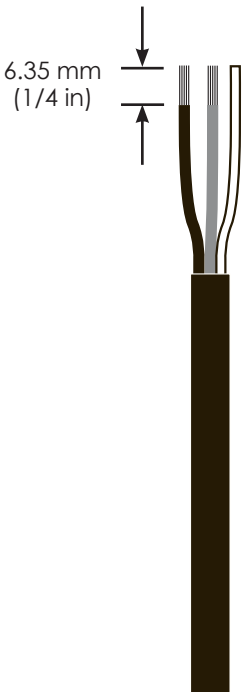


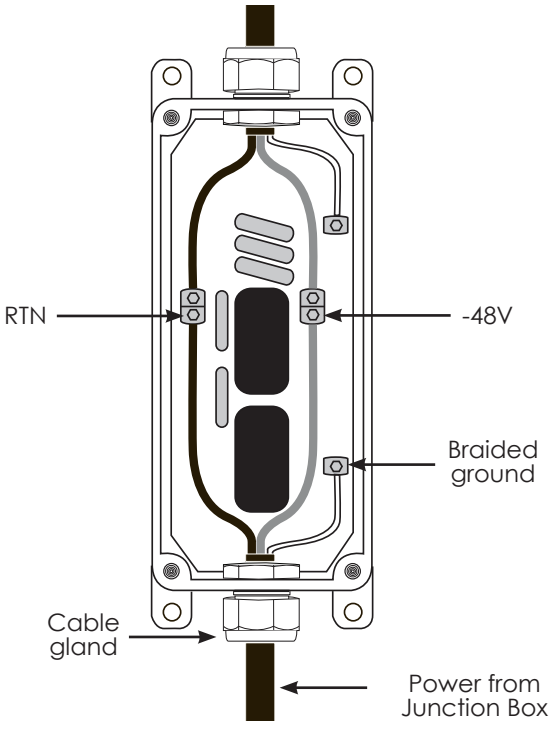
2 When lid is removed inspect pre-installed jumper to be sure nothing has come loose during shipping and handling.



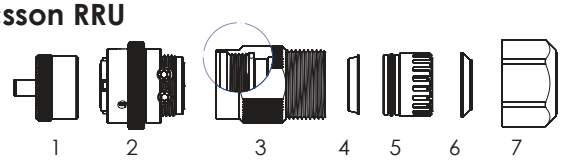
3 Remove 101.6 mm (4 inches) of outer shielding from the power trunk cable. Remove 6.35 mm (1/4 inch) of conductor jacketing. Install power trunk into enclosure by loosening gland nut and threading into gland opening. Connect 0 Volt conductor to the corresponding 0 Volt terminal. Connect -48 Volt conductor to the corresponding -48 Volts terminal. Connect the braided ground to its terminal. Tighten cable gland and reinstall the lid. Support the power trunk cable 152 mm (6 in) from the cable gland.



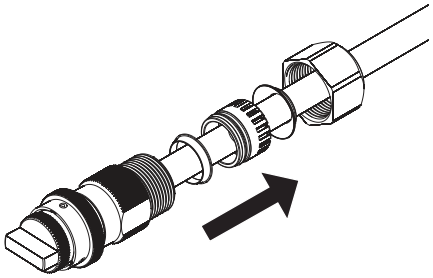




Section 10: Outdoor Power connection procedure for Ericsson RRU

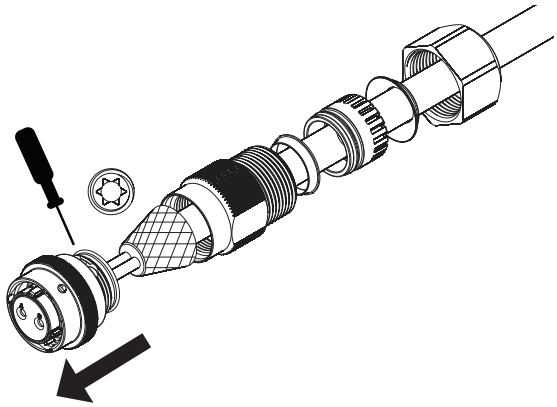


1



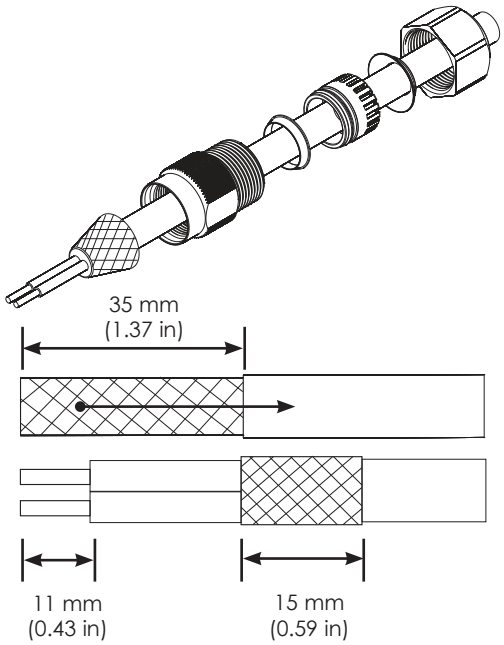
Loosen rear gland nut 7 using a M28 spanner. Using the dust cap and a M25 spanner separate items 2 and 3. Slide components 3 - 7 down the power cable.

2



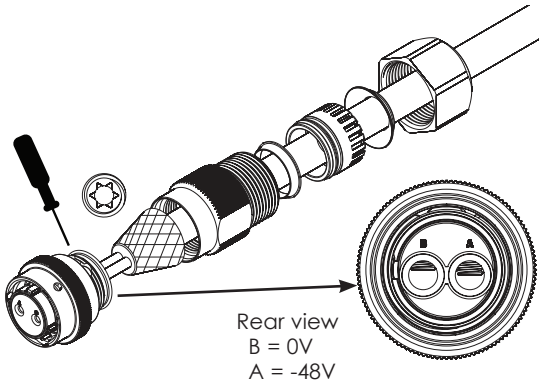
Remove cap and loosen Qty 2 star nuts until front end of connector can be removed. (Star nuts are NOT captivated, be careful not to lose them)

3



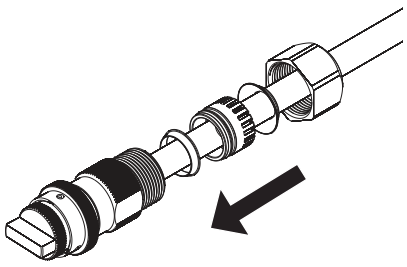
Cut power cord to length and prep end by removing 35 mm (1.37 inches) of jacketing. Fold braid over jacketing and trim to 15 mm (0.59 inches). Remove 11 mm (0.43 inches) of jacketing from power conductors.

4



Slide prepped power conductor into slots marked B (0V) and A (-48V), tighten Qty 2 star nuts until front end is secure and cannot be pulled off by hand.

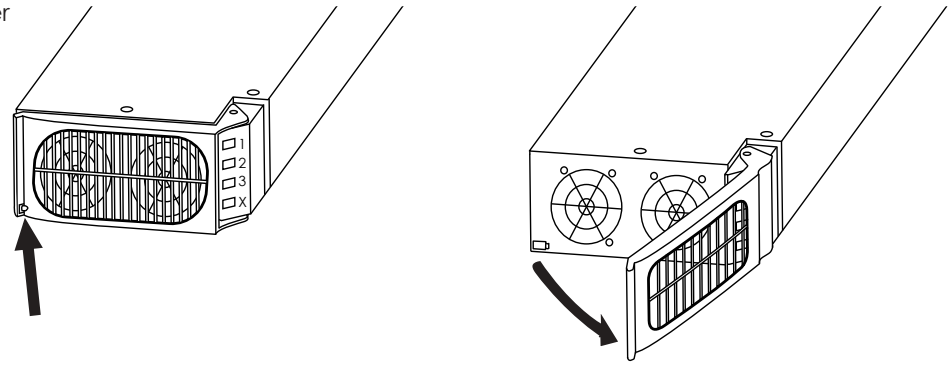
5



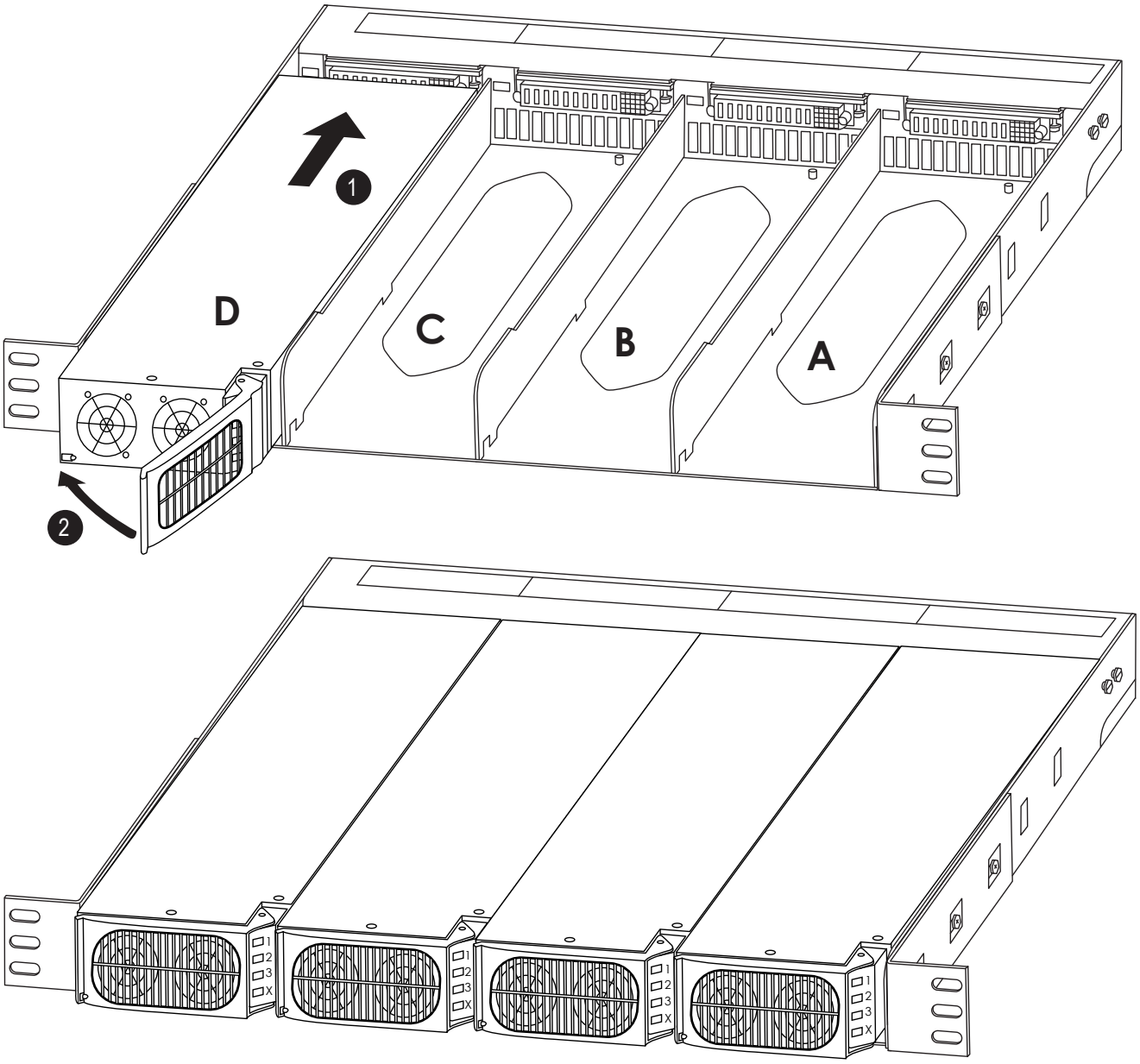
Slide item 3 over braid and tighten to item 2 using the dust cap and a M25 spanner. Slide remaining items into the back of item 2 and tighten the rear gland nut with a M28 spanner.

Section 11: Module Installation

Push in spring clip and open front cover

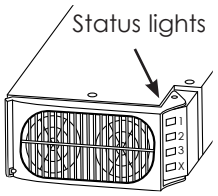


Slide module into rack until it stops. ❶ Close the front cover on the module to make connection and lock into place. ❷ Repeat with any remaining modules. The modules operate individually so ports may be left open for future expansion.



Completed 4 module (12 RRU) installation

Section 12: Testing and Maintenance



Power up circuits, test for correct installation

1. Check for continuity and proper connection of capacitive jumper for each circuit, as described in Section 7
2. Turn on one input circuit breaker at a time, the applicable PowerShift module circuit LED (1, 2, or 3) should blink green for about 30 seconds,
   - This indicates the module is measuring the output circuit line resistance
   - During this time there is a varying low voltage on the output circuit; the low voltage will not power on the radio
3. After about 30 seconds the applicable module LED should change from blinking green to solid green
   - The module will enable nominal output voltage on the circuit, the radio should power on
4. If the applicable circuit LED continues to blink green after 30 seconds then this indicates the module is unable to determine the line resistance
   - A major alarm will be raised on the base unit alarm relay
   - After the 30 second interval, the module will still enable output voltage to power up the radio; a default line resistance of 0.15 Ohms is used, which should result in an output voltage sufficient to power up the radio
   - Troubleshoot by confirming the capacitive jumper is connected, repeat the integrity check in Section 7
   - Note that PowerShift can not measure a line resistance that is > 3.5 Ohms
5. If any status lights are not green, refer to the alarm information below.
6. Note the following:
   - Cycling the input power to a circuit (off and back on) will restart the 30 second measurement interval (i.e., the module will perform a new measurement of the line resistance)
   - After the 30 second measurement interval is complete, the module will use the measured line resistance indefinitely; it will not attempt to re-measure the line resistance unless the input power to the circuit is cycled

Alarms

There are four LED status indicators on each PowerShift Module: 1, 2, 3 and X:

1. 1, 2 and 3 represent the status of each of the three power circuits in the module.
2. X represents the status of the overall module.
3. Intermittent or latent failures will be indicated by the X indicator even if the individual circuits are functioning correctly.

Circuit LEDs (1, 2, 3)

1. Solid green LED indicates the circuit is functioning properly.
2. A blinking green LED indicates the circuit is performing a line resistance measurement
   - This occurs every time input power is applied to the circuit (including when the input power is cycled off and back on)
   - The circuit LED should blink green for about 30 seconds and then change to solid green
   - If the LED continues to blink green after 30 seconds this indicates an alarm condition (the module is unable to measure the line resistance)

Module LED (“X”)

1. Solid green LED indicates the module is functioning properly.
2. If the X LED is not green, but 1, 2 and/or 3 are green, the indicated circuit(s) are still functioning properly and delivering power, but a latent failure has occurred (e.g., a temporary over-temperature condition)

See the alarm table on following page for additional information on LED status and troubleshooting

Circuit 1, 2 or 3 LED	Module "X" LED	Alarm Condition (GUI & Relay)	Description
Off	Off	Critical and Major	No input power on any module/circuit GUI will not be able to connect, but alarm relays will be active for both critical and major
Solid Green	Solid Green	None	Circuit and module are functioning normally
Green Blink	Solid Green	None Or Major	Circuit is performing line resistance measurement Nominal condition (30 second duration): - Circuit is measuring the line resistance, it takes ~30 to complete - Occurs whenever circuit input power is applied or is cycled off/on - After ~30 seconds the circuit LED should change to solid green - No alarm is raised during or after if the measurement is successful Alarm condition – line resistance measurement unsuccessful - If circuit LED continues to blink green after 30 seconds this indicates the module could not successfully measure the line resistance of the affected circuit - A major alarm condition is raised
Solid Green	Yellow Solid	Major	Circuits are functioning normally, but a module-level fault has occurred. The condition may not require immediate attention and can be corrected in the next available service window (e.g., the module can continue to run with the failure of one fan, until the module can be replaced). Possible cause – Fan failure or other module-level failure - Use the GUI to obtain additional status details for the module failure, or replace the module
Yellow Blink	Yellow Blink	Critical	Circuit is in alarm, no output power on the alarmed circuit Possible cause - Overload or Short-Circuit - Circuit is shut down to protect itself from over-current condition - Possible causes: Excess current demand (failed radio), a short in the trunk cable, etc. - Module will sense the circuit condition about every 3 seconds (the circuit LED briefly flashes green) to see if the fault condition has cleared - After 20 minutes if condition is not cleared then circuit latches off; fault must be cleared and input power cycled to re-enable output Possible cause – Module is over temperature - Module shuts down all 3 circuits to protect itself from high temperature condition - Possible causes: Module fan intake is blocked, site shelter cooling system has failed, module fan has failed - If the problem resolves itself (shelter cooling is restored) and module drops below threshold, then output power is restored and LED status changes (see next row below) Possible cause – Input Voltage out of range - Circuit is shut down due to its input voltage being out of range (see specification table) - Possible causes: DC rectifier plant output voltage out of range, DC plant on batteries that have discharged to a low voltage - If input voltage is brought back into range the circuit will immediately re-enable its output

Green Blink	Yellow Solid	Major	A latent module failure has occurred, circuit was likely previously shut down but is now providing output power Possible cause – Module was previously over temperature - Module was previously shutdown to protect itself from high temperature condition, but the high temperature subsequently cleared - The circuit output power is re-enabled, but alarm is latched to provide site technician with clarity on which module and circuits were impacted - Possible causes: Module fan intake were temporarily blocked, site shelter cooling system was temporarily failed - To clear the alarm, use the GUI "clear" button or cycle the input power for each affected circuit
Red Solid	Red Solid	Critical	The indicated circuit is shut down. Internal module hardware failure (e.g., internal fuse failure). Replace the module. The module is not user serviceable, contact customer technical support.
Red Blink	Red Blink	Critical	The indicated circuit is shut down. Fault condition may be internal to the module or in the external circuit. Confirm the circuit integrity as described in Section 7. Reset the circuit/module using the GUI clear button or by cycling the DC plant circuit breakers. If the fault recurs, replace the module. The module is not user serviceable, contact customer technical support. Note: A red blink circuit LED can occur if the input power is cycled off and immediately back on, and there is no load (radio) connected to the circuit. In this case the capacitive jumper retains a small amount of voltage, and the module must allow it to discharge down before it can start the line resistance measurement. Allow 1-2 minutes for the discharge to occur, the LED will then change to green blink to indicate the line resistance measurement is in progress.

Section 13: Output Circuit Overload Protection

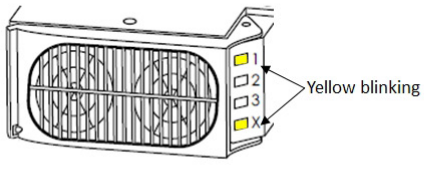
The power module is designed to shut off the output from a circuit in the event the load demand exceeds the circuit maximum output capacity of 1460W total power (radio demand + power loss in the trunk cable)

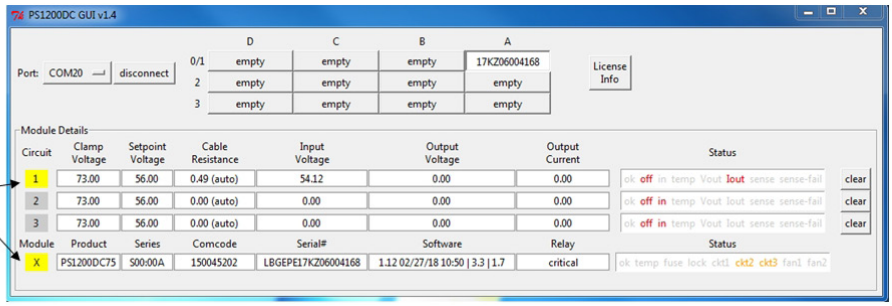
Under normal circumstance an output overload should not occur; the proper design and installation of the PowerShift system ensures the maximum radio load demand and the trunk cable length do not exceed the circuit capacity. However, off-nominal events such as a short in the trunk cable or a malfunctioning 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 GUI appears as shown below using Circuit 1 as an example

Note the following:

- The GUI shows Circuit 1 has input voltage but no output voltage or current (output is shut off due to the overload condition)
- The GUI Circuit 1 icon and the "X" icon are both highlighted yellow blinking
- The module front panel "1" and "X" LEDs are both yellow blinking
- The alarm relay on the back of the shelf is set for a critical alarm condition





Module Circuit-Overload Recovery

The module will check the condition of the circuit about every 3-5 seconds to determine if the overload condition remains or if it has cleared; each time the circuit check is performed the applicable module circuit LED will briefly flash green and the GUI status will briefly show "okay"

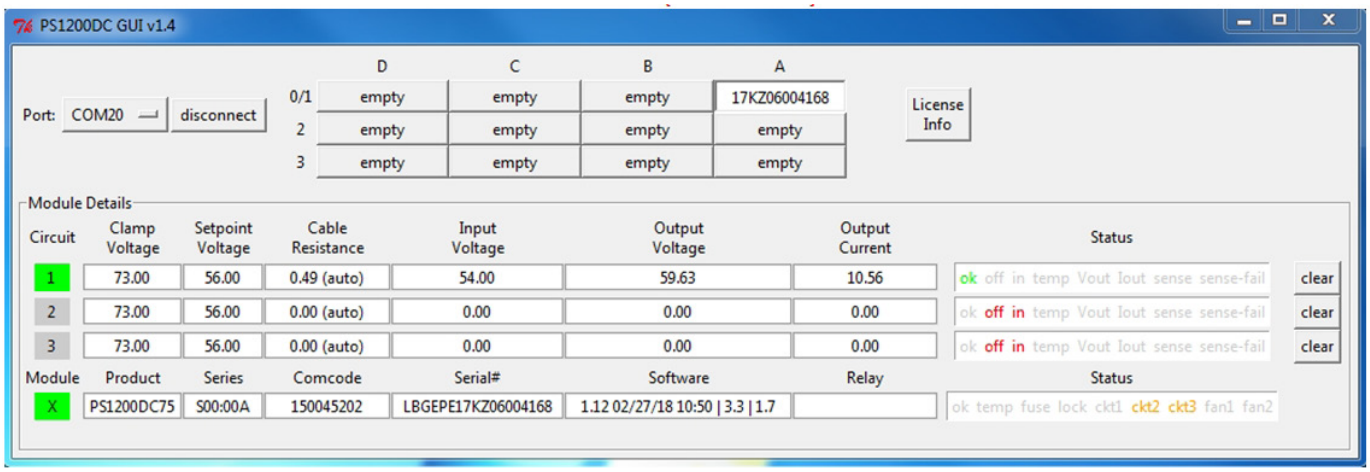
If the overload condition clears within 20 minutes then the module will re-enable power output of the circuit

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 3-5 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 (the applicable circuit and "X" LEDs will continue to blink yellow)

Once the circuit has latched off, the user must intervene as follows to re-enable the circuit:

- The circuit overload condition must be cleared
- The input power to the circuit must be cycled off and back on (typically by using the DC plant circuit breaker)
- The circuit will re-enable its output power, the applicable circuit LED will blink green for about 30 seconds while the line resistance is measured
- After about 30 seconds:
  - GUI Circuit number icon and the module front panel LED are both solid green
  - The GUI circuit status shows "okay"
  - The GUI "X" icon and module LED are both solid green



Module High Temperature Protection

The power module is designed to protect itself from an excessive temperature (overheating) condition. Under normal operating conditions the module cooling fans provide adequate cooling for the module. However in off-nominal conditions (blockage of the module's air intake or exhaust grill, failure of the site shelter cooling) the module will shutoff output if its internal temperature rises too high. In this event the module functions as follows:

- When the internal temperature rises too high the module shuts off the output of the affected circuit(s).
- There are two possible operating conditions for the module once a thermal overload has occurred:

  Condition 1, Critical Alarm: The high temperature condition (e.g., failure of the shelter cooling) has not been resolved and thus the module output remains shut off. The high temperature condition must be resolved and the internal module temperature allowed to drop down below threshold before the module will re-enable its output power

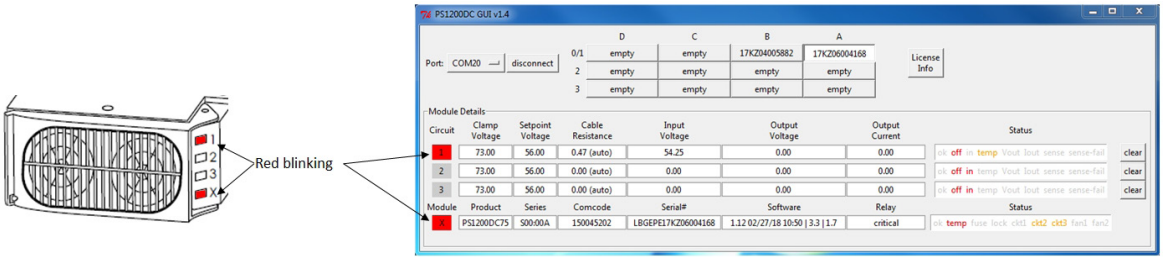
  Condition 2, Major Alarm: The thermal overload condition has been resolved and the module output has re-enabled. Note that the thermal overload alarm still remains active (latched) until the user intervenes to clear the alarm

- Using Circuit 1 as an example, the GUI and module LEDs will appear as shown below for the two conditions:

Thermal Shutdown, Condition 1, Critical Alarm (high temperature condition is not resolved, no output power)

Note the following:

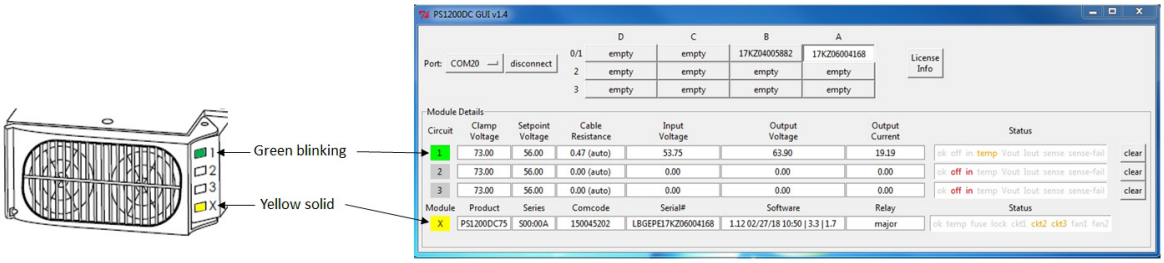
- The GUI shows Circuit 1 has input voltage but no output voltage or current (output is shut off due to an unresolved high temperature condition)
- The GUI Circuit 1 icon and the "X" icon are both highlighted red blinking
- The GUI Circuit 1 status shows "temp out-I off" indicating the circuit shutoff is due to a thermal overload
- The module front panel "1" and "X" LEDs are both red blinking
- The alarm relays on the back of the shelf is set for a critical alarm condition



Thermal Shutdown, Condition 2, Major Alarm (high temperature condition has resolved, output power in enabled)

Note the following:

- The GUI shows Circuit 1 has output voltage and output current
- The GUI Circuit 1 icon shows green blinking, the "X" icon shows yellow solid
- The GUI Circuit 1 status shows "temp " indicating there is an alarm condition on the circuit (i.e., a latched alarm for the prior thermal shutdown)
- The module front panel "1" LED is green blinking, and the "X" LED is yellow solid
- The alarm relays on the back of the shelf is set for a major alarm condition



Module Thermal - Overload Recovery

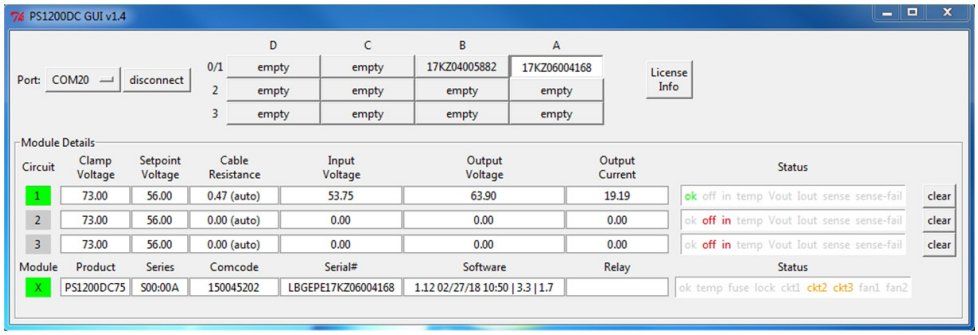
Note the following:

- If the module is still shutdown **(Condition 1, critical alarm)** then the high temperature condition must first be resolved (e.g., unblock the fan, restore shelter cooling) such that the module internal temperature falls below the shutdown threshold and the module re-enables output power (it will then be in Condition 2)
- Once the module has re-enabled power **(Condition 2, major alarm)** the user must clear the alarm by using the GUI to click the "clear" button for each circuit that has highlighted "temp" status
- The applicable circuits will change back to nominal operating condition (see below):

  The GUI Circuit number icon and the module front panel LED are both solid green

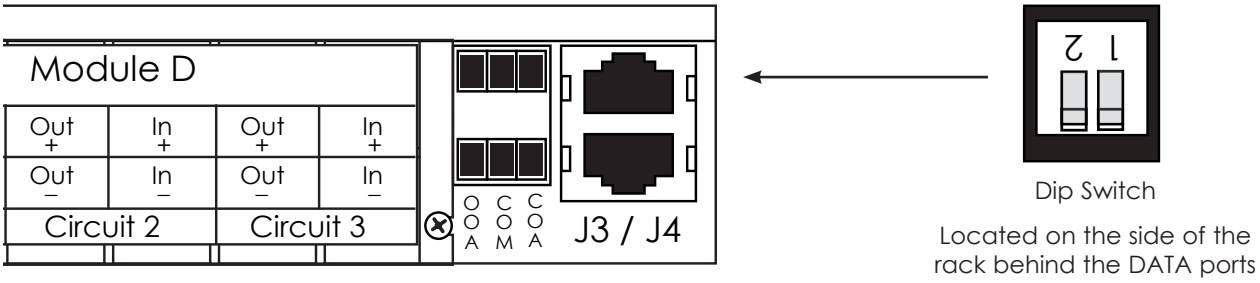
  The GUI circuit status shows "ok"

  The GUI "X" icon and module LED are both solid green



Section 14: Dip Switch / RJ45 Jacks / Alarm Relay

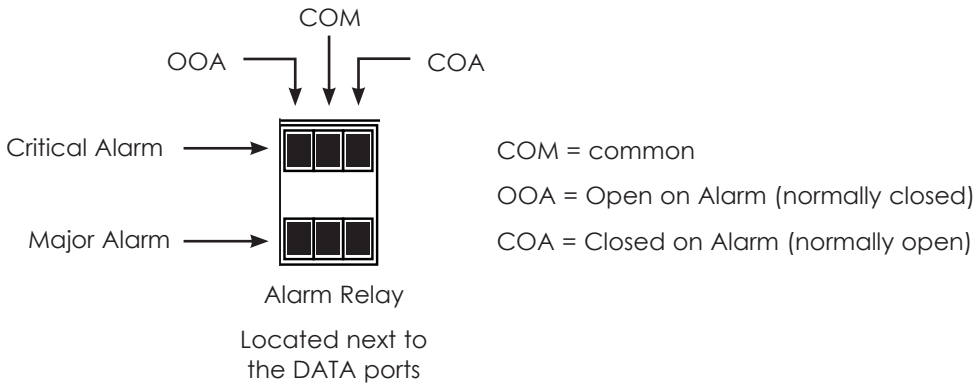
Dip Switch and **RJ45 jacks** are present on each base unit for possible attachment to an external controller such as a GE Critical Power Standard Controller.



The **Dip switch** position is factory preset for no controller with both switches down. If for any reason these switches are not set accordingly, the unit will not function properly unless configured for use with a controller. Please ensure that both switches are reset to the down position as illustrated above.

Alarm Relay Connections

1. The alarm status of the unit is externally accessible with the screw terminal present at the rear near the RJ45 Jacks.



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