REFERENCE MANUAL

GENERAC®

Diagnostic Repair Manual
PWRcell™

- PWRcell Inverter
- PWRcell Battery
- PV Link™
- SnapRS™
- PWRcell ATS



Clean Energy Systems

Safety

Throughout this publication and on tags and decals affixed to the equipment, DANGER, WARNING, and CAUTION blocks are used to alert personnel to special instructions about a particular operation that may be hazardous if performed incorrectly or carelessly. Observe them carefully. Their definitions are as follows:

⚠DANGER

Indicates a hazardous situation which, if not avoided, will result in death or serious injury.

(000001)

⚠WARNING

Indicates a hazardous situation which, if not avoided, could result in death or serious injury.

(000002)

⚠CAUTION

Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

(000003)

NOTE: Notes provide additional information important to a procedure or component.

These safety alerts cannot eliminate the hazards they indicate. Observing safety precautions and strict compliance with the special instructions while performing the action or service are essential to preventing accidents.

⚠WARNING

CANCER AND REPRODUCTIVE HARM

www.P65Warnings.ca.gov.

(000393a)

Read This Manual Thoroughly

This diagnostic manual has been written and published by Generac to aid qualified Generac dealer technicians and company service personnel when servicing the products described herein.

It is assumed that these personnel are familiar with the servicing procedures for these products, or like or similar products manufactured and marketed by Generac, and that they have been trained in the recommended servicing procedures for these products, including the use of common hand tools and any special Generac tools or tools from other suppliers.

Generac could not possibly know of and advise the service trade of all conceivable procedures by which a service might be performed and of the possible hazards and/or results of each method. We have not undertaken any such wide evaluation. Therefore, anyone who uses a procedure or tool not recommended by Generac must first satisfy themselves that neither his nor the product's safety will be endangered by the service procedure selected.

All information, illustrations and specifications in this manual are based on the latest product information available at the time of publication.



⚠DANGER

Electrocution. Initiate a system-wide shutdown and turn the PWRcell DC Disconnect Switch OFF on all connected batteries before performing service. Failure to do so will result in death, serious injury, or equipment and property damage.

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When working on these products, remember that the electrical system is capable of violent and damaging short circuits or severe electrical shocks. Verify that all equipment wiring is de-energized before servicing.

During any maintenance procedure, replacement fasteners must have the same measurements and strength as the fasteners that were removed. Metric bolts and nuts have numbers that indicate their strength. Customary bolts use radial lines to indicate strength while most customary nuts do not have strength markings. Mismatched or incorrect fasteners can cause damage, malfunction and possible injury.

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Section 1 The PWRcell System

Introduction

The Generac PWRcell system is an ecosystem of integrated products designed to enable any building to generate, store, and consume its own clean energy.

The typical PWRcell system is comprised of the following components:

- PWRcell Inverter
- PWRcell Battery
- PV Link
- SnapRS

In ***Figure 1-1***, a REbus-compatible PWRcell inverter (E) is directly connected to each PV Link (B) and to a PWRcell battery (C) on DC (REbus) lines (D). To the right of the inverter are AC lines: 240 VAC or 208 VAC for grid and home loads (G), and protected load (H) support.

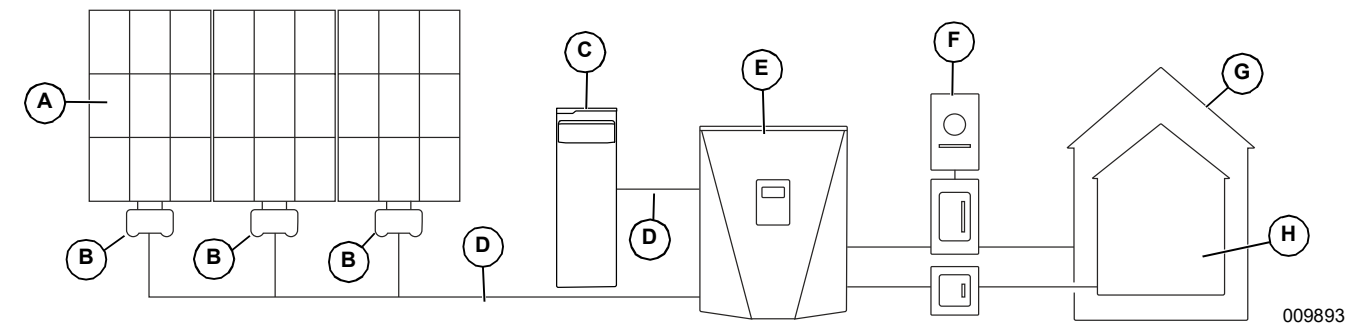


Figure 1-1. Typical Generac PWRcell System

(A) Solar Panels

PWRcell supports standard 60, 72, and 96-cell DC ungrounded solar modules arranged in a substring format. Each substring typically contains 3–8 modules (dependent on module specifications and local factors).

NOTE: Because of their electrical characteristics, 96-cell solar modules are configured in a topology different than 60 and 72-cell solar modules. For more information, refer to Parallel Substrings / PV Substring Design (Generac Part No. A0000648465).

(B) PV Link

A non-isolated, interleaved DC-DC converter that boosts PV input to a higher voltage and outputs it to REbus, Generac's regulated DC bus. The PV Link provides droop-mode power management, enabling multiple optimizers to connect in parallel on REbus (See D).

NOTE: PV array input power is not exported to the inverter until PV Link is enabled.

(C) PWRcell Battery

The energy storage component of the PWRcell system. The battery, paired with PV energy as described in (B), can be used to offset load demand during grid-tied operation and provide backup power to local loads when grid power is abnormal or unavailable.

(D) REbus

Generac's regulated bidirectional DC bus. Voltage on the REbus nanogrid will be 360–420 VDC. All communication between devices takes place over the REbus power conductors using Power Line Communications (PLC). No additional communication wiring or equipment is required for communication between a PWRcell inverter, PV Link, or PWRcell battery.

(E) PWRcell Inverter

The PWRcell Inverter is a bidirectional AC-DC power converter that serves as the interface between REbus, the building's AC loads, and the grid. Additionally, it serves as the communication gateway for other REbus devices.

(F) Grid

The PWRcell system can accept 240 VAC split-phase power or 208 VAC three-phase power depending on inverter model.

(G) Loads

The PWRcell system can help offset or eliminate grid demands from loads when properly equipped.

(H) Protected Loads

The PWRcell system offers backup power when equipped with a battery. The system can provide a range of backup options from a small protected loads panel up to whole home backup. The backup capabilities of the system are determined by the specifications of the PWRcell Inverter and battery.

SnapRS (not shown)

An in-line PV Rapid Shutdown device that satisfies 2017 and 2020 NEC 690.12 within the boundary PV rapid shutdown system (PVRSS) requirements. When used with Generac PV Link, Generac SnapRS devices limit all controlled conductors within an array's 1 ft (305 mm) boundary to 80 VDC or less within 30 seconds of rapid shutdown initiation.

System Modes Overview

Generac PWRcell offers several system modes for various installation configurations, markets, and applications. Connected REbus devices work together to manage the distribution of power based on the selected system mode.

Some modes interact with PWRcell batteries to store power and/or balance production and consumption.

See ***Table 1-1*** and ***Table 1-2*** for an overview of available system modes.

Table 1-1. Grid Connected Inverter System Modes

Priority	Grid Tie	Self Supply	Clean Backup	Priority Backup	Sell
1	Support local loads.	Support local loads with PV and Battery.	Charge batteries from solar only.	Charge batteries from solar.	Exports maximum amount of power using any energy available.
2	Export to grid.	Charge batteries from solar.	Support local loads with PV.	Charge batteries from grid.	Charge batteries from excess solar energy.
3	–	Export to grid.	Export to grid.	Support local loads with PV.	–
4	–	–	–	Export to grid.	–

Table 1-2. Optimal System Mode for Goal

Goal	Optimal Inverter Configuration
Net-metering solar energy without a battery.	Grid Tie
Use grid as little as possible.	Self Supply
Keep batteries charged using only solar power.	Clean Backup
Keep batteries charged as much as possible.	Priority Backup
Export maximum power including stored energy.	Sell

Grid Tie

In Grid Tie mode, the PWRcell Inverter functions as a conventional grid-tied inverter system. The system powers local loads and when generation exceeds load demand, excess power is exported to the utility for net metering and other credits.

NOTE: Grid Tie is intended for use with systems that do not include a PWRcell battery. For systems where a PWRcell battery will be connected at a later date, operate in Grid Tie mode until the battery is installed.

Self Supply

NOTE: This feature requires CTs to be properly installed and calibrated prior to use.

In Self Supply mode, the inverter prioritizes powering local loads first using solar and/or stored power. This mode is optimal in markets where net metering is unavailable or unfavorable, making battery-stored power more economically attractive than power from the utility grid.

See ***Figure 1-2***. If more power is being produced by the solar array than is needed by local loads, the inverter stores the energy in the battery for later use.

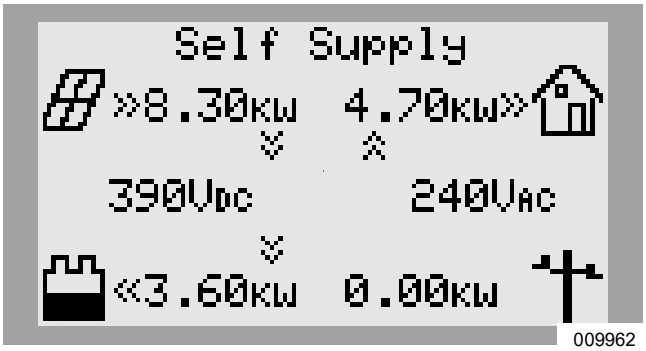


Figure 1-2. Self Supply (1 of 3)

See ***Figure 1-3***. When the battery is full and a surplus of power is available, that surplus is exported to the grid.



Figure 1-3. Self Supply (2 of 3)

See ***Figure 1-4***. When local demand exceeds available solar power, the battery will discharge to offset the demand. If the building requires more power than the battery and solar can provide, the excess demand is drawn from the grid.

Operating in Self Supply mode, the battery will discharge on a daily basis to the minimum reserve setting on the PWRcell Battery. The setting MinSocRsrv comes default set to 30 percent. This means a system operating in Self Supply, while grid connected, will only use up to 70 percent of the battery's stored capacity, leaving at least 30 percent available for Island Mode in the event of a utility service interruption.

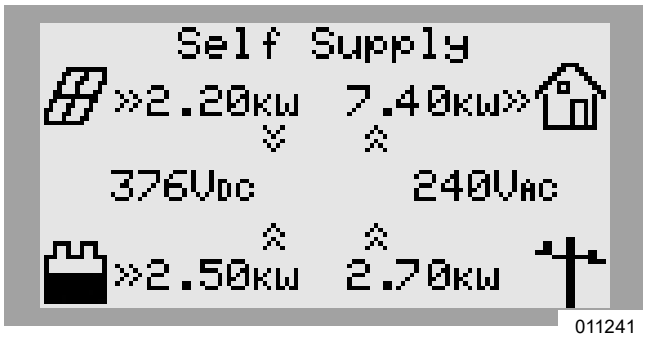


Figure 1-4. Self Supply (3 of 3)

Clean Backup

NOTE: Grid power is not used to charge batteries in this mode.

See ***Figure 1-5***. In Clean Backup mode, the inverter prioritizes keeping the battery charged and ready for a grid interruption using solar power only. If the battery is not fully charged, the inverter uses all available solar power to charge the battery. PWRcell Batteries will not export to grid in this system mode.

See ***Figure 1-6***. When the battery is fully charged, solar power will flow to local loads and the grid.

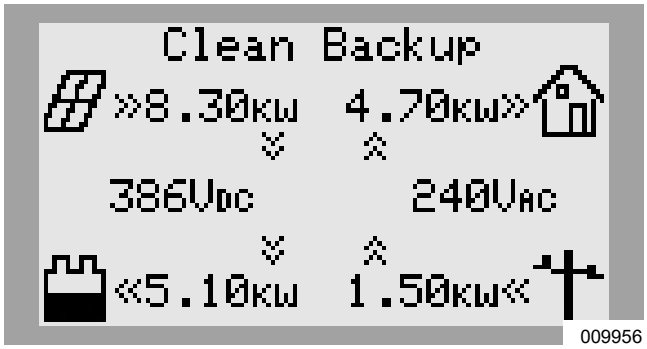


Figure 1-5. Clean Backup (1 of 2)

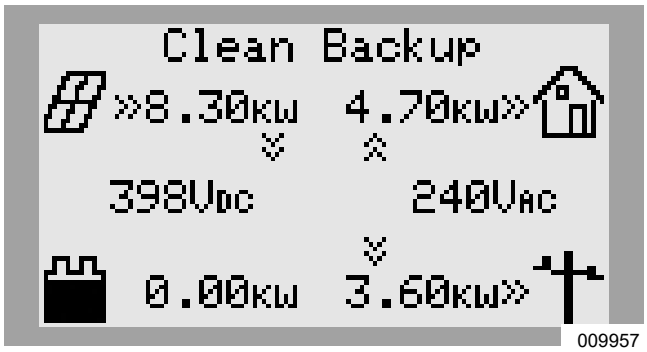


Figure 1-6. Clean Backup (2 of 2)

See ***Figure 1-8***. If there is a utility service interruption while operating in Clean Backup, the system will enter Island Mode. Protected loads will be supported by solar and battery power. If enough solar power is available, solar will simultaneously charge the battery and support the loads.

Priority Backup

In Priority Backup mode, the inverter prioritizes keeping batteries charged and ready for grid interruption using solar or grid power. If the battery is not fully charged, all available solar power is used to charge the battery. When the available solar power is lower than the battery input power rating, the inverter uses grid power to expedite battery charging. PWRcell Batteries will not export to grid in this system mode.

See ***Figure 1-7***. If solar and grid power are available, both can charge the battery. The system displays the amount of power being drawn from the grid and the amount of power being consumed by local loads before reaching the battery.

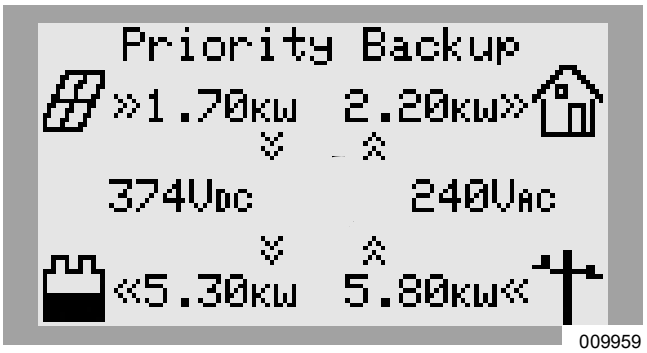


Figure 1-7. Priority Backup

See ***Figure 1-8***. If there is a utility service interruption while operating in Priority Backup, the system will enter Island Mode. Protected loads will be supported by solar and battery power. If enough solar power is available, solar will simultaneously charge the battery and support the loads.

Sell

Sell mode sets the system to export all available DC power to the grid up to the rated grid-tied output maximum. Available power from solar is exported first, followed by stored energy from the battery. When exporting power, connected batteries discharge to the grid until their state of charge reaches the MinSocRsrv setpoint. Once a battery is depleted to this point, it will not charge again until either of the following are true:

- Solar production exceeds the inverter rated grid-tied output power maximum.
- The inverter system mode is changed to a system mode prioritizing battery backup.

See the Generac PWRcell Battery Installation and Owner's Manual for more information.

Remote Arbitrage

This system mode is only to be enabled and configured for Distributive Energy Resource (DER) aggregation for the purposes of explicit control of a PWRcell system via IEEE 2030.5 communication protocol.

By default, this system mode is not enabled or selectable via the inverter control panel. If this system mode is enabled and selected without proper configuration, the inverter will not export AC power through its AC Grid Connection terminals. By default, in the event of an outage in this system mode, local loads connected to the Protected Loads terminals may be supported by available PV and ESS power depending on the configuration of the PWRcell system and inverter settings.

Island Mode

In the event of a grid outage, the PWRcell Inverter enters Island Mode. While in Island Mode, the inverter disconnects from the utility grid and powers the building from the REbus nanogrid. In a typical solar-plus-storage configuration, this means all REbus-connected batteries will work together with the PV links to supply power to REbus. The inverter will pull power from REbus to provide AC power to protected loads.

In Island Mode, the inverter will display "Islanding" on the home screen and a status of "islanded" on the inverter device page. Herein, use of islanding and islanded refer to Island Mode.



Figure 1-8. Island Mode

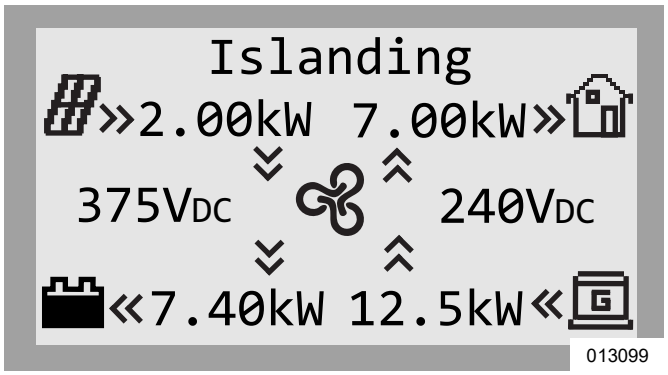


Figure 1-9. Island Mode with Integrated AC Generator

NOTE: To enter Island Mode, the inverter setpoint, "EnaIslanding", must be set to 'on' (default value) and the system mode can not be set to Grid Tie.

NOTE: If EnaIslanding is set to "off" when an outage occurs, the inverter will disconnect from the grid and enter Standby state if DC power is available from REbus devices. If DC power is not available from REbus devices, the inverter will power off. Backup loads will not be powered.

Table 1-3. Island Mode AC Short Circuit Current Contribution

Peak AC short-circuit current contribution	370 A p-p
Peak output fault current duration	300 us
Peak output RMS fault current	125 A rms
Max 3-Cycle RMS output fault current	47.7 A rms
Max fault current duration (Current limit in overload 32 A rms)	6.23 s

Export Override

NOTE: This feature requires CTs to be properly installed and calibrated prior to use. For more information on CT calibration, see the PWRcell Inverter Installation and Owner's Manual.

NOTE: This feature is NOT intended to serve as a means of achieving compliance to Utility interconnection requirements. For information on export limiting settings related to Utility compliance, see the PWRcell Inverter Installation and Owner's Manual.

While related to system operation, Export Override is an inverter setting, not a system mode. When enabled, Export Override allows the user to restrict inverter export such that excess power is not sent back to the grid. The system limits solar power generation to match power consumption measured by the PWRcell CTs. This feature is suitable as a simple and easy option for systems pending permission to operate (PTO) where the Utility does not specify a requirement for the system to be de-energized or otherwise disabled pending approval. Using the Inverter control panel, a user can find this feature on the "Mod. Settings" sub-menu within the Inverter device page.

PWRcell Safety

System Shutdown

1. See ***Figure 1-10***. Initiate an inverter shutdown by pressing and holding the red shutdown button (A).

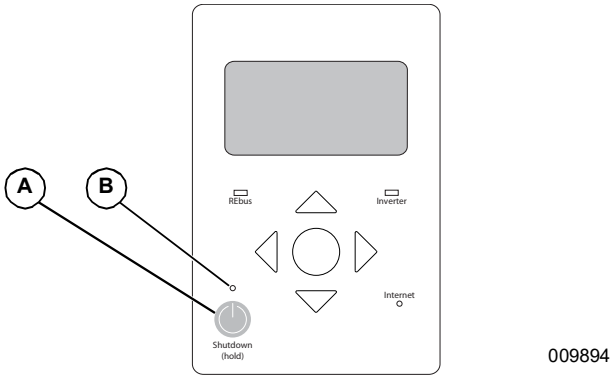


Figure 1-10. Inverter Control Panel

2. See ***Figure 1-11***. Turn off battery disconnect switch on battery cabinet.

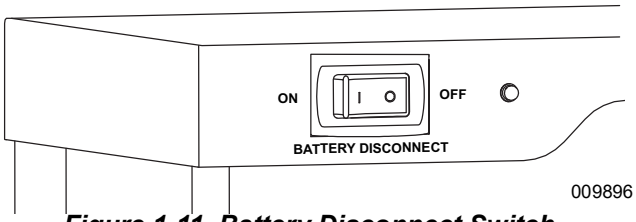


Figure 1-11. Battery Disconnect Switch

3. Allow REbus DC voltage to drop below 10 VDC
4. See ***Figure 1-12***. Open Inverter front cover by lifting the bottom to horizontal (C) and pushing inward (D).
5. Open all PWRcell DC Disconnects (E). Verify DC voltage reported on LCD screen has dropped to below 10 VDC.
6. Disconnect AC Grid source from inverter. Wait for Inverter LCD screen to turn off.
7. Verify all sources of AC and DC power are disconnected.

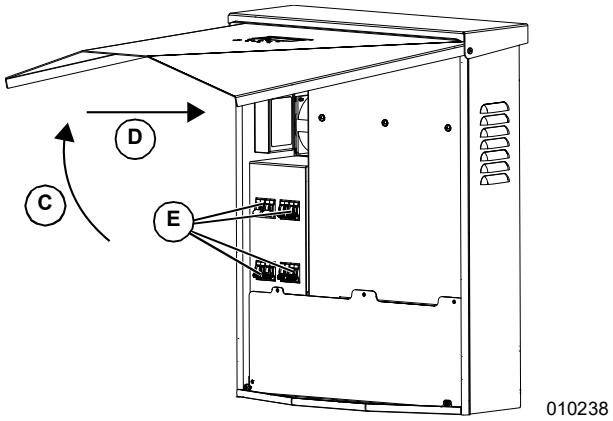


Figure 1-12. PWRcell DC Disconnects

Shutdown Mode

⚠DANGER

Electrocution. Initiate a system-wide shutdown and turn the PWRcell DC Disconnect Switch OFF on all connected batteries before performing service. Failure to do so will result in death, serious injury, or equipment and property damage.

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NOTE: A loss of grid power will not de-energize REbus in a PWRcell system with enabled energy storage.

Shutdown button (Item A, ***Figure 1-10***) activates a transition to shutdown system mode.

Disabled PWRcell equipment limits output voltages to a safe level for servicing.

NOTE: The AC section of the inverter will still be energized unless the building AC disconnect or main service breaker is shut off.

To enter shutdown, press and hold shutdown button.

In shutdown mode:

- PWRcell inverter will stop sourcing power to REbus, and immediately disable all communicating power sources on REbus by sending a system-wide system mode change signal.

NOTE: Successful signal transmission relies upon proper configuration of PLM channels across REbus devices (PV Links and Batteries).

- Shutdown LED (Item B, ***Figure 1-10***) will illuminate.
- Inverter screen will display REbus DC bus voltage and text indicting shutdown mode has been initiated.

Section 2 Understanding REbus

Introduction

Understanding REbus is crucial for the safety and performance of all PWRcell equipment.

REbus stands for Renewable Energy bus. It is the trademarked name for Generac's patented DC bus. REbus requires a three-wire connection, Positive, Negative, and Ground, between PWRcell devices and the inverter.

Two main functions of REbus are:

1. Power Distribution
2. Device Communications

Power Distribution

REbus nanogrid technology utilizes power curves on a common high voltage DC bus to regulate the flow and distribution of power depending on the selected system mode and settings.



⚠DANGER

Electrocution. Initiate a system-wide shutdown and turn the PWRcell DC Disconnect Switch OFF on all connected batteries before performing service. Failure to do so will result in death, serious injury, or equipment and property damage.

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SAFETY INFORMATION: Always disable the system before servicing. If the inverter or battery is enabled, REbus voltage (360–420 VDC) will be present on all connected REbus DC wiring! No other devices need to be enabled or connected for voltage to be present at the REbus terminals in the inverter or on connected wiring. The inverter builds DC voltage on REbus from its AC connection as soon as it has been enabled from the inverter device page.

Best Practices

1. **Wire Labeling**
   - It is recommended to label each set of REbus home run wires at both ends during installation.
2. **Pre-commissioning Wiring Checks**
   - Complete all pre-commissioning checks detailed in the Commissioning Quick Start guide, packaged with inverter, prior to energizing the inverter.
   - Performing all pre-commissioning checks is the best way to avoid damaging equipment.
3. **Inverter Control Panel**
   - After energizing and enabling the inverter, confirm the following on the Inverter Control Panel:
     – Inverter Status LED is solid green.
     – REbus DC voltage on the home screen displays 360-420 VDC.
4. **REbus Status LED**

LED Color	REbus Status
Green	All devices are enabled and functioning normally on REbus.
Yellow	One or more devices are disabled, or no devices are detected.
Red	A serious fault has been detected on a device or the REbus wiring.

Troubleshooting

For REbus power lines troubleshooting see ***Table 4-1*** in ***PWRcell Inverter*** section in this manual.

Device Communications

Generac PV Links, PWRcell Batteries, and the PWRcell Inverter utilize Power Line Communications for bidirectional communication. Power Line Communications are achieved using Power Line Modem (PLM) technology. Each REbus device can be programmed to a channel between 1–12. If devices on a given inverter system are programmed to different channels, they will not be able to communicate with one another.

Best Practices

1. **DC Disconnects**
   - Ensure DC disconnects for connected devices are in the ON position. In most cases REbus voltage must be present on device wiring for Power Line Communications.

NOTE: Due to its internal power source, the battery cabinet can communicate without REbus voltage.

2. **Polarity**
   - Ensure REbus positive and negative wiring polarity is correct at the inverter and all connected REbus devices (PV Links and Batteries). Devices will not communicate if polarity is reversed.
3. **REbus Ground**
   - Ensure each REbus device has an uninterrupted ground connection between it and the inverter.
   - It is recommended to run a separate ground wire for each REbus circuit.

NOTE: The ground wire for a circuit on REbus is necessary to maintain common mode voltage on the power lines for the system's Power Line Communications.

4. **PLM Channel**
   - Ensure all REbus devices on a given inverter system are set to the same PLM channel.
   - Each device and the inverter come preset to PLM channel 1 from the factory. It is only necessary to change the channel of a system if there is more than one PWRcell Inverter on-site. Refer to ***Commissioning Multiple Inverter Systems*** in ***Appendix B Inverter***.

NOTE: Channels 1–12 can be used in general operation. Channel 0 must only be used in certain setup and diagnostic procedures.

NOTE: If PWRcell system is installed in proximity to other PWRcell systems, cross talk may occur. Adjust all system channels accordingly. Refer to ***Commissioning Multiple Inverter Systems*** and ***PLM Cross-talk Recovery Procedure*** in ***Appendix B Inverter***.

Troubleshooting

For REbus device communications troubleshooting, see ***Table 4-1*** in ***PWRcell Inverter*** section in this manual.

REbus Confirmation

1. All wiring has correct polarity and each device has a direct ground connection.
2. All devices display their own unique device page and are functioning as expected.
3. Inverter LED is solid green.
4. REbus LED is:
   - *Green* all devices are enabled and functioning normally on REbus.
   - *Yellow* one or more devices are disabled, or no devices are detected.
5. The Inverter and its connected devices are programmed and communicating on the same PLM channel.
6. Each PWRcell system on site has been programmed to its own unique PLM channel. See ***Commissioning Multiple Inverter Systems*** in ***Appendix B Inverter*** to a different PLM channel to avoid crosstalk.

Section 3 Internet Connectivity

Internet

Connecting a PWRcell Inverter to the Internet via the homeowner's router is required for monitoring and warranty purposes. It is recommended to connect the system prior to commissioning for the first time.

Basic Requirements

To connect a PWRcell Inverter to the Internet, the system requires a hard-line connection from the homeowner's router to the inverter. The Internet service should be basic high-speed broadband with minimum data transfer speeds of at least 5 Mbps upload/download.

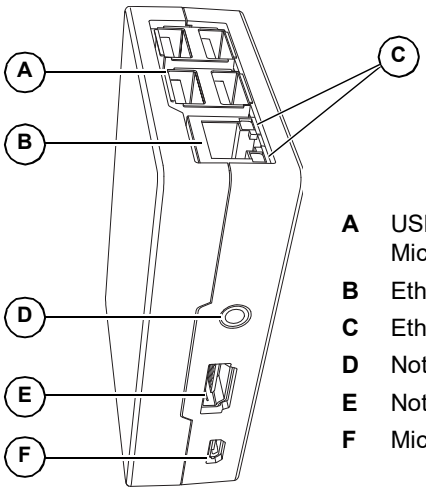
NOTE: The homeowner will not be able to use the PWRview™ Mobile Application or browser-based monitoring dashboard without an Internet connection to each inverter on site. Similarly, the installer will have no access to monitoring without a connection to each inverter.

NOTE: The homeowner will not be able to access their mobile application if the Internet connection is not routed through the factory connection to the REbus Beacon.

Device Profiles

REbus Beacon

See ***Figure 3-1***.The REbus Beacon is an important device in a PWRcell system. It stores data from REbus devices; it provides the system's scheduler feature for Time of Use (TOU); it stores the Installer Configuration Tool; and it communicates to Generac servers for system monitoring with PWRview Mobile App as well as PWR-fleet. Connecting Ethernet through the Beacon ensures the connection will be encrypted.



A USB A to Inverter or Micro-USB port
B Ethernet port
C Ethernet port LEDs
D Not Used
E Not Used
F Micro-USB port

Figure 3-1. REbus Beacon

Inverter Control Module (ICM)

See ***Figure 3-2***. The Inverter Control Module (ICM) houses the Inverter Control Panel and Liquid Crystal Display (LCD). It has an additional Ethernet port (A) for diagnostic use only. This connection is unencrypted and will not allow for remote system monitoring.

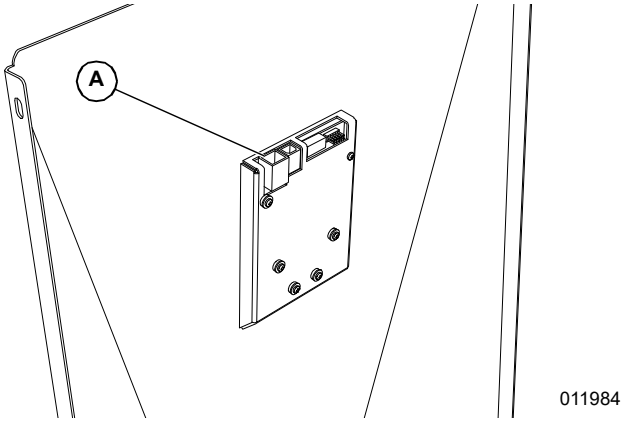


Figure 3-2. Inverter Control Module (viewed from underside of lid)

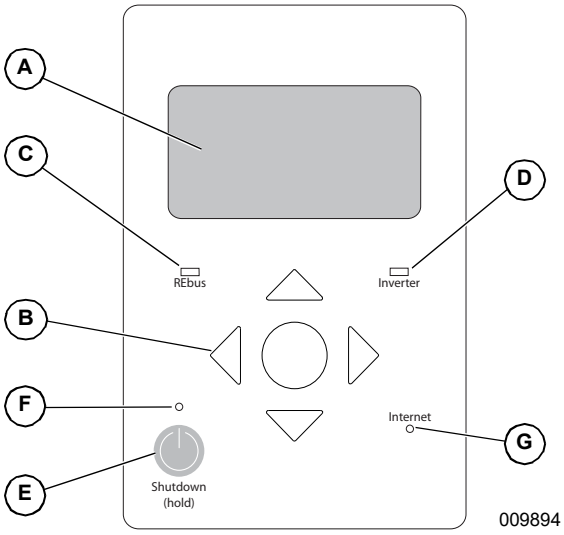


Figure 3-3. Inverter Control Panel

A LCD display
B Navigation keys
C REbus status LED
D Inverter LED
E Shutdown
F Shutdown LED
G Internet LED

Diagnostics

The diagnostics defined below, detail common inspections for troubleshooting Internet connectivity. Reference the ***Internet Troubleshooting Flowchart*** for further guidance.

1. **Verify Blue LED Indicator Light**
   - Verify Internet LED illuminates on the inverter front control panel when Internet CAT5 cable is connected. If the blue Internet light does not illuminate, follow the steps below.
2. **Verify Separate Field-Installed CAT5 cable**
   - Verify CAT5 is connected correctly at the homeowner's router to each inverter on site (each inverter requires its own Ethernet Cable from the router).

NOTE: Ethernet cables cannot be installed within the same raceways as the power conductors and should always be installed independently from all power wiring.

3. **Verify Correct Ethernet Ports**
   - Verify correct Ethernet port at router.
   - Verify correct Ethernet port at inverter underneath the REbus DC disconnects.
4. **Verify "Hot" Signal on CAT5 Cable**
   - Ensure other devices in the home can connect to the Internet over Wi-Fi, etc.
   - If there is no signal to other devices, the homeowner's modem and router may need to be reset. Otherwise, the homeowner may need to call their Internet service provider to verify service.
   - Once service has been verified, use a data tester or laptop computer to verify Ethernet signal passes on cable.
     – Use a data tester to check whether the RJ45 male connectors pass from one end of the cable to the other.
     – If using a laptop, leave the CAT5 cable plugged into the router, unplug the cable at the inverter and plug into the laptop computer. Ensure the computer is not using its Wi-Fi connection.
   - See ***Figure 3-4***. Remake the RJ45 male connectors on the CAT5 cable if necessary. RJ45 male connectors often need to be remade. Ensure proper configuration of CAT5 pairs into both RJ45 male connectors. T-568B configuration is most common.
5. **Verify REbus Beacon Device Page**
   - Verify the Beacon Device page appears on the inverter screen using the arrow keys on the inverter control panel. The Beacon will have its own device page like the Inverter, PV Links, and PWRcell Battery regardless of whether there is an Internet signal. It is connected to the inverter via USB.
     – If there is no device page for the Beacon see troubleshooting step 2 below.
   - Verify on the Beacon itself whether two small lights are lit (one green, the other amber) on either side of where the blue Ethernet patch cable plugs in at the top. These will illuminate when the Beacon is receiving an Ethernet signal from the router and USB power from the inverter.
   - The lights may be illuminated without a valid Ethernet signal if custom firewall settings are configured, outgoing ports are blocked, or the network is configured for LAN access only.
   - If the lights are not lit, there is either an issue with the physical port (disabled on the router, link speed mismatch, or faulty cable) or the beacon is not receiving power.

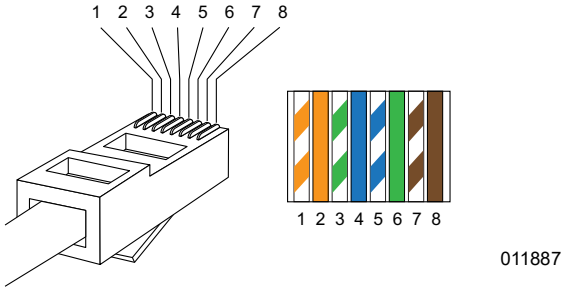


Figure 3-4. RJ45 EIA/TIA 568B Wiring Standard

1	White with orange stripe
2	Orange with white stripe or solid orange
3	White with green stripe
4	Blue with white stripe or solid blue
5	White with blue stripe
6	Green with white stripe or solid green
7	White with brown strip
8	Brown with white stripe or solid brown

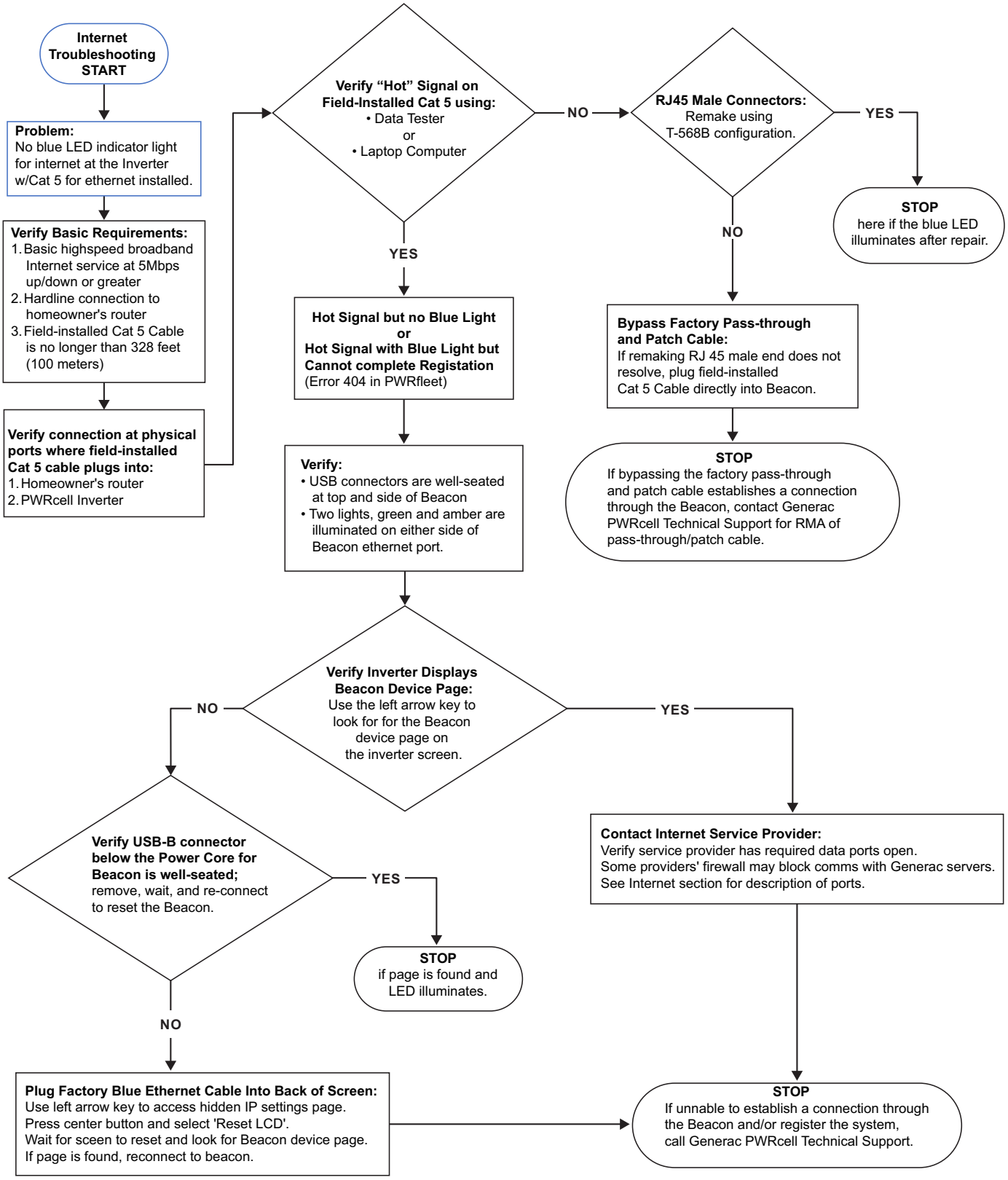
6. **Verify Server Ports**
   - See ***Table 3-1***. Verify the homeowner's Internet service provider has the correct outgoing data ports open to allow PWRcell equipment to communicate with Generac servers.

Table 3-1. Outgoing Data Ports

Protocol	Port
UDP	53
UDP	123
TCP	22
TCP	443
TCP	444

Internet Troubleshooting Flowchart

NOTE: Problems and diagnostics procedures are described in detail below.



1. **“Hot” Signal, No Blue Light, Beacon Shows Device Page**
   a. Ensure Internet connection is coming from the source at the homeowner's router. Intermediary devices such as Wi-Fi extenders, Ethernet-over-power switches, or mesh pods can lead to inconsistent connectivity through the Beacon.
   b. Connect field installed CAT5 directly to the top of the Beacon to bypass the inverter Ethernet pass-through and patch cable.
      – If this resolves the connection, the pass-through and/or patch cable from the factory may need replacing. Call Generac PWRcell Technical Support 855-635-5186.
   c. The Beacon automatically updates after being connected to the Internet, typically overnight.
2. **“Hot” Signal, No Blue Light, Beacon does Not Show Device Page**
   a. Ensure USB connections at the Beacon are well-seated in their respective ports. Unplug and reconnect; then check the screen for the Beacon device page and allow 30 seconds to a minute for connectivity and the blue light to appear.
   b. Locate the USB B connector for the Beacon to the right of the ATS port in inverter wiring compartment. This is where the Beacon plugs into the inverter. Unplug, wait 30 seconds, and reconnect. This will power cycle the Beacon. Check for the Beacon device page.
   c. If still unable to connect through the Beacon and/or the Beacon does not show up as a device on the inverter screen, remove the blue Ethernet patch cable from Beacon and plug it into the female RJ45 port on the back of the inverter screen.
      – If this does not resolve the connection, the system may require a new Beacon. Call Generac PWRcell Technical Support 855-635-5186.
   d. Use left arrow key to access hidden IP settings page. Press center button and select 'Reset LCD'. Wait for the screen to reset and look for Beacon device page. If page is found, reconnect the blue Ethernet patch cable to the Beacon.
3. **“Hot” Signal, Blue Light, Beacon Shows Device Page**
   a. After connecting Beacon, allow up to 30 minutes for the Beacon to receive automatic updates.
   b. Verify the type of Internet service being provided. If other than basic high-speed service, an upgrade may be required.
   c. If service has been verified to be basic high-speed service, verify with the Internet service provider that the ports in ***Table 3-1*** are open.
4. **Homeowner or Business Requires Manual IP Configuration**

PWRcell System comes default set to connect via DHCP. If connection requires manual IP configuration reference the Inverter Installation Manual Section 6.

Internet Confirmation

1. Confirm the blue LED indicator light for Internet is illuminated and the system is connected to the Internet through the REbus Beacon.
2. Confirm that the system is able to be registered at ***pwrfleet.generac.com***.
3. Confirm system monitoring on PWRview Mobile App or PWRview Dashboard.

NOTE: Do not leave the Internet connection routed through the inverter screen. If necessary to connect through the inverter screen for troubleshooting, call Generac PWRcell Technical Support 855-635-5186. System monitoring will not be available while connected through the inverter screen.

Section 4 PWRcell Inverter

Device Profile

The PWRcell Inverter, complete with its control panel LCD and its REbus Beacon, should be thought of as the central device in a PWRcell system. The PWRcell Inverter facilitates system-level functionality. It is important to follow all safety precautions when servicing this equipment. Initiate a ***System Shutdown*** and bring all voltages to safe working levels prior to servicing.

- **A** Inverter Control Module (ICM)
- **B** REbus Beacon
- **C** PWRcell DC disconnects
- **D** REbus bi-directional DC terminals
- **E** Internet connection
- **F** REbus DC fuses
- **G** Current Transformers (CTs) accessory ports
- **H** Automatic Transfer Switch (ATS) accessory port
- **I** REbus Beacon port
- **J** Authorized use only
- **K** STOP terminals
- **L** Protected Loads Disconnect
- **M** AC Grid Connection terminals
- **N** Protected Loads terminals
- **O** Grounding bar
- **P** RGM PWR / Gen Inhibit
- **Q** Fast Blow Mini Fuses 1A 250V

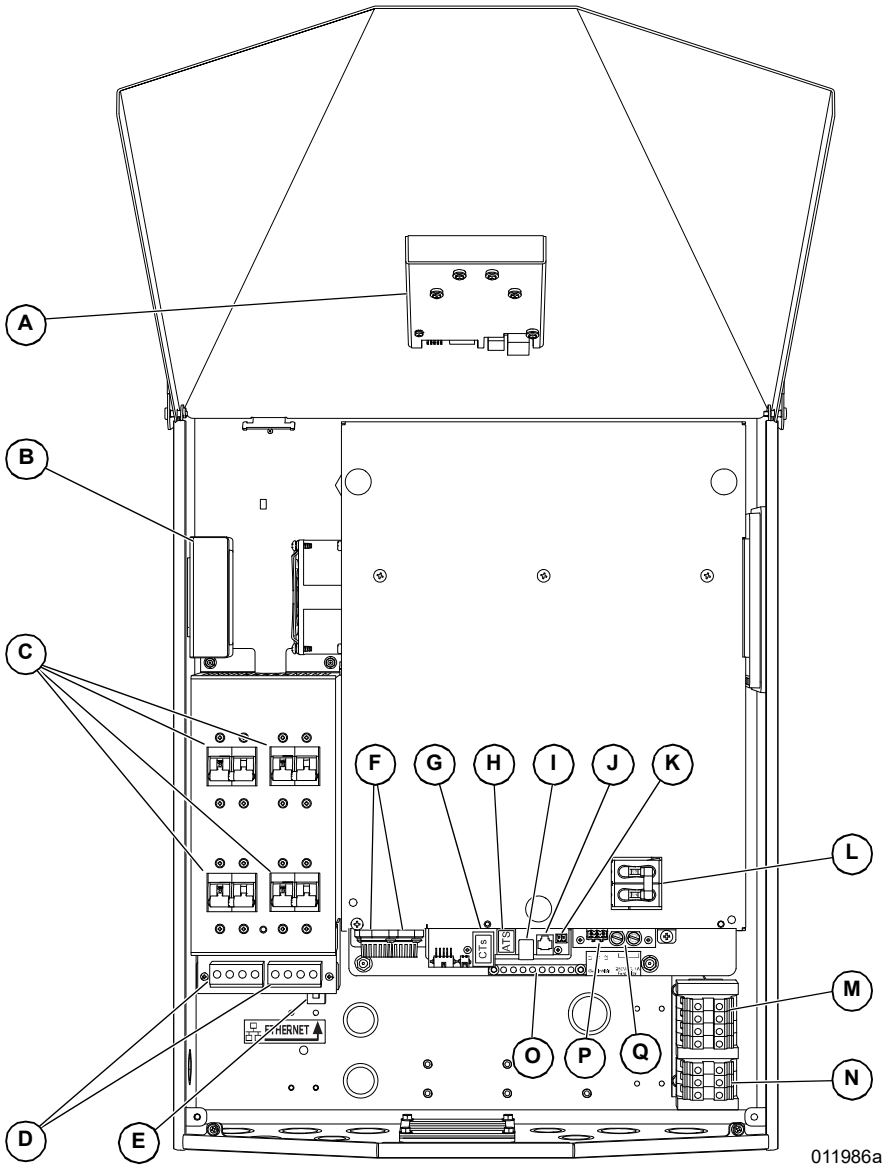


Figure 4-1. Inverter Component Locations

Diagnostics

The diagnostics defined below detail inspections for common scenarios. Reference and use in the order prescribed by ***Table 4-1*** in ***Troubleshooting***.

1. AC Configurations

- Review the permitted site plans to verify the system is properly configured and wired based on the approved plan set.

NOTE: Mistakes can often be revealed by reviewing the overall site configuration and retracing the installation.

2. AC Wiring

- Verify all connections are secure without loose wiring at the inverter, AC panel, backfeed breaker, combiner box, disconnect, tap, or otherwise.

- Verify Line 1, Line 2, Neutral, and Ground have stayed consistent as they have been wired across equipment.
- Verify the use of 2-pole 40 amp over current protection for the grid connection to the inverter.
  - If using a fused disconnect, verify fuses are installed and well-seated.
- Verify voltages are 120 VAC line-to-neutral and 240 VAC line-to-line nominal for split phase systems. For three phase systems, line-to-line voltage should be 208 VAC nominal. Reference the ***Generac PWRcell Commissioning Quick Start*** document (*Part No. DMAN00027*) that comes packaged with each inverter for full voltage ranges and more details on performing voltage checks.

3. REbus DC Wiring

- Verify each home run circuit consists of its own unique positive, negative, and ground wire. It is recommended to label both ends of each run during installation to avoid confusion. Use a digital multimeter (DMM) to “ring” out the runs using the continuity function if suspected mismatching has occurred.
- To rule out shorted wiring, use a DMM to verify resistance is greater than 10 kΩ for each DC circuit with DC disconnects in the OFF position.
- Verify correct polarity at each device and at the inverter.
- Verify REbus ground connections to each device (PV Links and Batteries).

4. Check Inverter Settings

- Verify the inverter settings are correct for the type of installation being executed.
- If the inverter settings are incorrect for the specific configuration of the site, the inverter may underperform or wind up in an error state.

Example	
Grid Tied Solar-only Installation	Turn 'EnaIslanding' to 'off' and choose 'Grid Tie' for the system mode.
Battery Backup Installation	Verify 'EnaIslanding' is set to 'on' and choose a backup system mode (Clean Backup, Self Supply, Priority Backup).
External ATS Installation	Verify 'NumTranSwtchs' is set to reflect the number of PWRcell ATS connected to the inverter system in addition to setting inverter for battery backup as described above.

- See ***Table B-1*** in ***Appendix B Inverter*** to reference inverter settings.

5. Disable/Enable

- For non-terminal errors, disabling and re-enabling the inverter may clear the error state and allow the inverter to return to operation.

6. Power Cycle

In limited cases, power cycling the inverter may resolve inverter functionality.

- Perform a system shutdown.
- Turn off the Battery Disconnect Switch
- Turn off AC power to the inverter.
- Wait for the inverter screen to go blank.
- Re-energize the system in reverse order.

7. REbus Fuses

- Always perform a system shutdown before removing the REbus fuses in the inverter.
- Watch the home screen and wait for VDC to fall below 12 volts.
- Use a DMM to check for voltage at the DC terminals.
- Once voltage has been turned off and system is safe to service, unscrew the two round black fuse holders at the lower left corner of the Power Core.
- Use a DMM to test fuses for continuity.

NOTE: Blown fuses almost always result from a short on REbus wiring or a failed device on the system. Do not replace fuses until system issue has been resolved.

8. Basic Function Test

This test isolates the Power Core from the DC bus for a health check on the core.

- Perform a system shutdown.
- Turn all DC disconnects to the OFF position.
- Recover from shutdown mode.
- Enable the inverter
- If the inverter connects to the grid and can bring up the DC bus internally, it passes the Basic Function Test.
- If the inverter does not pass this test, call PWRcell Technical Support.

9. DC Disconnects

- Verify DC disconnects are closed in the ON position. REbus voltage must be present at PV Links and Batteries for them to communicate with the inverter.
- Always disable the inverter before turning DC disconnects ON.

Troubleshooting

The troubleshooting table below references the images and diagnostics contained in this section and in ***Appendix B Inverter***. Use the diagnostic practices in the order they are listed to solve problems. If unable to resolve functionality call Generac PWRcell Technical Support 1-855-635-5186.

NOTE: Problems and diagnostics procedures are described in detail below.

Table 4-1. Inverter Troubleshooting

Problem	Observed Symptoms	Diagnostics
Multiple Inverter Systems Cross-Talking	Devices from one PWRcell system show up on another. Multiple inverter or Beacon pages on one inverter.	– Refer to ***PLM Cross-talk Recovery Procedure*** in ***Appendix B Inverter***.
Inverter Error	Inverter home screen displays: 'error detected on PWRcell [model]'	– Check Inverter Settings – Disable/Enable – Check REbus Fuses (after shutdown) – Basic Function Test – Check REbus DC Wiring – Check AC Wiring – Call Tech Support
No REbus Device Comms	Inverter is enabled and REbus device (PV Link or Battery) does not appear on inverter screen.	– Check DC disconnect – Check REbus DC Wiring Polarity – Check Grounding – Check REbus Fuses
	'N/A' on all device Icons at home screen and device pages say 'offline'	– Power Cycle – Check REbus fuses – Verify DC Disconnect(s) ON
	Known device 'offline'- device page shows the device but shows its status as 'offline'.	– Verify DC Disconnect(s) ON – Check REbus Fuses
Beacon Device Page Missing	Scrolling all the way through the device list on the screen, using the left or right arrow keys, there is no page for the REbus Beacon.	– Check USB connections at Beacon – Check Beacon USB at Power Core – Plug live Ethernet cable into Beacon – See ***Internet Troubleshooting Flowchart***
No Backup Power	Upon loss of utility grid power, system did not power protected loads. Inverter may be in state: islanding, waiting, standby, error.	– Ensure Protected Loads Breaker is ON – Check Inverter Settings – Check Protected Loads panel – Check Battery
Blackout /Brown-out	Protected Loads lose power and come back on briefly at intervals. Inverter screen says “Island Overload.”	– See ***Island Overload***.
Stuck in Waiting or Standby	Inverter will not connect to grid and will not export power.	– Check AC Wiring – Call Tech Support
REbus Voltage is Low	Inverter will not bring up REbus and may be in states: low REbus voltage, waiting, standby, or error.	– Check AC wiring – Check Inverter Settings – Check REbus devices – Basic Function Test
Stuck in Islanding	Inverter will not come out of islanded state	– Check Inverter Settings – Check AC wiring
Stuck in Shutdown	Inverter will not come out of shutdown mode	– ***Stuck in Shutdown Mode***
Unknown Devices Offline	Inverter screen shows unknown device pages where device says it is 'offline'	– See ***Unknown Devices 'Offline'***.
Configuration Error	Inverter device page shows “Configuration Error”	– Check Inverter Settings

Multiple Inverter Systems Cross-Talking

- Refer to ***Commissioning Multiple Inverter Systems*** in ***Appendix B Inverter*** to verify proper commissioning procedures were followed.
- If suspected that systems on-site are cross-communicating, refer to ***PLM Cross-talk Recovery Procedure*** in ***Appendix B Inverter***.

Inverter Error

If the Inverter goes to an error state, the inverter light will be red and the home screen will display, 'error detected on PWRcell [model]'. Navigate to the inverter device page to view specific inverter state. Certain error states will show specificity (e.g. error: REbus fault). Others will show a generic error.

1. Check Inverter Settings
   a. Ensure the inverter is set properly for the configuration of the site.
   b. Improper configuration of settings can lead to an inverter error.
2. Disable/Enable
   a. For generic errors, attempt to disable the inverter then re-enable. This could clear a non-terminal/ non-persistent error.
   b. Briefly observe inverter operation. If the inverter returns to error state proceed with Steps 3 and 4.
3. Check REbus Fuses
   a. If after attempting steps one and two the inverter error persists, perform a shutdown of the system by pressing and holding the red shutdown button.
   b. Use a DMM to ensure there is no voltage present at the DC terminals.
   c. Locate the REbus DC fuses at the lower left corner of the power core (two round black fuse holders). Reference the inverter wiring compartment cover diagram if necessary.
   d. Unscrew REbus fuses by hand.
   e. Use a DMM to test both fuses for continuity. The meter should ring out with an audible tone if the fuses have not been blown.
   f. If one or more fuses has been blown, this indicates a short on REbus either from an issue with the wiring or with one of the connected devices.
   g. Follow steps 4 and 5.
4. Basic Function Test
   a. With the system shutdown, turn off all four REbus DC disconnects to isolate the Power Core from any possible shorts on the DC side.
   b. Recover from Shutdown Mode using the center button.
   c. Navigate to the inverter device page and enable the inverter.
   d. Verify inverter connects to the grid and displays 'grid connected'.
   e. Verify the inverter is able to bring up REbus voltage at the home screen. DC voltage should be at least 360 VDC.
   f. Verify the Inverter light is green.
   g. If the inverter goes immediately back into error or REbus DC voltage does not reach a minimum of 360 VDC, call Generac PWRcell Technical Support. Otherwise, proceed to the next steps.
5. REbus DC Wiring
   a. If Power Core passes the Basic Function Test, proceed to isolate the REbus short.
   b. Ensure REbus wiring is not loose at any of the terminals.
   c. Visually inspect wiring for defects to best ability.
   d. With the DC disconnects turned off, use a DMM to check each DC circuit for continuity between positive and negative, positive and ground, negative and ground at the inverter.
   e. Set the DMM to measure ohms in the MΩ range.
   f. Measure the resistance at each DC circuit and record the measurements. Measure positive to negative, positive to ground, negative to ground. Resistance should be greater than 10 kΩ.
   g. If a set of REbus wires rings out with continuity across conductors, positive to ground, negative to ground, or measures 10 kΩ or less, there is a short on that wiring.
6. Check AC Wiring
   a. Visually inspect for miswiring or arcing.
   b. Perform voltage checks with a DMM.
7. Devices
   a. If fuses are intact and wiring has been verified, a short could be registering on REbus due to a failed PV Link or Battery on the system.
   b. Attempt to isolate the circuit with the short by enabling the inverter with only one DC disconnect on at a time. Repeat this for each DC circuit. Always disable the inverter before turning any DC disconnect to the ON position.
   c. After isolating the circuit, inspect the devices connected to that circuit.

No REbus Device Comms

1. Device Does Not Appear on Screen
   a. The most common reason for a device not to appear at the screen is due to reverse polarity of positive and negative REbus wiring. Devices communicate with the Inverter over the REbus power lines. Polarity must be correct. Check polarity of REbus wiring at the device and at the inverter.
   b. Check grounding. REbus ground is required for common mode voltage on the power lines which allows for PLM comms. Verify each device has an uninterrupted ground connection between it and the Inverter.
2. 'N/A' on Device Icons
   a. If at the home screen the solar panel icon or battery icon display 'N/A', this means there is no communication with the Inverter from those devices.
   b. Allow the screen to update. The screen will exhibit a certain amount of delay in the information it displays from the system, especially after a change has been made.
   c. Verify the DC disconnects for the connected devices are in the ON position and REbus voltage is present at the output terminals of the DC disconnects.
   d. Verify the Inverter is enabled to be able to communicate with devices. Devices will show as 'offline' on their respective device pages.
   e. Verify PLM_Disable setpoint for inverter is set to 'off.'
   f. If all of the above checks out, power cycle the inverter.
   g. Re-energize the inverter. This allows for the internal processor to be reset. If comms do not return at this point, call Generac PWRcell Technical Support.
3. Known Device Offline
   a. Verify the inverter is enabled and REbus voltage is at least 360 VDC out to the devices.
   b. Verify this device is still connected to the Inverter.
   c. Verify PLM_Disable setpoint for inverter is set to 'off.'
   d. Verify the DC disconnect for this device is in the ON position.
   e. Inspect wired connections for any loose wires.

NOTE: Ensure the inverter is disabled before disconnecting wiring or performing tug-tests.

   f. Verify polarity and grounding.
4. PLM Channel Configuration
   a. For sites with one inverter, leave PLM channel set to default value of 1 for all devices.
   b. For sites with more than one inverter, reference ***Commissioning Multiple Inverter Systems*** in ***Appendix B Inverter***.
   c. Verify that each Inverter system is using its own unique PLM channel across all connected devices.

NOTE: Do not leave any devices or inverters on channel 1 or channel 0 at multiple inverter sites.

Beacon Device Page Missing

See ***Internet Troubleshooting Flowchart***.

No Backup Power

If the utility grid goes down and the system does not provide backup power:

1. Verify the Protected Loads breaker is in the ON position.
   a. Cycle the Protected Loads breaker OFF then back ON.
2. Check Protected Loads Panel.
   a. If the protected loads panel has its own main breaker, verify this breaker is ON.
3. Check Inverter Settings
   a. Verify a backup system mode has been selected (e.g. Clean Backup, Self Supply, Priority Backup)
   b. Verify that the islanding setting, 'EnaIslanding' is set to 'on' in the 'mod. settings' menu for the inverter.
   c. If system has been installed with an external transfer switch, ensure the setting, 'NumTranSwtchs' is set to reflect the number of PWRcell ATS connected to the inverter system in the 'mod. settings' menu for the inverter.
4. AC Wiring
   a. Verify the AC grid connection wiring (top AC terminals at Inverter) has not been swapped with the Protected Loads wiring (bottom AC terminals at Inverter).
      (1) Turn the Protected Loads breaker OFF.
      (2) Turn on AC power to Inverter.
      (3) If AC voltage is measured at Protected Loads terminals, wiring is reversed.
   b. If system has been installed with an external transfer switch, verify all wiring to and within the transfer switch.
5. Check PWRcell Battery
   a. See ***PWRcell Battery*** Section for more details.

Island Overload

If too much load is applied to the PWRcell system during a grid outage, the system will go into an overload fault to protect itself. The inverter will attempt to reconnect on an ever-increasing interval until the load is reduced. This interval begins at one (1) minute and increases by 20 seconds on each subsequent attempt (1 minute 20 seconds, 1 minute 40 seconds, 2 minutes, 2 minutes 20 seconds...).

1. Turn Off Inverter Protected Loads Breaker/ reduce house loads.
   a. Inverter should return to 'islanded' state.
   b. Turn off individual loads breakers in the backup panel.
   c. Verify that large loads, like motor loads (ex. pumps, water heaters, etc), being backed up have been turned off.
   d. Turn on Protected Loads Breaker.
   e. Turn on each individual loads breaker one-by-one.
   f. If inverter will not return to 'islanded' state, leave Protected Loads breaker OFF.
   g. Disable inverter at the inverter device page.
   h. Re-enable the inverter.
   i. Inverter should return to 'islanded' state.
   j. If trouble persists, call Generac PWRcell Technical Support.

Island Overload (Alternate Procedure)

1. Turn off the 2-pole 40 A inverter AC backfeed breaker or AC disconnect.
2. Reduce load at the Protected Loads panel either by turning loads off in the home, or by turning breakers in the Protected Loads panel off.
3. Turn on the inverter AC backfeed breaker or AC disconnect.
4. Wait for five-minute time out.
5. Inverter should re-connect to the grid.
6. Restore Protected Loads.

Stuck in Waiting or Standby

1. AC Wiring
   a. The inverter will go into a waiting state if it cannot fully connect to the AC grid. This can happen when voltage or frequency is outside of connection and/or operating thresholds.
   b. Determine whether grid power is present or whether there has been an outage.
   c. If grid power is present and the inverter does not connect after five minutes, check all AC connections for loose wiring.
   d. Use a DMM to check for proper AC voltage line-to-neutral and line-to-line.

NOTE: Split phase inverters must have true 240 Volt split phase power. Installation of a split phase unit on two legs of a three phase service (single phase 208V) will result in perpetual waiting state.

   e. Verify that the AC backfeed breaker is closed in the ON position.
   f. If using a fused AC disconnect, verify that the fuses are fully seated and that the disconnect is closed in the ON position.
   g. If Inverter remains in waiting state, call Generac PWRcell Technical Support.

NOTE: After a grid outage, when grid power has returned, the inverter monitors the AC voltage for five minutes prior to reconnecting to the grid.

REbus Voltage Is Low

1. Check AC wiring
   a. If only partial AC voltage is present, and all other REbus devices are disabled, the inverter will not be able to bring up REbus.
2. Check REbus devices
   a. If the inverter is attempting to island without an adequate source of DC power, the inverter will not be able to bring up REbus. Potential DC power sources include PWRcell batteries and PV Links. Ensure these devices are not disabled or disconnected.
3. Basic Function Test
   a. If steps 1 and 2 do not resolve functionality, perform the Basic Function Test.
   b. If the inverter Power Core has experienced a terminal fault, the inverter will not be able to bring up REbus voltage.
   c. If the Power Core passes the Basic Function Test, repeat steps 1 and 2.
   d. If the Power Core fails the Basic Function Test, call Generac PWRcell Technical Support.
4. Check transfer switch settings and wiring.
   a. If system is not installed with an automatic transfer switch, confirm 'NumTranSwtchs' is set to '0'.
   b. If system is installed with an automatic transfer switch, confirm all wiring to the transfer switch.

Stuck in Islanding

1. Check AC Wiring
   a. If the inverter does not see AC voltage, and it is set to island with a battery attached and enabled, it will island.

2. Check Inverter Settings
   a. If 'NumTranSwtchs' is set to a value other than '0' without an external transfer switch correctly installed, the inverter may not correctly recognize the grid.
      (1) If external transfer switch is installed, check ATS CAT5 cable.

Stuck in Shutdown Mode

1. Check the 'STOP' terminals to verify the presence of a jumper between the two terminals.
2. Verify a field-installed external shutdown switch is in the 'closed' position (for a common residential light switch this would be the ON position).
3. Use the center button and follow directions on the inverter screen to recover from Shutdown mode.

NOTE: If site has more than one inverter, system may be stuck in shutdown mode due to crosstalk. See ***PLM Cross-talk Recovery Procedure*** in ***Appendix B Inverter***.

4. If unable to recover, Call Generac PWRcell Technical Support 855-635-5186.

Unknown Devices 'Offline'

1. Log into the Beacon Installer Configuration Tool.
   a. Select 'Inverter'.
   b. Select 'PWRcell Configuration'.
   c. Select 'Clear Display'.
   d. Click 'Submit'.
   e. Inverter screen should blank out, pixilate, and test its LEDs. Try again if this does not happen.
   f. Wait for screen to re-boot then scroll through device pages. Unknown devices should be cleared.

Device Confirmation

1. Confirm LEDs at the inverter are:
   - Green for Inverter indicating it is enabled and grid-connected.
   - Green for REbus indicating all devices are enabled and functioning normally.
   - Blue for Internet
2. All icons on ICM are present on the home screen, including the power pole icon in the lower right-hand corner to indicate CTs are working properly.
3. Power flow arrows at home screen display expected directionality and values are as expected for the chosen system mode and current sun state/ charge state.
4. DC and AC voltages at the home screen display within correct value ranges for the installation (e.g. REbus is nominally 380–420 VDC and AC connections are 120/240 or 120/208 VAC nominal).
5. Wattage is being produced at the home screen and the inverter device screen.
6. PV Links are making power if the sun is shining; or displaying Low Sun if the sun has gone down.
7. Battery is charging, discharging, or in standby based on chosen system mode and environmental circumstances.
8. Settings for the inverter are set properly for the installation and desired performance.
9. Protected loads breaker is 'on' for systems with a battery where backup power is desired.
10. Verify that the system will island and provide backup power to loads by simulating an outage.

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Section 5 PWRcell CTs

Device Profiles

Current transformers (CTs) are small transformers that generate a current signal back to the inverter when power is flowing through the wires they are clamped around. CTs in a PWRcell system measure power flowing on the service conductors of a home or business. The inverter uses those measurements to determine when to send or withhold power based on the system mode and selected settings.

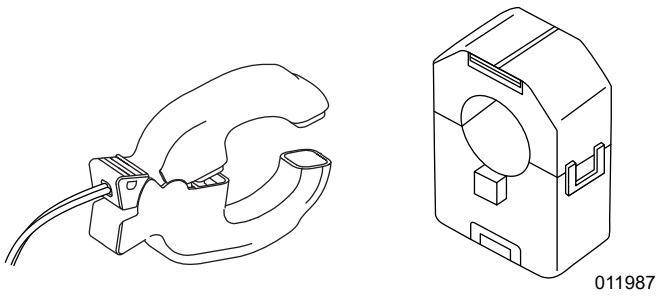


Figure 5-1. Universal 264A and 600A Current transformers (CTs)

Properly installed CTs are required for:

- Self Supply Mode
- Export Override
- Export Limit
- Import Limit
- Consumption Data

See ***Figure 5-2***. If CTs are properly installed, the building's consumption data can be viewed locally on the inverter screen or via the PWRview Mobile Application by referencing the power pole icon and the associated power flow values.

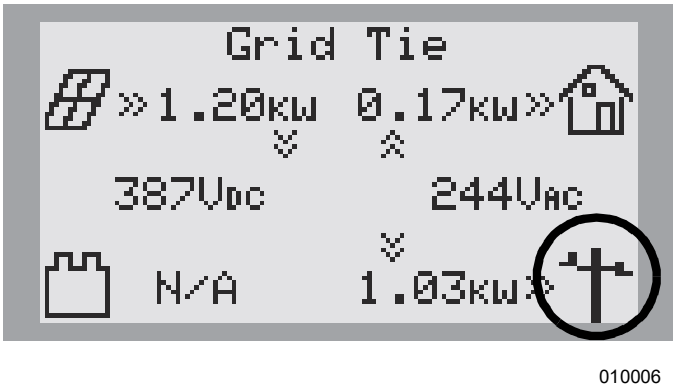


Figure 5-2. PWRcell Inverter Home Screen

NOTE: CTs are NOT a factor in the ability of a PWRcell system to provide backup power during a grid outage.

Diagnostics

The diagnostics defined below detail inspections for common scenarios. Reference and use in the order prescribed by the ***CTs Troubleshooting*** table.

1. CT Calibration

- Press the right arrow key one time to go to the inverter device page.
- Use the center button to access the inverter menu.
- Select 'Calibrate CTs' from the options shown and select confirm.
- Watch the screen closely for validation.
  - If the message, 'CT cal success' displays on the screen, CTs have been successfully calibrated.
  - If the validation message is something other than 'CT cal success', see ***Table C-1*** in ***Appendix C CTs***.
- Return to the home screen and verify the power pole icon is present with appropriate power flow values.

NOTE: Upon energizing the inverter, with CTs properly placed and wired, CTs will be automatically detected and calibrated, however, it is recommended to always calibrate manually.

2. Placement of CTs for Calibration

- CT detection and calibration is triggered by the inverter sending a small amount of power to its point of interconnection with the grid.
- Ensure CTs are installed upstream of the point of interconnection between the inverter and the utility grid.
  - See ***Figure 5-3***. If interconnection is achieved using a backfeed breaker in the main panel, place CTs on the line side service conductors.

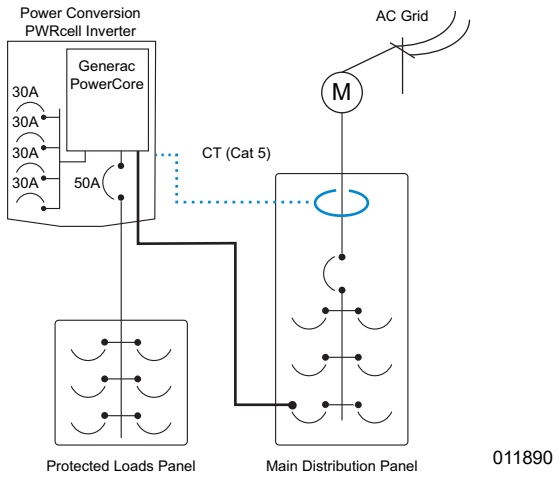


Figure 5-3. Interconnection With Backfeed Breaker

– See ***Figure 5-4***. If interconnection is achieved using a line side or supply side tap, place CTs upstream (the meter side) of the tap.

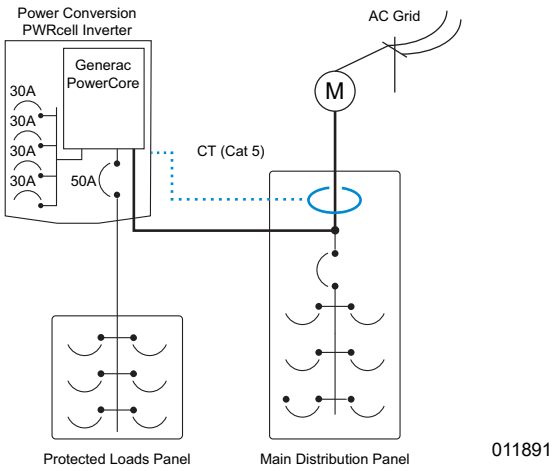


Figure 5-4. Interconnection With Line Side Tap

3. Placement of CTs for Load Capture

- Verify CTs are placed such that they capture all house loads. Those loads that are left out of the capture will not be seen as loads to be covered by the system.
  – If CTs are placed inside of a combiner box on the line-side of the interconnection breaker, house loads will not be captured.
  – If CTs are placed in an external transfer switch fed by a two pole breaker off of the main service panel, where there are additional house loads coming off of the main service panel, those additional house loads will not be captured.

4. CTs Wiring

- See ***Figure 5-5***. Ensure CTs are wired in the proper order to the RJ45 breakout adapter.
  – Use the yellow lead for CTx+
  – Use the green lead for CTx-
- Perform a tug-test on each CT lead after terminating to the breakout adapter.

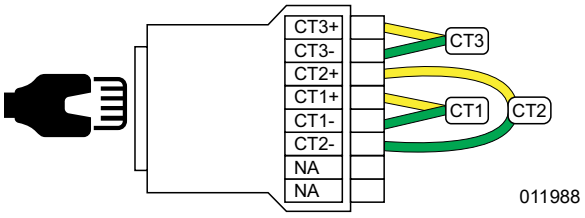


Figure 5-5. RJ45 Breakout Adapter

- See ***Figure 5-6***. Ensure the CAT5 cable for CTs is plugged into one of the silver, double-stacked CAT5 ports below the Power Core.
  – It does not matter which port is used in the silver double-stacked terminal block.
- Set inverter setting 'GridParInvrtrs' to a value of '2'.
  – Reference the inverter wiring compartment cover for additional diagram and labeling.



Figure 5-6. CTs Port

- Verify the crimped male RJ45 ends on the field installed CAT5 cable are properly terminated, using a data tester.
  – CAT5 wires often wind up out of position or fail to make contact with the metallic pins inside the RJ45 male ends.
  – Ensure both RJ45 ends are terminated with the same order of pairs so that the signal “passes.”
  – Remake as necessary.
  – Refer to ***Table 5-1*** CT RJ45 Pinout for CAT5 wiring.

NOTE: Ethernet cables cannot be installed within the same raceways as the power conductors and should always be installed independently from all power wiring.

Table 5-1. CT RJ45 Pinout

Pin	Wire Color (T-568A)	Wire Color (T-568B)	Value
1	White / Green	White / Orange	CT3+
2	Green	Orange	CT3-
3	White / Orange	White / Green	CT2+
4	Blue	Blue	CT1+
5	White / Blue	White / Blue	CT1-
6	Orange	Green	CT2-
7	White / Brown	White / Brown	Not Used
8	Brown	Brown	Not Used

5. CTs on multi-inverter systems

- Ensure CTs are connected to the double-stacked RJ45 CT port of the first inverter.
- Ensure a second CAT5 cable is run from the remaining port of the first inverter to the double-stacked port of the second inverter.
- Verify additional CAT5 male ends are properly terminated.
- Ensure the setting, 'GridParInvrtrs' is set to a value of '2' on both inverters so that both units share the load correctly.
- Ensure calibration at the first inverter was successful; then connect daisy chain CAT5 to the second inverter.

  See ***Table C-2*** in ***Appendix C CTs***

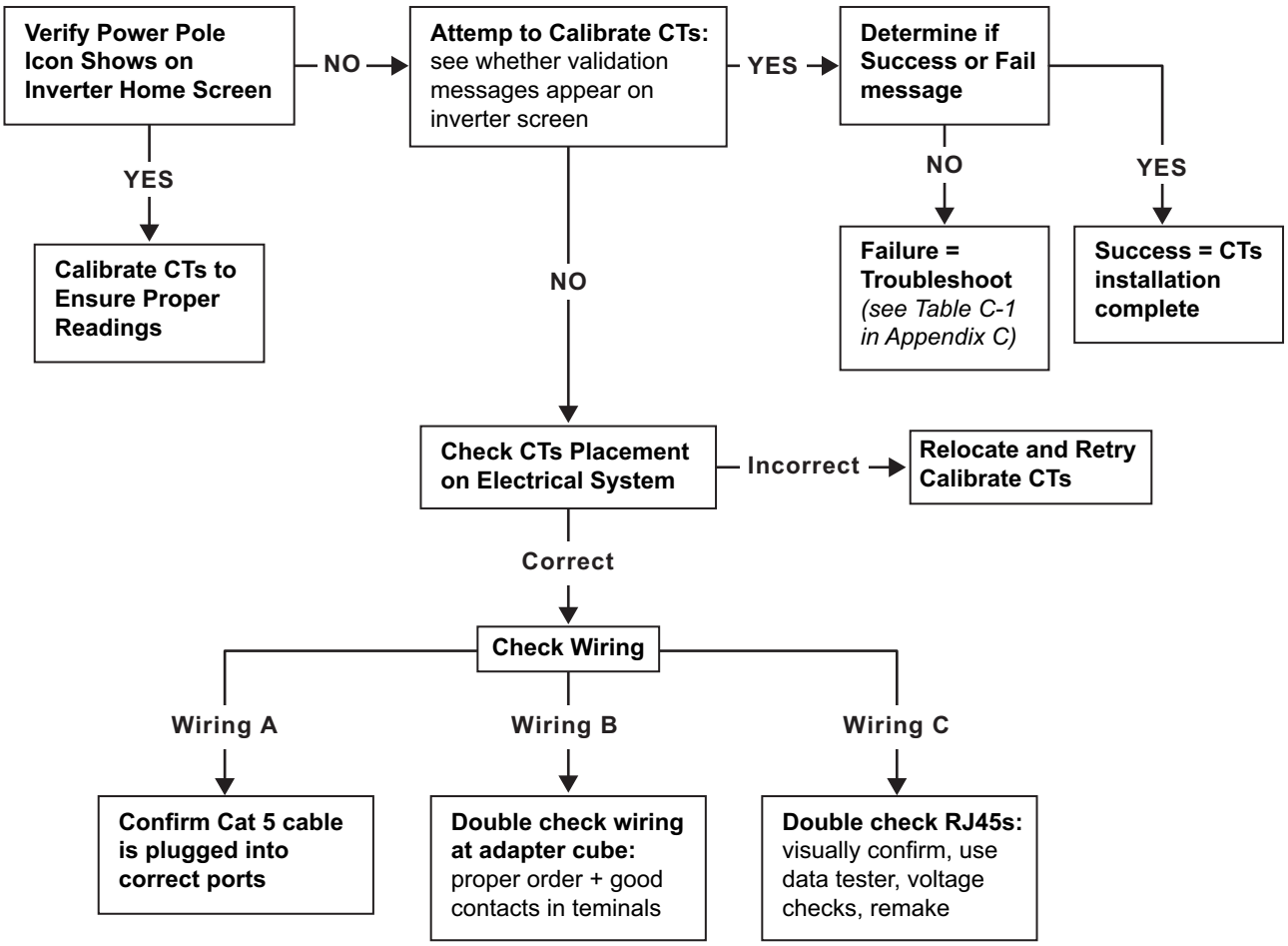
Troubleshooting

The troubleshooting table below references the images and diagnostics contained in this section as well as relevant materials in the appendix. Use the diagnostic practices in the order they are listed to solve problems. If unable to resolve functionality call Generac PWRcell Technical Support 1-855-635-5186.

Table 5-2. CTs Troubleshooting

Problem	Observed Symptoms	Diagnostics
No Power Pole Icon	Upon enabling the inverter, the power pole icon in the lower right-hand corner goes away or is missing.	- CT Calibration (reference ***Table C-1*** in ***Appendix C CTs***) - Placement of CTs - CTs Wiring
CTs Will Not Calibrate	After navigating to the inverter device page and selecting 'calibrate CTs', no validation message appears.	- Placement of CTs - CTs Wiring
Inverter Will Not Make Power w/ Export Override 'on'	PV Links and inverter are properly commissioned but sitting idle, not making power with the sun shining. Export Override is turned 'on' in the inverter ‘mod. settings’ menu.	- CT Calibration (reference ***Table C-1*** in ***Appendix C CTs***) - Placement of CTs - CTs Wiring
Battery Not Discharging in Self Supply Mode	PWRcell Battery is not discharging as expected to offset house loads while operating in Self Supply.	- CT Calibration (reference ***Table C-1*** in ***Appendix C CTs***) - Placement of CTs - CTs Wiring

CTs Troubleshooting Flowchart



Section 6 PV Link and SnapRS

Device Profiles

Generac PV Link

Where other manufacturers use micro-inverters or solar optimizers for each solar panel, Generac's PV Link optimizes several panels at once connected as a substring. The PV Link is a DC-to-DC converter that uses Maximum Power Point Tracking (MPPT) to boost power onto REbus. It also detects for arc faults and ground faults within the array. And as a key component of the Photovoltaic Rapid Shutdown System (PVRSS), the PV Link commands SnapRS devices to close and open, maintaining a count of the SnapRS in its substring using an algorithm based on resistance.

SnapRS

SnapRS devices are normally open, frequency-controlled switches that attach to the negative lead of each solar panel to achieve module-level rapid shutdown upon initiation of the PVRSS. SnapRS devices are required for all installations where NEC adoption is 2017 and higher.

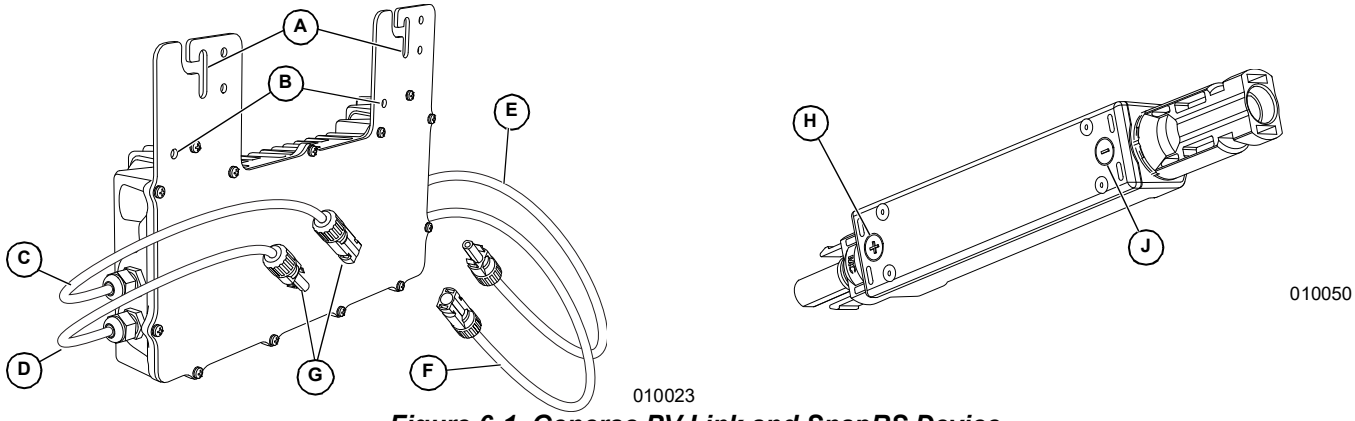


Figure 6-1. Generac PV Link and SnapRS Device

A Attachment Flange Slots
B Grounding Terminals
C REBus DC Nanogrid Output Negative (-) Lead
D REBus DC Nanogrid Output Positive (+) Lead
E PV Substring Input Negative (-) Lead
F PV Substring Input Positive (+) Lead
G MC4 Connectors
H Positive PV Connector
J Negative PV Connector

String

See ***Figure 6-2***. PWRcell equipment uses a substring topology to facilitate power production from the solar array through the inverter to the consumer loads. One “string” for PWRcell equipment consists of one home run (A) back to the inverter and up to three series substrings for a total of up to three PV Links.

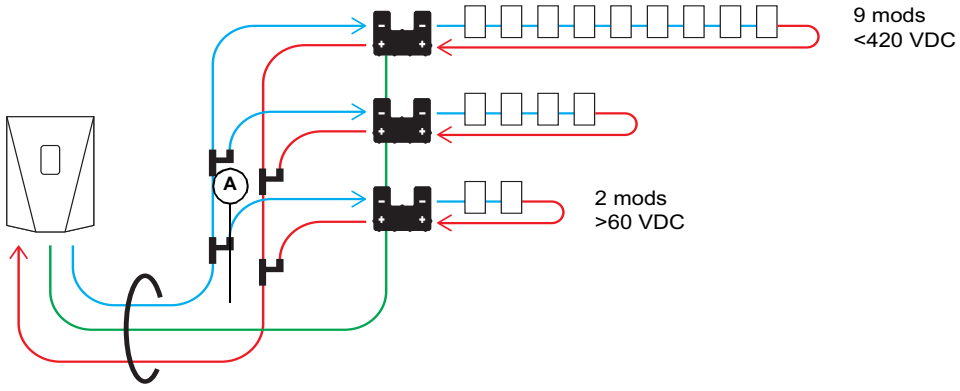


Figure 6-2. One String with Three Series Substrings

Substring

Each substring will connect to one PV Link. Up to three substrings can be paralleled back the inverter on one REbus home run. The number of solar panels going into one PV Link can typically be anywhere from 2–9 with a minimum substring input Voc of 60 VDC and a maximum Voc of 420 VDC. The number of solar panels will depend on manufacturer's specifications for make, model and local factors, such as temperature. The maximum quantity of SnapRS per substring is 10 devices total. Follow permitted plan-set for building site and reference the PV Link Sizing Tool at ***https://www.generac.com/resources-and-tools/ce-installer-resources/system-sizing-tools***.

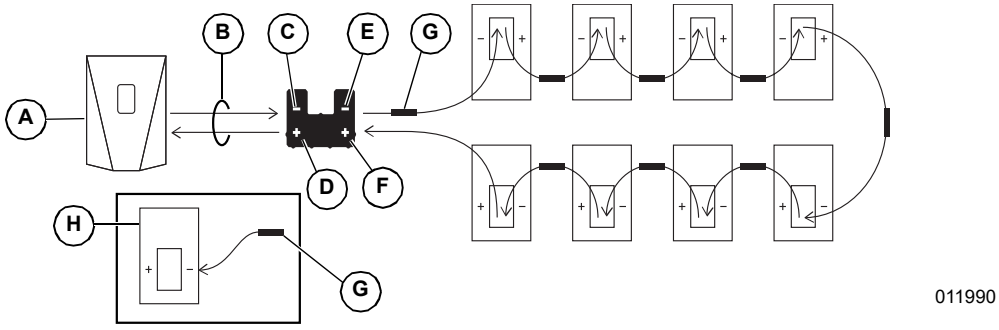


Figure 6-3. Single-String PV Substring with SnapRS Devices

A	PWRcell Inverter	E	PV Substring Input -
B	REbus homerun	F	PV Substring Input +
C	REbus Output -	G	SnapRS Device
D	REbus Output +	H	PV Panel

Parallel Substrings

Parallel substrings are two series substrings, matching in quantity of solar panels, paralleled to the input of one PV Link. Parallel substrings will be necessary for use with 96 cell solar panels to keep the input voltage below 420 Voc.

See ***Figure 6-4***. When dual substrings are connected in parallel, each substring must use the same number and type of PV modules. When using parallel substrings with SnapRS, the 'String Count' setting on the PV Link device page must be set to 2. ***See Table D-1 in Appendix D PV Link.***

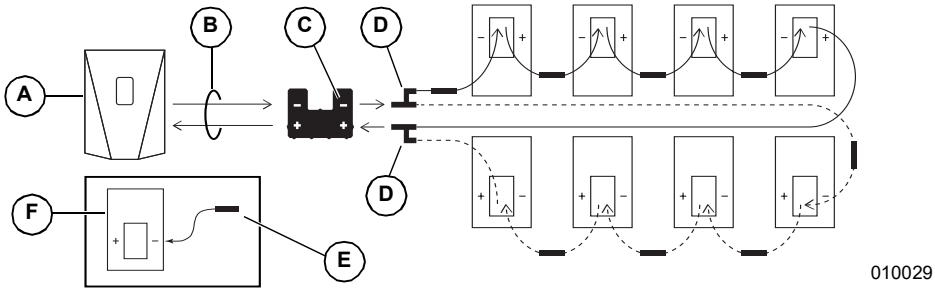


Figure 6-4. Single PV Substring with Parallel Series Inputs and SnapRS Devices

A	PWRcell Inverter	D	MC4 branch connector
B	REbus homerun	E	SnapRS Device
C	PV Link	F	PV Panel

IMPORTANT NOTE: Installing a number of panels that will generate in excess of 420 V will permanently damage the PV Link.

NOTE: substrings will need to include SnapRS where NEC adoption is 2017 and higher.

NOTE: Total substring voltage can be measured using a digital multimeter (DMM) before plugging positive and negative into the PV Link, only if SnapRS are not installed. If SnapRS are installed, cumulative string voltage cannot be measured. See SnapRS ***Diagnostics***.

Diagnostics

PV Link Universal

1. PV Panel Configurations

- Confirm solar panel type. If using 96 cell type solar panels, reference ***Parallel Substrings*** above and follow the instructions in the Generac PV Link Installation Manual for paralleling the inputs of two series substrings.
- Verify input voltage is not too high or too low for PV Link.
  - Input voltage range is 60–420 Voc.
  - Default minimum start up voltage is set to 135 Voc. Ensure Vin Startup is adjusted appropriately in the 'mod. settings' menu for the PV Link if input voltage will be lower than 135 Voc (typically required for substrings of 4 or fewer 60 cell type solar panels).
- Use PV Link String Sizing Worksheet to determine how many panels of a specific make and model may be put into one PV Link in a given region.

2. REbus DC Wiring

- Check REbus wiring polarity. Power Line Communications will not function if polarity is reversed between PV Link and Inverter.
- Check REbus ground. Power Line Communications will not function properly between the PV Link and Inverter with poor grounding or if grounding wire layout is subject to reflections. Avoid ground loops and complex “Y” or “Star” configurations in ground wires.
- Check for loose connections at inverter and PV Link(s). Ensure the inverter is disabled before disconnecting wiring or performing tug-tests.
- Verify each REbus home run circuit consists of its own unique positive, negative, and ground wire. It is recommended to label both ends of each run during installation to avoid confusion. If suspected mismatching has occurred, use a DMM to “ring” out the runs using the continuity function.
- To rule out shorted wiring, with DC disconnects in the OFF position, use a digital multimeter (DMM) to verify resistance is greater than 10 kΩ for each circuit.

3. DC Disconnects

- Verify DC disconnects are closed in the ON position. REbus voltage must be present at PV Links for them to communicate with the inverter.
- Always disable the inverter before turning DC disconnects ON.

4. Disable/Enable

- For non-terminal errors, disabling and re-enabling the PV Link from the inverter control panel may clear the error state and allow the PV Link to return to operation.

PV Link Only (No SnapRS) (NEC 2014 and older)

1. PV Link Settings (see *Appendix D PV Link*)

- Do not enable the PV Link using the “Enable w/ PVRSS” option if no SnapRS devices are installed.
- Verify Vin Startup is adjusted appropriately in the 'mod. settings' menu for the PV Link if input voltage will be lower than the default 135 Voc (typically required for substrings of 4 or fewer 60 cell type solar panels).
- Verify the PLM channel of the PV Link matches the inverter. If there is only one inverter on-site, leave all devices set to default at channel 1.
  - To find a device that has been set to a different channel than the inverter, navigate to the inverter 'mod. settings' menu and set the inverter PLM channel to 0 temporarily. Channel 0 is a catch-all channel.

NOTE: For multi-inverter system sites, take precautions to completely de-energize all other inverter systems before selecting channel 0 on a given inverter for troubleshooting.

NOTE: Do not leave the inverter on channel 0. See ***Appendix B Inverter*** for details on ***Multiple Inverter System Commissioning Procedure*** and ***PLM Crosstalk Recovery Procedure***.

2. Measuring Substring Voltage

- After substring has been wired, use a DMM to measure cumulative substring voltage before plugging PV positive and negative into PV Link.
- If voltage is not present, check PV wiring for loose connections.
- If a short is suspected, measure PV positive to ground, then measure PV negative to ground. If more than one volt is measured positive to ground, negative to ground, a short is likely present on the substring wiring.

3. PV Wiring

- Verify PV wiring is connected to the 'Input' side of the PV Link.
- Verify REbus wiring is connected to the 'Output' side of the PV Link.
- Verify PV connection points are making good contact.
- Unplug and plug back in or remake connections if connection is poor.
- Verify wire management is not pinching PV wires.
- Verify PV wires are not too tight between connection points.

PV Link + SnapRS (NEC 2017 and newer)

1. PV Link Settings (see *Appendix D PV Link*)

- Be certain to choose 'Enable w/PVRSS' when commissioning PV Links for the first time.
- After enabling the PV Link, verify the number of 'SnapRS Installed' matches the number of 'SnapRS Detected'.
  - Verify the number of SnapRS devices installed on substring does not exceed the maximum quantity allowed. The maximum quantity allowed is 10 devices total per substring.
- If using parallel substrings with 96 cell type solar panels, ensure 'String Count' has been set to a value of '2'.
- Verify Vin Startup is adjusted appropriately in the 'mod. settings' menu for the PV Link if input voltage will be lower than the default 135 Voc (typically required for substrings of 4 or fewer 60 cell type solar panels).
- Verify the PLM channel of the PV Link matches the inverter. If there is only one inverter on-site, leave set to default at channel 1.
  - To find a device that has been set to a different channel than the inverter, navigate to the inverter 'mod. settings' menu and set its PLM channel to 0 temporarily. Channel 0 is a catch-all channel.

NOTE: For multi-inverter system sites, take precautions to completely de-energize all other inverter systems before selecting channel 0 on a given inverter for troubleshooting.

NOTE: Do not leave the inverter on channel 0. See ***Appendix B Inverter*** for details on ***Multiple Inverter System Commissioning Procedure*** and ***PLM Cross-talk Recovery Procedure***.

2. Override PVRSS

IMPORTANT NOTE: Use this setting for troubleshooting only—not for long-term use.

- Access the 'Override PVRSS' setting in the 'mod. settings' menu for the PV Link.
- Temporarily set override to 'on' as a test to see if bypassing the SnapRS devices causes PV Link to begin making power.
- If PV Link begins making power, this indicates an issue in counting SnapRS devices on the substring.
- Clear the counts, turn off Override PVRSS, and try again.
- If still not counting correctly, manually enter the number of 'SnapRS Installed' with the PV Link disabled and try again.
- Check PV wiring and SnapRS if problem persists.
- Make certain to turn Override PVRSS 'off' after troubleshooting.

IMPORTANT NOTE: Leaving a PV Link operable with the override 'on' could result in unsafe conditions for first responders in an emergency.

3. Measuring Substring Voltage w/SnapRS

- While cumulative substring voltage cannot be measured w/SnapRS devices installed, it is possible to measure a correct value for bleed-through voltage based on the ratio of panels to SnapRS devices when the sun is shining.
- Determine the open circuit voltage (Voc) of one solar panel for the type of solar panel being installed.
- Next, multiply the Voc of one panel by the total number of panels in the substring. See equation below.

(Voc * number of panels) / (1 + number of SnapRS)

Ex. (40.1 * 8) / (1 + 8)

320.8 / 9

= 35.64

- Measure the substring with SnapRS installed for DC voltage.
- Measured voltage should be about 5 volts less than the Voc of a single solar panel. See equation above.
- Voltage should not exceed the Voc of one solar panel; this would indicate too few SnapRS installed on the substring.
- By contrast, voltage should not be lower than 10 volts below the Voc of one solar panel; this would indicate too many SnapRS devices have been installed on the substring.

4. PV Wiring

- Verify there is one SnapRS device installed on every negative solar panel lead.
- Verify PV wiring is connected to the 'Input' side of the PV Link.
- Verify REbus wiring is connected to the 'Output' side of the PV Link.
- Verify PV connection points are making good contact.
- Unplug and plug back in or remake connections if suspect.
- Verify wire management is not pinching PV wires.
- Verify PV wires are not too tight between connection points.

5. SnapRS Health Check

- Visually inspect SnapRS devices. If any appear physically damaged, replace them. Otherwise, device is likely operable.

- There are no functional tests that can be performed on SnapRS devices in the field. However, some simple checks with a digital multimeter (DMM) can confirm the general health of a SnapRS device.
  - **DMM Red to SnapRS +, DMM Black to SnapRS -**
    (1) Resistance reads ~ 300 kΩ to 350 kΩ
    (2) Diode check reads ~ 0.50 V to 0.55 V
  - **DMM Red to SnapRS -, DMM Black to SnapRS +**
    (1) Resistance reads ~ 12 MΩ

Troubleshooting

The troubleshooting table below references the images and diagnostics contained in this section as well as relevant materials in the appendix. Use the diagnostic practices in the order they are listed to solve problems. If unable to resolve functionality call Generac PWRcell Technical Support 1-855-635-5186.

NOTE: Problems and diagnostics procedures are described in detail following the table.

Table 6-1. Troubleshooting

Problem	Observed Symptoms	Diagnostics
Low Sun (no SnapRS installed)	PV Link enables and goes into 'low sun' - does not begin making power with sun shining. *PV Links will show 'low sun' every night when the sun goes down or if solar panels are covered.	– Check PV Panel Configurations – Check PV Link Settings – Measure Substring Voltage – Check PV Wiring *Low sun when the sun is shining indicates a problem w/PV wiring. This is not a REbus wiring issue.
Low Sun (w/SnapRS)	PV Link enables and goes into 'low sun' - does not begin making power. *PV Links will show 'low sun' every night when the sun goes down or if solar panels are covered.	– Check PV Panel Configurations – Check PV Link Settings: – Override PVRSS – Measure Substring Voltage w/SnapRS – Check PV Wiring – SnapRS Health Check *'Low sun' when the sun is shining indicates a problem w/PV wiring. This is not a REbus wiring issue.
No PV Link Device Comms	PV Link(s) do not show up with a device page on inverter screen upon enabling the inverter.	– Ensure DC Disconnect is ON – Check REbus Wiring Polarity – Check REbus Wiring Ground May Need to: – Power Cycle Inverter – Check REbus Fuses See *Inverter Troubleshooting Table*
Known PV Link 'Offline'	A PV Link that has communicated with the inverter previously shows 'offline' at its device page.	– Ensure DC Disconnect is ON – Check PV Link Settings – Check REbus Wiring May Need to: – Power Cycle Inverter – Check REbus Fuses See ***Inverter Troubleshooting***
PV Link Error	Inverter screen says: "error detected on S2502"	– Disable/ Enable – Watch for event message – Check PV Panel Configurations – Check PV Wiring – Check REbus DC wiring

Table 6-1. Troubleshooting		
Problem	**Observed Symptoms**	**Diagnostics**
PVRSS Not Configured	Upon enabling PV Link, the message 'PVRSS not configured' appears.	– Check PV Link Settings – Disable/ Enable
PVRSS Count Mismatch	Upon enabling PV Link, the message 'PVRSS Mismatch' appears. Number of ‘SnapRS Installed’ does not match number of 'SnapRS Detected' in mod. settings menu for PV Link.	– Disable/ Enable – Check PV Link Settings – Override PVRSS – Measure Substring Voltage w/SnapRS – Check PV Wiring – SnapRS Health Check
Input Overvoltage	PV Link device page says, 'Input Overvoltage'. This will result from connecting too much voltage to the PV Link input.	– Check PV Panel Configurations – Measure Substring Voltage – Check PV Wiring
Input Reversed	PV Link device page says, 'Input Reversed'. This may indicate reverse polarity of the PV wiring to the input side of the PV Link.	– Disable/ Enable – Check PV Wiring
Insulation Fault	'Insulation Fault' appears on PV Link device page.	– Disable/ Enable – Check PV Wiring
Ground Fault	'Ground Fault' or 'Ground Fault Lockout' appears on PV Link device page.	– Disable/ Enable – Check PV Wiring
Arc Fault	'Arc Fault' or 'Arc Fault Lockout' appears on the PV Link device page.	– Disable/ Enable – Check PV Wiring

Low Sun (with no SnapRS installed)

Low Sun is not a fault or an error; it is a PV Link status. PV Links will enter this state every night when the sun goes down. Specifically, 'low sun' means there is not adequate input voltage to the PV Link. If PV Link says, 'low sun' when the sun is shining, do the following:

1. PV Panel Configurations
   a. Ensure the configuration of panels connected to the PV Link do not require PV Link settings to be changed.
2. PV Link Settings
   a. If 4 or fewer 60 cell type solar panels, determine whether Vin Startup value should be lowered.
3. Measure Substring Voltage
   a. Disable the PV Link from the inverter screen.
   b. Unplug PV input +/- from the PV Link and use a DMM to measure cumulative DC voltage from the substring.
   c. If voltage does not match the expected Voc of the substring, inspect PV wiring.
4. PV Wiring
   a. Low sun is either a settings issue or a PV wiring issue; it is not an issue with REbus wiring.
   b. Check for loose connections, faulty MC4 crimps, or strained wiring management.

Low Sun (with SnapRS installed)

See above description for 'low sun'. For installations where SnapRS devices are installed on the substring and the 'low sun' message appears with the sun shining, do the following:

1. PV Panel Configurations

a. Ensure the configuration of panels connected to the PV Link do not require PV Link settings to be changed.

2. Check PV Link Settings
   a. Ensure PV Link was enabled w/PVRSS upon commissioning. If not, disable and select 'Enable w/PVRSS'.
   b. If 4 or fewer 60 cell type solar panels, determine whether Vin Startup value should be lowered.
   c. If installing 96 cell type solar panels using two parallel substrings to the input of one PV Link, ensure 'Sting Count' has been adjusted to a value of '2'.
   d. Verify 'SnapRS Installed' match the number of 'SnapRS Detected'.
3. Override PVRSS
   a. If still unable to resolve, temporarily override PVRSS to see if PV Link will make power without relying on its SnapRS count.
   b. If the PV Link begins making power, this indicates a SnapRS count issue.
   c. If the PV Link does not begin making power, there is a PV wiring issue. This may also indicate that the SnapRS enable signal is not able to transmit through the PV substring(s). Check for open circuits, wiring issues, or damaged PV modules.
4. Measure Substring Voltage w/SnapRS
   a. Disable the PV Link from the inverter screen.
   b. Unplug the PV input +/- and measure DC voltage of substring.
   c. Voltage should not exceed the Voc of one solar panel.
   d. Voltage should not be 10 volts lower than the Voc of one solar panel.
   e. If value is above or below where it should be, check PV wiring and number of SnapRS installed.

(Voc * number of panels) / (1 + number of SnapRS)

Ex. (40.1 * 8) / (1 + 8)

320.8 / 9

= 35.64

5. PV Wiring
   a. Low sun is either a settings issue or a PV wiring issue; it is not an issue with REbus wiring.
   b. Check for loose connections, faulty MC4 crimps, strained wire management.
6. SnapRS Health Check
   a. Visually inspect SnapRS devices for any deformities.
   b. Perform health check measurements on SnapRS devices as necessary.

No PV Link Device Comms

If upon commissioning, PV Link does not show up with a device page on the inverter screen, there is an issue with the Power Line Communications—likely a wiring mistake on REbus. See also ***Inverter Troubleshooting*** table.

1. DC Disconnects
   a. Ensure DC disconnects are closed in the ON position for PV Link in question. REbus voltage must be present at the PV Link for it to communicate with the inverter.
   b. Always disable the inverter before turning DC disconnects ON.
2. REbus Wiring
   a. This problem is most commonly a polarity issue. Check REbus wiring to ensure correct polarity.
   b. If polarity checks out, check the REbus ground connection. Make sure PV Link is grounded back to the inverter.
   c. If polarity and grounding are correct, verify each REbus home run circuit is consistent so that the positive from one home run is not paired with the negative of another. See ***REbus DC Wiring*** in this section for more details.

Known PV Link 'Offline'

If a PV Link that has been communicating previously with the inverter shows up as 'offline', this is a result of losing Power Line Communications. See also ***Inverter Troubleshooting***.

1. DC Disconnects
   a. Ensure DC disconnects are closed in the ON position for PV Link in question. REbus voltage must be present at the PV Link for it to communicate with the inverter.
   a. Always disable the inverter before turning DC disconnects ON.
2. PV Link Settings
   a. Verify that the PLM Channel matches the inverter by navigating to the inverter device page.
   b. If only one PWRcell inverter on site, access the 'mod. settings' menu for the inverter and change the PLM channel to 0.
   c. Channel 0 is a catchall channel and will pick up devices that may be set to other channels. Be certain to de-energize any other PWRcell inverter systems on site before setting to PLM 0.

d. Navigate back to the PV Link in question: if it says 'disable' or 'enable,' it is back online.
   (1) Change the PV Link PLM Channel back to the channel being used by all other devices on that system.
   (2) Navigate back to the inverter 'mod. settings' menu and change the PLM Channel back to the system's channel.

3. Check REbus Wiring
   a. Ensure polarity and ground connections are correct and intact.
   b. With system de-energized, perform a tug-test at the REbus terminals to check for loose connections.

PV Link Error

If the home screen of the inverter says: 'error detected on S2502', navigate to the PV Link device page(s) and determine the PV Link state; it may lead you to another problem on the PV Link Troubleshooting Table. Otherwise, do the following:

1. Disable/ Enable
   a. Attempt to clear the error by disabling the PV Link then re-enabling.
   b. Watch for an event message to appear on the PV Link device page upon re-enabling.
2. PV Panel Configurations
   a. Ensure there are not too many panels and therefore too much voltage at the input of the PV Link.
3. PV Wiring
   a. Ensure PV wiring is connected to the 'input' side of the PV Link.
   b. Ensure REbus wiring is connected to the 'output' side of the PV Link.
4. REbus Wiring
   a. Rule out shorts by testing REbus circuit resistance with the inverter disabled and the DC disconnect(s) OFF. Resistance should be greater than 10 kΩ.

PVRSS Not Configured

There are two possible causes: either PVRSS has not been enabled when it should have been, or PVRSS has been enabled when it should not have been.

1. PV Link Settings
   a. If PV Link is installed w/SnapRS devices, ensure PV Link has been enabled w/PVRSS.
      (1) Navigate to 'mod. settings' menu for PV Link.
      (2) Enable PVRSS setting should be 'on.'
   b. If PV Link is installed w/out SnapRS, ensure PV Link has not been enabled w/PVRSS.
      (1) Navigate to 'mod. settings' menu for PV Link.
      (2) Enable PVRSS setting should be 'off.'
2. Disable /Enable
   a. Disable and re-enable to clear the fault after fixing the issue.

NOTE: Always use 'Enable w/PVRSS' to commission a PV Link with SnapRS devices connected.

PVRSS Count Mismatch

PV Links continually count their SnapRS, storing a value for the number of 'SnapRS Installed'. In some instances, the PV Link may come up with a different number of 'SnapRS Detected' depending on various factors. Do the following:

1. **Disable/ Enable**
   a. Disabling and re-enabling will cause the PV Link to run its count again. This may resolve the issue.
2. PV Link Settings
   a. Verify 'SnapRS Installed' = 'SnapRS Detected'
   b. If two parallel substrings are connected, verify 'String Count' has been adjusted to a value of '2'.
   c. Disable PV Link.
   d. Manually enter the value of 'SnapRS Installed' and retry.
3. Override PVRSS
   a. Temporarily override PVRSS to see if PV Link will make power without relying on its SnapRS count.
   b. If the PV Link begins making power, this indicates a SnapRS count issue. Go back to steps 1 and 2.
   c. If the PV Link does not begin making power, this indicates a PV wiring or SnapRS device issue.
4. Measure Substring Voltage w/SnapRS
   a. Disable the PV Link from the inverter screen.
   b. Unplug the PV input +/- and measure DC voltage of substring.
   c. Voltage should not exceed the Voc of one solar panel.
   d. Voltage should not be 10V lower than the Voc of one solar panel.
   e. If value is above or below where it should be, check PV wiring and number of SnapRS installed.
5. Check PV Wiring
   a. Inspect PV wiring for any loose connections

and locate SnapRS devices in the substring.

6. SnapRS Health Check
   a. Visually inspect SnapRS devices connected to substring in question.
   b. If physically damaged, replace device.
   c. Use DMM to perform resistance and diode checks as outlined in SnapRS Health Check diagnostics procedure.

Input Overvoltage

This indicates too much voltage has been connected to the input of a PV Link.

1. PV Panel Configurations
   a. Ensure the input voltage does not exceed 420 Voc.
   b. Ensure there aren't too many panels connected in series to the input of the PV Link.
   c. If using 96 cell type solar panels, verify configuration of parallel substrings to minimize the input voltage.
   d. Use the PV Link String Sizing Worksheet on the Generac website to ensure correct number of panels has been installed for panel make, model, and region of installation.
2. Measure Substring Voltage
   a. Disable PV Link.
   b. Unplug PV input +/- and measure DC voltage of substring.
   c. If cumulative substring voltage exceeds 420 volts, reduce the number of panels connected in series to the input of the PV Link.
3. Check PV Wiring
   a. Ensure PV wiring is connected to the 'Input' side of the PV Link.
   b. Ensure REbus Wiring is connected to the 'Output' side of the PV Link.

Input Reversed

Seeing this message at the PV Link device page may indicate that the polarity of the PV wiring to the input side of the PV Link is reversed. If PV Link has previously been operable, this may be a false positive. Perform the following diagnostics:

1. Disable/ Enable
   a. Disabling and re-enabling the PV Link may clear the fault and resolve the issue.
2. Check PV Wiring
   a. If fault persists, it is likely a true case of reverse polarity.
   b. Disable PV Link.
   c. Check PV input wiring polarity.

Insulation Fault

An insulation fault occurs when there is an unintended electrical connection to ground on a normally ungrounded current carrying conductor in the PV array. This condition can result in a hazardous situation posing a safety risk.

As part of the enable sequence, the PV Link evaluates the insulation resistance between PV + and system ground, and PV - and system ground. If low insulation resistance is detected, the PV Link will not generate power until the fault has been removed and the PV link has been disabled and re-enabled.

An insulation fault usually results in a solid ground reference within the array, which can be detected using a multimeter.

NOTE: Under normal operating conditions the PV source circuit conductors are ungrounded and should exhibit a ‘floating’ voltage when measured with reference to ground. A ‘floating’ voltage will be indicated on a multimeter reading a slight voltage drift. Typically, the voltage measurement will quickly approach 0V shortly after connecting the DMM leads to a PV conductor and system ground.

1. Disable/ Enable
   a. Disable and re-enable the PV Link to clear the fault.
   b. This will force the PV Link to reevaluate the PV array for Insulation Faults.
2. Check PV Wiring
   a. Disable PV Link.
   b. Disconnect the PV inputs +/- from the PV Link.
      (1) Use a DMM to measure voltage from PV+ to ground and PV- to ground.
      (2) If measuring more than one (1) volt for either measurement, PV wiring has an unintended electrical connection to ground somewhere with the PV substring.
   c. Inspect PV substring wiring for loose connections, compromised insulation, or faulty MC4 crimps.

Ground Fault

A Ground Fault occurs when there is an unintended electrical connection to ground on a normally ungrounded current carrying conductor in the PV array. This condition can result in a hazardous situation posing a safety risk.

As part of continuous operation, the PV Link evaluates differential current flowing through the PV + and PV – inputs of the PV Link. If unbalanced current is detected, this indicates that there is an unintended current path through system ground within the PV array. The PV Link will not generate power until the fault has been removed and the PV link has been disabled and re-enabled.

1. Disable/ Enable
   a. Disable and re-enable the PV Link to clear the fault.
   b. This will force the PV Link to reevaluate the PV array for Insulation Faults and Ground Faults.
2. Check PV Wiring
   a. Disable PV Link.
   b. Disconnect the PV inputs +/- from the PV Link.
      (1) Use a DMM to measure voltage from PV+ to ground and PV- to ground.
      (2) If measuring more than one (1) volt for either measurement, PV wiring has an unintended electrical connection to ground somewhere with the PV substring.

NOTE: In some circumstances the electrical connection(s) to ground may be of high resistance and can be difficult to locate. Electrical connections with system ground can be influenced by weather, specially moist conditions, and dirty or soiled PV modules.

   c. Inspect PV substring wiring for loose connections, compromised insulation, or faulty MC4 crimps.

NOTE: Do not use a megohmmeter (megger) on Generac equipment to check for ground faults. Damage to sensitive electronics is likely to occur.

Arc Fault

PV Link circuitry is designed to detect series electrical arching. If seeing this message at the PV Link device page, the PV Link has detected electrical arcing at its PV input. This can be a result of: disconnecting or connecting the PV array to the PV Link with the unit enabled, a loose connection in the PV substring wiring, or a partial open in the wiring.

When the PV Link detects an arc fault it will shut down for five (5) minutes before trying to re-enable.

If five arc fault events are detected within a 24-hour period, the PV Link will enter arc fault lockout, and will need to be disabled and re-enabled (and the fault will need to be fixed) before it will generate power.

1. Disable/ Enable
   a. Disable and re-enable the PV Link to clear the fault.
   b. This fault will likely persist.
2. Check PV Wiring
   a. Disable PV Link.
   b. Inspect PV substring wiring for loose connections, compromised insulation, or faulty MC4 crimps with exposed wire—especially near connection points.

NOTE: Multimeters and megohmmeters (meggers) are not appropriate tools for identifying arc faults.

Device Confirmation

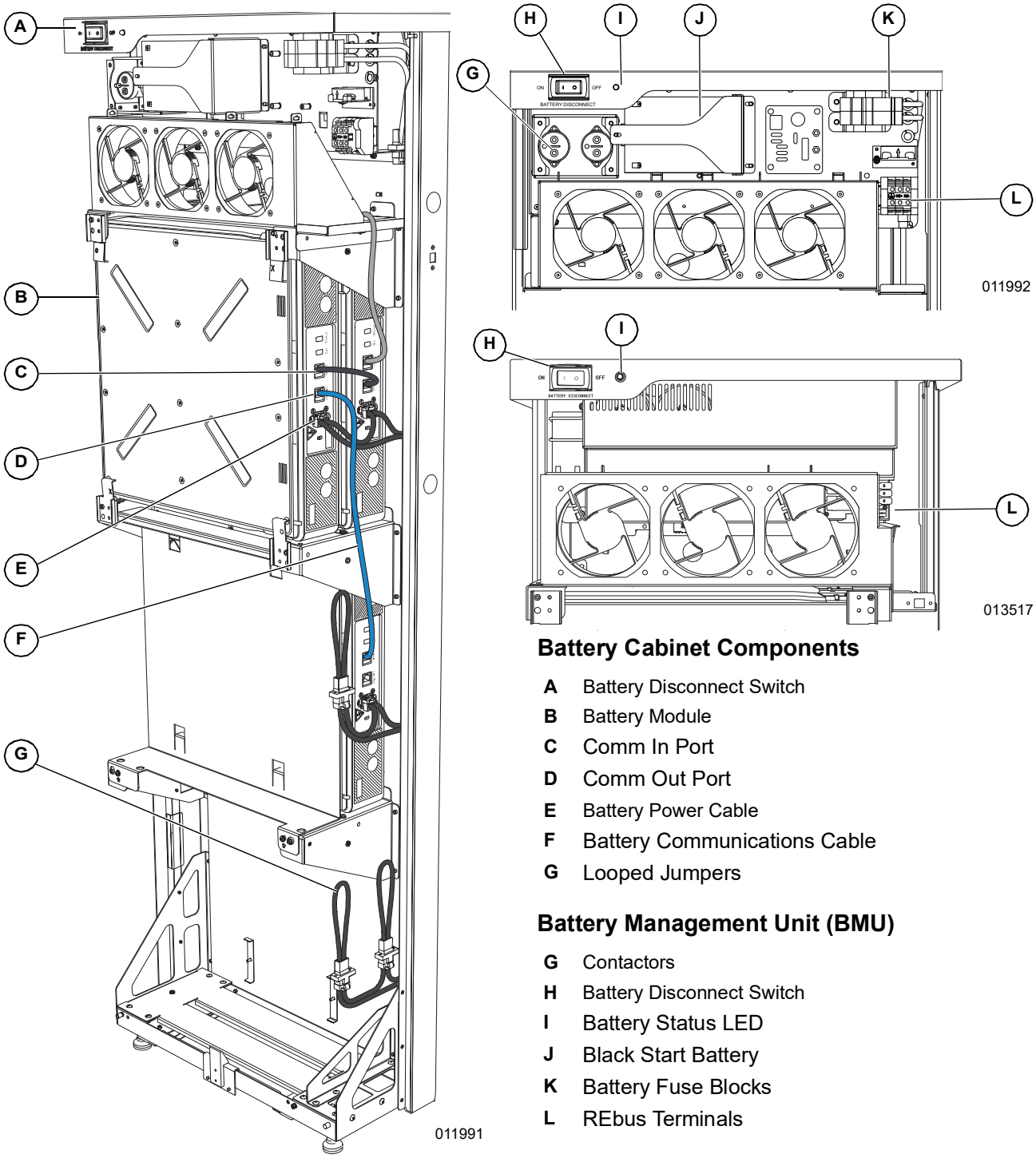
1. REbus LED is:
   - *Green* indicating all devices are enabled and functioning normally.
2. At PV Link device page, PV Links say, 'making power' (without 'Override PVRSS' on) if the sun is shining; or they say 'low sun' if the sun has gone down.
3. If SnapRS are installed, 'Enable PVRSS' setting is 'on'.
4. If SnapRS are installed, the number of 'SnapRS Installed' matches the number of 'SnapRS Detected.'

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Section 7 PWRcell Battery

Device Profile

The Generac PWRcell Battery is a DC-coupled lithium-ion battery system. The Battery Management Unit (BMU) provides the interface between the battery modules and REbus, moving power to and from the battery modules depending on the selected system mode, the available solar power, and the AC load demand at the inverter. In the event of a grid outage, the battery will maintain the DC bus and provide backup power to the inverter while continuing to be able to charge from available solar energy.



Battery Cabinet Components

- **A** Battery Disconnect Switch
- **B** Battery Module
- **C** Comm In Port
- **D** Comm Out Port
- **E** Battery Power Cable
- **F** Battery Communications Cable
- **G** Looped Jumpers

Battery Management Unit (BMU)

- **G** Contactors
- **H** Battery Disconnect Switch
- **I** Battery Status LED
- **J** Black Start Battery
- **K** Battery Fuse Blocks
- **L** REbus Terminals

Figure 7-1. PWRcell Battery Component Locations

Safety Information



DANGER

Electrocution. Initiate a system-wide shutdown and turn the PWRcell DC Disconnect Switch OFF on all connected batteries before performing service. Failure to do so will result in death, serious injury, or equipment and property damage.

(000600)

Due to the ability of the battery to bring up and hold REbus voltage, there are several important safety precautions to take when servicing:

The battery disconnect switch in the upper left corner of the battery cabinet only acts as a disconnect between the lithium-ion battery stack and the charge controller in the BMU; it has no effect on the cumulative battery module voltage or the REbus voltage from the inverter.

- When the switch is off, there will still be battery stack voltage at the battery fuse block inside the BMU. For safety purposes, while working inside the battery cabinet, it is recommended to always disconnect one of the DCB modules or power jumpers to break the battery stack circuit.
- Even with the battery disconnect switch off, there can still be REbus voltage supplied from the inverter on the REbus terminals of the BMU. It is recommended to always perform a system shutdown before working inside the battery cabinet.
- If the inverter is disabled, but the battery is left enabled with the battery disconnect switch on, the battery will still maintain REbus voltage inside the battery cabinet, inside the inverter cabinet, and on all connected REbus wiring. It is recommended to disable the battery, turn the battery disconnect switch off, and turn off the DC disconnect inside the inverter before working inside the inverter wiring compartment.

Diagnostics

The diagnostics defined below detail inspections for common scenarios. Reference and use in the order prescribed in ***Table 7-1 Troubleshooting***.

1. **REbus DC Wiring**
   - Verify REbus wiring (positive, negative, and ground) between the battery REbus terminals and the inverter DC disconnect and ground bar.
     – It is recommended to label both ends of each REbus home run during installation to avoid confusion.
     – If suspected mismatching has occurred, use a digital multimeter (DMM) to “ring” out the runs using the continuity function.
   - Verify correct polarity of positive and negative wire runs at both battery and inverter.
   - Verify REbus ground connection.
2. **REbus Communications**
   - At inverter, turn on DC disconnect to battery, then power on and enable inverter to bring up DC bus.
     – Verify correct REbus voltage (360–420 VDC, displayed on inverter home screen) at DC disconnect terminals of inverter
     – Verify correct REbus voltage between RE+ (red) and RE- (blue) terminals at battery terminal block.
     – Verify symmetric half-REbus voltage between RE+ and RE- to GND (green) terminals at battery terminal block.
   - Verify that battery status LED illuminates.
   - Verify that PWRcell battery device appears on inverter screen.
3. **Battery Disconnect Switch**
   - Verify switch is in the “On” position.
4. **Battery Power Wiring**
   - Verify power connections to all li-ion battery modules.
     – Power harness must be connected to all modules.
     – Looped jumpers must fill in all open slots in power harness.

6 module system	no jumpers
5 module system	1 looped jumper
4 module system	2 looped jumpers
3 module system	3 looped jumpers

   - Verify battery stack voltage by measuring DC voltage between the positive (red wire) and negative

(black wire) left hand terminals of battery fuse block.

– Each li-ion battery module should measure approximately 50 VDC; therefore, the stack voltage should be approximately equal to 50 multiplied by the number of installed modules (i.e. 4 modules should be ~200 V)

5. Battery Fuses

- Make sure battery is disabled before removing the battery fuses.
- Lift the two fuse holder levers on the top-right of the battery cabinet.
- Use a DMM to test fuses for continuity.

6. Battery Module Communications Wiring

- Verify gray CAT5 cable in harness is connected from battery controller to input port of top-back module.
- Verify black CAT5 jumper is connected from output port of top-back module to input port of top-front module
- Verify blue CAT5 cable in harness is connected from output port of top-front module to input port of middle-back module
  - [if >3 battery modules] Verify black CAT5 jumper is connected from output port of middle-back module to input port of middle-front module
  - [if >4 battery modules] Verify orange CAT5 cable in harness is connected from output port of middle-front module to input port of bottom-back module
  - [if >5 battery modules] Verify black CAT5 jumper is connected from output port of bottom-back module to input port of bottom-front module

NOTE: If battery communications issue is suspected, it is recommended to test continuity of all CAT5 cables with a data tester.

7. Battery Module Check

- With battery enabled (battery cabinet status LED illuminated), verify that status and SOC lights on all battery modules are illuminated
  - Verify Battery Status LED is not blinking red. See ***Battery Status LED*** in ***Appendix E Battery***.
- With battery disabled, verify voltage at power terminals of each module by disconnecting power connector and measuring DC voltage with a DMM.
  - Modules should read between 42–53 VDC.

IMPORTANT NOTE: Use extreme caution not to short out positive and negative terminals of module.

8. Black Start Battery Check

- Disconnect positive lead from black lead-acid (black start) battery in top center of battery cabinet.
- Verify that DC voltage measured between positive and negative terminals of black start battery is >12.5 VDC.
- Twist in-line fuse holder to remove fuse from holder on red black start battery wire. Use a DMM to check fuse for continuity.
- After checking, verify that both positive and negative leads are re-connected to black start battery terminals.

9. Battery Settings

- Verify the battery settings are correct for the type of installation being executed.

NOTE: The state of charge (SoC) settings on the battery will limit the ability to charge and discharge in certain combinations of system mode and module state of charge.

- See ***Table E-1*** in ***Appendix E Battery*** to reference battery settings.

10. Battery Enable

- Confirm DC disconnect for battery at inverter is in the ON position.
- Enable PWRcell battery from its device page on the inverter screen.
- Verify that the:
  - Battery contactors click on and stay on.
  - Cabinet light turns green.
  - PWRcell status changes to 'charging', 'discharging' or 'standby' on inverter screen.
- For non-terminal errors, disabling and re-enabling the battery may clear the error state and allow the inverter to return to full operation.

11. REbus Power Cycle

- Disable battery from inverter screen. Turn battery disconnect switch off.
- Disable inverter from inverter screen.
- Verify REbus displayed on inverter screen goes to 0V and battery cabinet status light turns off and stays off for >10 seconds.
- Re-enable inverter from inverter screen, then re-enable battery.

12. Charge/Discharge Test

- Verify charging:
  - With battery enabled, from inverter main page, change system mode to Priority Backup or Clean Backup.
  - Verify that battery status changes to 'charging' and the battery power reading is negative.

NOTE: The battery will not charge if the state of charge is 95% or greater. In this case, first verify successful

discharge of the battery to below 95% before verifying battery charging.

- Verify discharging:
  - With battery enabled, from inverter main page, change system mode to Sell.
  - Verify that battery status changes to 'discharging' and the battery power reading is positive.
  - If PV Links are generating enough power from PV to max out the inverter, it will be necessary to disable one or two PV Links before the battery will discharge in Sell Mode.

NOTE: The battery will not discharge if the module state of charge is below the MinSoCRsrv setting (default 30%). In this case first verify successful charging of the battery to 5% above the min setting before verifying battery charging.

NOTE: In cases where exporting to the grid is prohibited, turn on as many AC loads as possible to provide a path of discharge for the battery.

13. Temperature Check

NOTE: Battery modules will only charge and discharge within a certain temperature range. If the module temperature is too high or too low, charging may be limited or not allowed at all. See Battery Module Data Sheets for specific battery module installed**.**

Troubleshooting

The troubleshooting table below references the images and diagnostics contained in this section as well as relevant materials in ***Appendix E Battery***. Use the diagnostic practices in the order they are listed to solve problems. If unable to resolve functionality call Generac PWRcell Technical Support 1-855-635-5186.

NOTE: Problems and diagnostics procedures are described in detail following the table.

Table 7-1. Battery Troubleshooting

Problem	Observed Symptoms	Diagnostics
Device Not Powering On	Battery status LED not Illuminating with inverter enabled and Battery Disconnect Switch 'On'.	– Check DC disconnect at inverter – Check Battery Disconnect Switch – Check REbus DC Wiring – Check REbus Communications – Check Blackstart Battery
No REbus Battery Comms	Battery device page does not appear on inverter screen	– Check REbus Communications – Check DC disconnect at inverter – Check REbus DC Wiring – Check Battery Settings – Verify PLM Channel matches Inverter
Battery Not Ready	Battery won't stay connected; 'Battery not ready' displays temporarily on PWRcell (battery) device page on inverter screen upon enabling the battery.	– Battery Disconnect Switch – Battery Fuses – Battery Power Wiring – Battery Module Communications Wiring – Battery Module Check
Battery Not Charging/ Discharging	Battery not charging or discharging to expected limits	– Check Battery Settings – Check System Mode – Temperature Check
Error	Battery in Error state; 'Error detected on PWRcell' displayed on inverter home page and 'error' state displayed on battery device page of inverter.	– Battery disable/enable – REbus Power Cycle – Battery Module Check
Cell Imbalance	Cell Imbalance state displayed on battery device page of inverter	– Battery Module Check

Device Not Powering On

If, after enabling REbus from the inverter, the PWRcell Battery cabinet status light is not illuminating, this likely indicates that the BMU is not powering on from REbus.

1. Check that the inverter DC disconnect is on and inverter REbus output voltage is present.
   a. Use a digital multimeter (DMM) to measure the DC voltage at the REbus power terminals (red probe on RE+ and black probe on RE-). The measured voltage should be between 360 V and 420 V.
   b. This should match the voltage displayed on the inverter home screen.
2. Check REbus input voltage on battery terminal block.
   a. Use a DMM to measure the DC voltage at the REbus power terminals (red probe on RE+ and black probe on RE-). The measured voltage should be between 360 V and 420 V.
   b. If REbus voltage is not at least 360 V:
      (1) Confirm that the DC breaker in the inverter is in the ON position.
      (2) Confirm that the REbus fuses at the inverter are not blown (use DMM to verify resistance of fuse is less than 1 Ω).
      (3) Check wiring from battery cabinet to inverter.
   c. If REbus voltage is correct:
      (1) Verify device shows up on inverter screen.
      – If device shows up and can be enabled there is likely an issue with the indicator light and/or its connector.
      – Check REbus connector from battery terminals (blue and red wires running through blue ground current sensor) is fully connected to BMU.

No Comms from Battery to Inverter

If REbus is present at the battery terminals and the battery status LED is illuminated, but the device is not appearing on the inverter screen, this likely indicates that there is a communications issue between the inverter and the battery.

1. Confirm that there is a direct ground wire between the inverter and the green REbus terminal on the battery and the ground bus bar at the inverter.
2. Verify that the battery and inverter are using the same PLM channel:
   a. Check the inverter PLM channel by going to the Mod Settings page of the inverter on the ICM and checking the PLM_Channel setting.
      (1) If battery is new, it will be set to channel 1 by default, so inverter will need to also be set to channel 1 to communicate with it.
      (2) If battery is previously programmed to a different PLM channel, the inverter channel will have to be changed to match before communications with the battery will function.

NOTE: The inverter can be changed to channel 0 to communicate with any PLM device. Do not do this prior to powering down all other inverter systems at a multi-inverter site. See ***Commissioning Multiple Inverter Systems*** in ***Appendix B Inverter***.

"Battery Not Ready"

If, after enabling the battery, the inverter displays the message "Battery Not Ready," this indicates that the battery controller is not able to detect an expected battery voltage on its input terminals.

1. Check that the battery disconnect switch on the upper left corner of the battery cabinet is switched on.
2. Check the battery fuses. Measure the voltage on each side of the fuse blocks on the battery using a DMM set to measure DC voltage.
   a. Measure the right side of the fuse blocks with the red probe on the contact for the red wire and the black probe on the contact for the black wire.
   b. Repeat this procedure on the left side of the fuse block.
   c. The voltages should be within less than 1V of each other. If not, confirm that the fuses are present and intact.
   d. If there is adequate stack voltage on the right side of the fuses but 0V on the left side, the fuses are likely blown. Check for continuity.
3. If the voltage measured at the right side of the battery fuse block is near 0V:
   a. Verify that any unused connectors on the battery power cables are all filled using the provided loop jumpers and that the jumpers are well-seated (see ***Figure 7-1***). This is only necessary if the battery contains fewer than 6 battery modules.
   b. Verify that the battery power cables are correctly connected (see ***Figure 7-1***). Confirm that all power cables are well-seated.
4. If the voltage at the right side of the fuse block is more than 0V, confirm that the voltage matches the expected battery stack voltage.

NOTE: The typical battery voltage is a function of the total number of battery modules. The voltage for one battery module can vary between 42V and 52V. Multiply this range by the number of modules to get the total battery voltage. For example, a 6-module battery will have a typical voltage range of between 252V and 312V. Verify that the Status and SoC indicators on the battery modules are all on.

   a. If any of the battery modules have indicators that are off:
      (1) Confirm that all battery modules are right-side up. The COM IN port should be above the COM OUT port on the modules.
      (2) Verify that the COM cables are correctly connected per the installation instructions (see ***Battery Wiring Sequence Diagrams*** in ***Appendix E Battery***).
      (3) Confirm that all COM cables are well-seated.
      (4) Check battery module comms cables for continuity using a data tester.

NOTE: After correcting any issue detected in the steps above, a full system reset may be necessary for the battery to re-initialize communications with the modules and resume functioning correctly.

Error

After enabling the battery, if an "Error on PWRcell" message is displayed on the inverter screen and the battery cabinet status LED is blinking red, this indicates that an unexpected event has occurred on the battery, and manual intervention is necessary.

1. Disable and the re-enable the battery.
2. Perform a REbus power cycle.
3. Verify the battery module status lights (blinking red indicates an error with that module).
4. If the error persists, contact Generac PWRcell Technical Support 855-635-5186.

Battery Cannot Charge Or Discharge To Expected Power

If the battery is not charging or discharging at the expected rate (or at all), it typically indicates that some combination of system settings and battery temperature or state-of-charge are limiting charge/discharge. See ***Table E-1*** Battery Settings in ***Appendix E Battery***.

1. **Battery settings check:** confirm the battery set points are valid. Navigate to the Mod. Settings menu for the PWRcell [Battery].
   a. Verify that the charge current limit settings are not reduced.
   b. Verify that the reported battery SOC is not equal to or above the MaxSocAbs (for charging) or below the MinSocRsrv (for discharging) set-points.
2. **System check:**
   a. If trying to discharge to grid, make sure inverter does not have Export Override turned 'ON.'
   b. If trying to discharge to AC loads, confirm enough load is on the system and that PV Links are not generating full power to the inverter.
   c. If trying to charge in Self Supply Mode, confirm PV Links are generating enough power to cover more than the AC loads on the inverter.
3. **Temperature check:** confirm that the battery is operating in the acceptable temperature range. See Battery Module Data Sheets for specific battery module installed**.** Operating outside the specified battery temperature range will impede charge or discharge of the battery.

Cell Imbalance

This message indicates a reported state of charge (SOC) or voltage mismatch between battery cells/modules.

1. Verify that no module is in error state.
2. Verify module voltages match each other by disconnecting each module and using a DMM to measure the DC voltage at each module terminal.
   a. If a module differs from the rest by more than 0.2V, perform the Vset procedure to equalize the voltage on the different modules. See ***Vset to Equalize Battery Module Voltages*** in ***Appendix E Battery***.
   b. If the modules match in voltage, place inverter into Priority Backup system mode, fully charge the battery modules, and allow them to sit fully charged for over an hour to reset the internal state of charge counter.
3. If the cell imbalance persists, contact Generac PWRcell Technical Support 855-635-5186.

Device Confirmation
1. Battery status LED is solid or blinking green.
2. Battery device page appears on inverter ICM screen.
3. Battery device page indicates state of either 'charging', 'discharging', or 'standby.'
4. Battery settings are configured properly for the installation and desired performance. • Example: If customer wants to use more capacity in Self Supply, lower MinSoCRsrv.
5. System mode is correctly configured for desired performance.
6. Battery has been tested to charge or discharge.
7. System has been confirmed to properly island (EnaIslanding = on).

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Section 8 PWRcell ATS

Contactor Switching Mechanisms

The switching mechanism is physically responsible for carrying the rated electrical current and shifting the connection from one power source to another.

Contactors are constructed as a double-throw switch where a single operator opens one set of power contacts while closing a second set. In an open transition design, a mechanical interlock is often employed to prevent simultaneous closure of both contact sets.

Basic V-Type Contactor

The V-Type Contactor is available in 100 through 200 Amp ratings at 250 volts maximum with a 2-pole configuration (single phase only).

See ***Figure 8-1*** and ***Figure 8-2***. A basic 2-pole contactor consists of a pair of movable LOAD contacts, a pair of stationary UTILITY contacts, and a pair of stationary STANDBY contacts. The LOAD contacts connect to the UTILITY contacts by energizing a utility closing coil or to the STANDBY contacts energizing the standby closing coil. In addition, the LOAD contacts can be actuated to either the UTILITY or STANDBY position by means of a manual transfer handle. The closing coils actuate and energize using source voltage from the side to which the load is being transferred. For example, if the contactor is in the UTILITY position, the standby closing coil will energize utilizing generator voltage.

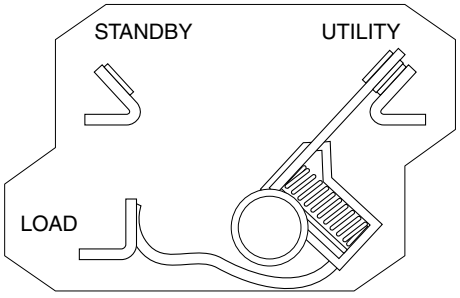


Figure 8-1. Load Connected to Utility Power Source

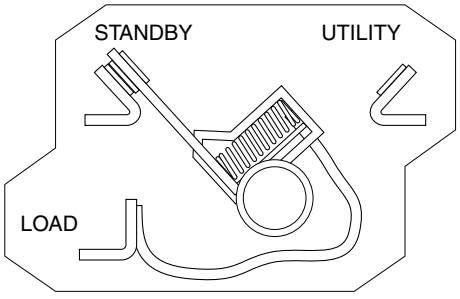


Figure 8-2. Load Connected to Standby Power Source

Utility Closing Coil C1

See ***Figure 8-3***. The utility closing coil (C1) utilizes rectified Utility source power to actuate the LOAD contacts to the UTILITY position. When energized, the coil will move the LOAD contacts to an “over center” position.

A limit switch opens the circuit and the spring force will complete the transfer back to UTILITY. The bridge rectifier, which changes the Utility source, alternating current (minimum of 190 VAC), to direct current (DC), is sealed in the coil wrappings. If either the coil or the bridge rectifier replacement becomes necessary, replace the coil assembly.

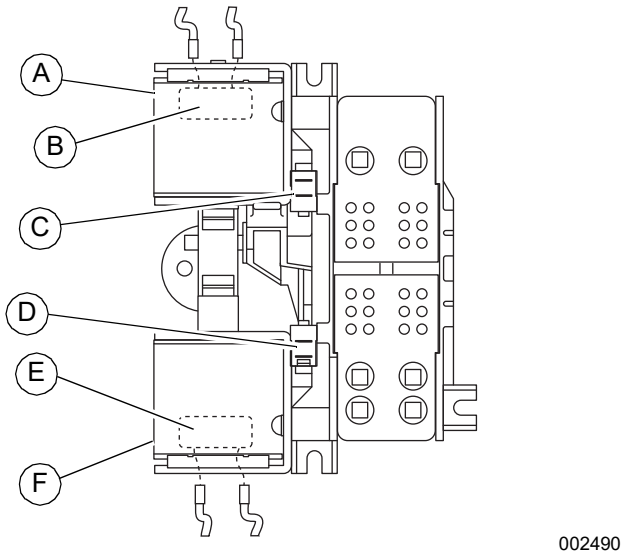


Figure 8-3. The “V-Type” Transfer Mechanism

A. Utility Closing Coil C1
B. Bridge Rectifier
C. Limit Switch XA1
D. Limit Switch XB1
E. Bridge Rectifier
F. Standby Closing Coil C2

Standby Closing Coil C2

The standby closing coil (C2) utilizes rectified standby source power (minimum of 190 VAC) to actuate the load contacts to their STANDBY position. Energizing the coil moves the load contacts to an over-center position. A limit switch opens the circuit and spring force completes the transfer to STANDBY. If replacement of either the coil or the bridge rectifier becomes necessary, replace the coil assembly.

Limit Switches XA1 And XB1

Movement of the LOAD contacts mechanically actuates the limit switches. When the LOAD contacts connect to the UTILITY contacts, limit switch (XA1) opens the Utility circuit to C1 and limit switch (XB1) closes the standby

circuit to standby closing coil (C2). The limit switches arm the system for transfer back to UTILITY when the LOAD contacts connect to the STANDBY position. Respectively, when the LOAD contacts connect to the UTILITY side, XA1 and XB1 arm the system for transfer to the STANDBY position. An open condition in XA1 will prevent transfer back to UTILITY. An open condition in XB1 will prevent transfer to STANDBY.

Auxiliary Contacts

The V-Type contactor has the option* to mount auxiliary contacts on the side of the contactor. The limit switches mechanically connect to the switch and the contacts will electrically represent the position of the switch. Contacts are rated 15 amps at 250 VAC.

NOTE: *Auxiliary contacts are used by the PWRcell ATS controller for identifying contactor position.

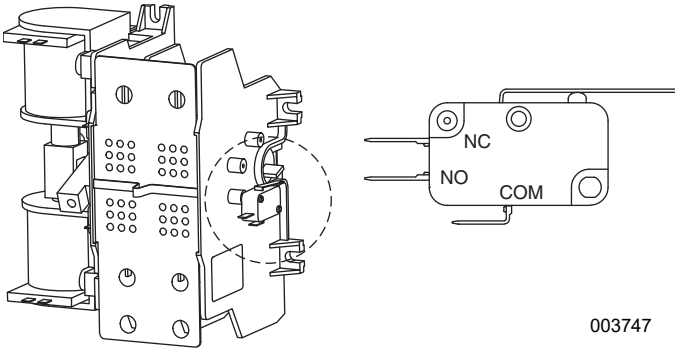


Figure 8-4. V-Type Auxiliary Contacts

NC = Normally Closed
NO = Normally Open
COM = Common

Standard 100/200 Amp V-Type Transfer Switch

Introduction

Standard 100/200 amp transfer switches utilize a V-type contactor and are rated for their perspective amperages. They are available in a 2-pole configuration for use with 1-phase systems only.

These switches do not have intelligent systems of their own. A circuit board housed in the generator controls automatic operation of the transfer switch.

Transfer Switch Contactor

These switches are equipped with solder-less, screw type lugs with typical ratings as shown. Always refer to the unit specific owner's manual for correct specifications.

Switch Rating	Wire Range	Conductor Tightening Torque
100A	#14-1/0 AWG	50 **in-lbs**
200A	#6-250 MCM	275 **in-lbs**

The switch is suitable for control of motors, electric discharge lamps, tungsten filament and electric heating equipment where the sum of motor full load ampere ratings and the ampere ratings of other loads do not exceed the ampere rating of the switch and the tungsten load does not exceed 30 percent of the switch rating

The UL listed transfer switch is for use in optional standby systems only. For further information on the contactor assembly, refer to ***Contactor Basics***.

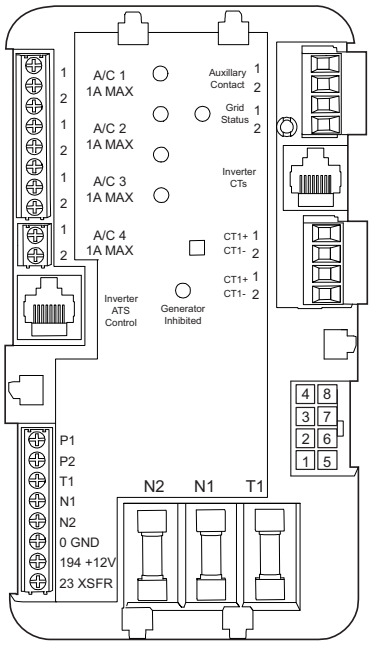


Figure 8-5. Customer Connections

Utility N1 and N2

Generator Only Configuration

Wires N1 and N2 (Utility) are connected with identically labeled terminals in the generator customer connection area. This is utility sensing voltage to the generator control board. The signal is delivered to the generator through the ATS controller then through the N1 and N2 fuses. N1 and N2 voltage is used by the generator controller as follows. If Utility source voltage drops below a preset level, circuit board logic will initiate automatic cranking and startup, followed by automatic transfer to the standby source.

Inverter Only Configuration

Wires N1 and N2 (Utility) are monitored by the Inverter through the ATS controller via the ATS CAT5 wire to the ATS connection in the inverter. This is utility sensing voltage to the inverter. N1 and N2 voltage is used by the inverter as follows. If Utility source voltage drops below a preset level, circuit board logic will initiate automatic transfer to the standby source.

Terminals 0, 194, and 23

These terminals connect to the transfer relay and internally to the load management portion of the ATS PWRcell Controller (if equipped).

Generator Only Configuration

These are the dedicated terminals from the ATS controller external connections (bottom left) through the on-site harness to the generators customer connection deck.

Inverter Only Configuration

These circuits are internal to the ATS controller and are connected to the inverter via the ATS CAT5 cable from the ATS controller to the inverters ATS connection.

Load T1

Wire T1 is connected with an identically labeled terminal in the generator customer connection area. This Load voltage is delivered to the generator to supply 120 VAC to the control board for battery charging.

NOTE: The T1 connection is not utilized in the Inverter Only Configuration.

Fuses

Fuses F1 and F2

Fuses F1 and F2 protect the Utility N1 and Utility N2 circuit against overload.

NOTE: These fuses only protect the circuit going to the generator.

Fuse F3

Fuse F3 is installed in-line with Wire T1. It protects the battery charger circuit from overload.

NOTE: This fuse only protect the circuit going to the generator.

ATS CAT5 Connection

The ATS controller CAT5 connection uses the RJ45 EIA/TIA 568B Wiring Standard.

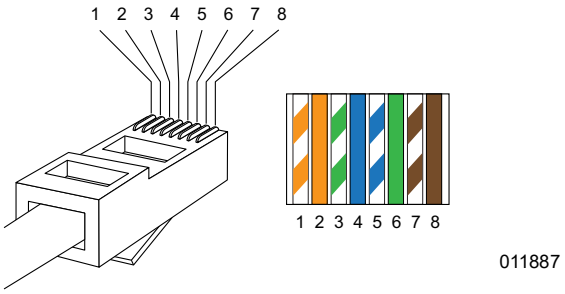


Figure 8-6. RJ45 EIA/TIA 568B Wiring Standard

1	White with orange stripe	Inverter 12V
2	Orange with white stripe or solid orange	Inverter Transfer Signal
3	White with green stripe	N2 Sense
4	Blue with white stripe or solid blue	N1 Sense
5	White with blue stripe	N1 Neutral
6	Green with white stripe or solid green	N2 Neutral
7	White with brown strip	Generator Inhibit
8	Brown with white stripe or solid brown	Ground

Operational Analysis – Inverter Only Configuration

Utility Source Voltage Available – Inverter Only Configuration

Figure 8-7 shows the Switch is in the UTILITY position and utility source voltage is available.

- Rated utility source voltage is available to the transfer switch terminal lugs N1 and N2 through sensing wires to the ATS controller through the CAT5 wire to the inverter.
- Utility voltage is available from N2 to Terminal N2A of the transfer switch.
- Utility voltage is available from N1A to the normally closed contact of the internal transfer relay (TR). From the transfer relay it continues on through Wire 126 to the now open contact of the XA1 limit switch.

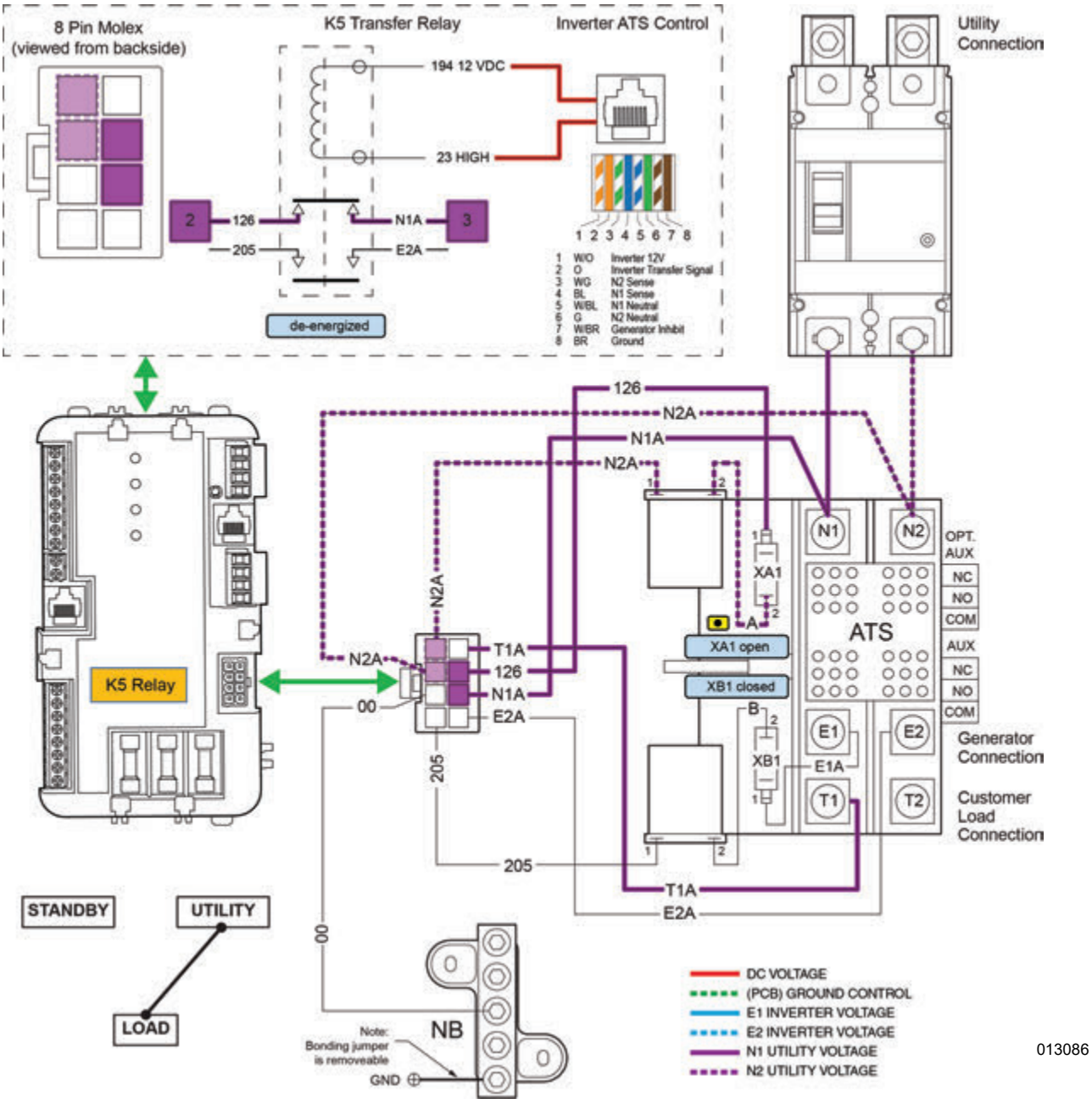


Figure 8-7. Utility Source Voltage Available

Utility Source Voltage Failure – Inverter Only Configuration

The inverter senses that utility voltage falls below a voltage dropout set point via N1 and N2. When the line interrupt drops below specifications, the inverter responds to the utility failure and will initiate transfer by grounding Wire 23. The inverter supplies voltage to the switch through E1 and E2.

Inverter voltage from E2 is connected to Terminal 4 of the controller. Because the switch is in the UTILITY position, the XB1 limit switch contacts are closed. This connects E1 through the closed XB1 limit switch to C2 terminal 2. The closing coil requires a minimum of 190 VAC from both phases of the supply to activate. Even though E1 is connected through the XB1 contact, the coil will not energize until the internal controller K5 relay contacts close (Wire E2 to the open TR contact).

As soon as the inverter controller grounds Wire 23, the internal relay standby contacts close (UTILITY contacts open) and the switch powers to the STANDBY position.

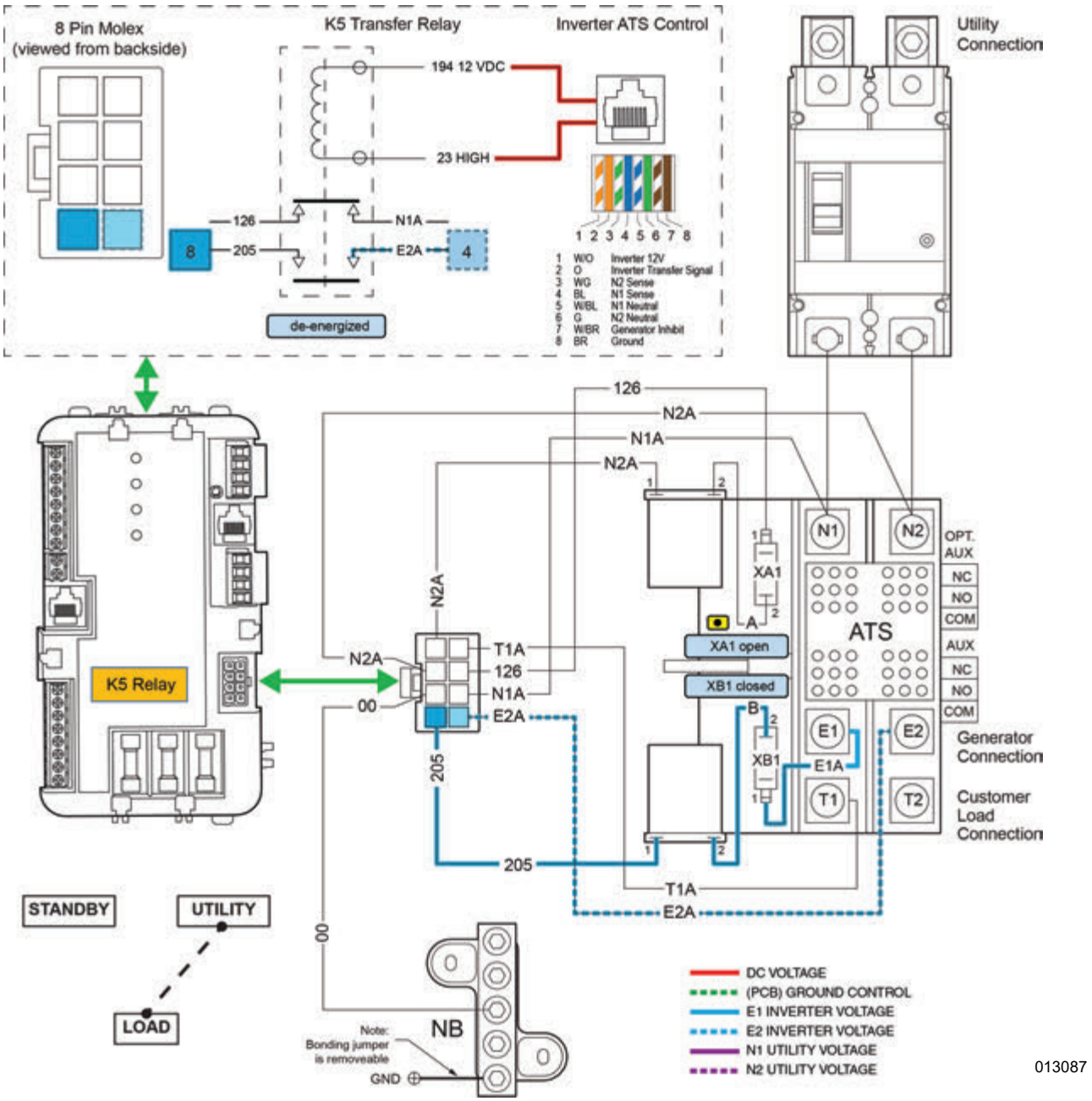


Figure 8-8. Utility Source Voltage Failure

Transferring to Standby – Inverter Only Configuration

The inverter takes Wire 23 to ground. This energizes the internal transfer relay (TR) within the ATS PWRcell controller. The TR contacts change state – opening on the UTILITY side (opens Wire N1A from Wire 126) – and closing on the STANDBY side (connecting Wire E2 and 205). This allows inverter voltage to be applied to the standby coil. Inverter voltage is already available to the coil from E1A. The voltage from E1 and E2 go to both sides of the bridge rectifier (BR). The BR rectifies the AC voltage to DC voltage and applies it to either side of the closing coil. The closing coil energizes and pulls the contactor to the STANDBY position.

In STANDBY the XB1 limit switch changes state and removes E2 inverter voltage from the coil. In the STANDBY position the XA1 limit switch will also change state and go to its normally closed position, setting the switch up for the next transfer.

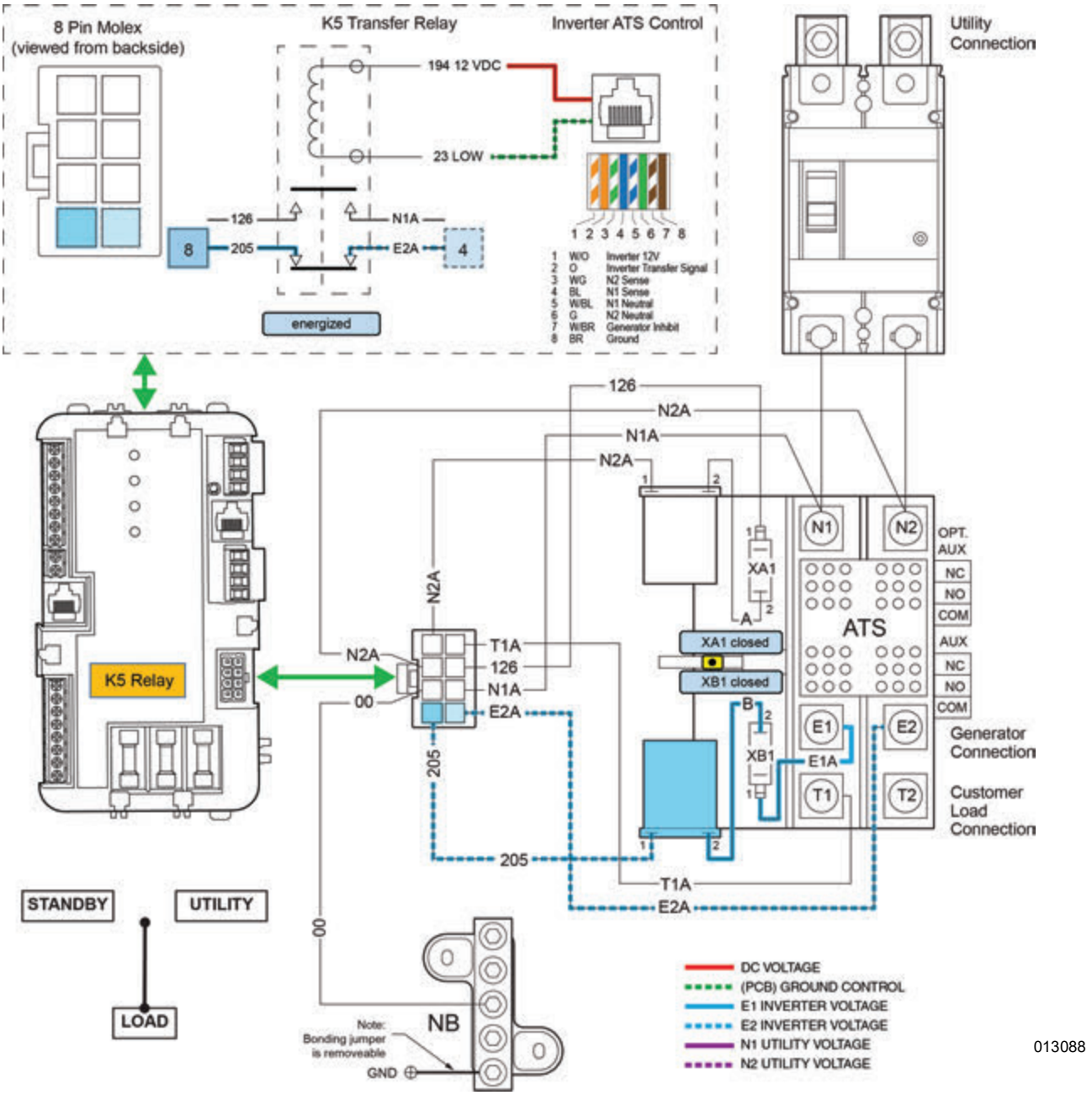


Figure 8-9. Transferring to Standby

Transferred to Standby – Inverter Only Configuration

When the XB1 limit switch opens voltage is removed from the coil, and the coil de-energizes. Spring tension in the switch mechanism now closes the switch to STANDBY. The next time it is actuated by the utility coil it will transfer to UTILITY.

NOTE: The closing coil is always powered by the source it is transferring to.

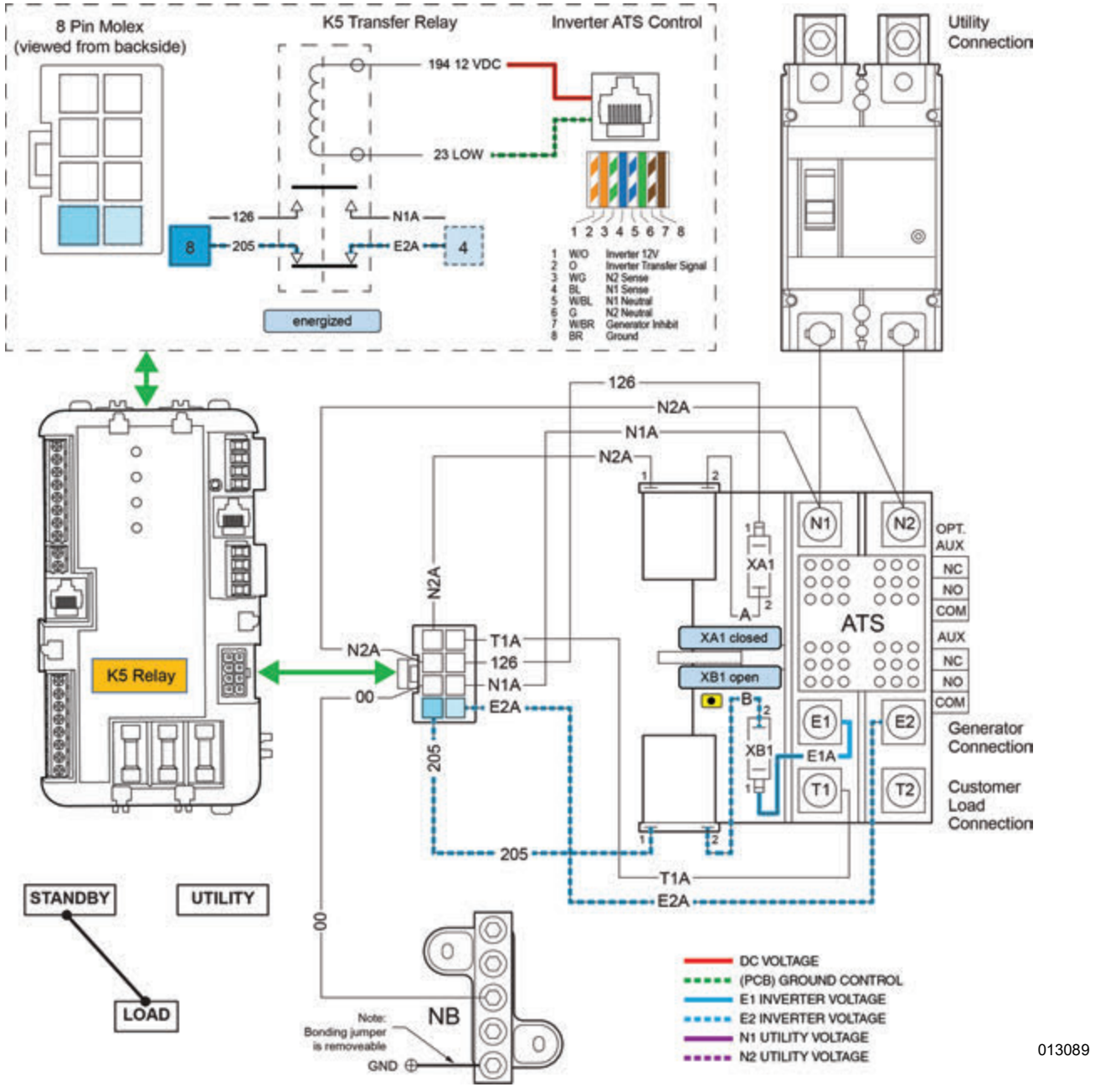


Figure 8-10. Transferred to Standby

Utility Restored – Inverter Only Configuration

The switch is in the STANDBY position and the inverter is powering the load.

When Utility voltage returns, the inverter sees the voltage from N1 and N2 through the CAT5 cable. If the voltage is higher than the voltage pickup setting the return to utility timer starts.

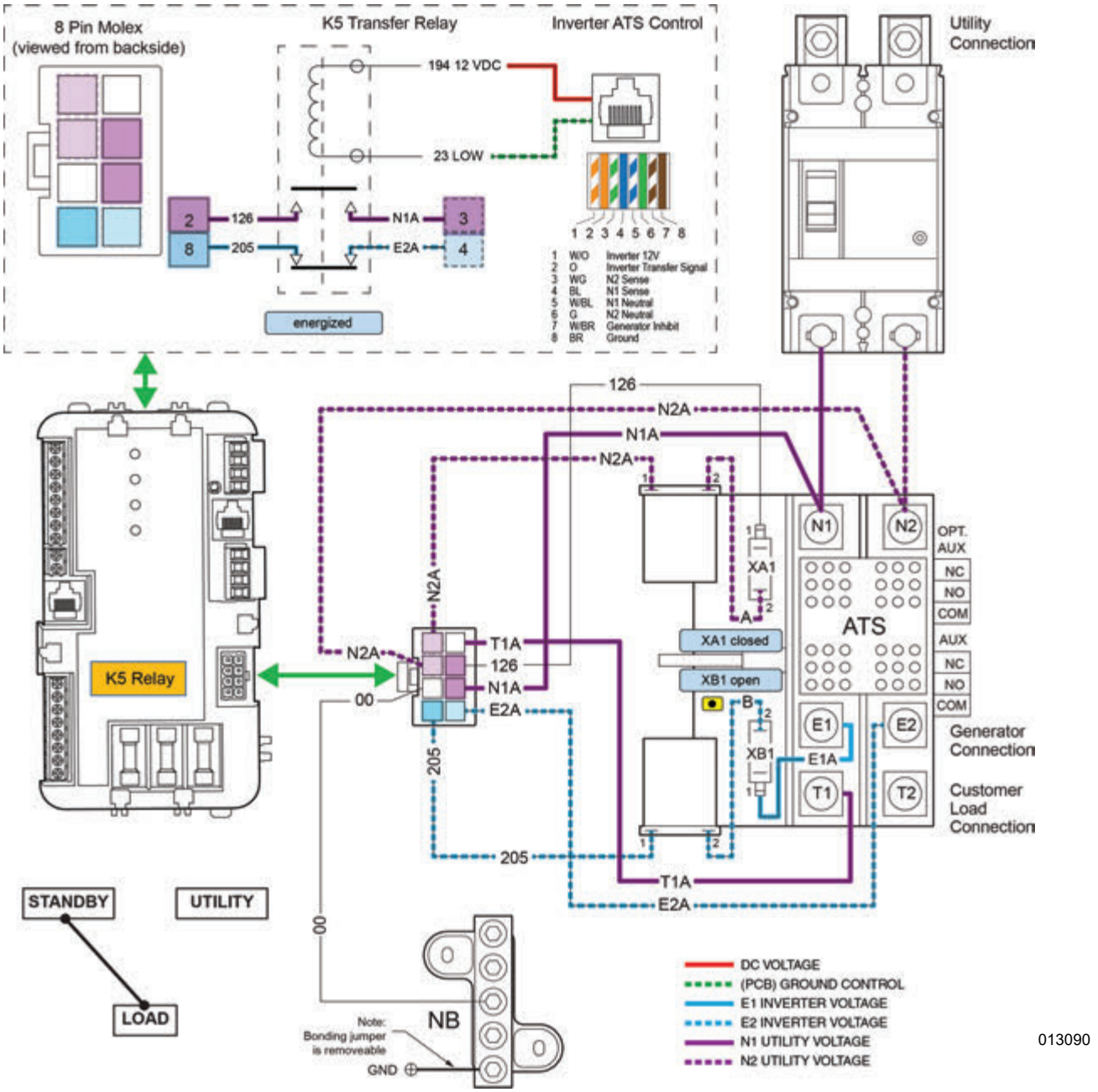


Figure 8-11. Utility Restored

Utility Restored, Transferring Back to Utility – Inverter Only Configuration

When all of the conditions are met, the inverter lifts the ground from Wire 23 and the transfer relay (TR) de-energizes. The TR contacts change states – opening E2A from 205, and closing N1A to 126.

Utility voltage is applied to the bridge rectifier and the coil. The closing coil energizes and pulls the switch to the UTILITY position, which opens the contacts from INVERTER to LOAD and closes the contacts from UTILITY to LOAD.

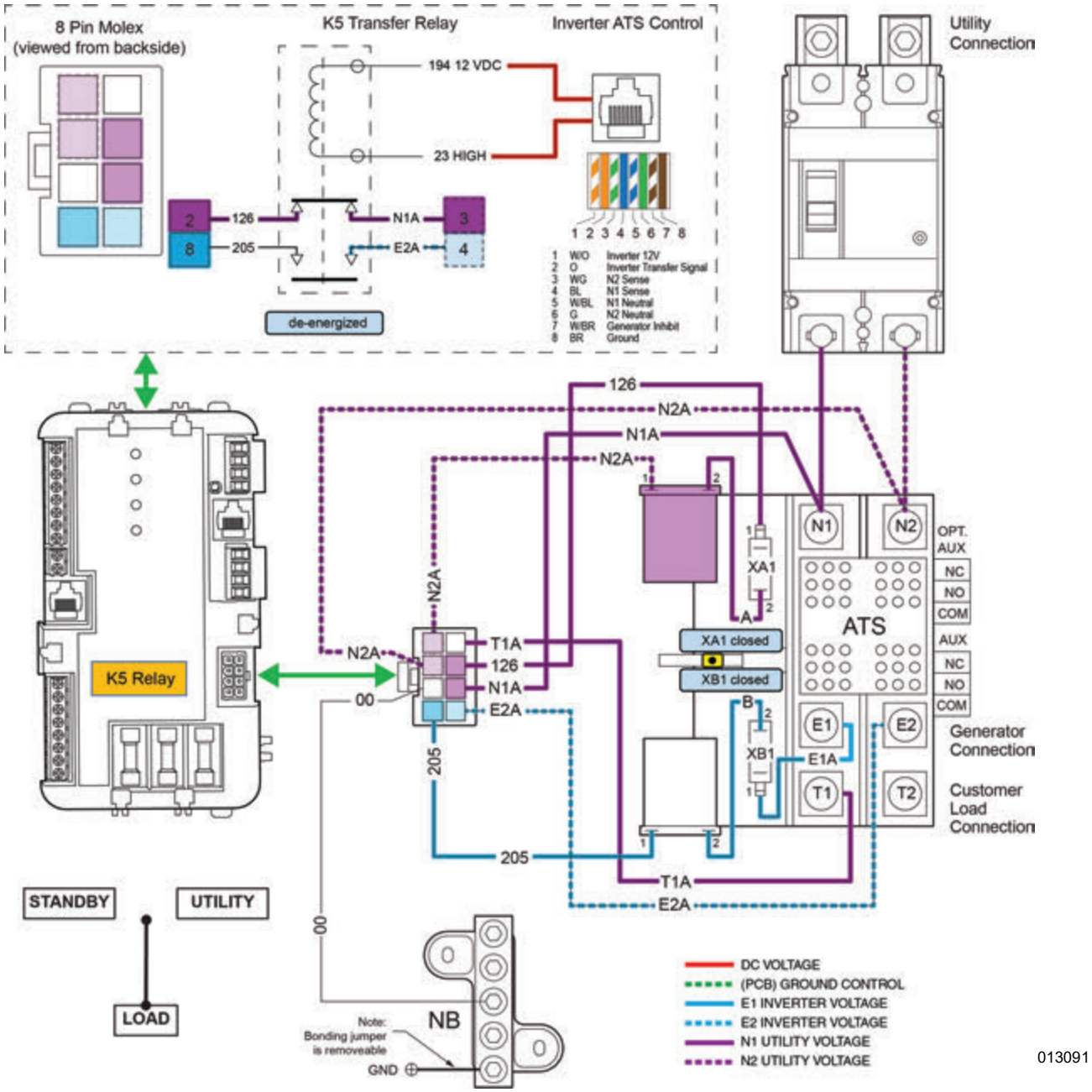


Figure 8-12. Utility Restored, Transferring Back to Utility

Utility Restored, Transferred Back to Utility – Inverter Only Configuration

The XA1 limit switch now opens. Spring tension in the switch mechanism closes the switch to the UTILITY position, and utility voltage powers the load through the main load lug connections.

As the switch closes to the UTILITY position, the XA1 limit switch changes states. With the switch in UTILITY, voltage is disconnected from the utility coil. XB1 is connected to the standby coil. This makes the switch ready for the next transfer.

NOTE: The closing coil is always powered by the source it is transferring to.

The switch is ready for the next utility power loss event.

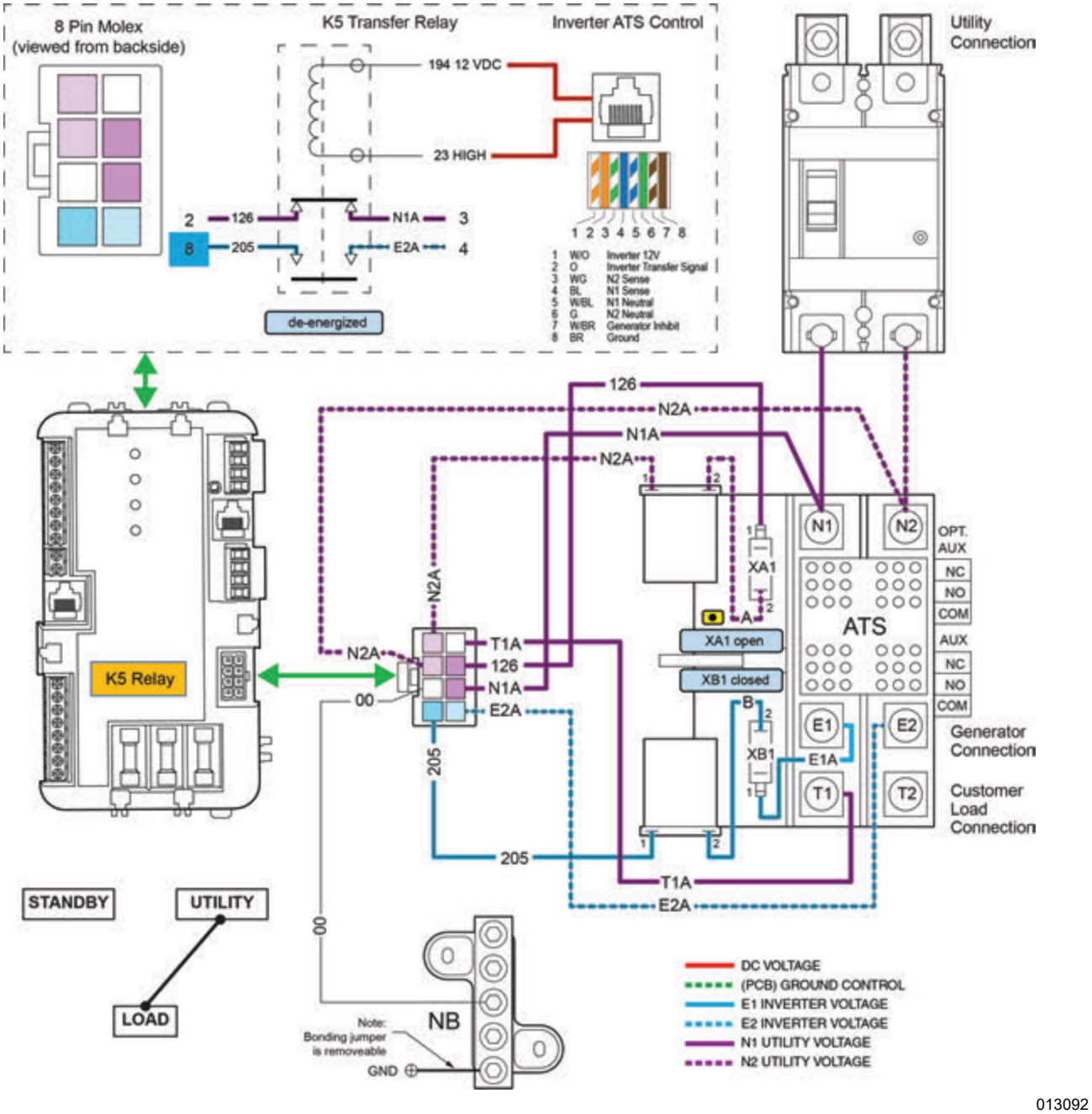


Figure 8-13. Utility Restored, Transferred Back to Utility

Operational Analysis – Generator Only Configuration

Utility Source Voltage Available – Generator Only Configuration

Figure 8-14 is a schematic representation of the transfer switch with utility source power available. The circuit condition is briefly described as follows:

- Utility source voltage is available to terminal lugs N1 and N2 of the contactor; the transfer switch is in the UTILITY position; and Utility voltage is available to T1 and T2, customer load.
- Utility source voltage is available to the limit switch (XA1) via the normally closed transfer relay contacts (1 and 5) and Wire 126; however, XA1 is open and the circuit to the utility closing coil is open.
- Utility voltage sensing signals are delivered to controller on the generator, via Wire N1A, and a 5-amp fuse (F1). The second line of the utility voltage sensing circuit is via Wire N2A, and a 5 amp fuse (F2).

NOTE: This is an example of Transfer Switch Operational Analysis. For troubleshooting use the operational analysis with the appropriate wiring/schematic diagrams.

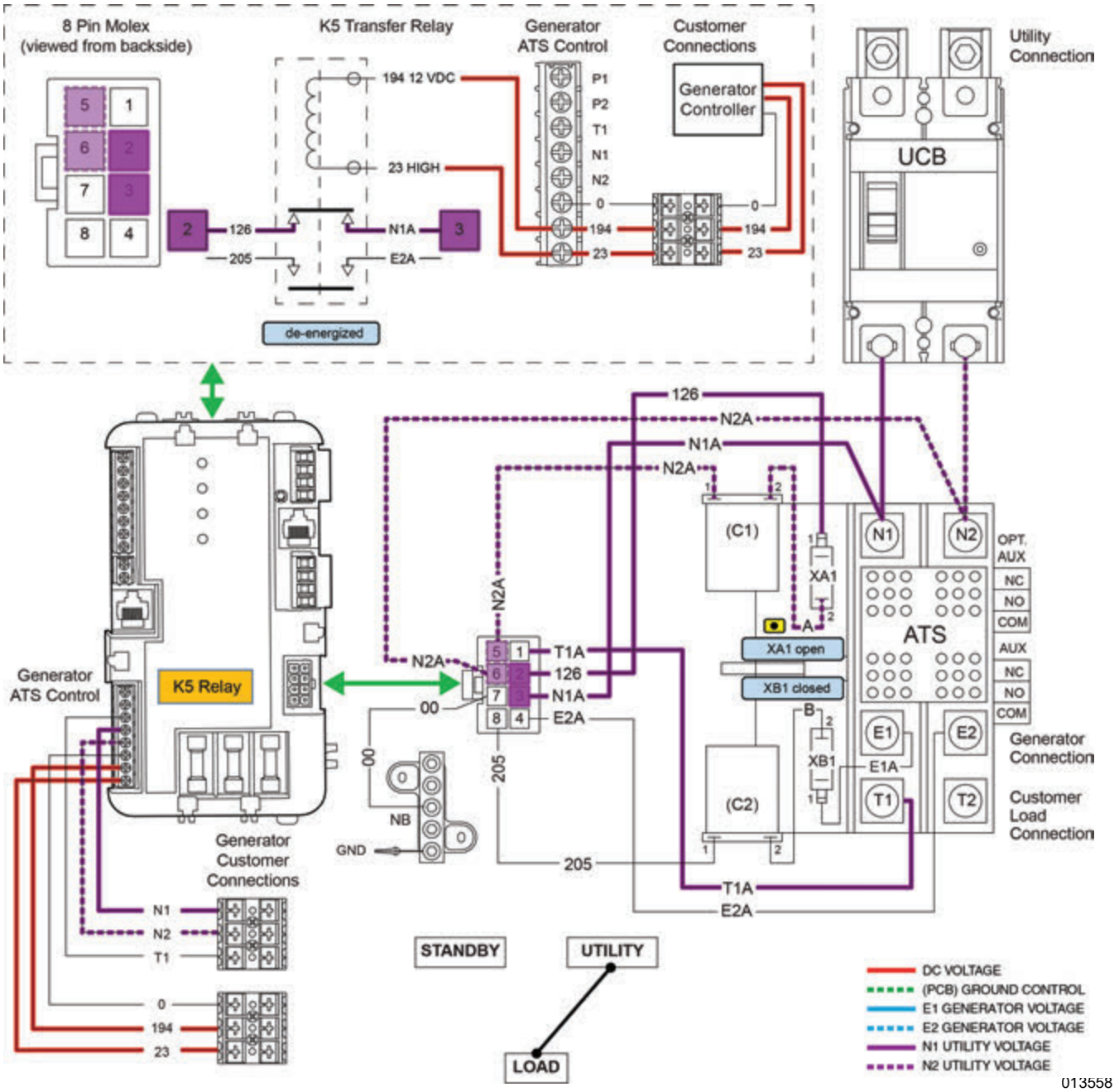


Figure 8-14. Utility Source Voltage Available

Utility Source Voltage Failure – Generator Only Configuration

If Utility source voltage drops below 65% of nominal voltage for five (5) seconds, the controller will initiate engine start. After the generator starts, a five (5) second engine warm-up timer is initiated. During this warm-up the generator is running at rated frequency and voltage. ***Figure 8-8*** is a schematic representation of the transfer switch with the Generator running with voltage available to the transfer switch.

Generator voltage available on contactor terminals E1 and E2.

- Controller logic is holding Wire 23 open from ground.
- Generator voltage from terminal E2 is available at the standby coil (C2); generator voltage from Terminal E1 is available to the transfer relay at Pin 9. The transfer relay is not energized so E1 voltage will not go through the N.O. contact (4 & 6) to Wire 205.

NOTE: This is an example of Transfer Switch Operational Analysis. For troubleshooting use the operational analysis with the appropriate wiring/schematic diagrams.

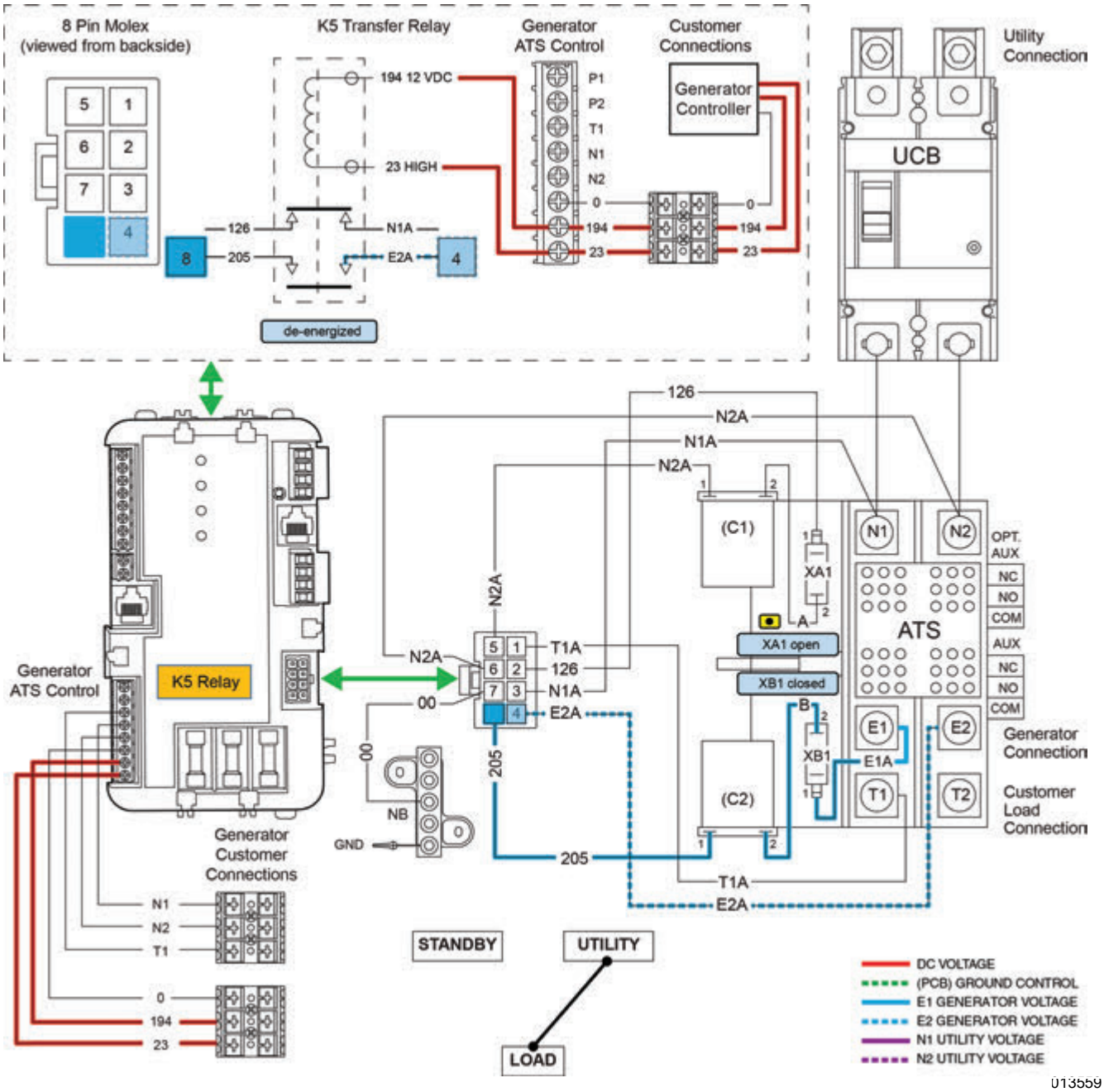


Figure 8-15. Utility Source Voltage Failure

Transferring to Standby – Generator Only Configuration

12 VDC is delivered to the transfer relay through Wire 194 and back to the controller through Wire 23. When the five second engine warm-up timer expires, the controller will take Wire 23 to ground which will energize the Transfer Relay. The N.O. and N.C. relay contacts will change states. This will connect generator voltage from E1 through wire 205 at relay connector 6 to E2A relay connector 4. The voltage will go through the N.C contact of XB1. Voltage from both E1 and E2 will be available at the C2 coil. This voltage will pass through the rectifier in the coil and the coil will energize.

Generator voltage is now delivered to the standby closing coil (C2), via generator voltage E1 and E2, the now closed relay contacts, Wire 205, the limit switch (XB1), Wire B, and a bridge rectifier. The standby closing coil energizes and the main current carrying contacts of the transfer switch are actuated to the “Standby” position.

- As the main contacts move toward the “Standby” position, limit switch XA1 closes (Utility Coil). When the contacts are in the “Standby” position, a mechanical interlock actuates XB1 to its open position. When XB1 opens the C2 coil de-energizes.
- Generator voltage is now available to the LOAD terminals (T1 and T2) of the transfer switch and 120 VAC is also supplied to the controller on Wire T1 for the battery charger. (220 VAC on T1 and T2 50 Hz only.)

NOTE: This is an example of Transfer Switch Operational Analysis. For troubleshooting use the operational analysis with the appropriate wiring/schematic diagrams. XA1 and XB1

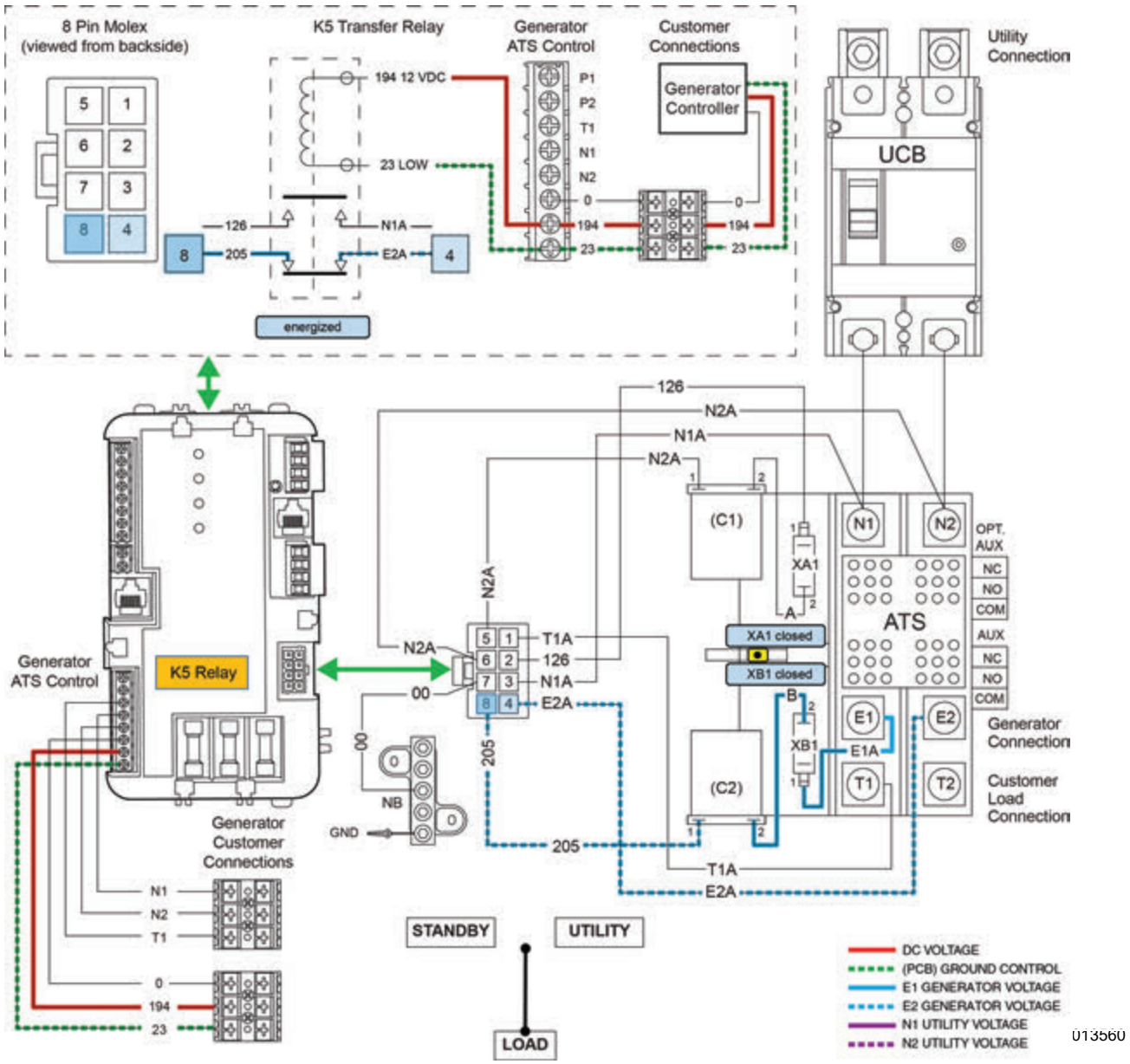


Figure 8-16. Transferring to Standby

Transferred to Standby – Generator Only Configuration

When the standby coil (C2) energizes it pulls the contactor to an “over center” position towards the STANDBY position, the transfer switch electronically/mechanically snaps to that position. Upon closure of the main contacts to the STANDBY position limit switches XA1 and XB1 mechanically actuate to “arm” the circuit for re-transfer to the UTILITY position. When XB1 changes, it opens the circuit providing voltage to the standby closing coil (C2). Voltage from the generator, connected through T1 and T2, provides power to customer connected loads.

NOTE: This is an example of Transfer Switch Operational Analysis. For troubleshooting use the operational analysis with the appropriate wiring/schematic diagrams.

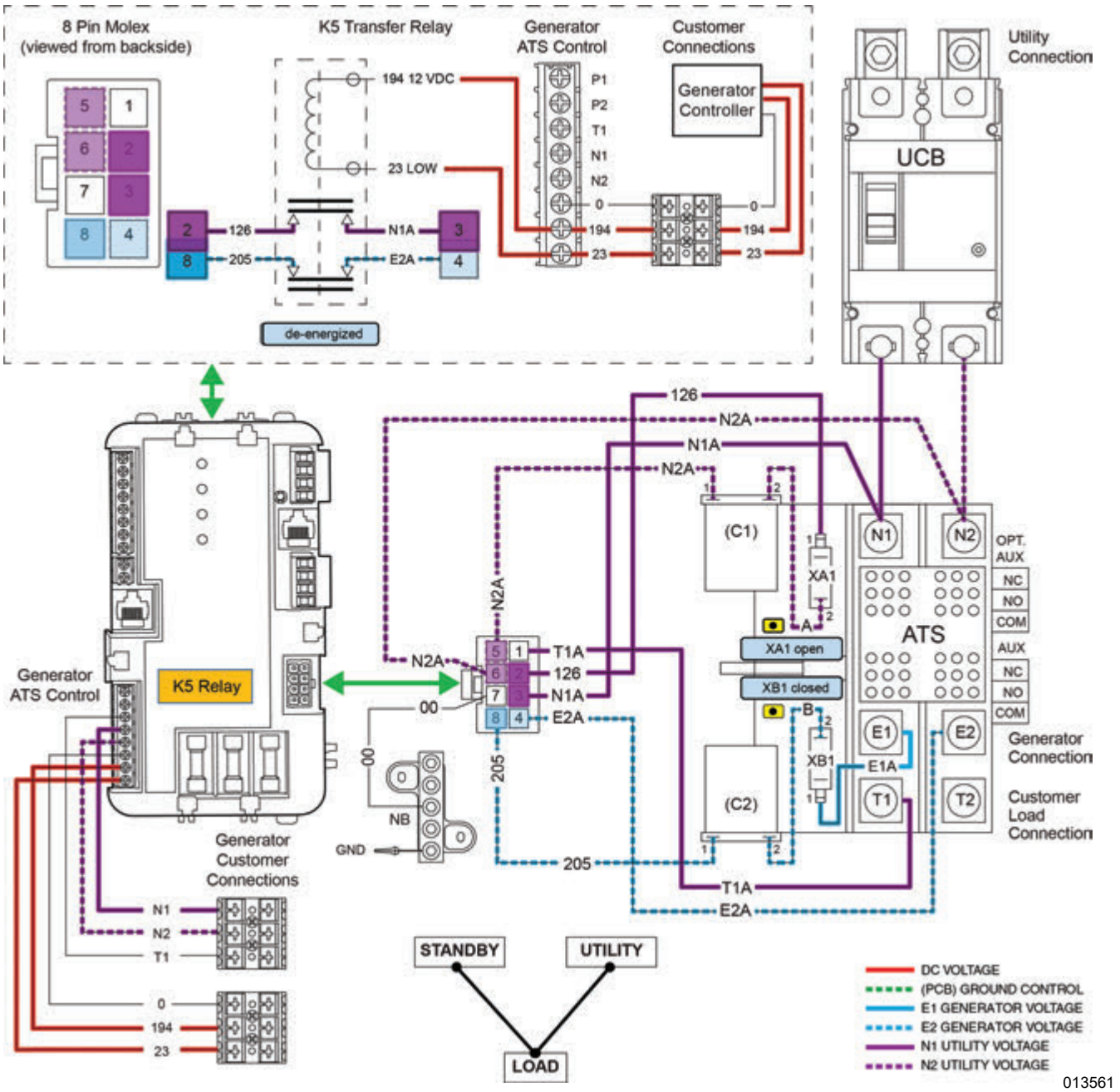


Figure 8-17. Transferred to Standby

Utility Restored – Generator Only Configuration

Utility voltage is restored and available to terminals N1 and N2. The Utility voltage is “sensed” by the controller and, if it is above 75% of nominal for 15 consecutive seconds, a transfer back to UTILITY will occur.

NOTE: The open contacts containing Wires N1A and 126 keep the switch from immediately transferring to the utility position.

NOTE: This is an example of Transfer Switch Operational Analysis. For troubleshooting use the operational analysis with the appropriate wiring/schematic diagrams.

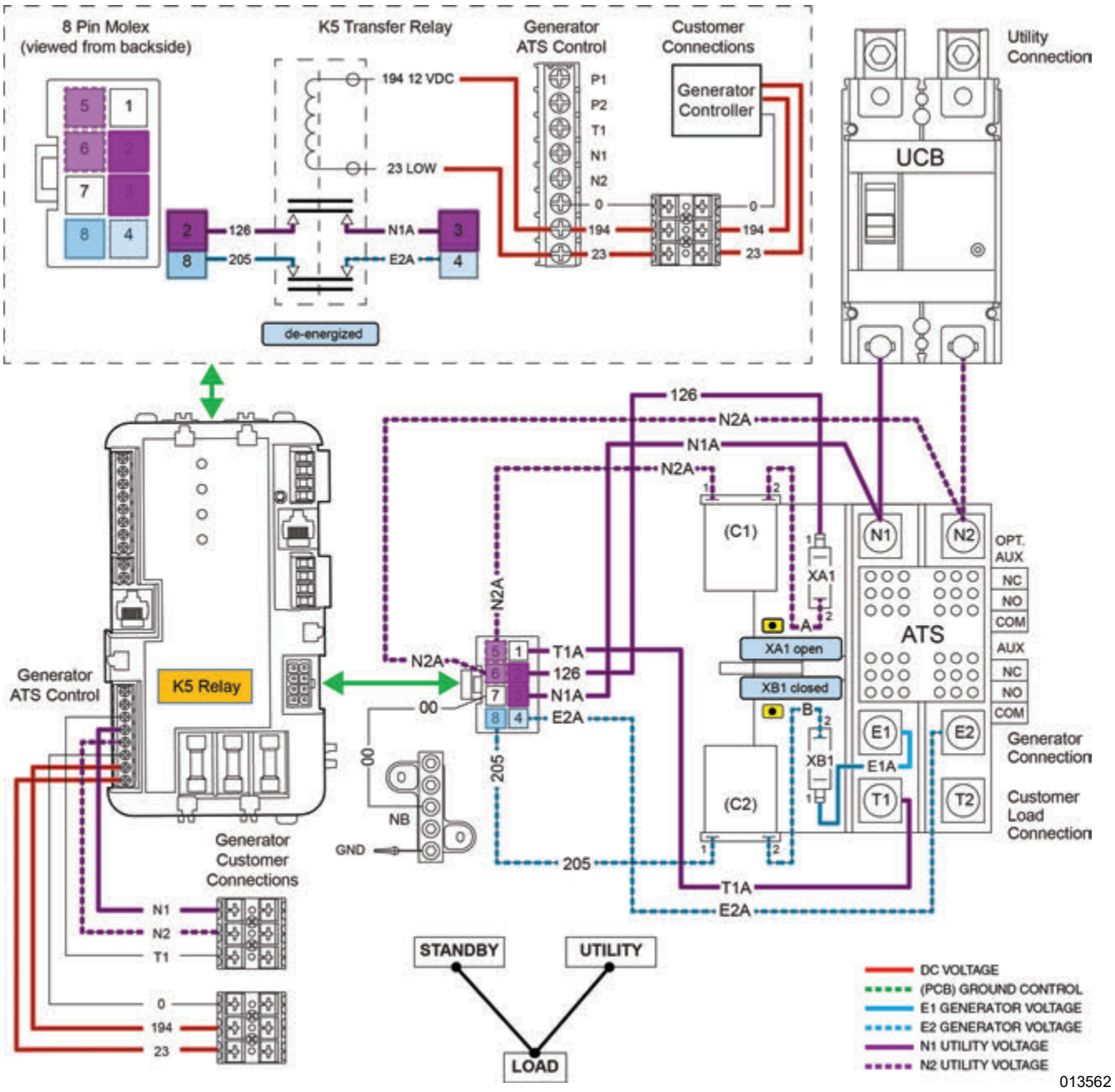


Figure 8-18. Utility Restored

Utility Restored, Transferring Back to Utility – Generator Only Configuration

After the 15 second return to utility delay expires, the controller will open the Wire 23 circuit from ground. The transfer relay de-energizes, the N.O. and N.C. contacts change state. Utility voltage is delivered to the utility closing coil (C1) through Wires N1A and N2A, the normally closed contacts containing Wires N1A and 126, and limit switch (XA1). With utility voltage applied to both sides of the utility closing coil (C1), the rectifier in the coil causes the coil to energize.

When the relay de-energizes its utility side contacts close, utility voltage is delivered to the utility closing coil (C1), via utility voltage from N1A and N2A, the closed relay contacts, Wire 126, limit switch (XA1), and a bridge rectifier.

- The C1 coil energizes and moves the main contacts to their “Utility” Position; the LOAD terminals are now powered by Utility.
- Movement of the main contacts to the “Utility” position actuates the limit switches. XA1 opens and XB1 closes on the Standby source side.

NOTE: This is an example of Transfer Switch Operational Analysis. For troubleshooting use the operational analysis with the appropriate wiring/schematic diagrams.

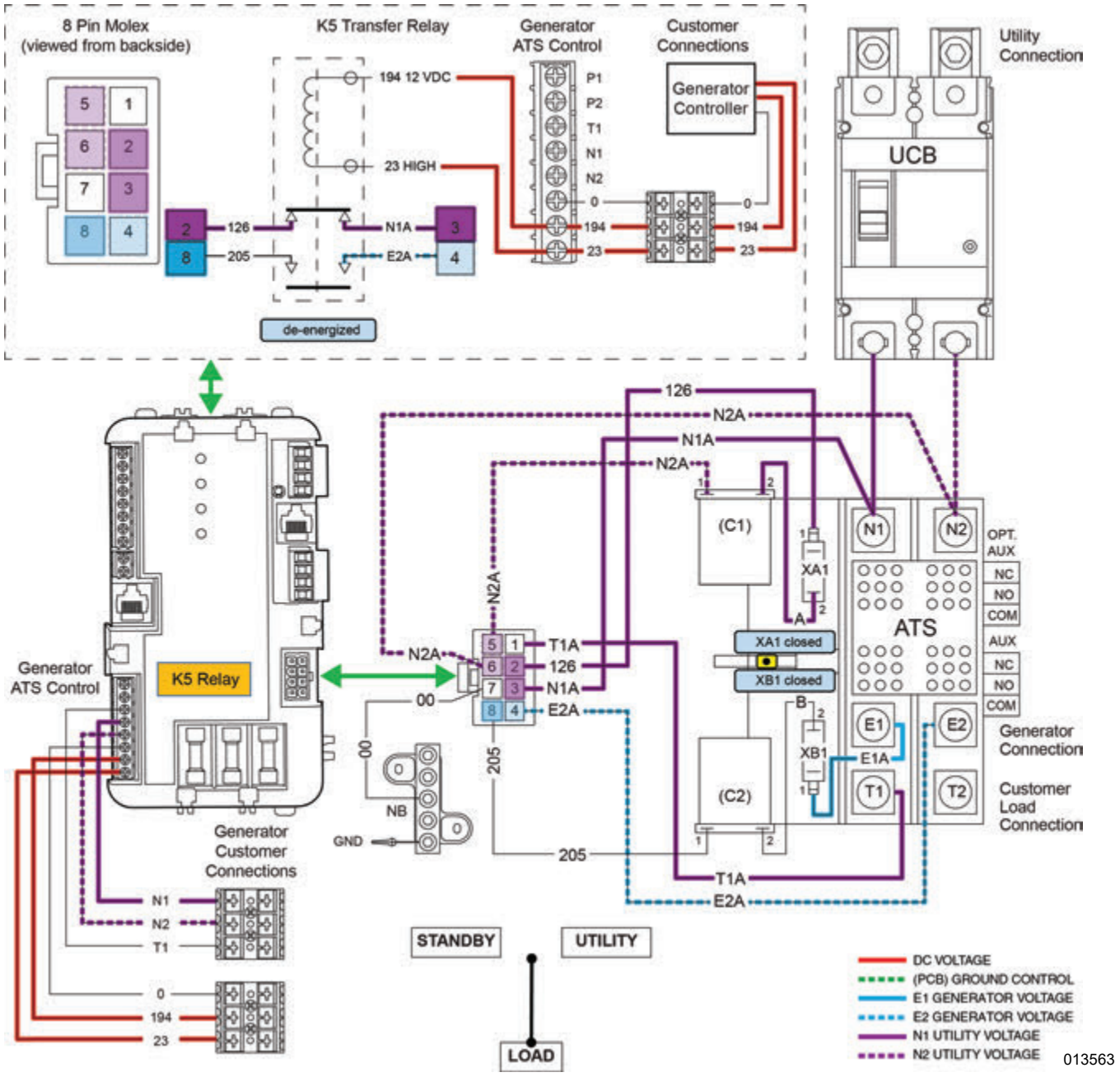


Figure 8-19. Utility Restored, Transferring Back to Utility

Utility Restored, Transferred Back to Utility – Generator Only Configuration

As the utility closing coil pulls the transfer switch to an “over center” position, the switch mechanically snaps to the UTILITY position. Upon closure of the contacts to UTILITY, the limit switches (XA1 and XB1) mechanically actuate to “arm” the circuit for the next transfer to STANDBY. When switch XA1 changes states, the circuit providing voltage to the utility transfer coil is opened, and the coil de-energizes.

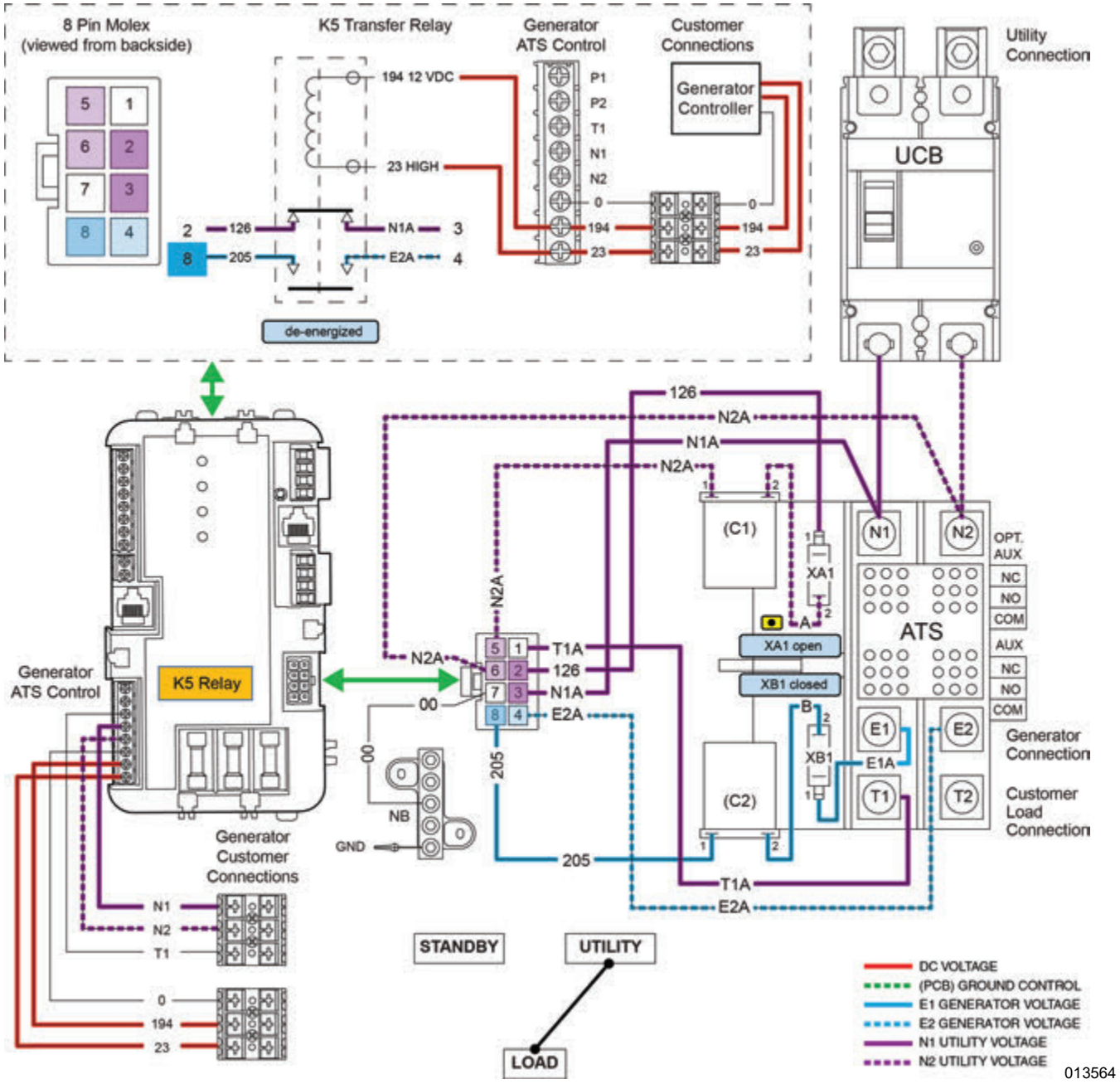


Figure 8-20. Utility Restored, Transferred Back to Utility

Transferred Back to Utility, Generator Shutdown

When the transfer switch returns to the UTILITY position the controller will shut the generator down after the one minute engine cool-down timer expires.

NOTE: This is an example of Transfer Switch Operational Analysis. For troubleshooting use the operational analysis with the appropriate wiring/schematic diagrams.

PWRcell ATS Controller

Up to four air conditioner loads can be managed by the PWRcell ATS Controller. The PWRcell ATS Controller manages the loads by “shedding” the connected loads in the event of a drop in generator frequency (overload). Loads to be shed are in 4 priority levels on the module.

Priorities A/C 1-4 have connections for an air conditioner. To control an air conditioner, no additional equipment is required. Internal normally closed relays interrupt the 24 VAC thermostat control signal to disable the air conditioner load.

Four LEDs, located on the PWRcell ATS Controller, illuminate when a load is connected and powered. The PWRcell ATS Controller has a test button used to simulate an overload condition.

An inverter overload condition is determined by the inverters internal CTs. Loads are shed when the current exceeds the inverters output capability.

Test Button

See ***Figure 8-21***. The PWRcell ATS Controller load shed module has a TEST button (A) which forces the unit to act as if an overload has occurred. This button operates even when the transfer signal is inactive.

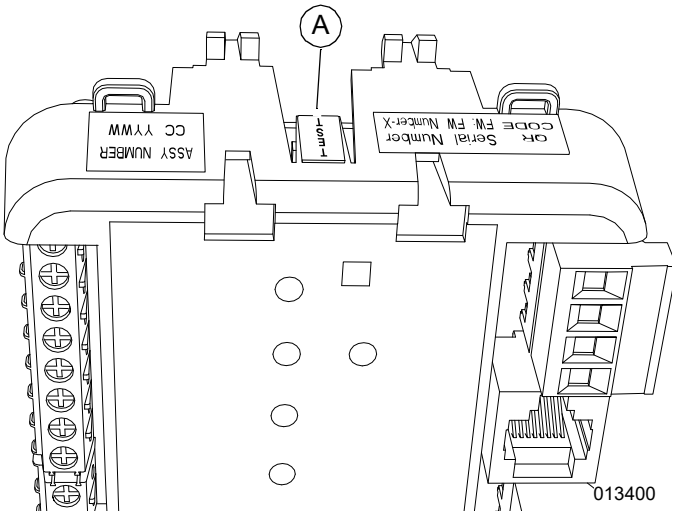


Figure 8-21. PWRcell ATS Controller TEST Button

The TEST button will work when the ATS is in the Utility or the Generator position.

1. Turn on the utility supply to the ATS.
2. Press and hold the TEST button on the PWRcell ATS Controller for approximately 1 second.
3. Verify that all of the connected loads to be “shed” become disabled. The method of verification will depend on the type of load.
4. After five (5) minutes verify A/C1 (Priority 1) are energized. Status LED AC 1 and Load 1 is ON.
5. After another 15 seconds, verify A/C2 (Priority 2) are energized. Status LED AC 2 and Load 2 are ON.
6. After another 15 seconds, verify A/C3 (Priority 3) is energized. Status Load 3 is ON.
7. After another 15 seconds, verify A/C4 (Priority 4) is energized. Status Load 4 is ON.

Load Shed Operation

NOTE: The following sequence of operation is the same for the PWRcell ATS Controller and the generator Integrated SACM controller.

The 4 green status LEDs will indicate when a load priority level is enabled or disabled.

All loads are enabled when the transfer signal is off. (ATS in Utility position, Wire 23 not grounded).

When utility power is interrupted, T1 is de-activated. The module remains powered via Wire 194 (12 VDC) and Wire 0. Wire 23 is not grounded (high, 12 VDC) at this time.

As the generator starts, runs, and transfers, Wire 23 is pulled to ground (low, 0 VDC). Once the transfer switch goes to the standby position, T1 is powered by the inverter.

The module senses that the system is on standby and disables all loads. A 5 minute timer is activated.

- A/C1 (Priority 1) load(s) are enabled after 5 minutes.
- A/C2 (Priority 2) load(s) are enabled after 15 seconds.
- A/C3 (Priority 3) load is enabled after another 15 seconds.
- A/C4 (Priority 4) load is enabled after another 15 seconds.

When an overload is detected all loads are disabled.

Inverter overload condition is determined by inverter CTs. Loads are shed when the current exceeds the capability of the inverter.

If an overload is detected within 15 seconds of a priority being enabled, that load is then locked out. The sequence will continue until all load levels have been checked (temporarily bypassing the faulting level). The level that caused the overload will not be enabled/tested again for 30 minutes. The PWRcell ATS Controller will attempt to enable the load every 30 minutes. During enabling, if the current exceeds the capability on the inverter, the PWRcell ATS controller will disable again. This will continue until the current is not exceeded when the priority is enabled, the system is returned to utility, or the TEST button is pressed.

When utility voltage returns, Wire 23 is released from ground (back to 12 VDC, high) and the transfer switch returns to the utility position. The ATS controller will disable all loads, time out for 5 minutes and then enable all 4 priorities at the same time.

PWRcell ATS Controller Example

Follow the sequence of operation when an overload condition occurs on example Priority Circuit 3. After a 30 minute timer expires, Priority 3 is activated. All priorities will remain active if the current load is still OK.

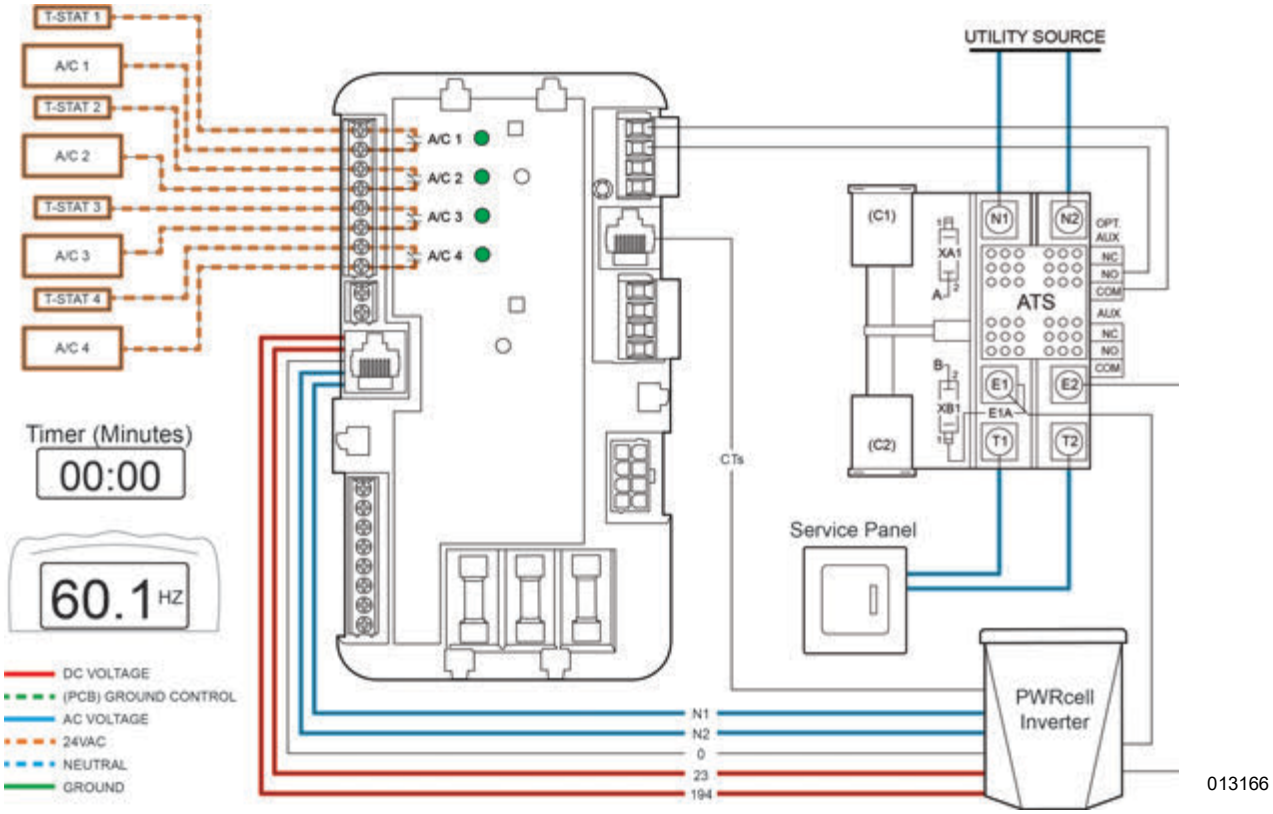


Figure 8-22. Utility Power Present - All Priorities Enabled

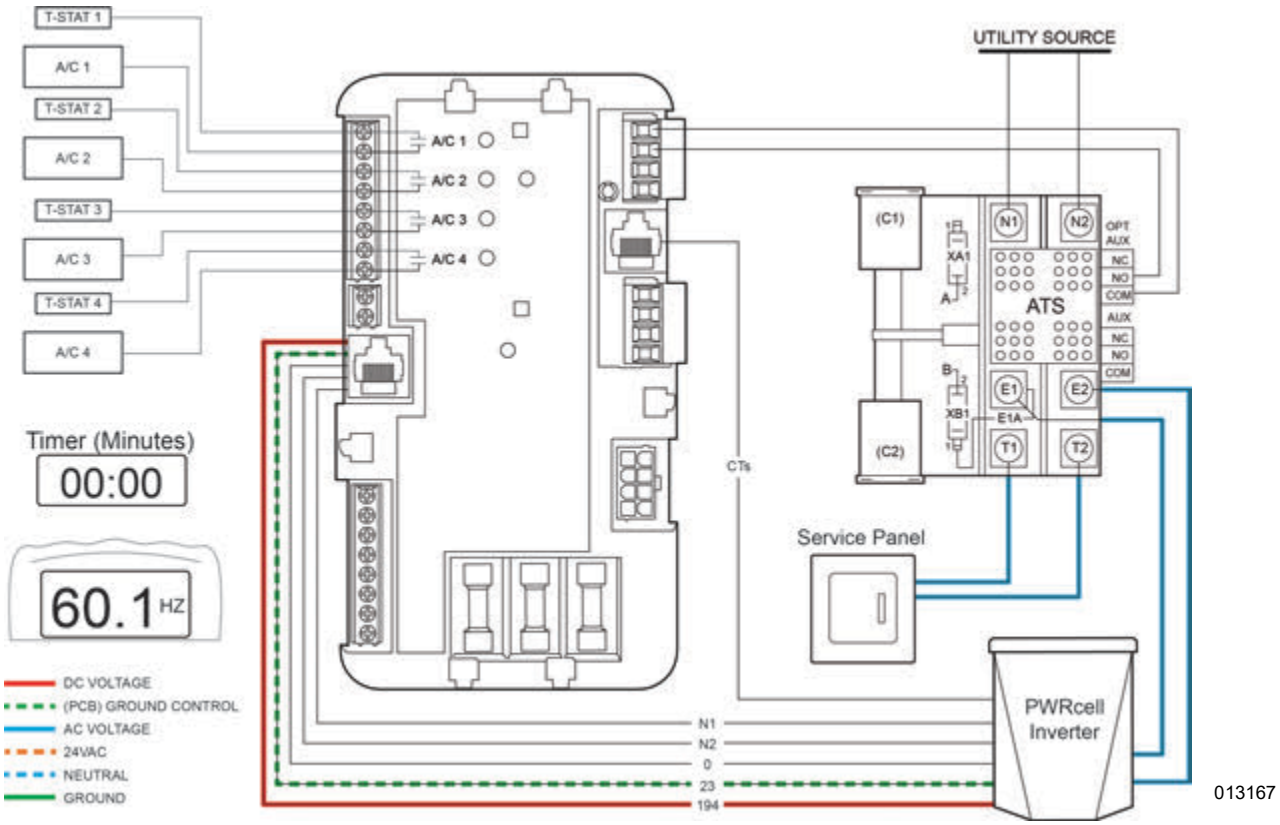


Figure 8-23. Loss of Utility Power - All Priorities Disabled, Inverter Supplying Power

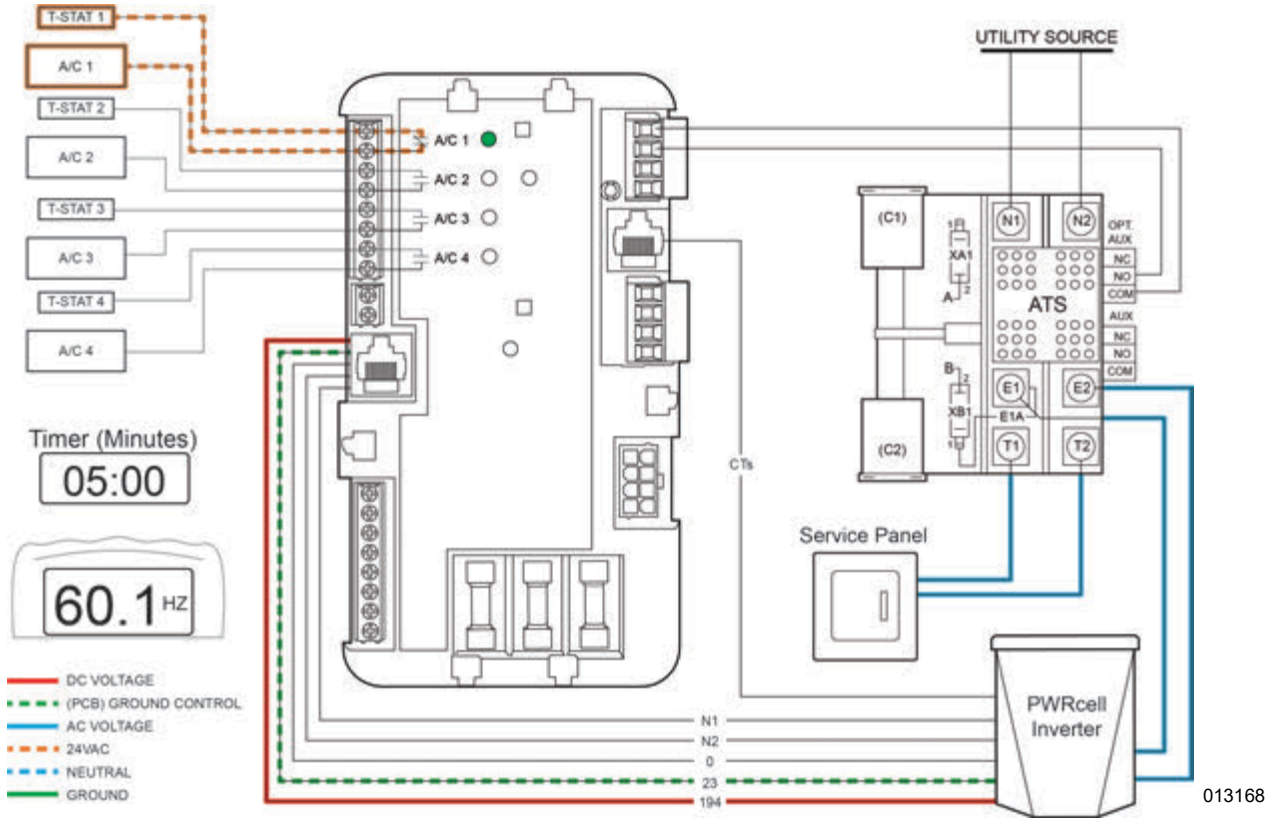


Figure 8-24. Priority 1 Enabled at 5 Minutes

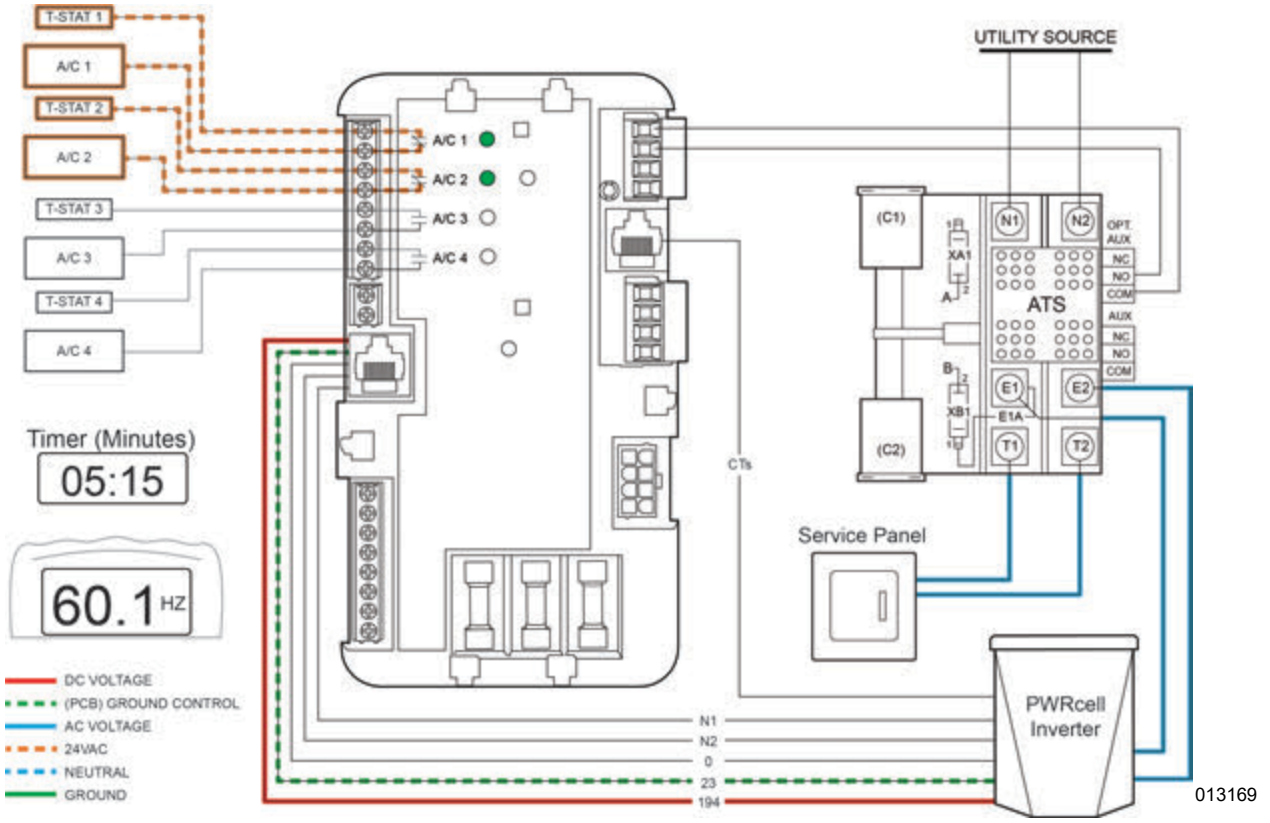


Figure 8-25. Priority 2 Enabled at 5 Minutes 15 Seconds

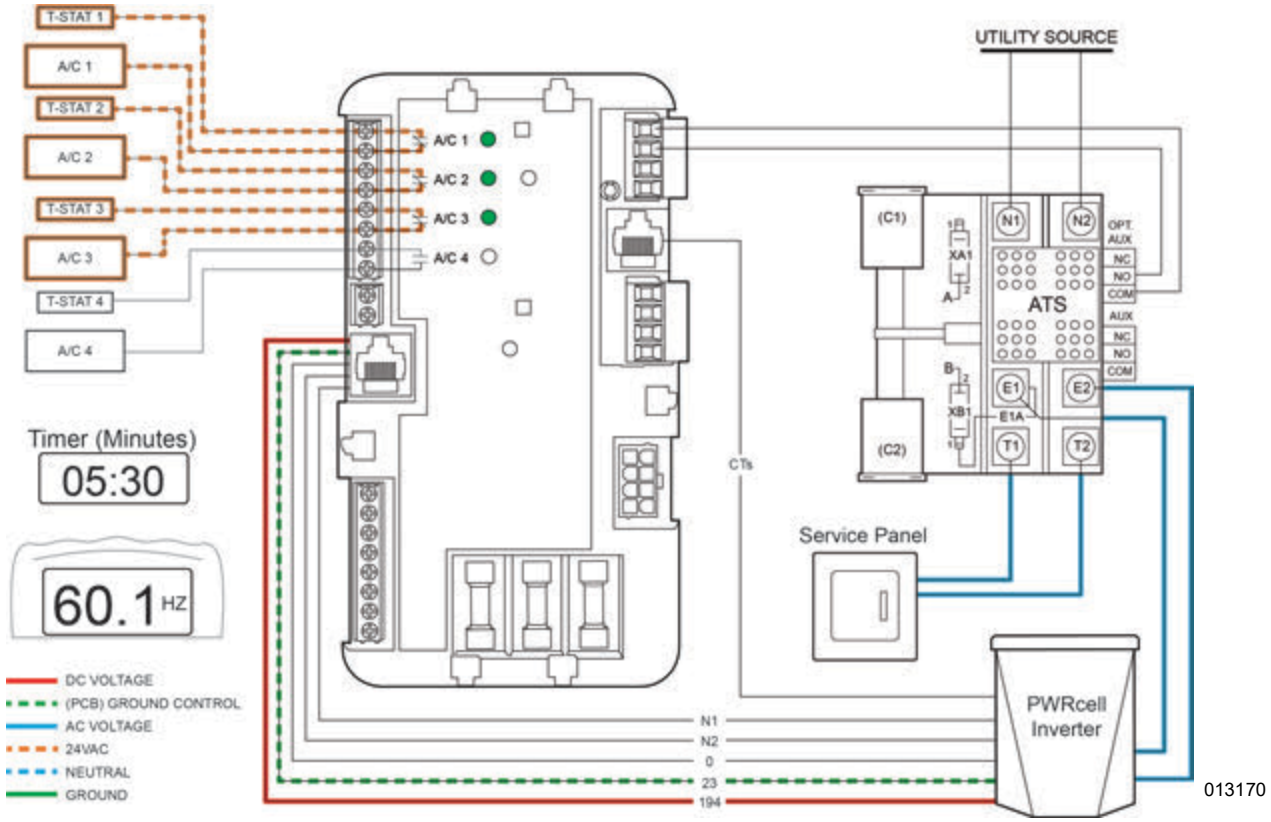


Figure 8-26. Priority 3 Enabled at 5 Minutes 30 Seconds

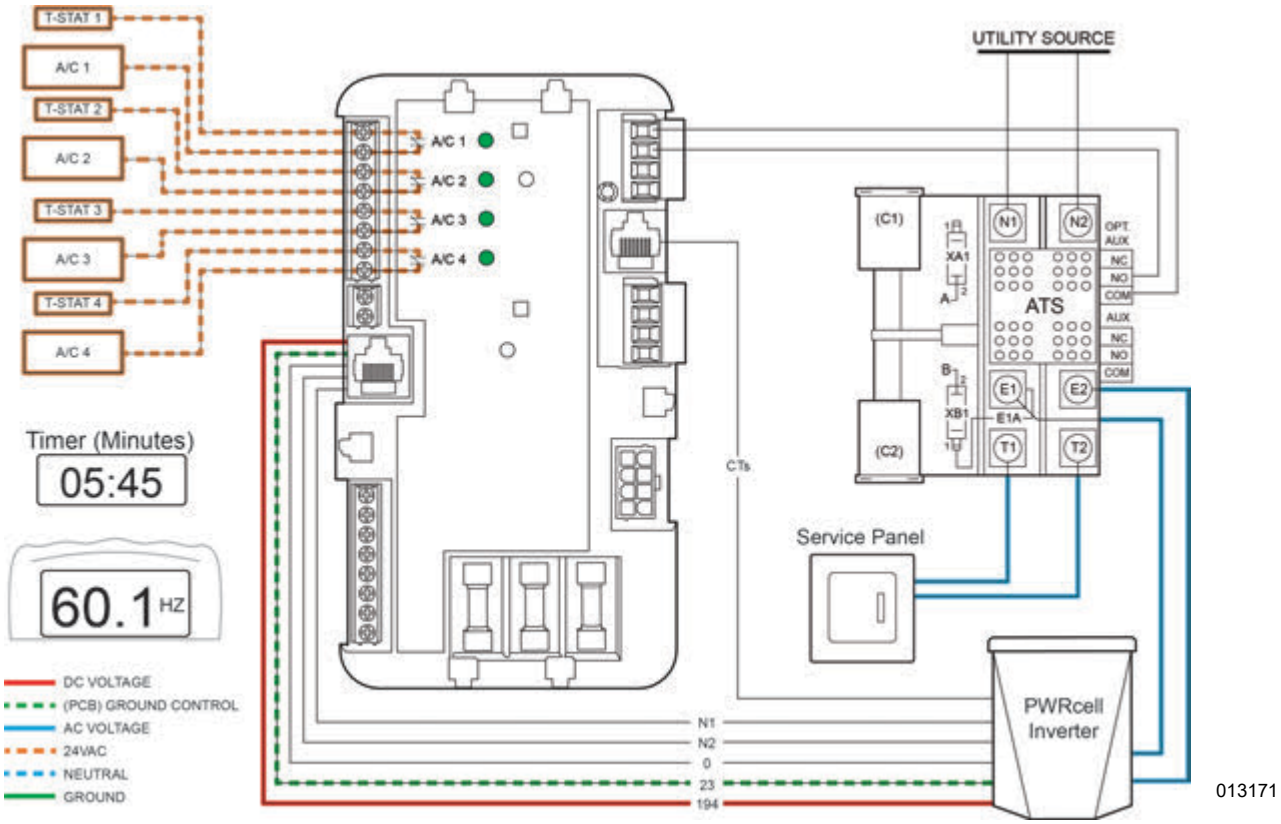


Figure 8-27. Priority 4 Enabled at 5 Minutes 45 Seconds

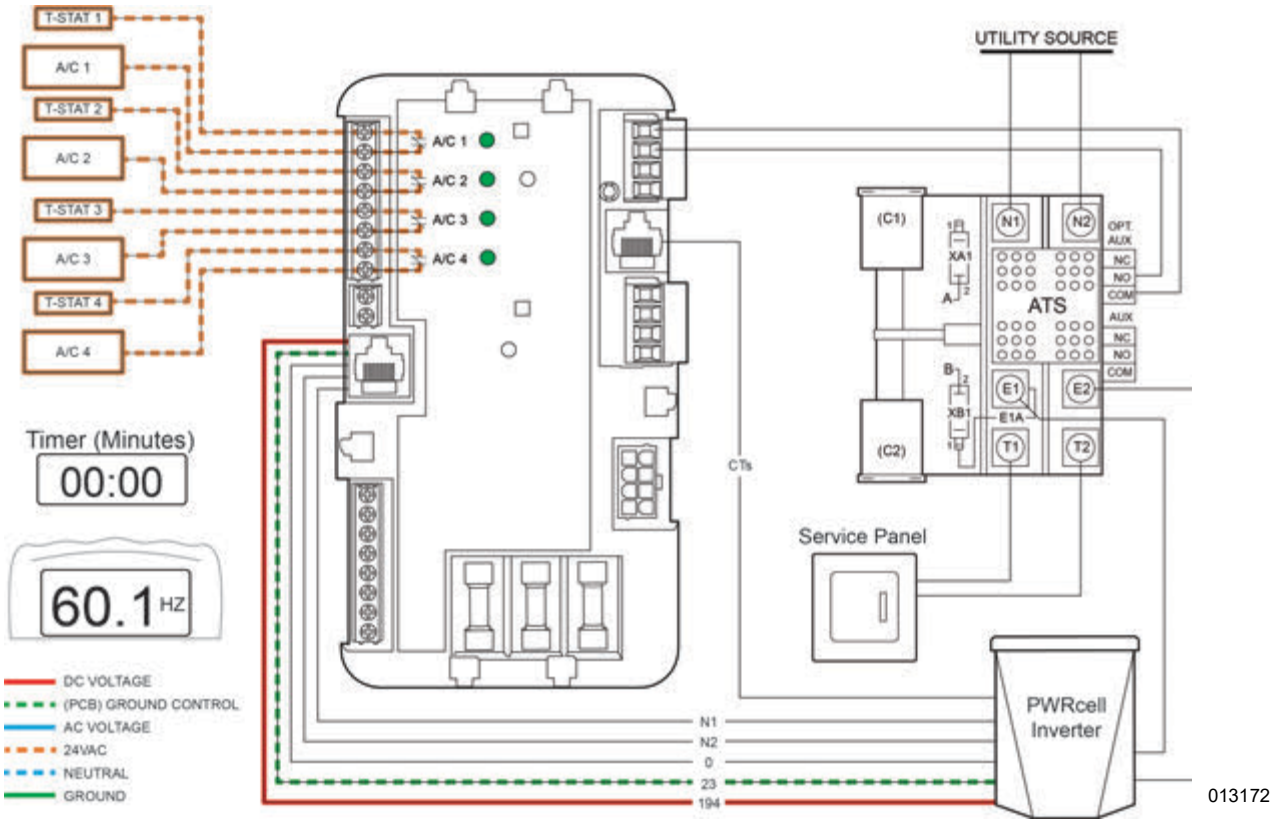


Figure 8-28. All Priorities Enabled - Timer Reset

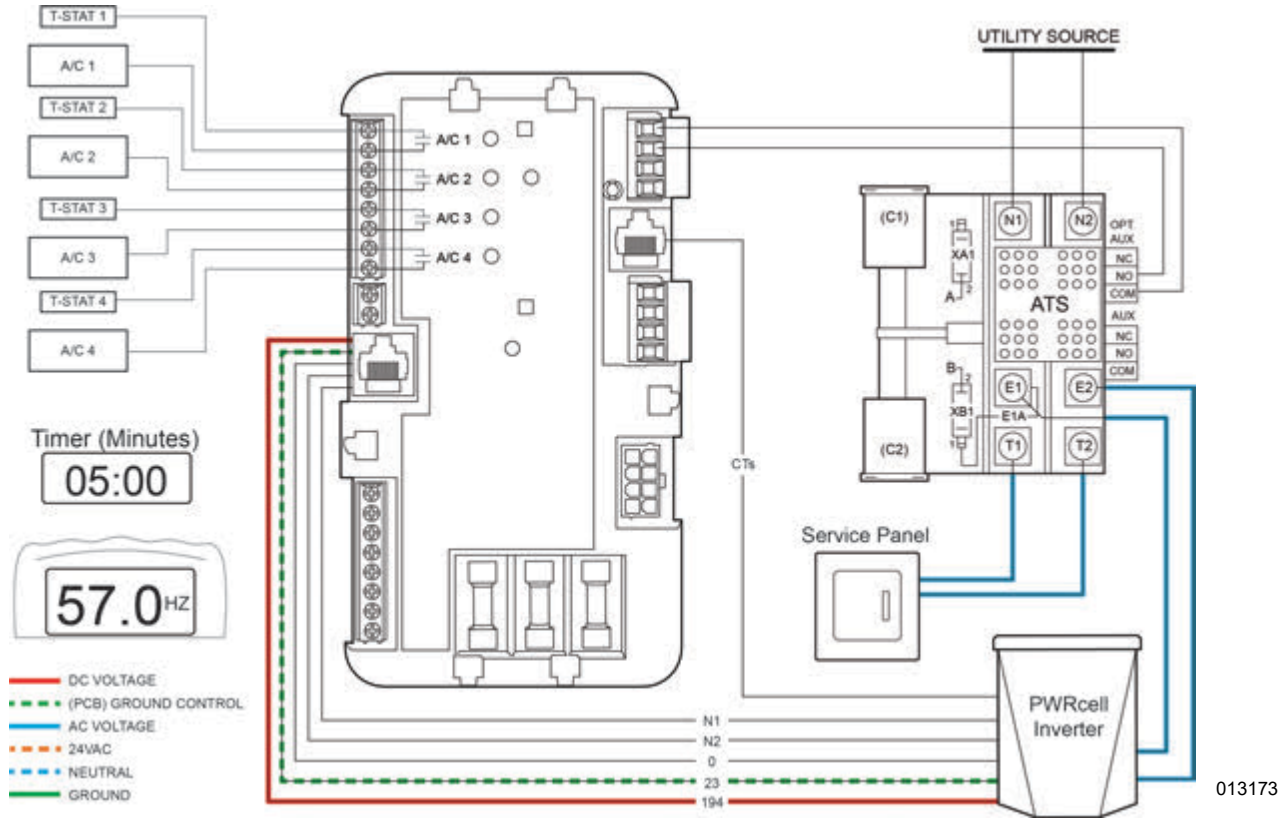


Figure 8-29. Unidentified Overload - All Priorities Disabled - Begin 5 Minute Timer

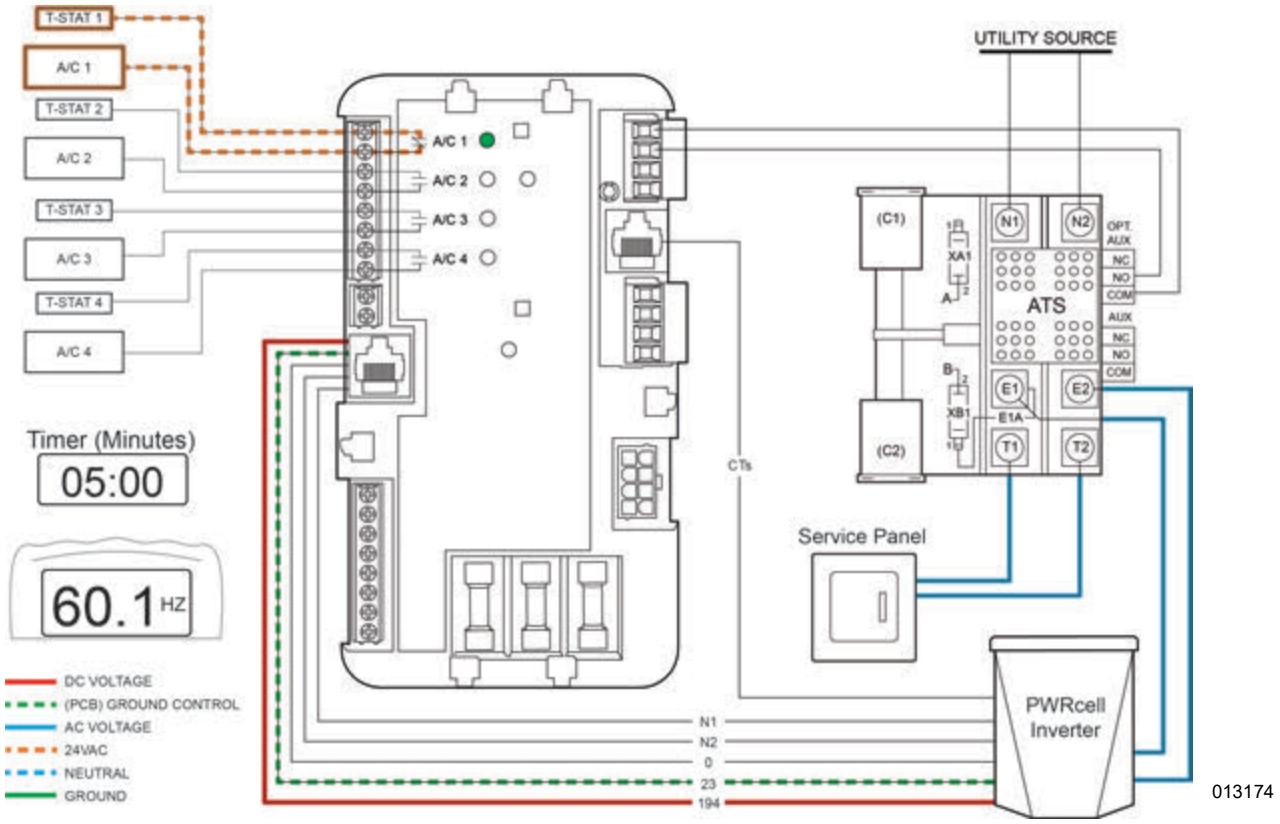


Figure 8-30. Priority 1 Enabled at 5 Minutes

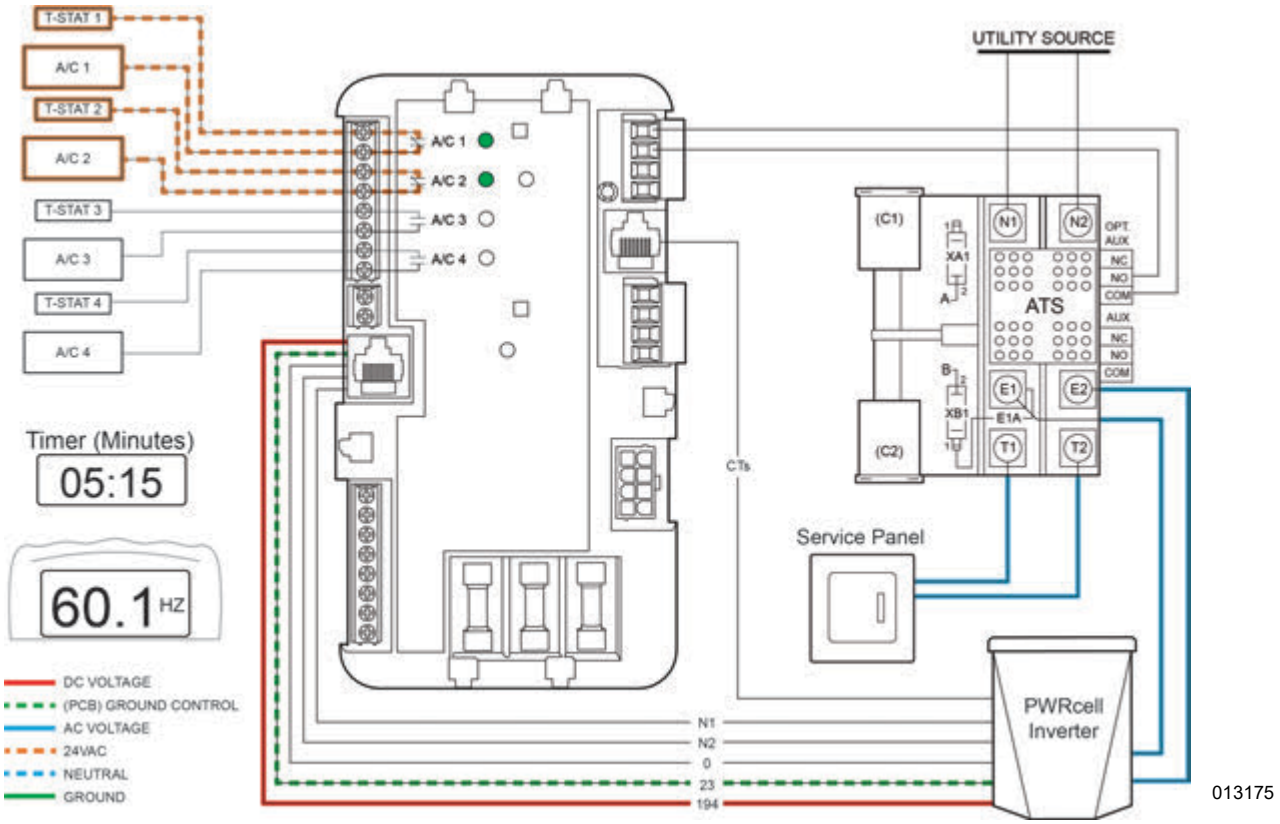


Figure 8-31. Priority 2 Enabled at 5 Minutes 15 Seconds

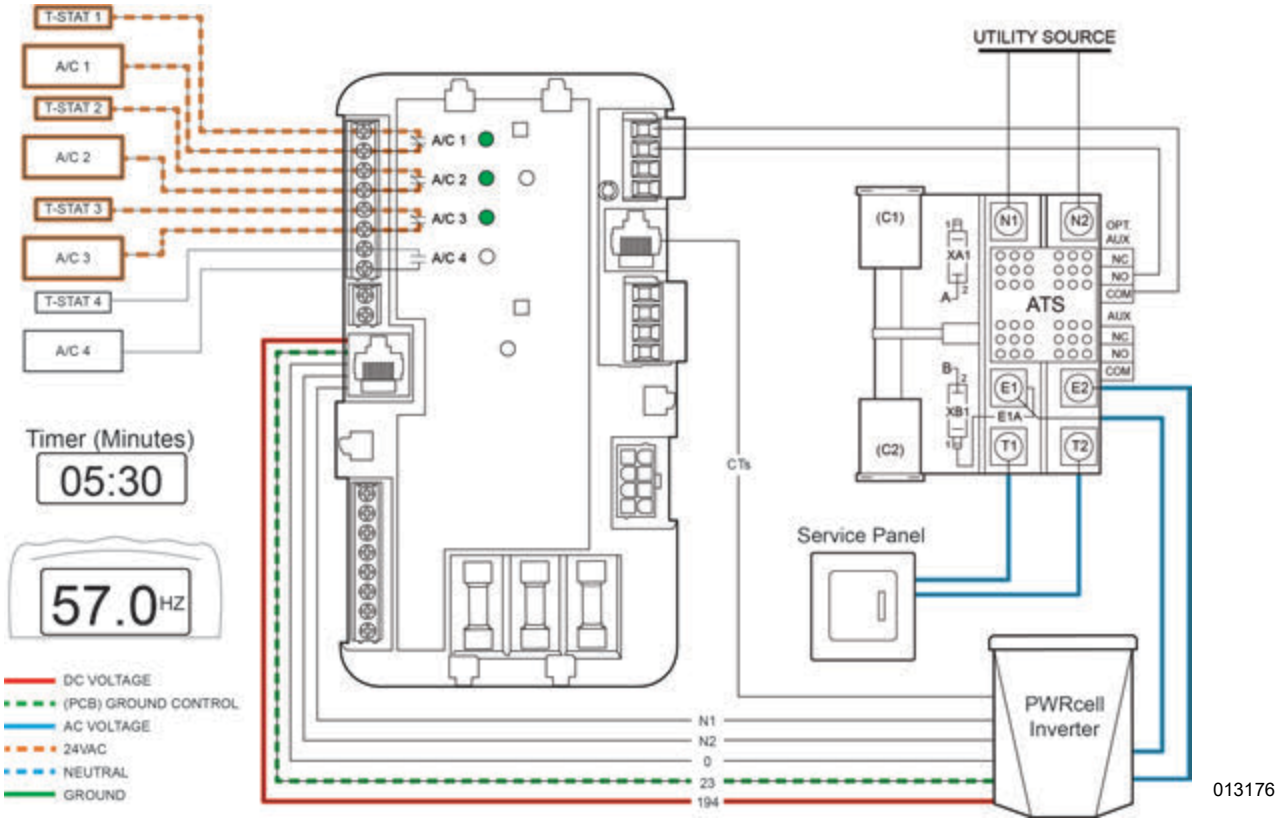


Figure 8-32. Priority 3 Enabled at 5 Minutes 30 Seconds

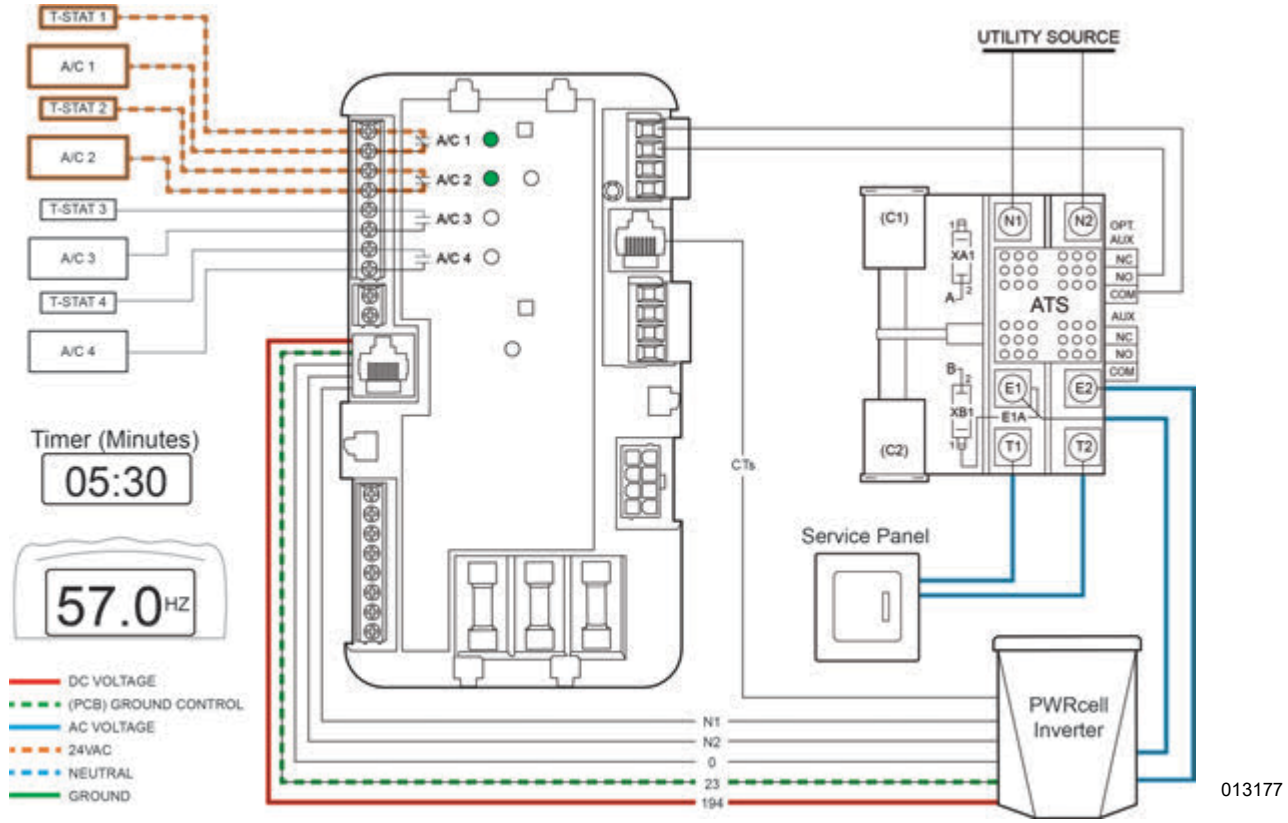


Figure 8-33. Overload - Priority 3 Disabled

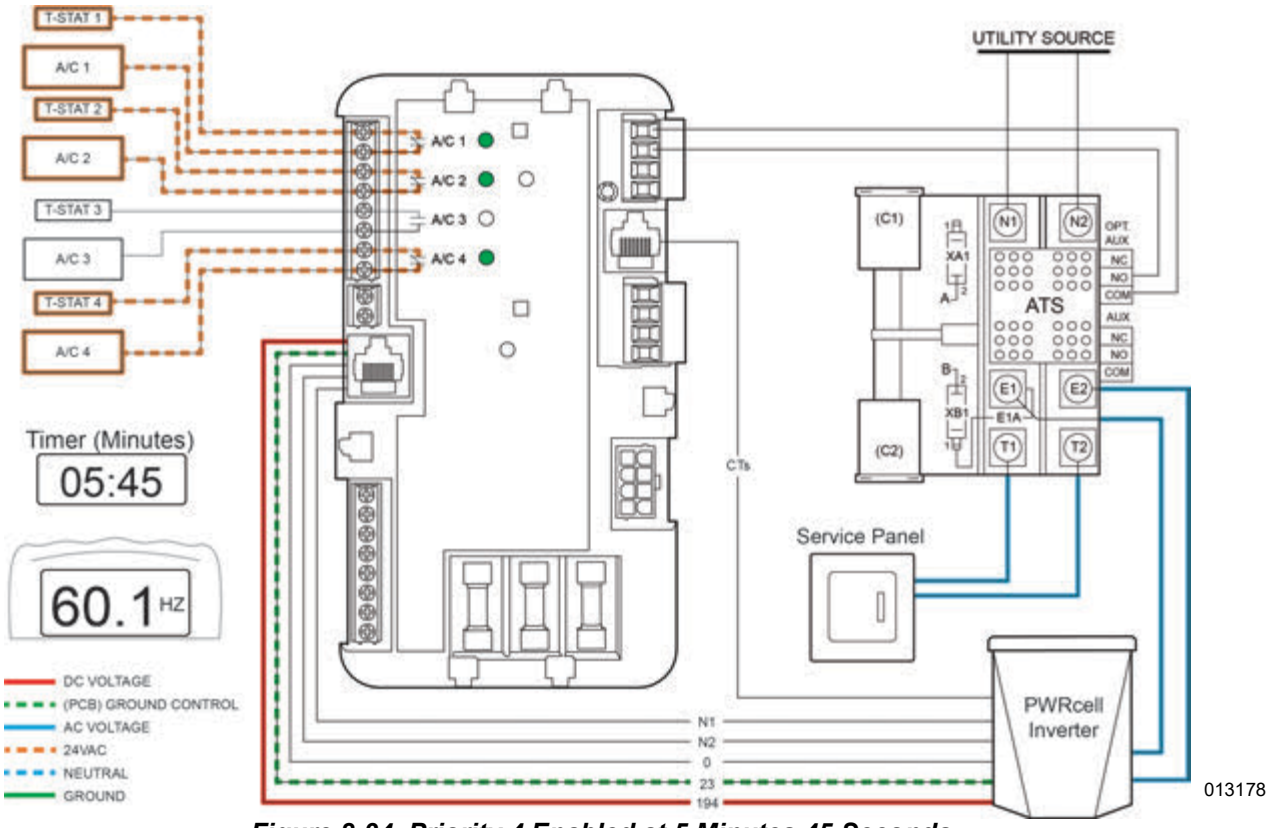


Figure 8-34. Priority 4 Enabled at 5 Minutes 45 Seconds

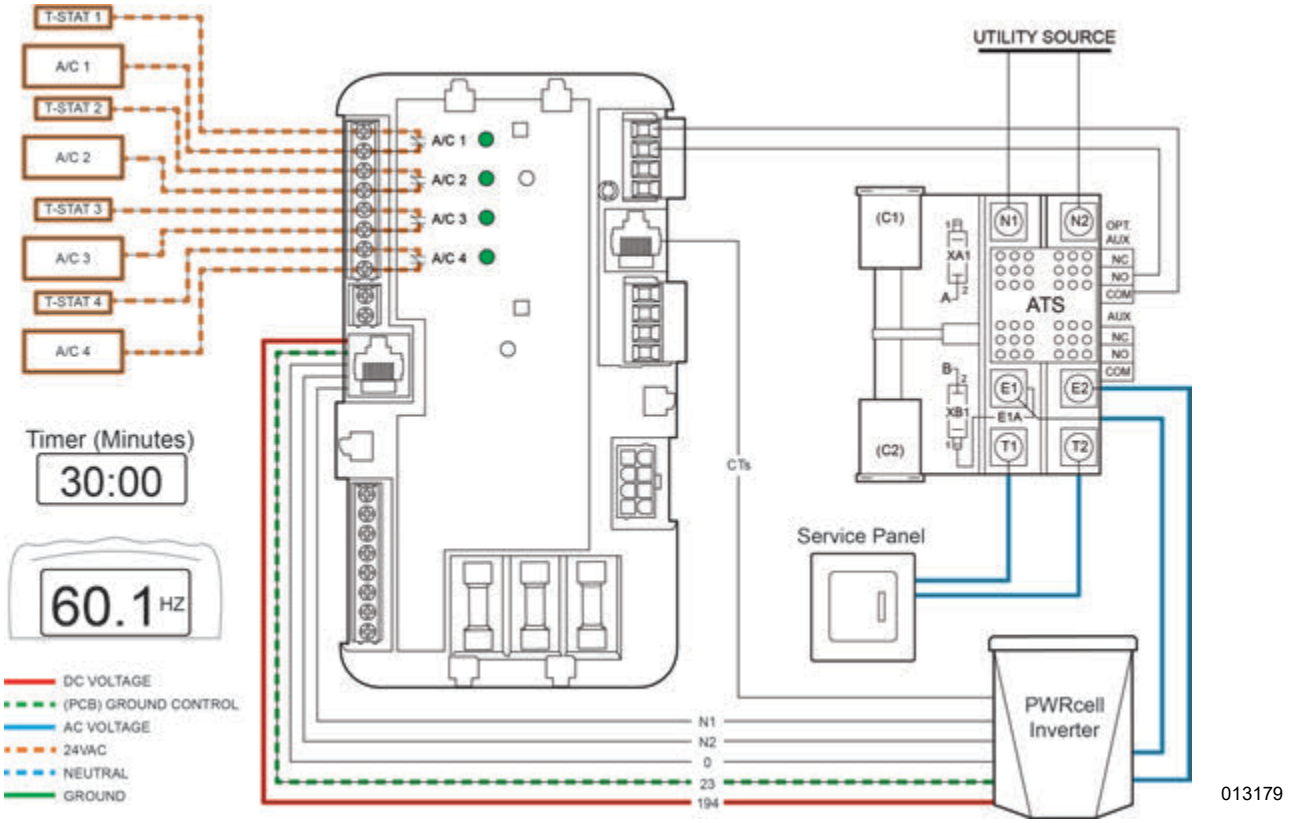


Figure 8-35. Priority 3 Enabled at 30 Minutes

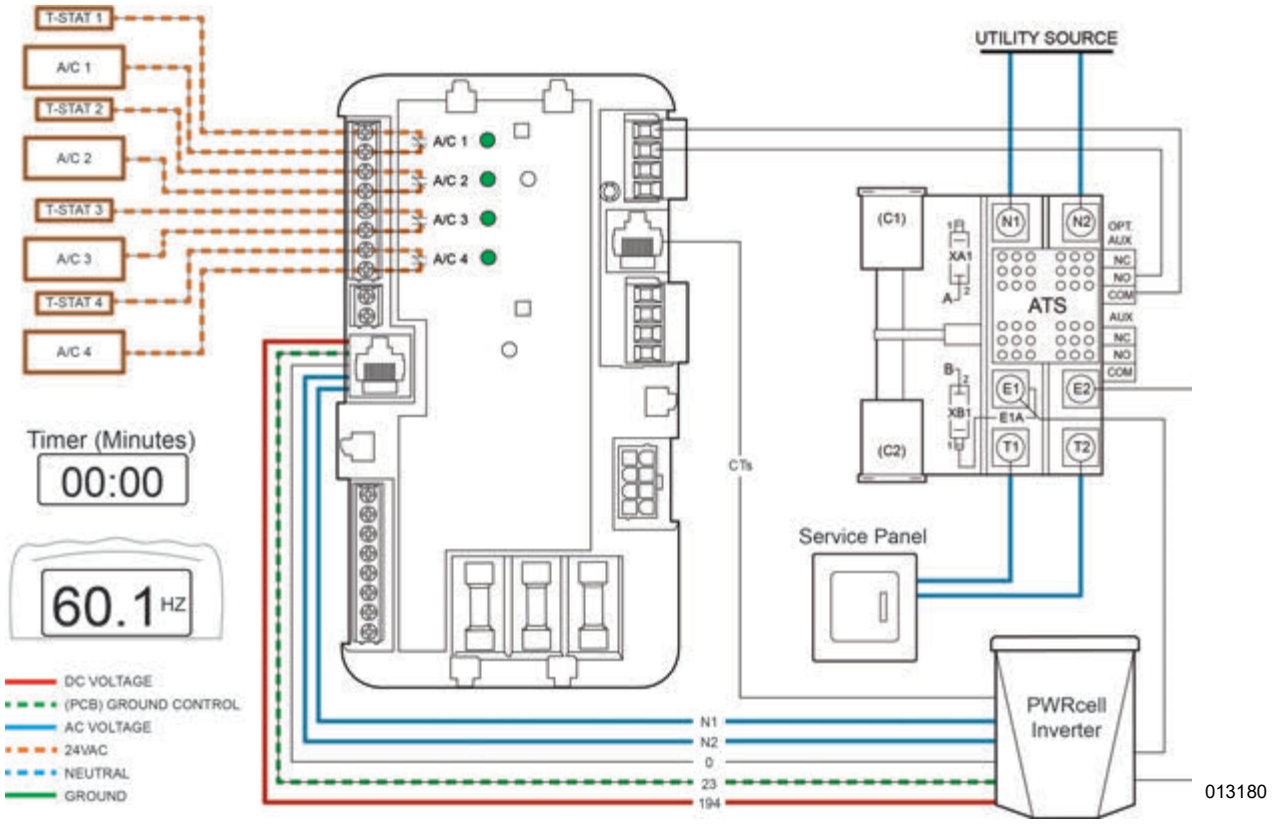


Figure 8-36. Utility Returns - 5 Minute Timer Begins

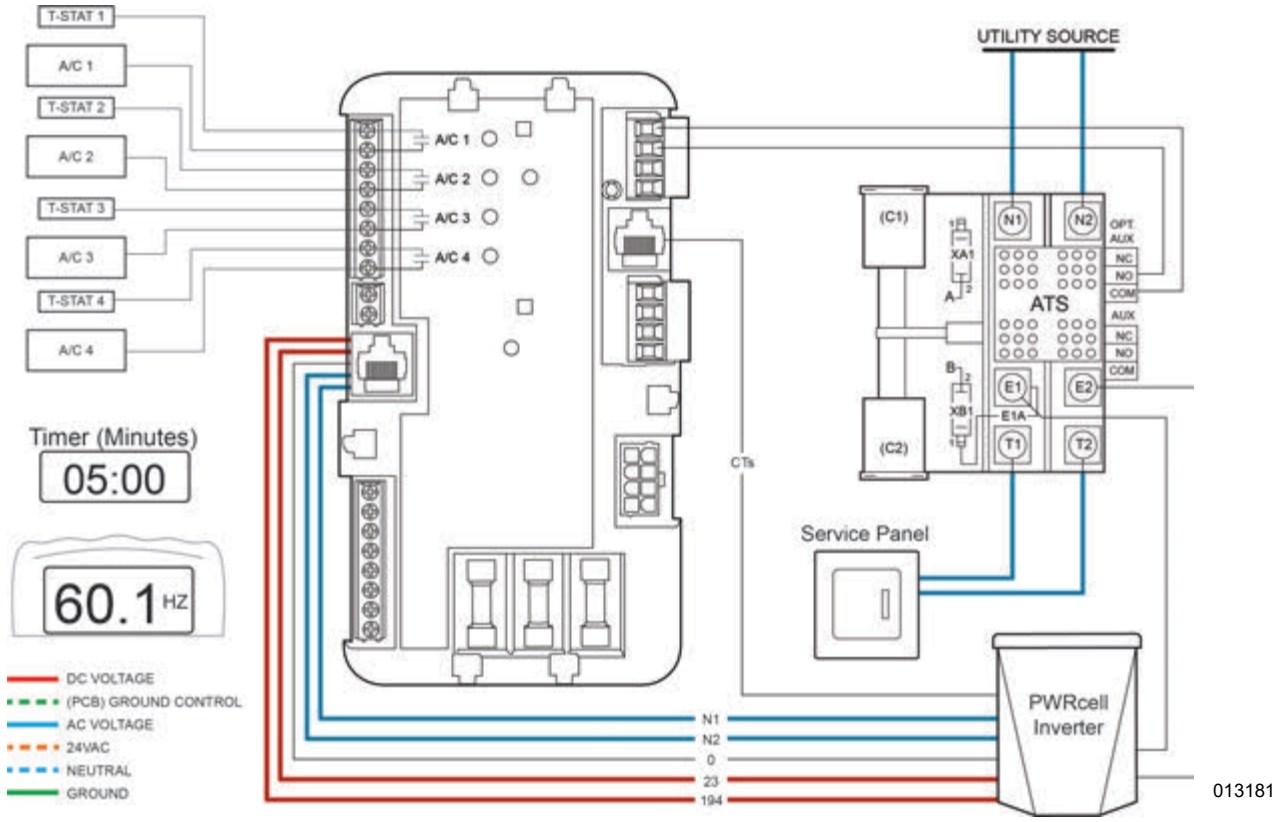


Figure 8-37. All Priorities Disabled for 5 Minutes

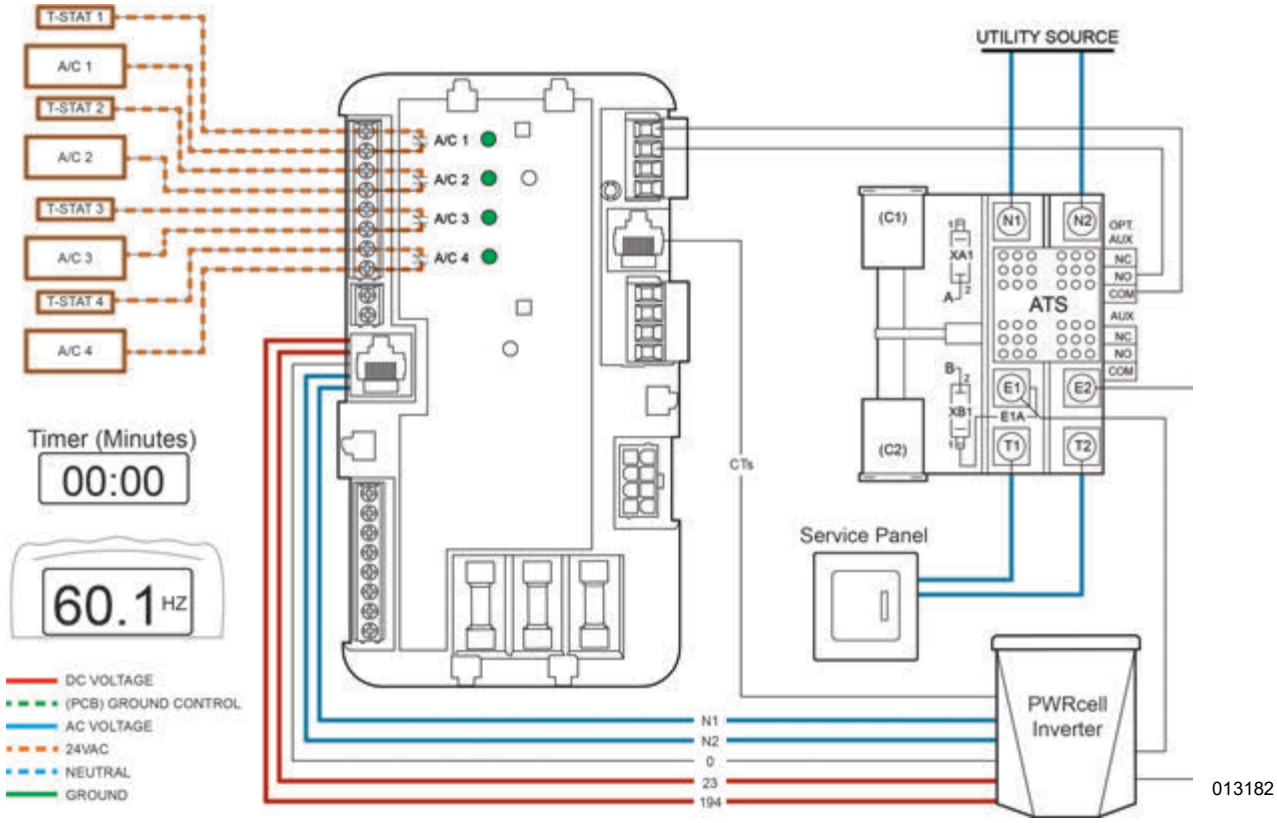


Figure 8-38. Utility Power Present - All Priorities Enabled

V-Type Transfer Switch Troubleshooting

V-Type Transfer Switch with PWRcell ATS Controller with AC Generator ONLY (NO Inverter) – No Transfer to Standby

DANGER

Electrocution. High voltage is present at transfer switch and terminals. Contact with live terminals will result in death or serious injury.

(000129)

NOTE: The transfer switch mechanism is still in the utility position.

1. Test wire 194 to ground 12 VDC. Minimum acceptable voltage is 10 DCV
   - If minimum voltage is not available there is a problem with the control board or harness.

NOTE: Refer to system wiring diagram for the AC generator being serviced.

2. Test wire 23 to ground, 0.1 to 0.9 VDC
   - If 12 VDC is present the problem is with the control board or harness. If 0 VDC measured check the ATS controller internal transfer relay coil resistance.

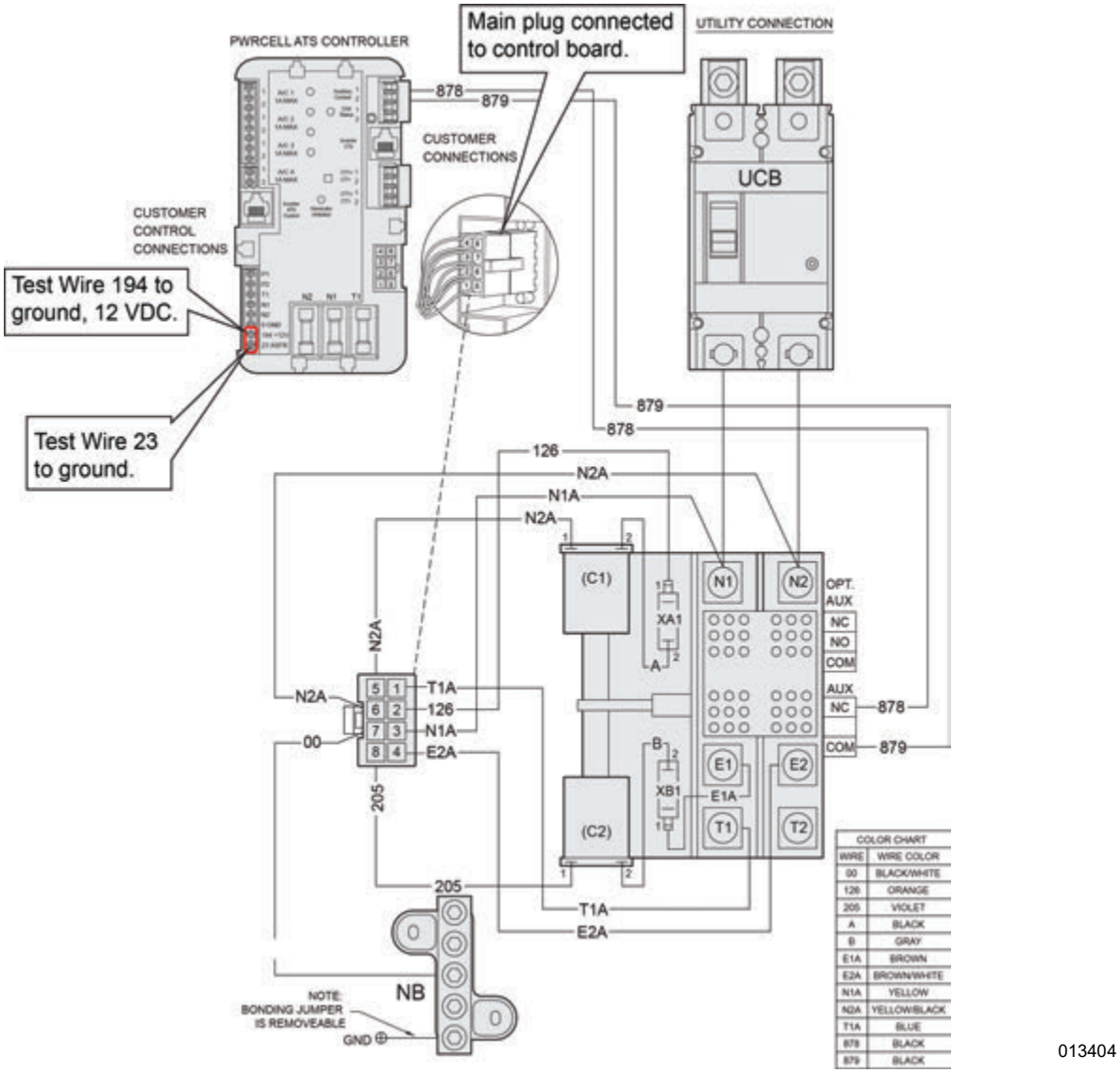


Figure 8-39.

V-Type Transfer Switch with PWRcell ATS Controller with AC Generator ONLY (NO Inverter) – No Transfer to Standby

DANGER

Electrocution. High voltage is present at transfer switch and terminals. Contact with live terminals will result in death or serious injury.

(000129)

NOTE: The transfer switch mechanism is still in the utility position.

1. Disconnect the main connector on the control board.
2. With the board not energized (Wire 23 NOT grounded) measure resistance between pins 2 and 3, and between pins 5 and 6. Continuity should be measured.
3. With the board not energized (Wire 23 NOT grounded) measure resistance between pins 4 and 8. Open (OL) should be measured.

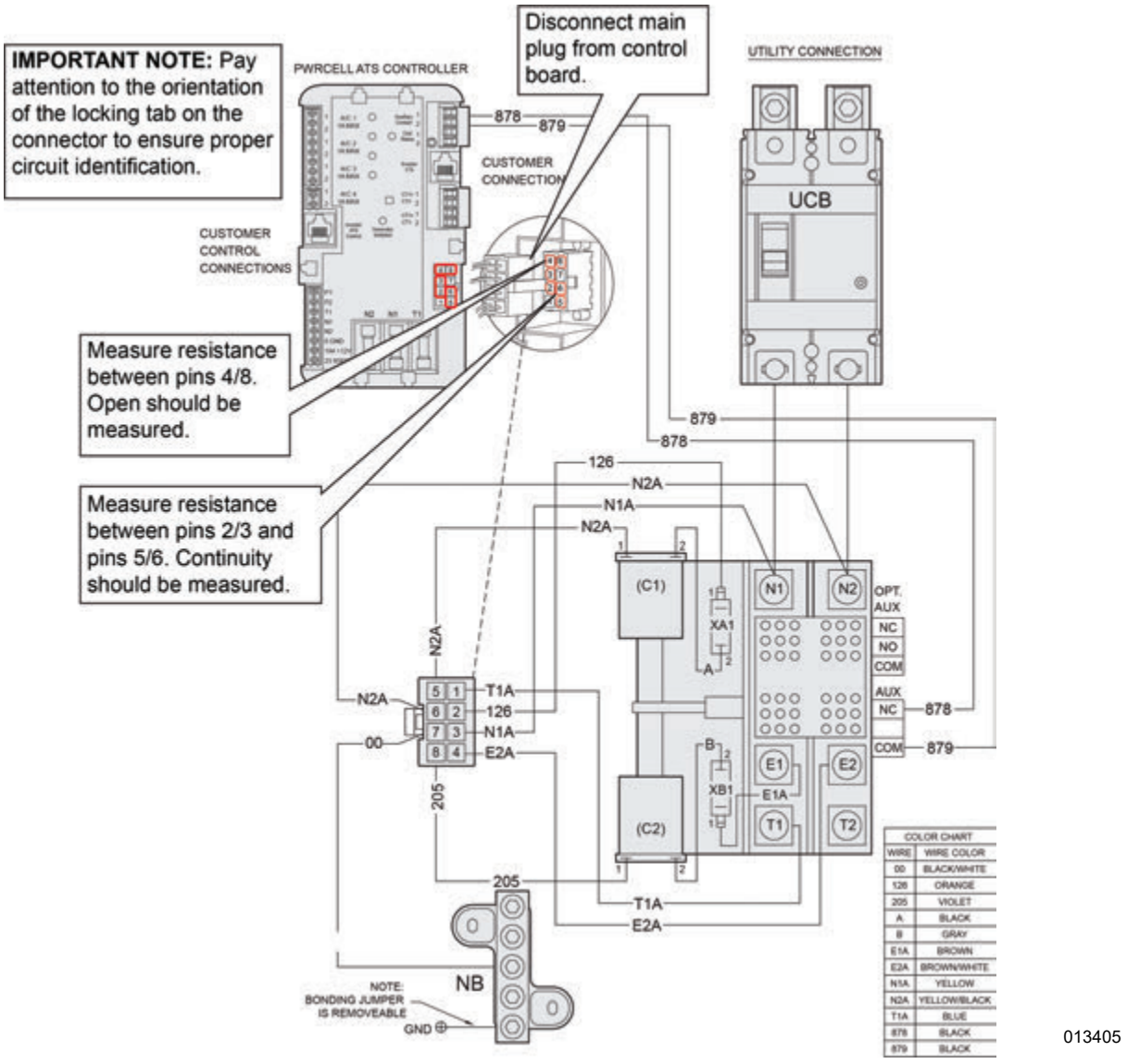


Figure 8-40.

V-Type Transfer Switch with PWRcell ATS Controller with AC Generator ONLY (NO Inverter) – Testing Operation of On-board (K5) Relay

DANGER

Electrocution. High voltage is present at transfer switch and terminals. Contact with live terminals will result in death or serious injury.

(000129)

1. Ground Wire 23.
2. Disconnect the main connector on the control board.
3. With the board energized (Wire 23 grounded) measure resistance between pins 2 and 3 on the ATS controller pins. An open should be measured.
4. With the board energized (Wire 23 grounded) measure resistance between pins 4 and 8 on the ATS controller pins. Continuity should be measured.

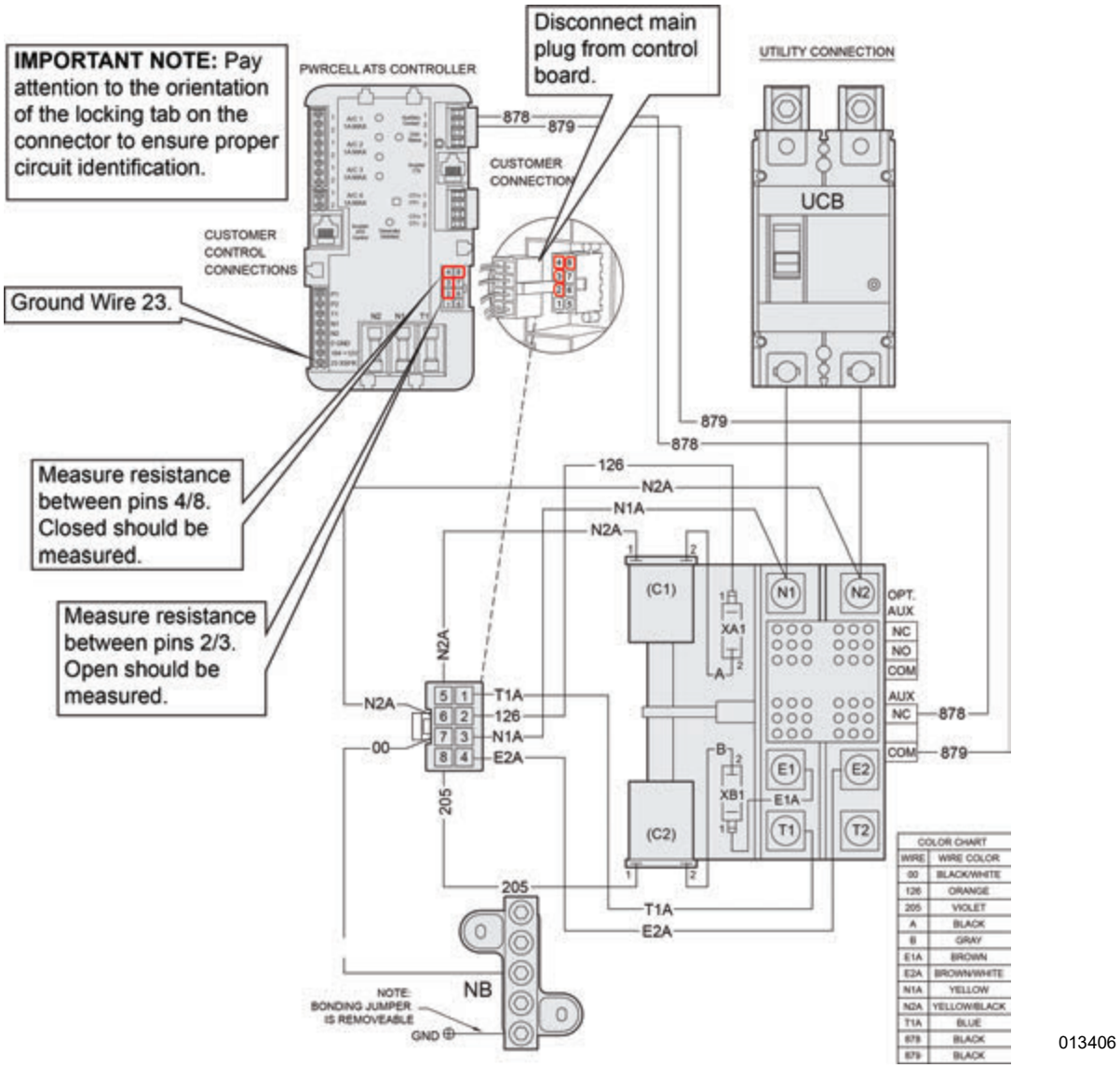


Figure 8-41.

V-Type Transfer Switch with PWRcell ATS Controller with AC Generator ONLY (NO Inverter) – No Transfer to Standby

⚠ DANGER

Electrocution. High voltage is present at transfer switch and terminals. Contact with live terminals will result in death or serious injury.

(000129)

NOTE: Generator is operating during Step 1.

1. Check for generator output voltage at B and 205 on the C2 coil.
   - If generator output voltage is present at B and 205 then the problem is internal to the C2 coil. Test coil for resistance—approximately 30 ohms. Replace if open.
   - If generator output voltage is NOT present at B and 205 troubleshoot the wiring harness relay contacts.
2. With generator OFF and utility breaker OPEN, measure the resistance of Wire 205 between pin 8 and C2 coil (disconnect and isolate the wire).
   - Replace wire if open.
   - If continuity is measured proceed to next step (connect).
3. Measure the resistance of Wire E2A between Lug E2 and pin 4 (disconnect and isolate the wire).
   - Replace wire if open.
   - If continuity is measured proceed to next step (connect).

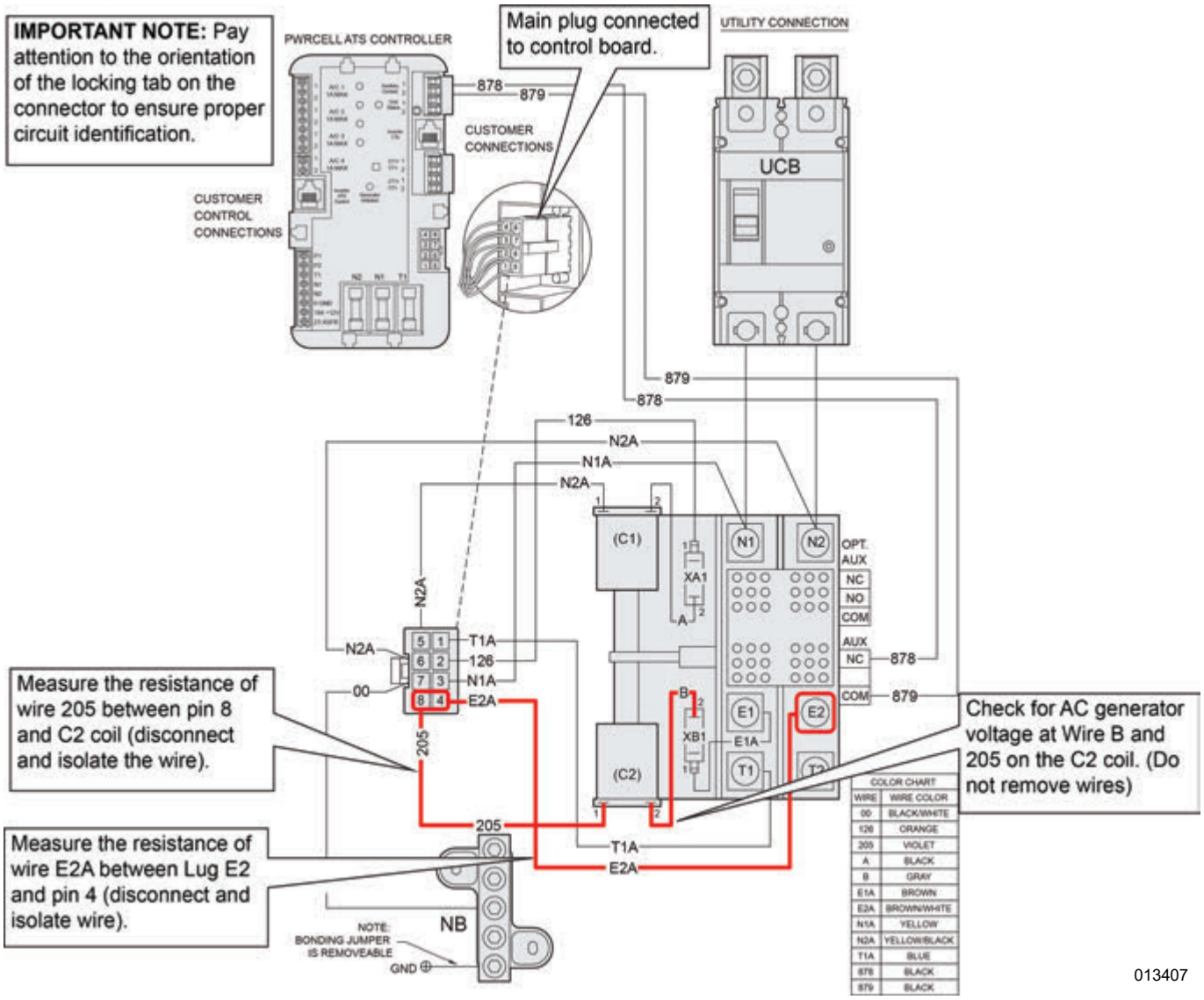


Figure 8-42.

V-Type Transfer Switch with PWRcell ATS Controller with AC Generator ONLY (NO Inverter) – No Transfer to Standby

DANGER

Electrocution. High voltage is present at transfer switch and terminals. Contact with live terminals will result in death or serious injury.

(000129)

NOTE: Generator output voltage must be present at lugs E1 and E2 of the switch and transfer relay must be energized.

1. Set DMM to measure AC volts.
2. Place the black test lead on main lug E2 of the transfer switch.

NOTE: Leave the black test lead on E2 throughout all steps.

3. Use the red test lead to measure for generator output voltage on Wire E1A at limit switch XB1.
   - If generator output voltage not present replace wire E1A.
   - If generator output voltage is present proceed to next step.
4. Remove Wire B from limit switch XB1 terminal. Measure for voltage at limit switch XB1 terminal.
   - If generator output voltage is not measured the problem is with the XB1 limit switch. Replace limit switch.
   - If generator output voltage is present proceed to next step (do not remove the wire).
5. Measure for voltage at C2 coil Wire B (do not remove the wire).
   - If generator output voltage is not measured the problem is with Wire B. Replace Wire B.

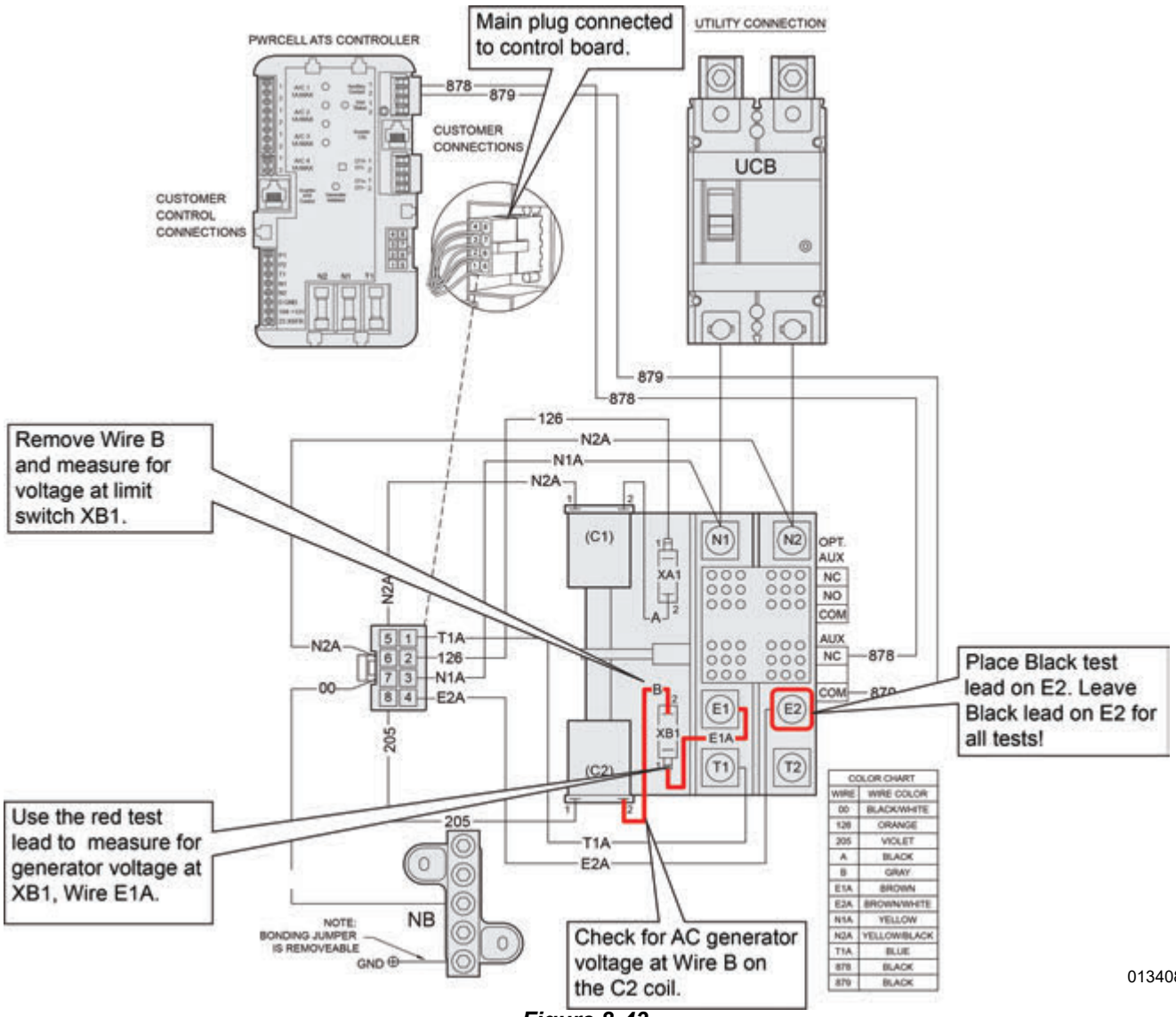


Figure 8-43.

V-Type Transfer Switch with PWRcell ATS Controller with AC Generator ONLY (NO Inverter) – No Transfer to Utility

⚠ DANGER

Electrocution. High voltage is present at transfer switch and terminals. Contact with live terminals will result in death or serious injury.

(000129)

1. Check for AC utility voltage at A and N2A on the C1 coil.
   - If utility voltage is present at Wire A and Wire N2A the problem is internal to the C1 coil. Test coil for resistance.

NOTE: The C1 coil has an internal AC to DC rectifier Resistance is typically over 5 Meg ohms. An O/L reading indicates an open rectifier and requires coil replacement.

NOTE: Inspect coil for mechanical or thermal damage, replace as necessary.

- If utility voltage is NOT present at A and N2A troubleshoot the wiring harness relay contacts.

2. Measure the resistance of wire N2A between pin 6 and lug N2 (disconnect and isolate the wire).
   - Replace wire if open.
   - If continuity is measured reconnect the wire and proceed to next step.
3. Measure the resistance of wire N2A between pin 5 and C1 coil (disconnect and isolate the wire).
   - Replace wire if open.
   - If continuity is measured reconnect the wire and proceed to next step.

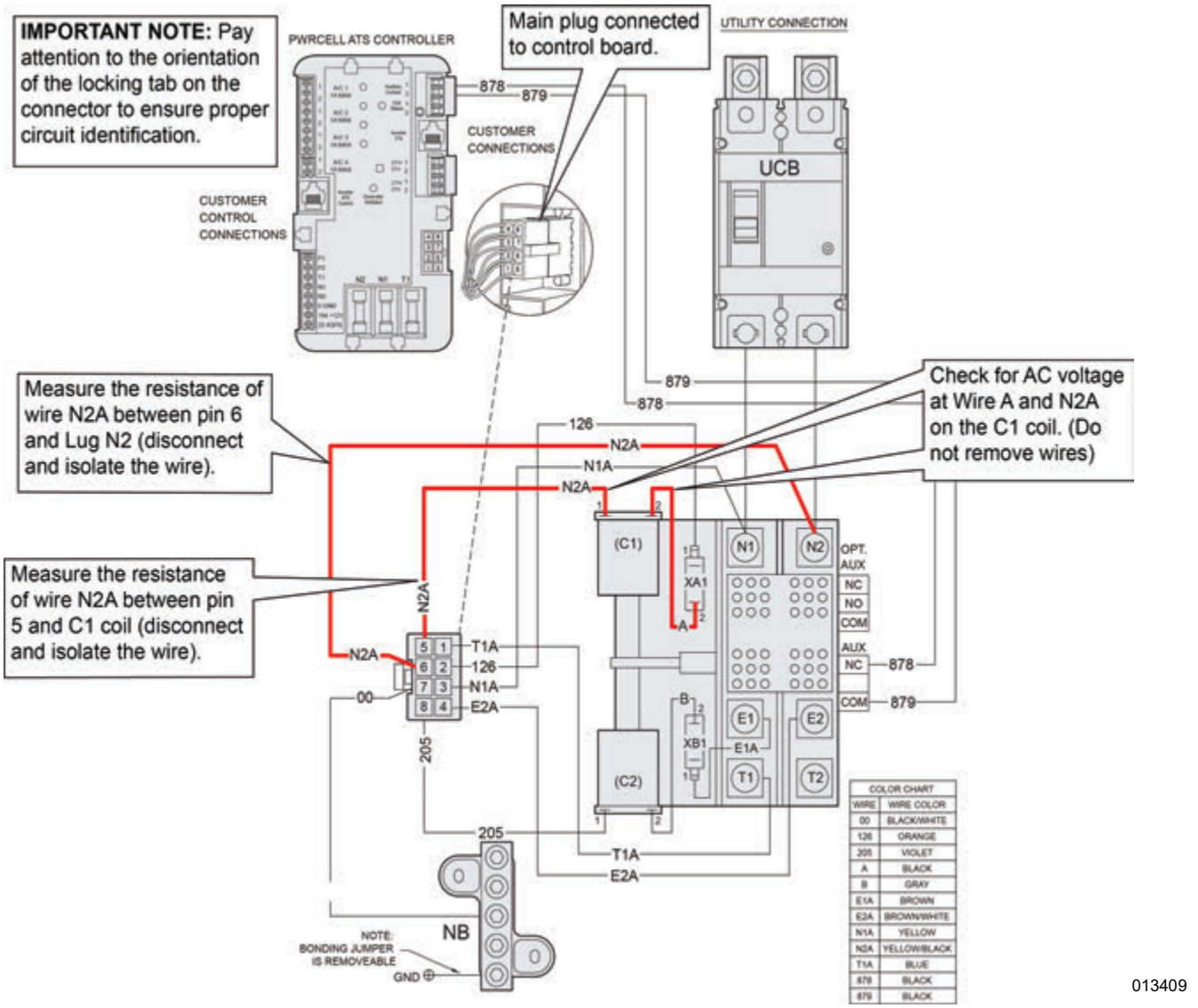


Figure 8-44.

V-Type Transfer Switch with PWRcell ATS Controller with AC Generator ONLY (NO Inverter) – No Transfer to Utility

DANGER

Electrocution. High voltage is present at transfer switch and terminals. Contact with live terminals will result in death or serious injury.

(000129)

NOTE: Utility voltage must be present at lugs N1 and N2 of the switch and the transfer relay must NOT be energized.

1. Set DMM to measure AC volts.
2. Place the black test lead on main lug N2 of the transfer switch.

NOTE: Leave the black test lead on N2 throughout all steps.

3. Use the red test lead to measure for utility voltage at pin 3, Wire N1A.
   - If voltage not present replace wire N1A.
   - If voltage is present proceed to next step (do not remove the wire).
4. Measure for voltage at pin 2 Wire 126 (do not remove the wire).
   - If utility voltage is not measured the problem is with the PWRcell ATS Controller. Replace the PWRcell ATS Controller.
   - If utility voltage is present proceed to next step (do not remove the wire).
5. Measure for voltage at limit switch XA1, Wire 126 (do not remove the wire).
   - If utility voltage is not measured the problem is with Wire 126. Replace Wire 126.
   - If utility voltage is present proceed to next step.
6. Measure for voltage at limit switch XA1, Wire A (do not remove the wire).
   - If utility voltage is not measured the problem is with limit switch XA1. Replace limit switch XA1.
   - If utility voltage is present proceed to next step.
7. Measure for voltage at coil C1, Wire A (do not remove the wire).
   - If utility voltage is not measured the problem is with Wire A. Replace Wire A.

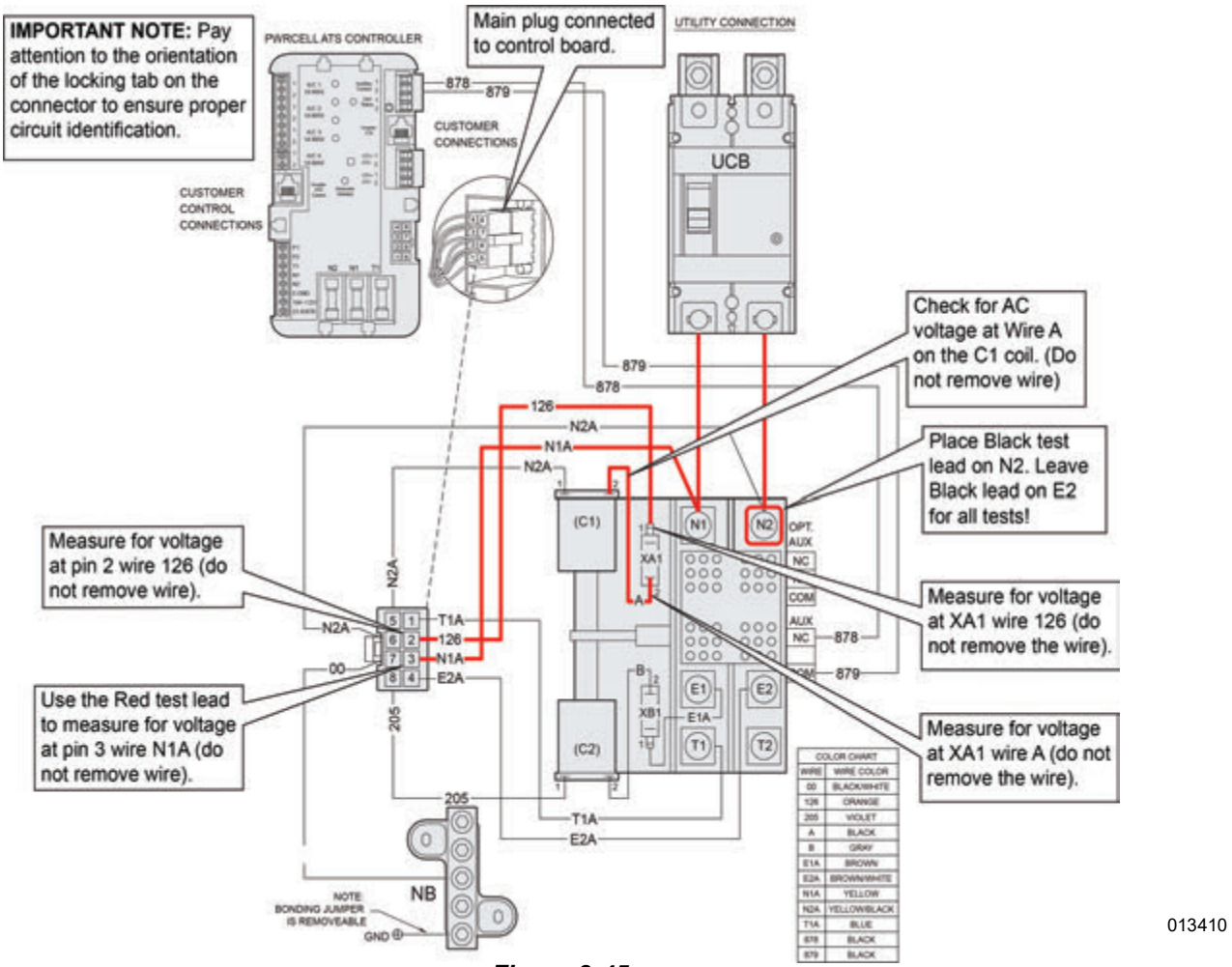


Figure 8-45.

Section 9 Other Accessories

Smart Management Module (SMM)

Description

The Smart Power Management System is designed to optimize the performance of a PWRcell Inverter system, a standby generator, or both. The system can consist of up to 8 individual Smart Management Modules (SMM). Unlike other load management systems that depend on another control device, the SMM modules are self-monitoring and operate autonomously.

SMM modules monitor the frequency (Hz) of the power being produced by a PWRcell Inverter system or standby generator. If the frequency falls below a certain threshold, the module will automatically follow a power management algorithm to ensure that the inverter or generator is not overloaded.

A PWRcell Inverter system identifies an overload condition by monitoring current using the inverters CTs. When current exceeds the inverters limit the inverter will reduce it's frequency to below the trigger points of the SMM.

Generator overload condition is determined by generator frequency. Loads are shed when the frequency is <58 Hz for 3.5 seconds or <50 Hz for 1 second. These same frequency values apply to the inverter output.

The modules can be set to a load priority between 1 and 8 or be set in a lock out only mode for loads that do not need to run during a power outage.

NOTE: PRIORITY MUST BE DIFFERENT for each module in an installation. Priority sets the order in which loads recover from a load shed event. Recovery time from a load shed event is five minutes for Priority 1. Each priority after Priority 1 waits an additional 15 seconds after the initial recovery time. See ***Table 1-1***.

Table 1-1. Priority Settings

Priority	Recovery Time
1	5 minutes
2	5 minutes 15 seconds
3	5 minutes 30 seconds
4	5 minutes 45 seconds
5	6 minutes
6	6 minutes 15 seconds
7	6 minutes 30 seconds
8	6 minutes 45 seconds

IMPORTANT NOTE: Early versions of the SMM use a normally open (N.O.) contactor. Later versions use a normally closed (N.C.) contactor with an added set of mode selector jumper pins on the circuit board.

Features and Controls

See ***Figure 9-1***.

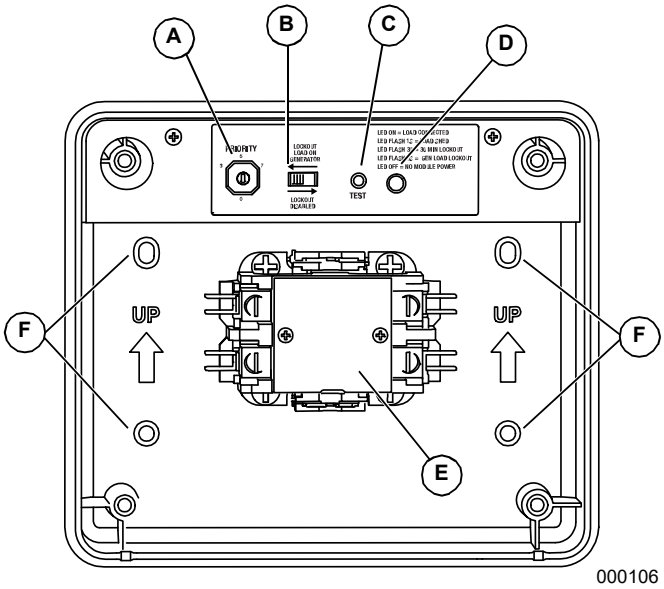


Figure 9-1. SMM Features and Controls

Priority Dial (A) – Sets module priority.

Lockout Switch (B) – Initial switch to generator power will allow load to operate until an overload condition occurs. If overload happens the load will be locked out until utility returns. See ***Setting Lockout***.

NOTE: Early Version: When lockout switch is engaged and running on generator, module will start in load shed mode. After approximately 1 minute of run time the module will enter lockout mode. When utility returns while in lockout mode, the module will delay for 2 minutes before returning to load shed mode. After a 4 minute timer expires the load will be activated.

Test Button (C) – Disables contactor output for a specified time.

LED (D) – Provides module status. See ***Table 1-5***.

Contactor (E) – Controlled by a smart controller in module. Contactor remains CLOSED until generator power is required. Upon generator/inverter activation, controller moves to OPEN to handle overload conditions.

NOTE: When the system is on generator or inverter power, the contactor is also opened during lockout switch ACTIVE state.

Mounting Holes (F) – Internal enclosure mounting holes provide clean and sturdy mounting.

Recovery time is based on priority dial settings. See ***Table 1-1***.

Electrical Specifications

Input Voltage	240 VAC
Current Rating	50A resistive, 40A inductive
Locked Rotor Amp Rating	240A
Motor Rating	3 HP
Contactor Coil Voltage	240 VAC

Enclosure Specifications

UL Rating	Type 3R
Temperature	-30 to 50 deg C (-22 to 122 deg F)

Connections

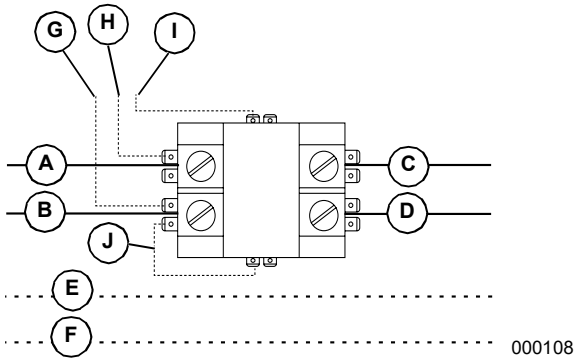


Figure 1-1. Smart Management Module Connections

A	Red (240 VAC - Line)
B	Black (240 VAC - Line)
C	Red (240 VAC - Load)
D	Black (240 VAC - Load)
E	White - Neutral (as required)
F	Green - Ground (as required)
G	Black - Factory (PCB)
H	Red - Factory (PCB)
I	Blue - Factory (PCB)
J	Blue - Factory (Jumper)

Setting Priorities

High priority 240 VAC loads should be set to the highest priorities so those loads recover first in the event of generator/inverter overload.

NOTE: The highest priority, and first load to activate is Priority 1. The last load to activate is Priority 8.

Setting priority determines timing for 3 scenarios:

- Order in which loads recover
- Delay time until power returns during an outage
- Delay time for post load shed recovery

An example configuration is shown in ***Table 1-2***. Configurations will vary depending on customer prioritization of loads.

Table 1-2. Typical SMM Configuration

Priority 1 - Baseboard heat	Priority 5 - Non-essential circuits
Priority 2 - Air conditioner	Priority 6 - Pool pump or hot tub
Priority 3 - Range	Priority 7 - Other circuits
Priority 4 - Clothes Dryer	Priority 8 - Other circuits

1. Set the priority of each SMM module as desired (using the example configuration for reference).
2. Apply priority decal in a suitable location on electrical panel to record chosen priority designations.
3. Record priorities on decal.

Setting Lockout

Early, Normally Open Contactor

Most installations will require the lockout switch to be DISABLED. When performing a whole house backup with a generator/PWRcell system not sized to manage all household loads, SMM's can be used to disable appliances or circuits during an outage. For non-essential loads that will not be used on generator or inverter power, set lockout switch to ENABLED.

Table 1-3. Lockout Switch Settings (Early, Normally Open Contactor)

Lockout Switch Position	Mode	Function
ON	GENERATOR INVERTER	If overloaded, module sheds load until utility returns. Contactor is OPEN. **NOTE:** Early version goes into lockout mode. Load is never activated until Utility returns.
ON	UTILITY	Power is available on module output (contactor output). Contactor is CLOSED.
OFF	GENERATOR INVERTER	Module operates with standard load shed logic. Contactor is OPEN or CLOSED per logic.
OFF	UTILITY	Power is available on module output (contactor output). Contactor is CLOSED.

NOTE: *Early Version:* When lockout switch is engaged and running on generator, module will start in load shed mode. After approximately 1 minute of run time the module will enter lockout mode. When utility returns while in lockout mode, the module will delay for 2 minutes before returning to load shed mode. After a 4 minute timer expires the load will be activated.

Setting Lockout (Later, Normally Closed Contactor)

Two steps are required for setting SMM to enable standard lockout mode:

1. See ***Figure 9-2***. Slide the lockout switch (1) to LOCKOUT LOAD ON GENERATOR.
2. Move the mode selector jumper (4) on the control board as directed in ***Jumper Locations***.

Table 9-4. Lockout Switch Settings (Later, Normally Closed Contactor)

Lockout Switch Setting	Mode Selector Jumper Position	Mode	Function
LOCKOUT LOAD ON GENERATOR/ INVERTER	A	GENERATOR /INVERTER	Module sheds load and does not reconnect until utility returns. This setting is considered standard for most installations.
LOCKOUT LOAD ON GENERATOR/ INVERTER	A	UTILITY	Power is available on module output.
LOCKOUT DISABLED	A	GENERATOR /INVERTER	Module operates with standard load shed logic. See ***Table 1-1*** for more information.
LOCKOUT DISABLED	A	UTILITY	Power is available on module output.
NOTE: PWRcell systems do not support the operation of Mode Select Jumper in B position.			

Jumper Locations

See ***Figure 9-2***. Later SMM control boards are equipped with two movable jumpers (2). Jumper locations are indicated on the diagram:

- (3) Frequency (50 Hz/60 Hz) Jumper
- (4) Mode Selector Jumper (identified on control board as “Lock Out Jumper”).

The frequency jumper is factory set at the 60 Hz position. The mode selector jumper is factory set at position “A” which is considered standard for most installations.

IMPORTANT NOTE: For PWRcell applications jumpers should remain in the factory positions.

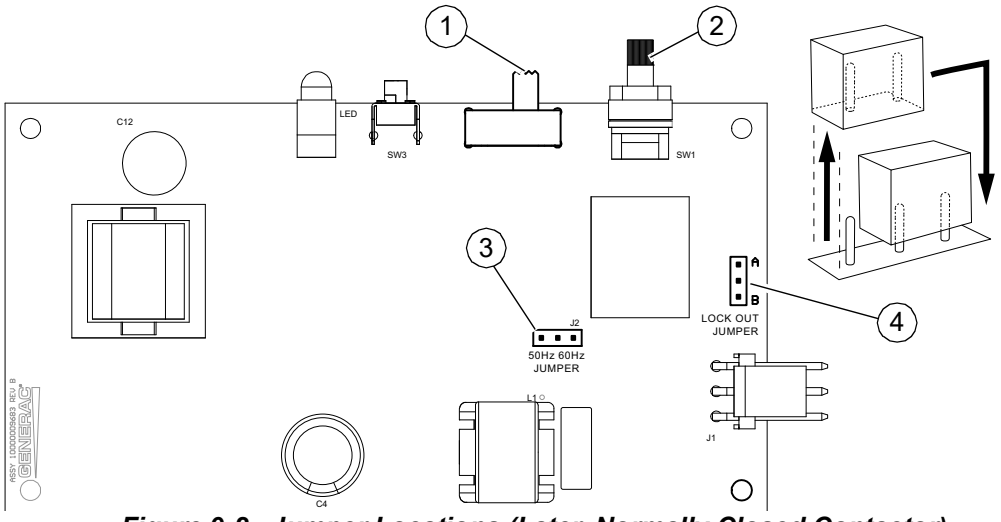


Figure 9-2. Jumper Locations (Later, Normally Closed Contactor)

Table 1-5. LED States

State	LED State	Mode	Note
Shed	1 second flash (1 On – 1 Off)	Generator/ Inverter	Module detected an overload and shed its load. This state only occurs in generator mode, or during a first time utility power-up for five minutes of initial operation.
Lockout (30 minutes)	3 second flash (3 On – 3 Off)	Generator/ Inverter	Module detected an overload while trying to recover from a shed situation. Operation is disabled for 30 minutes. This state only occurs in generator mode.
Lockout Switch Active	6 second flash (6 On – 6 Off)	Generator/ Inverter	Module output is disabled and there is no power to the appliance while in generator mode and generator is overloaded. Lockout switch must be ON. See ***Table 1-3***.
Lockout Switch Active	ON	Utility	Lockout switch operates in generator mode only. It has no function in utility mode. LED is solid, indicating the load is connected. Lockout switch must be ON. See ***Table 1-3***.
Normal	ON	Generator or Utility	Indicates the appliance has power. This is the default in utility mode. It is the normal operating state in generator/inverter mode when an overload is not detected.
Test	1 second flash	Generator or Utility	Test button triggers a typical shed condition and overrides all other states except generator lockout switch ACTIVE state. **NOTE:** Actual test time varies depending on SMM priority setting. Use the following formula to calculate test time: **Time = (P-1) x 15 seconds, where P represents priority setting.** Example: SMM Priority 6 test time = (6-1) x 15 seconds, or 75 seconds.

Tests

Utility Test

1. Turn utility power ON and enable all module feeding circuits.
2. Verify LED begins to flash at one second intervals.
3. All contactors will close after five minutes. LED will illuminate, and stay ON.
4. Wait 30 seconds after contactor closes, then press TEST button and verify module load shed. LED will flash at one second intervals.
5. Wait five minutes, plus predefined priority set time for module to recover.
6. Contactor will CLOSE and LED will illuminate, and stay ON.

Generator/PWRcell Inverter Test

1. Enable Islanding and verify load shed settings.
2. Simulate a utility loss by turning main line circuit breaker (MLCB - service disconnect) OFF while generator is in AUTO and inverter is configured with EnaIslanding ON.
3. All modules will lose power and LEDs will disable when power is supplied via generator. When powered by inverter there will be a quick blink of the LED.
4. Generator will power on after preset delay. Inverter will transfer to Island mode.
5. All LEDs will flash when generator transfers. When on Inverter power the SMM will go into its programmed control state.
6. Allow each module to enable output per its priority setting.
7. After predefined priority time elapses, each contactor will CLOSE and LED will illuminate and stay ON.
8. Once LED stays ON, press TEST button and verify load shed occurs.
9. Once load shed occurs, LED will flash at one second intervals.
10. Allow time for each module to enable contactor output per priority setting.
11. After predefined priority set time, each contactor will CLOSE and LED will illuminate and stay ON.

NOTE: Depending on load size, the SMM module may immediately go into load shed mode or lockout during test. In this event, remove one or more higher priority loads to allow testing of each module.

Generator/PWRcell Inverter Test with Lockout Switch Enabled (perform if Lockout Switch Enabled on any loads)

1. Enable Islanding and verify load shed settings.
2. Simulate a utility loss by turning MLCB (service disconnect) to OFF.
3. All modules will lose power and LEDs will disable.
4. Generator should power on after preset delay. Inverter will transfer to Island mode.

NOTE: The inverter will lower it's frequency output for approximately one second at one minute intervals to maintain the SMM lockout setting.

NOTE: For modules with lockout switch enabled, LEDs will flash at six second intervals and load will remain disabled while in generator/inverter power.

Return to Utility Test

1. Return utility power by setting the MLCB (service disconnect) to ON.

NOTE: All modules should begin flashing at one second intervals. All modules will recover in five minutes (including units with lockout switch enabled).

Troubleshooting

See ***SMM Functionality Flowchart***.

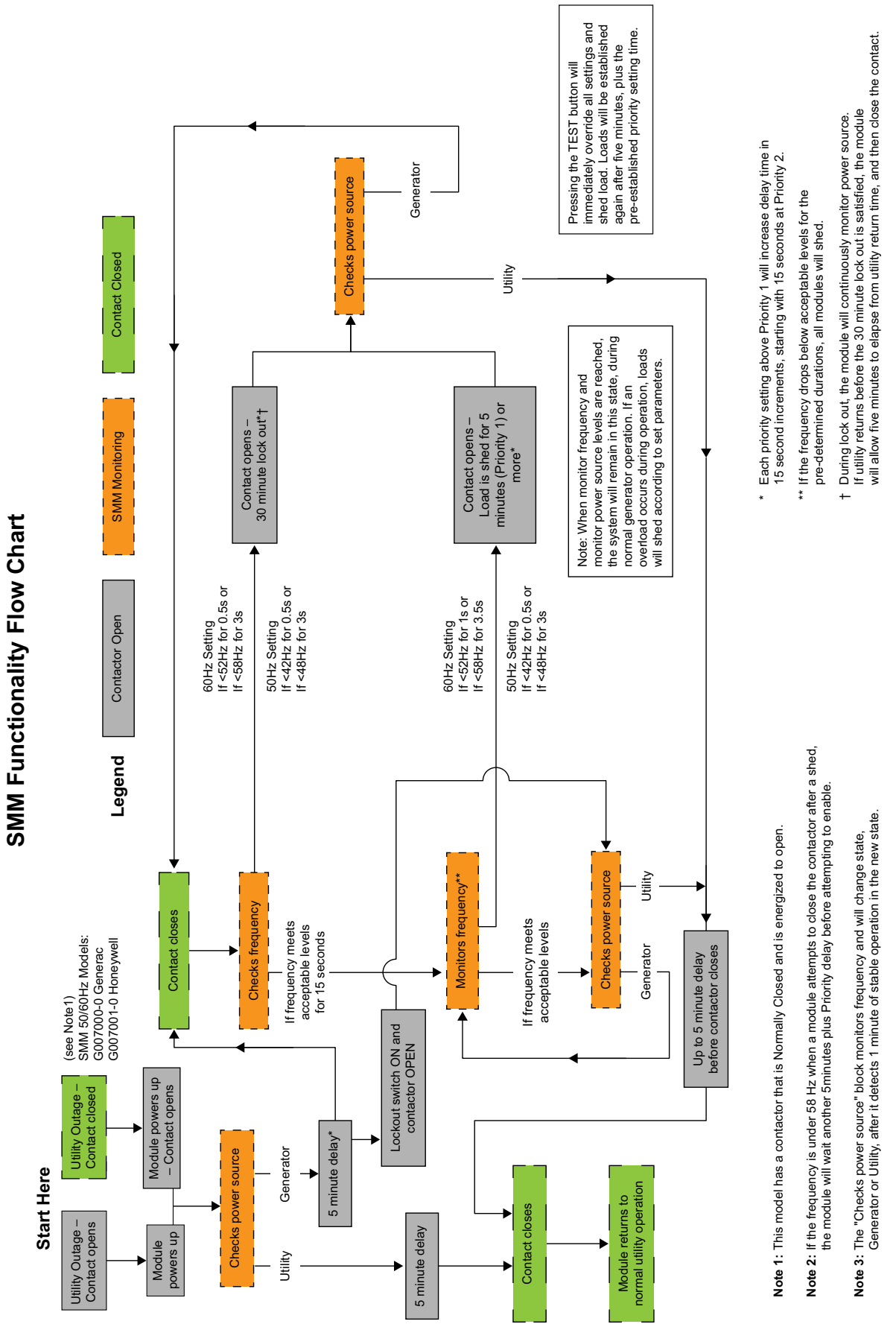
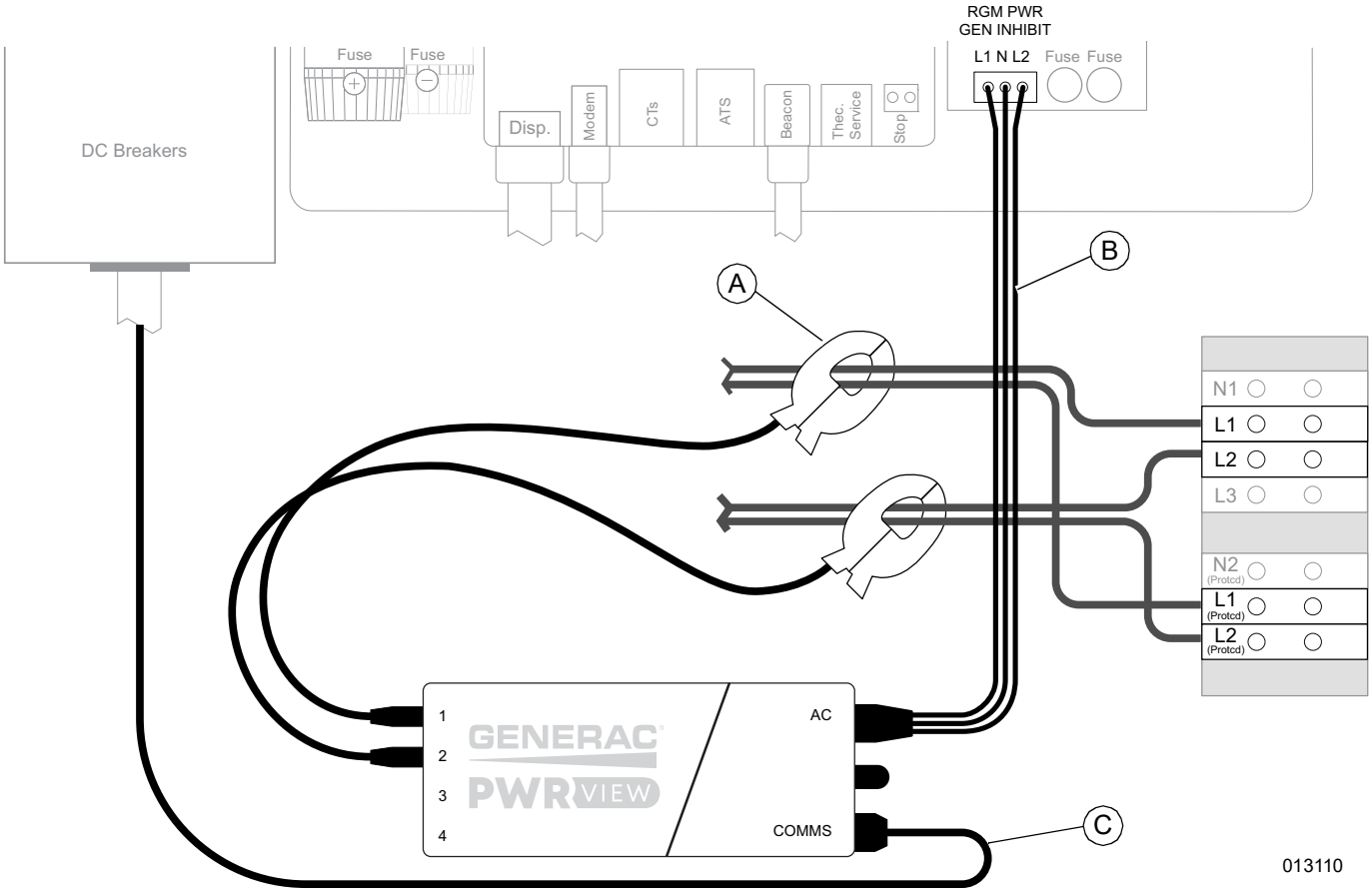


Figure 9-3. SMM Functionality Flowchart

Revenue Grade Meter (RGM) Kit

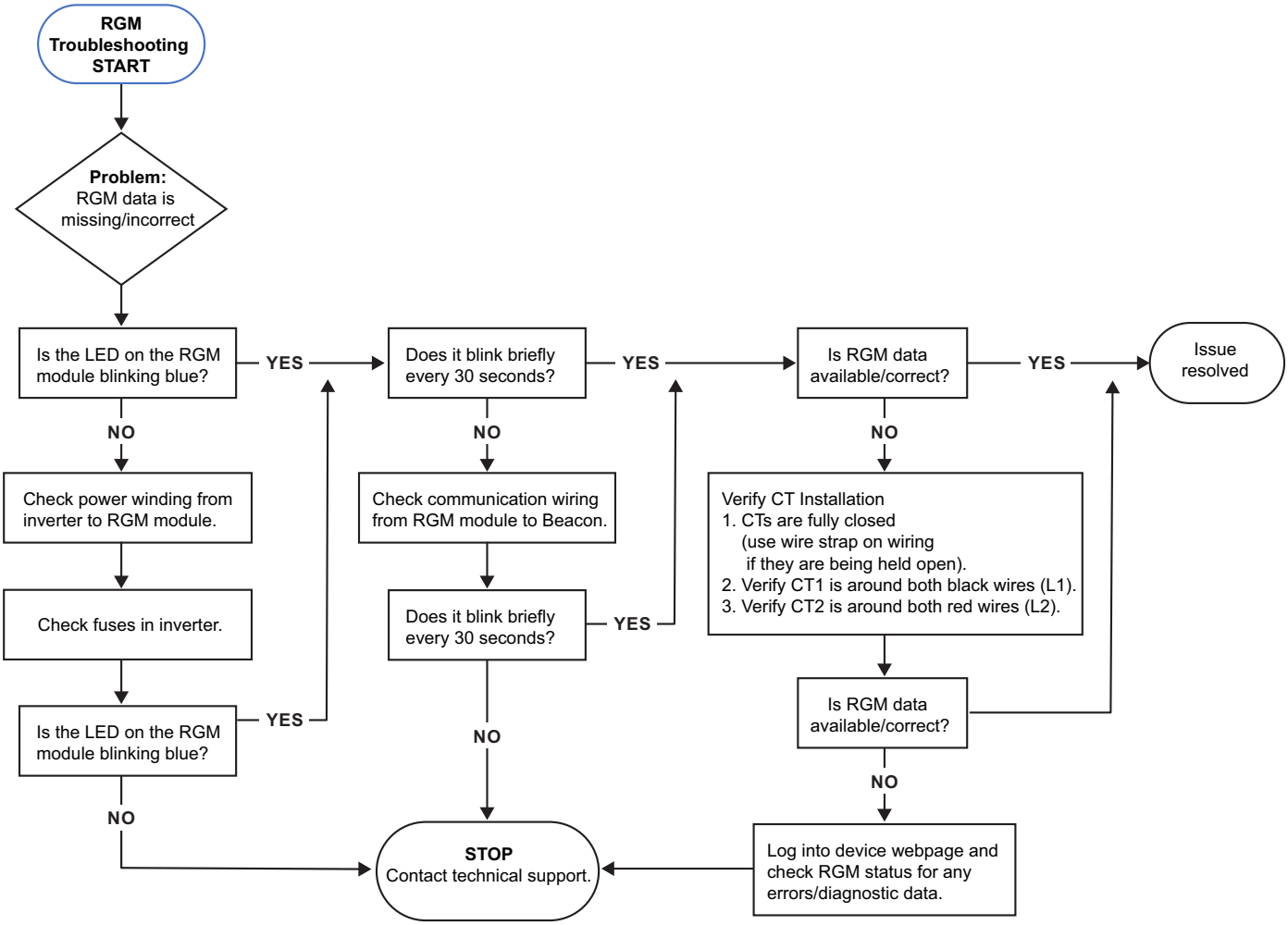
Device Profile

The PWRcell RGM Kit allows for revenue grade metering of a PWRcell system. It includes a PWRview Meter, two CTs, a power cable, and a plastic mount for the meter.



A CT
B AC Voltage Cable
C 6-pin Connector Cable

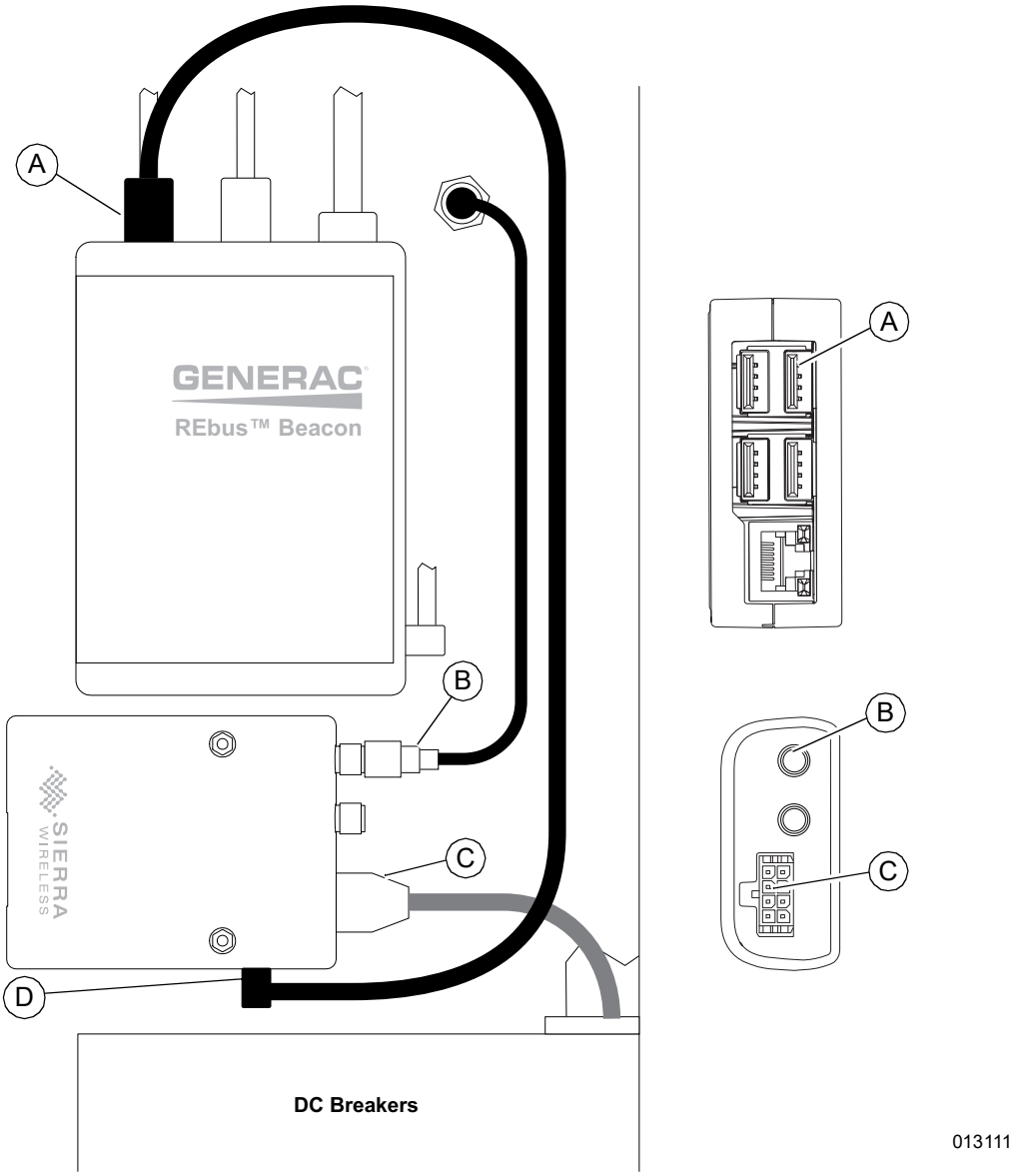
Troubleshooting Tree



LTE Modem

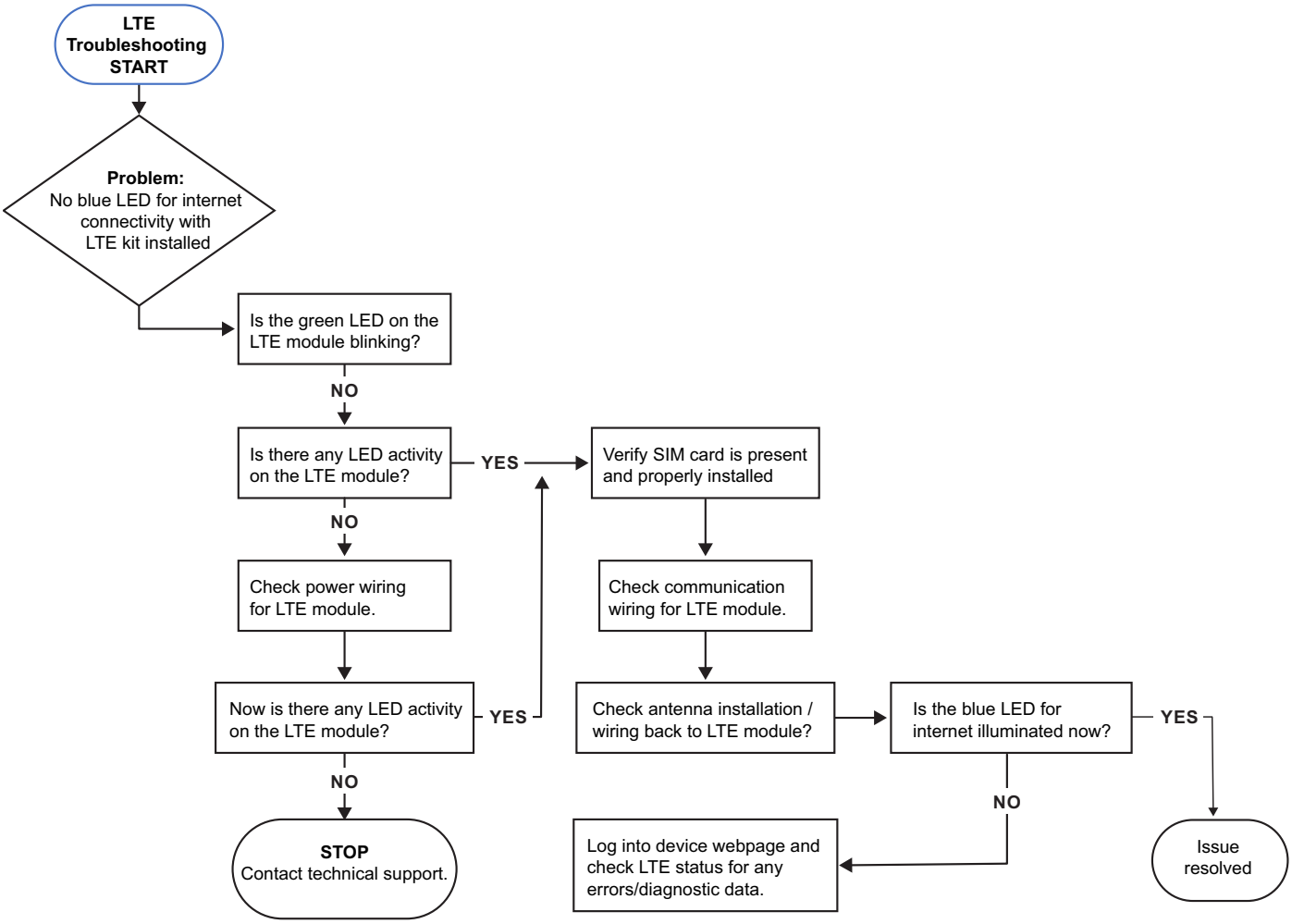
Device Profile

The LTE Modem Kit allows for cellular connectivity between a PWRcell inverter and the Generac server for monitoring capabilities. The kit includes an LTE modem, an LTE antenna with cable, and one USB cable. The LTE modem requires additional cellular service not provided by Generac and is available only in select markets.



A Beacon™ USB Type-A Port
B SMA Connector from LTE Antenna
C 8-pin Connector Cable
D LTE Modem USB Micro-B Port

Troubleshooting Tree



Section 10 PWRcell Power Core Replacement

Overview

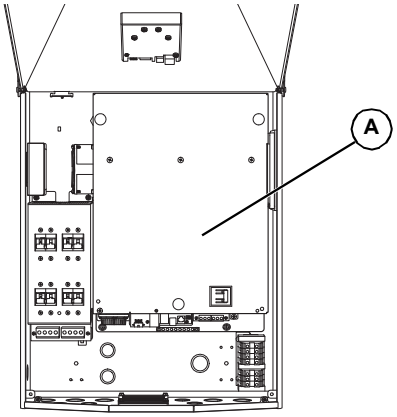


Figure 10-1.

See ***Figure 10-1***. Replace the power core unit (A) within the PWRcell inverter.

Required Tools

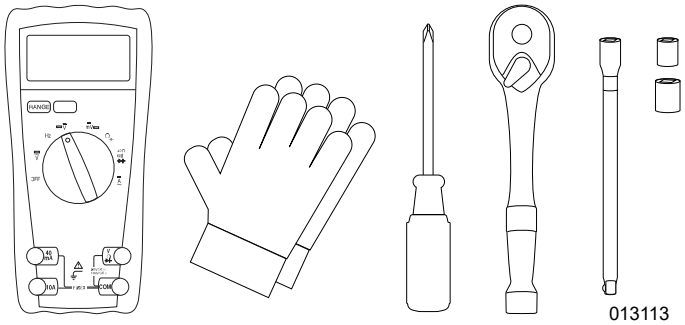


Figure 10-2.

Required Tools:

1. Digital multimeter (DMM)
2. Cloth/other protective hand wear
3. Slotted head screwdriver — 6 mm
4. Phillips head screwdriver — No. 2
5. Ratchet — ¼" drive with 6" or longer extension, 7 mm and 10 mm sockets (see Note)

NOTE: 7 mm and 10 mm nut drivers with 6" or longer shaft (¼") are also suitable for use.

Before You Start

Inverter Mod. Settings Values

PLM Channel:	_____	(default = 1)
TargMaxImprtP:	_____	(default = 0)
TargMinImprtP:	_____	(default = 0)
EnaIslanding:	_____	(default = off)
NumTransSwtchs:	_____	(default = 0)
ExtTransVolt:	_____	(default = 95.0V)
ExportOverride:	_____	(default = off)
CalOverride:	_____	(default = off)
CTTurnsRatio:	_____	(default = 1500)
EnaLoadShed:	_____	(default = 0)
GridParInvrtrs:	_____	(default = 0)
ACPVPower:	_____	(default = 0)
GenPower:	_____	(default = 0)
GenCtrlMode:	_____	(default = 0)

Navigate to the Mod. Settings page and retrieve inverter set points. Record these values to program the new Power Core. Additionally, if Utility Interconnection Standard is not IEEE 1547 (Ex. Rule 21, Rule 14H, etc), this will need to be set up on the new Power Core after replacement.

De-energize All Wiring To Inverter

⚠ DANGER

Electrocution. Initiate a system-wide shutdown and turn the PWRcell DC Disconnect Switch OFF on all connected batteries before performing service. Failure to do so will result in death, serious injury, or equipment and property damage.

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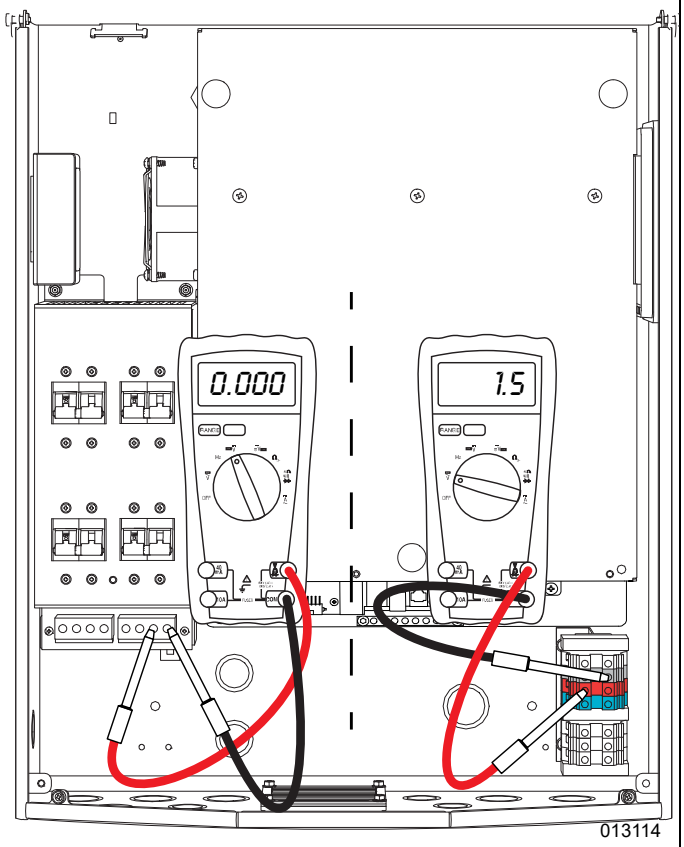


Figure 10-3.

1. Wait for the inverter to power off and the internal capacitor bank completely discharge (approximately 3–5 minutes).
2. Use a digital multimeter (DMM) to verify AC and DC wiring is safe to work on. Measurements should read 0 volts.

Prepare Power Core for Removal

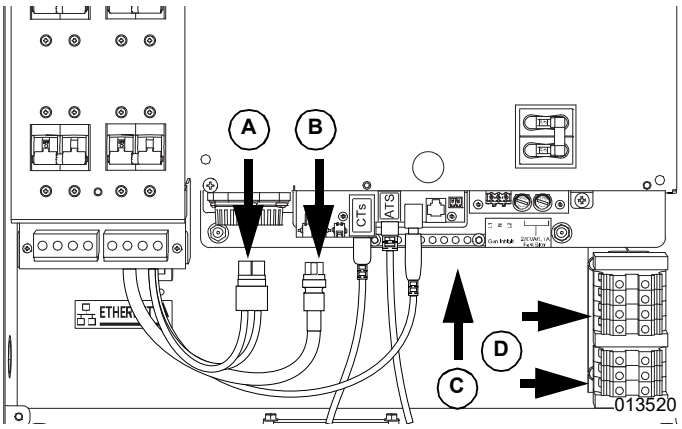


Figure 10-4.

1. Disconnect all AC wiring, grounds, and DC wiring connector from Power Core.
   - Unplug and tuck away the DC wiring connector (A) and the LCD cable (B).
   - Unscrew and tuck away ground wires (C) and AC wiring (D).

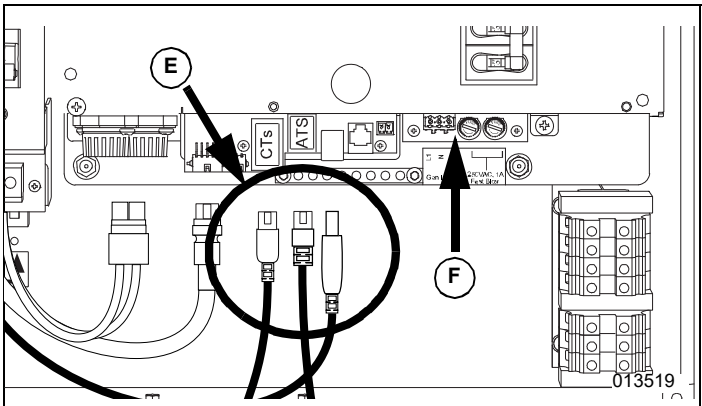


Figure 10-5.

2. Unplug and tuck away accessory cables (E and F).

NOTE: If green accessory screw terminals (F) are occupied with wiring, pull to remove the terminal blocks to avoid disconnecting individual wires. Tuck all wiring away.

3. Route wires away from Power Core to make clearance for Power Core removal.

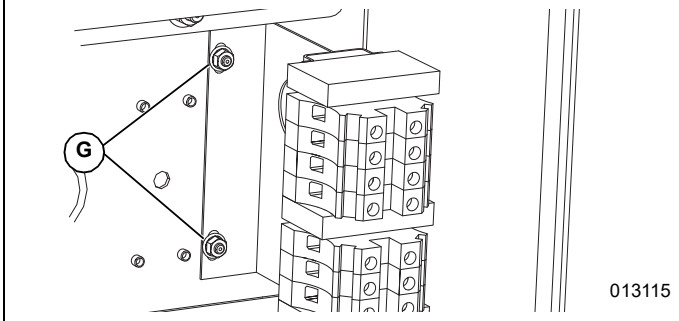


Figure 10-6.

4. Remove two 7 mm AC terminal nuts (G).

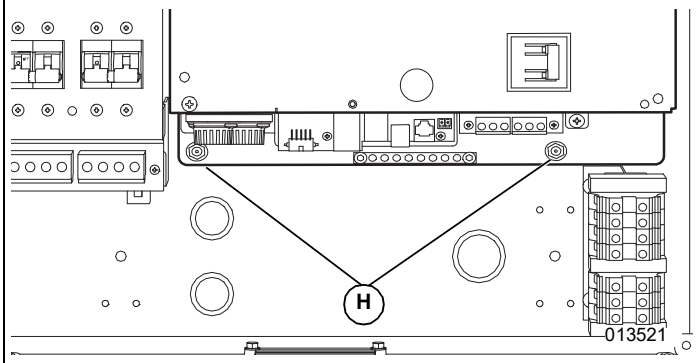


Figure 10-7.

5. Remove two bottom 10 mm Power Core nuts (H).

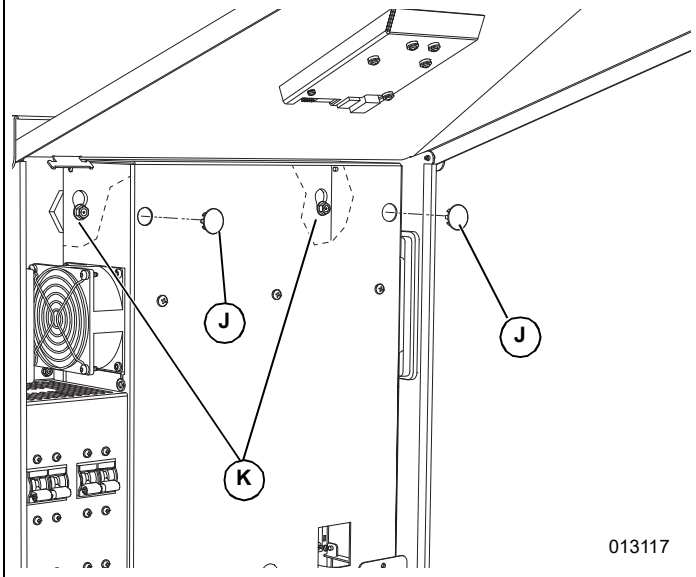


Figure 10-8.

6. Remove two plastic caps (J) covering the top access holes on top front of Power Core. Use a flathead screwdriver as needed.

NOTE: Caps may be black or clear.

7. Loosen but do NOT remove two 10 mm nuts (K) inside the Power Core accessible via the top access holes.

IMPORTANT NOTE: This should be approximately 2.5 turns. DO NOT REMOVE NUTS. If the nuts are loosened too much they may fall off the stud into the Power Core. These nuts fit in a teardrop shaped hole that allows the Power Core to slide over and up to be removed.

IMPORTANT NOTE: Removing Power Core cover to retrieve loose nuts will void the warranty.

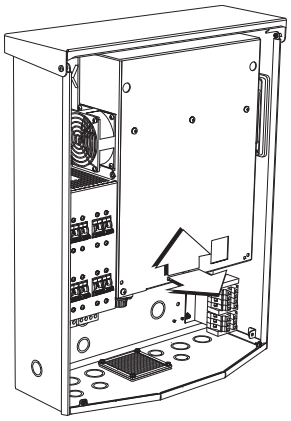
Remove Power Core

DANGER

Electrocution. Initiate a system-wide shutdown and turn the PWRcell DC Disconnect Switch OFF on all connected batteries before performing service. Failure to do so will result in death, serious injury, or equipment and property damage.

(000600)

NOTE: Power Core outer sheet metal may be warm/hot to the touch. If so, use of protective hand wear is recommended.



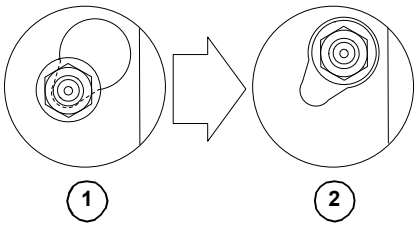
013118

Figure 10-9.

1. See ***Figure 10-9***. Place right hand under the bottom of the Power Core and left hand on top-left near the intake fan.
   - Lift Power Core assembly upward while pulling bottom out to clear bottom studs.

NOTE: Once clear of bottom studs, the Power Core will shift down, to the left, and rest only on top studs.

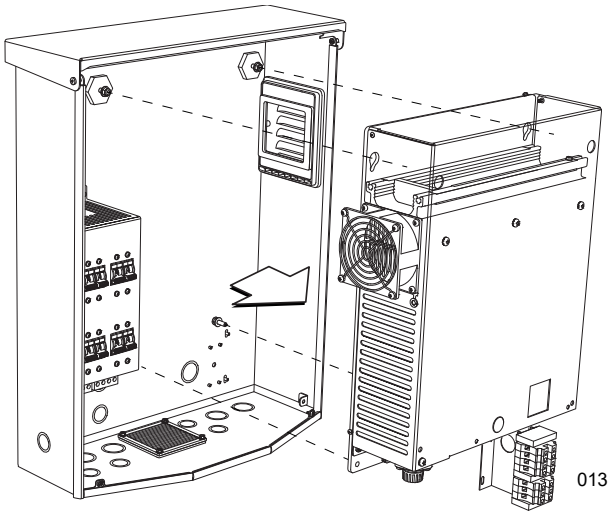
NOTE: Use caution. Hold onto the Power Core tightly.



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Figure 10-10.

2. See ***Figure 10-10***. Use the hand holding the bottom of Power Core to lift and align top clearance holes with top nuts.



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Figure 10-11.

3. Pull the Power Core assembly outward.

Install Replacement Power Core

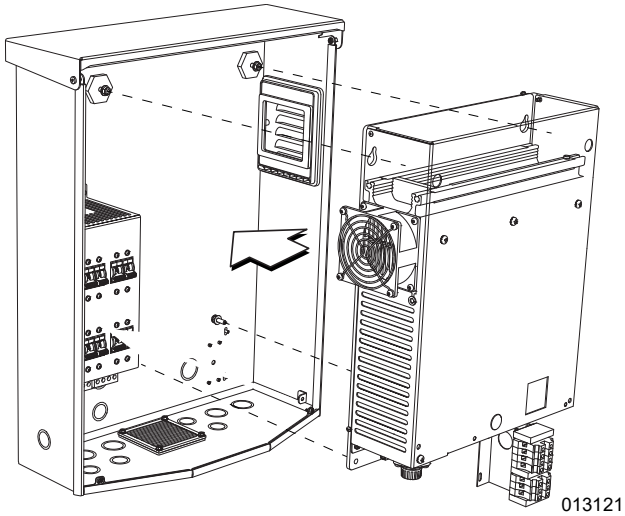


Figure 10-12.

1. Raise replacement Power Core into the enclosure over the top studs.

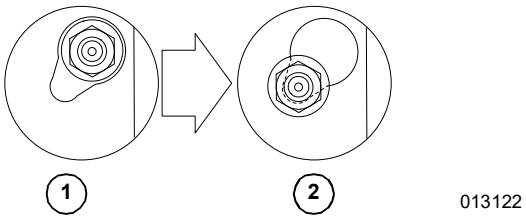


Figure 10-13.

NOTE: Align the clearance holes to slide over the nuts.

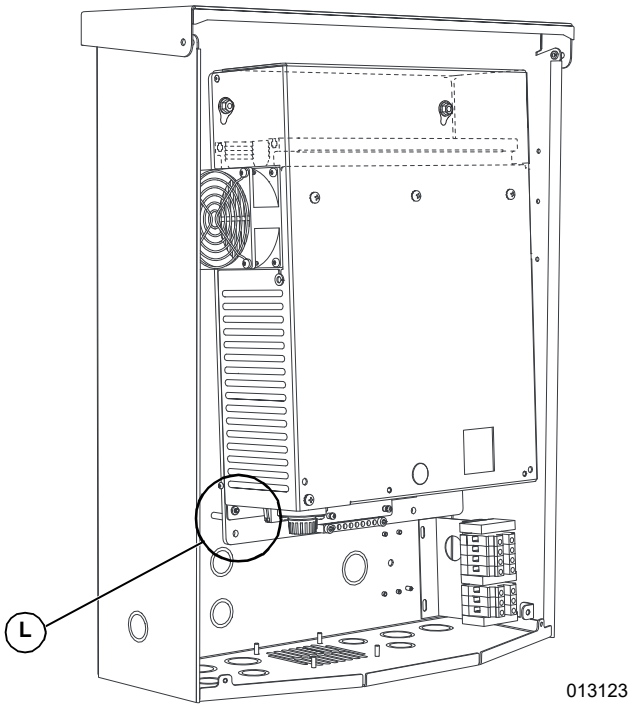


Figure 10-14.

2. Position bottom of Power Core as close to vertical as possible.

NOTE: The bottom studs will NOT be aligned with the bottom holes in the Power Core (L).

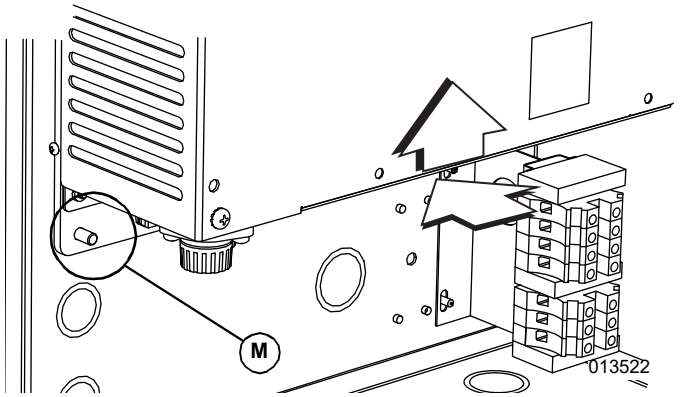


Figure 10-15.

3. Gripping the Power Core from the bottom, push up and to the right to align bottom studs with bottom holes (M).

NOTE: The Power Core should now rest on all 4 studs.

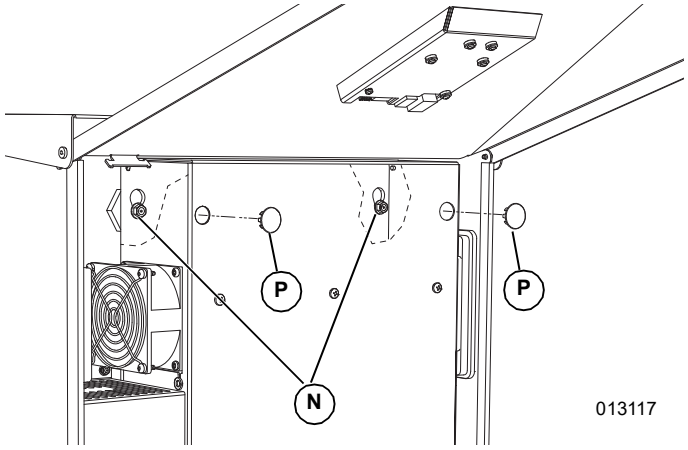


Figure 10-16.

4. Tighten two 10 mm nuts (N) inside the Power Core using a 10 mm socket. Tighten nuts securely.
5. Install plastic caps (P) in two top access holes of Power Core.

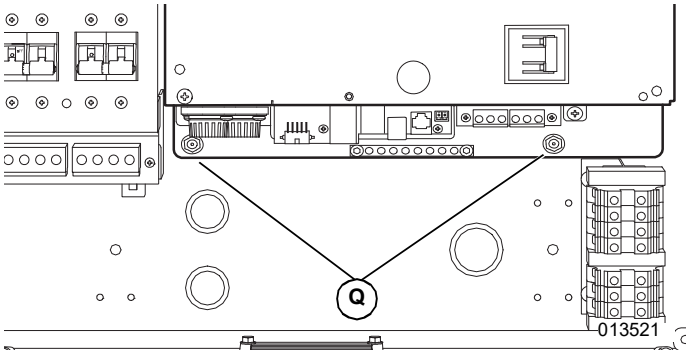


Figure 10-17.

6. Install and tighten the bottom nuts (Q) using a 10 mm socket. Tighten nuts securely.

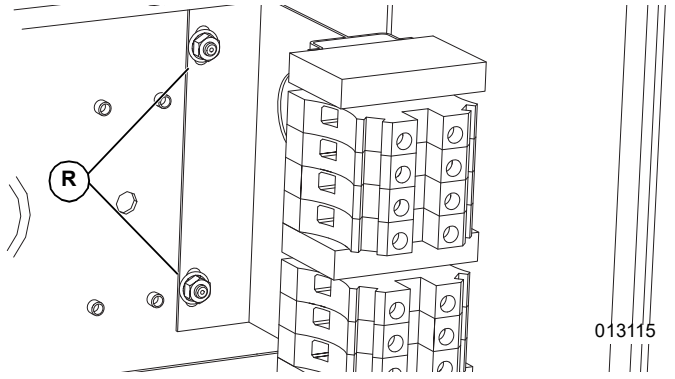


Figure 10-18.

7. Align the AC wiring terminal assembly with the mounting studs and install two retaining nuts (R) using a 7 mm socket. Tighten nuts securely.

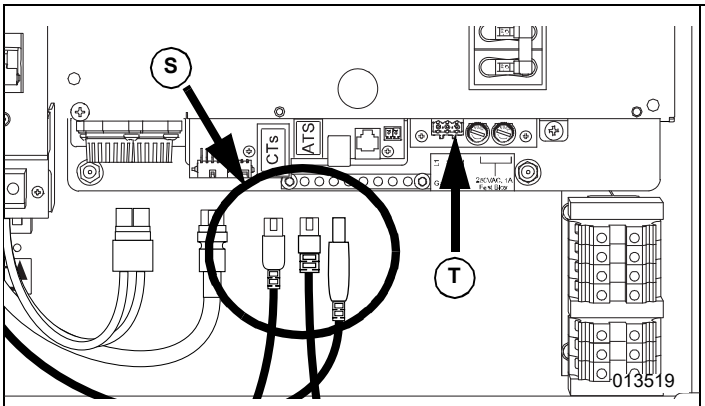


Figure 10-19.

8. Connect accessory cables (S) and plug in green screw terminals (T) if previously removed.

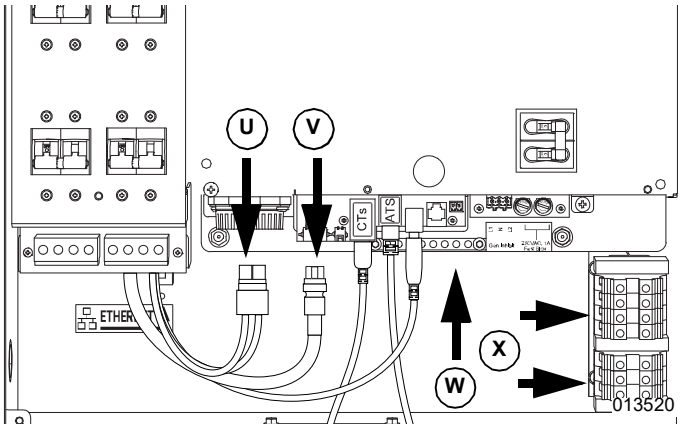


Figure 10-20.

9. Connect AC wiring, grounds, the DC wiring connector, and LCD cable to Power Core.
   - Connect the DC wiring connector (U) and the LCD cable (V).
   - Connect ground wires (W) and AC wiring (X).

Recommission Inverter With Replacement Power Core

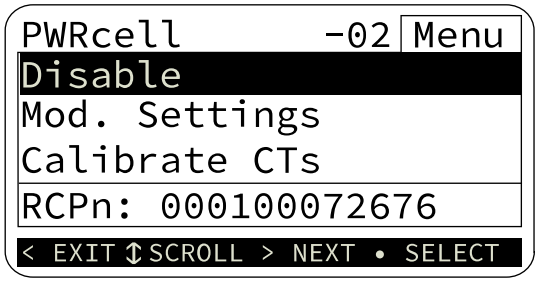


Figure 10-21.

1. Refer to Inverter Installation and Owner's Manual for commissioning steps.

NOTE: Modify any non-default set points and access the Installer Configuration Tool to update any advanced settings per Utility interconnection requirements.

NOTE: The original Power Core will show up as “Device Offline” on the LCD screen. This page should be removed to not confuse which inverter is operating at the site. Access the inverter device settings sub-menu and select “Remove Device”.

Activate Warranty / Register New Power Core

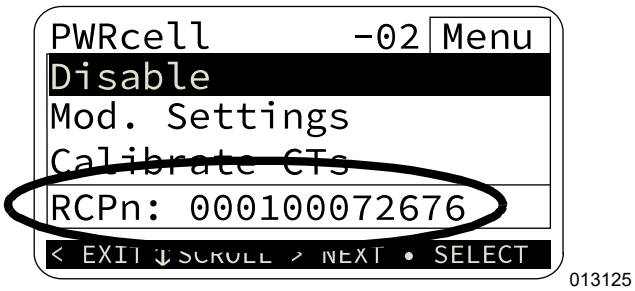


Figure 10-22.

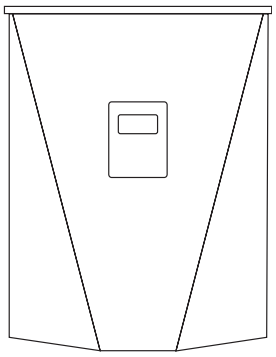
1. Create a service ticket at ***https://www.generac.com/resources-and-tools/ce-installer-resources/technical-support*** with the following info:
   - Registration email
   - New inverter's RCPn (see Note)
   - In subject line, enter “Power Core Swap Registration”

NOTE: See ***Figure 10-22***. This is shown in the Inverter device page sub-menu.

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Section 11 PWRcell Inverter Lid Replacement

Overview

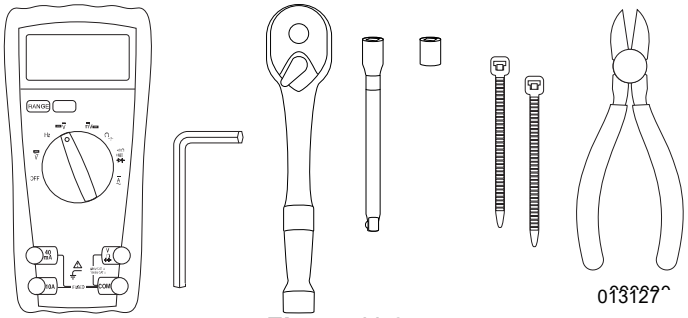


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Figure 11-1.

Replacement instructions for PWRcell Inverter lid.

Required Tools



013127

Figure 11-2.

Required Tools:

1. Digital Multimeter (DMM)
2. 2.5 mm Hex Driver
3. Ratchet (¼" drive) with 6" or longer extension, 7 mm socket (see Note)
4. Zip Ties
5. Side Cutter
6. Needle Nose Pliers (optional, not shown)

NOTE: 7 mm nut driver is also suitable for use.

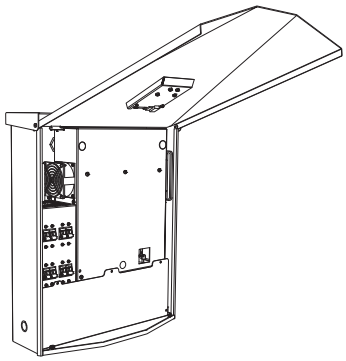
Safety

⚠DANGER

Electrocution. Initiate a system-wide shutdown and turn the PWRcell DC Disconnect Switch OFF on all connected batteries before performing service. Failure to do so will result in death, serious injury, or equipment and property damage.

(000600)

Prepare Lid For Removal



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Figure 11-3.

1. Disable all REBus devices and inverter.
2. Secure AC power to inverter (the inverter screen will turn off).
3. Verify absence of voltage at AC and DC terminals using digital multimeter (DMM).
4. Place lid in open position.

NOTE: If replacing the lid of an inverter while it is mounted, be sure to lift lid completely and push into inverter housing.

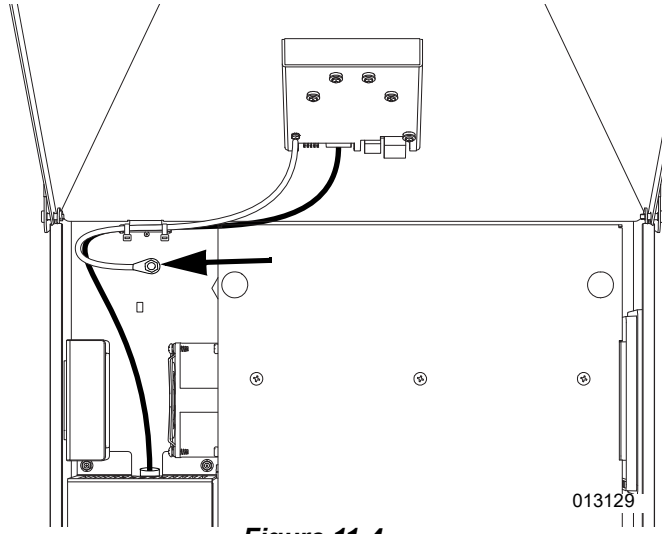


Figure 11-4.

5. Use a 7 mm socket or nut driver to remove the 7 mm nut fastening braided wire grounding strap (for inverter screen) from the back plane of inverter housing.

NOTE: Use caution to avoid dropping nut into DC breaker assembly. DC breaker assembly may be removed to retrieve loose nuts.

IMPORTANT NOTE: Removing DC breaker assembly cover to retrieve loose nuts will void the warranty.

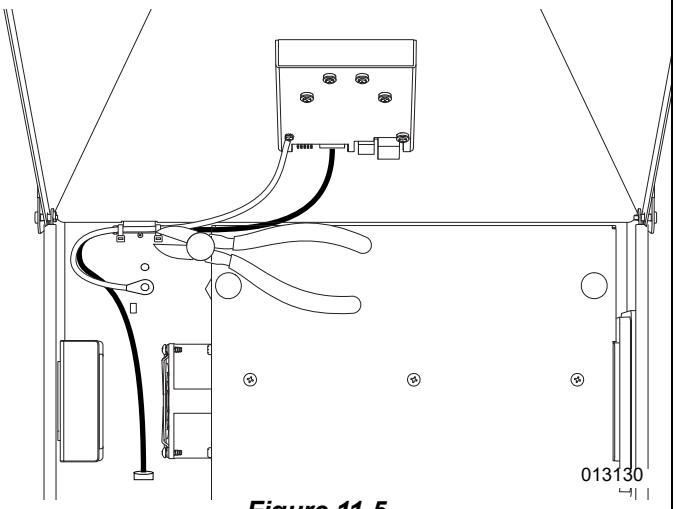


Figure 11-5.

6. Cut zip ties holding the inverter screen electrical and network connection cables and braided wire grounding strap to lid assembly.

NOTE: Avoid damaging the grounding strap when cutting zip ties.

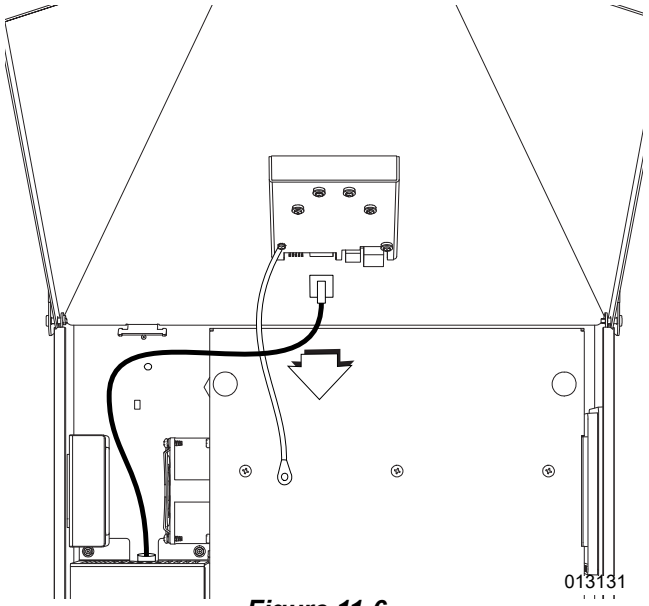


Figure 11-6.

7. Disconnect inverter screen electrical connector by pushing on the lock tab and pulling straight down.

Removing Lid

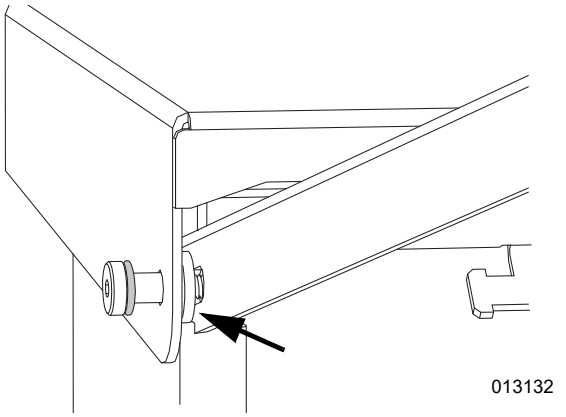


Figure 11-7.

1. Use a 2.5 mm Hex driver to loosen the two pivot bolts.
2. Remove the two pivot bolts.

NOTE: Be careful to not lose the plastic spacer between the inverter housing and lid.

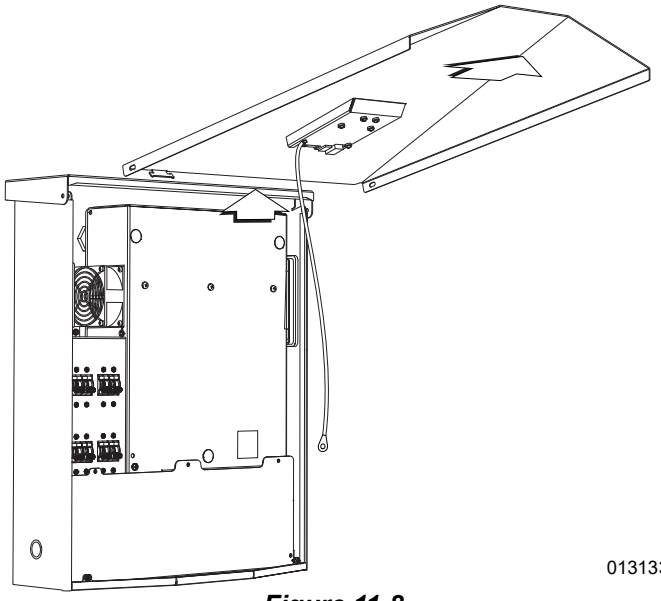


Figure 11-8.

The lid is now ready to be removed.

3. Lift the lid slightly and pull away from the inverter housing.

Installing New Lid

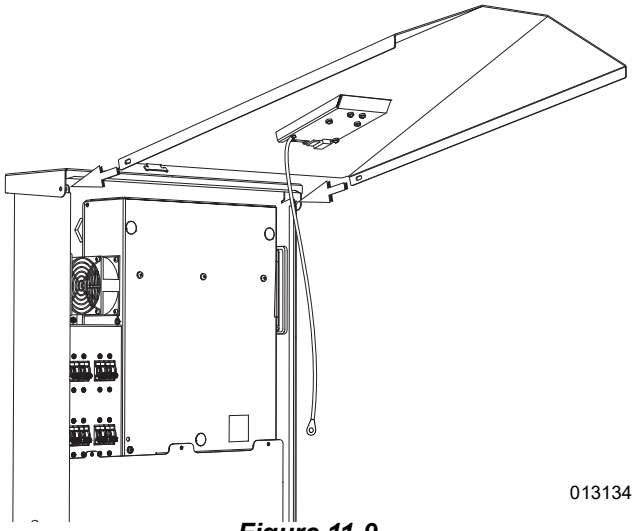


Figure 11-9.

1. Lift the new lid into place in the inverter housing.

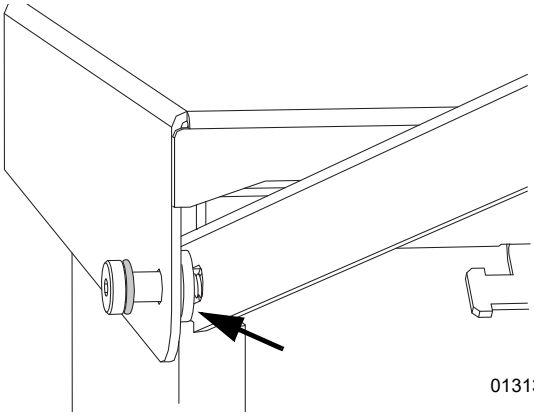


Figure 11-10.

2. Install lid pivot bolts with washers and spacers in correct placement.

NOTE: See ***Figure 11-10***. Spacer must be installed between lid and housing. Use needle nose pliers or the 2.5 mm hex driver to help position the spacer.

Figure 11-10 shows the order of assembly for the lid pivot bolts. The rubber washer is directly under the head of the bolt against the inverter housing.

The white plastic spacer goes between the inverter housing and the lid.

3. Tighten pivot bolt using 2.5 mm Hex Driver until bolt is tight by hand. Lid should pivot freely and not bind at any point.

NOTE: *Lift upwards on the lid to help position bolt threads to bolt hole.*

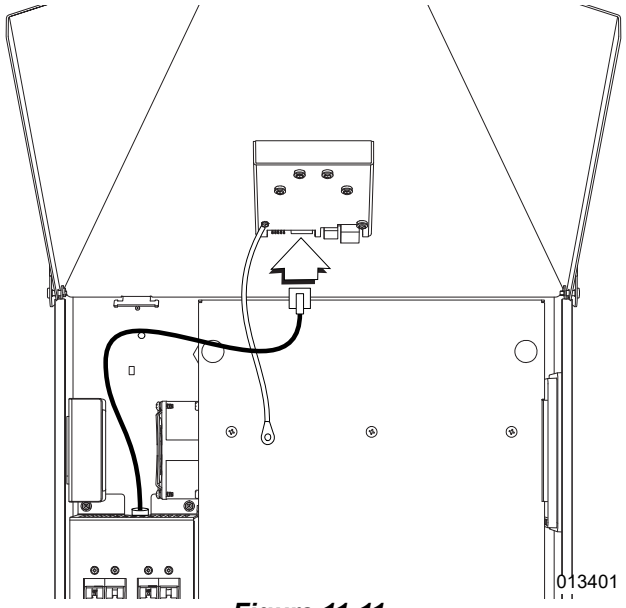


Figure 11-11.

4. Connect inverter screen electrical connector by pushing in until the lock tab clicks securely in place.

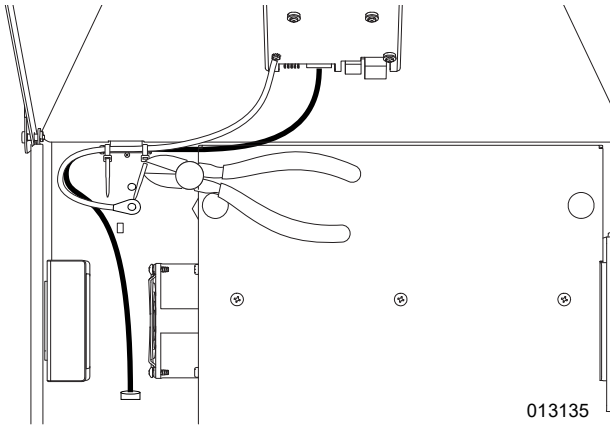


Figure 11-12.

5. Secure the inverter screen cables and strap to the lid using zip ties.

NOTE: Zip tie points are designated by the outer edge of the T-shaped ends. Zip ties should land on the inside of those ends.

NOTE: Do NOT over tighten zip ties. Cables can become internally pinched.

6. Cut zip tie excess length.

NOTE: Discard excess zip tie ends. Do not allow the excess to drop into DC breaker assembly.

IMPORTANT NOTE: Removing DC breaker assembly cover to retrieve loose objects will void the warranty.

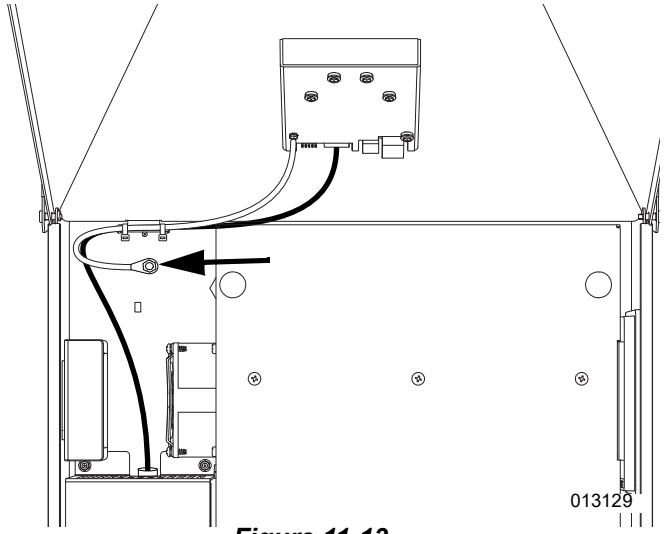


Figure 11-13.

7. Replace 7 mm nut to fasten inverter screen braided wire ground strap to back plane of inverter housing.

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Section 12 DC Breaker Assembly Replacement

Overview

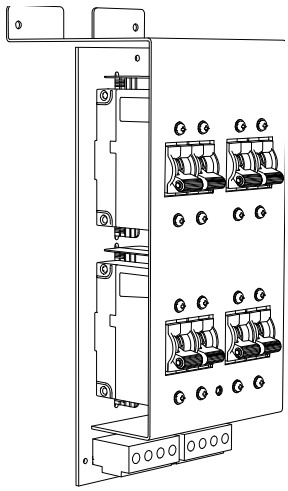


Figure 12-1.

Replace the DC Breaker Assembly for a PWRcell Inverter.

Required Tools

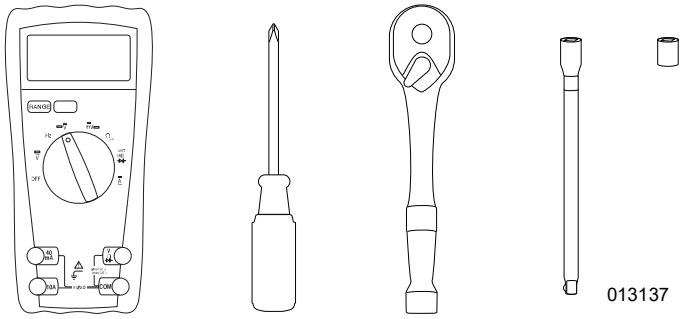


Figure 12-1.

Required Tools:

1. Digital Multimeter (DMM)
2. Phillips Head Screwdriver (No. 1 and No. 2)
3. Ratchet (¼" drive) with 6" or longer extension, 7 mm socket (see Note)

NOTE: 7 mm nut driver is also suitable for use.

De-energize Inverter

⚠DANGER

Electrocution. Initiate a system-wide shutdown and turn the PWRcell DC Disconnect Switch OFF on all connected batteries before performing service. Failure to do so will result in death, serious injury, or equipment and property damage.

(000600)

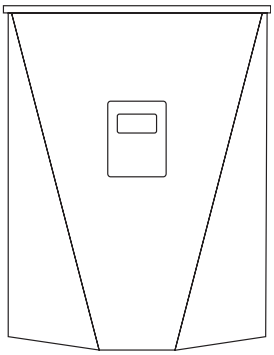


Figure 12-2.

1. De-energize all wiring to the inverter.
2. Disable any connected ESS (PWRcell Battery)
3. Open PWRcell DC disconnects
4. Open Interconnected System AC disconnect/AC Backfeed breaker
5. Wait for the inverter to power off.

NOTE: Inverter screen will go blank within several seconds after the internal capacitor bank is sufficiently discharged.

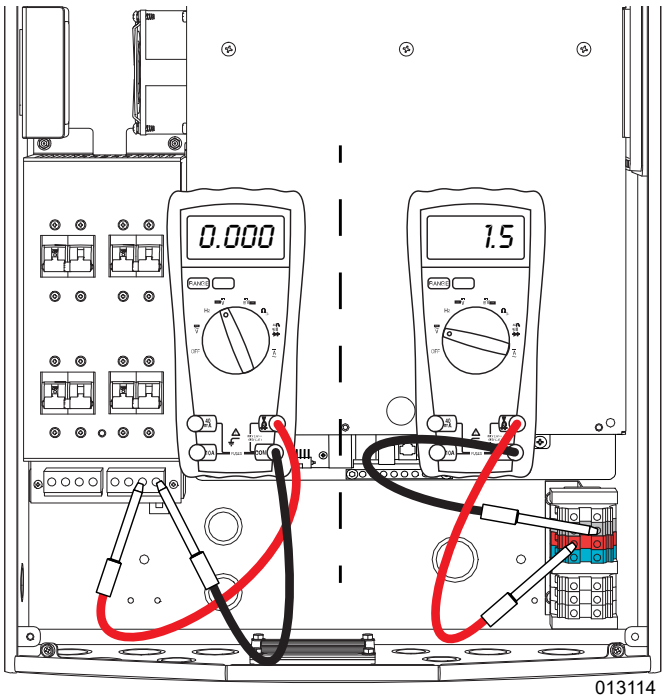


Figure 12-2.

6. Use a digital Multimeter (DMM) to verify no voltage is present on either AC or DC terminals.

Replace DC Breaker Assembly

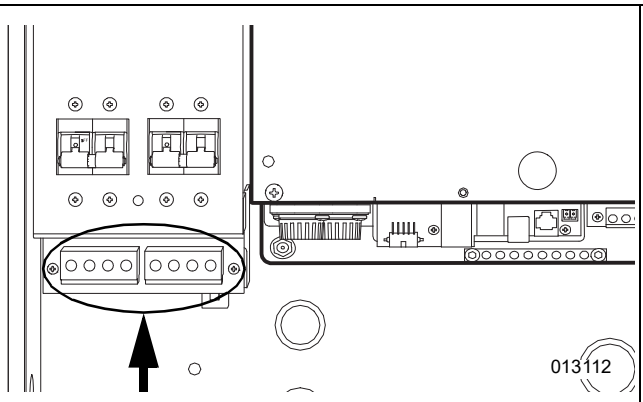


Figure 12-3.

1. Disconnect all REbus DC wiring connected to DC assembly terminal block.

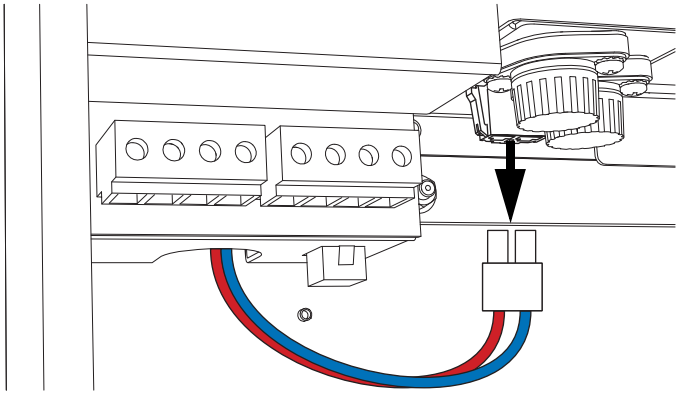


Figure 12-4.

2. Disconnect DC wiring connector from Power Core.

NOTE: This connector is a plug with red and blue wires coming from the DC breaker assembly to the Power Core.

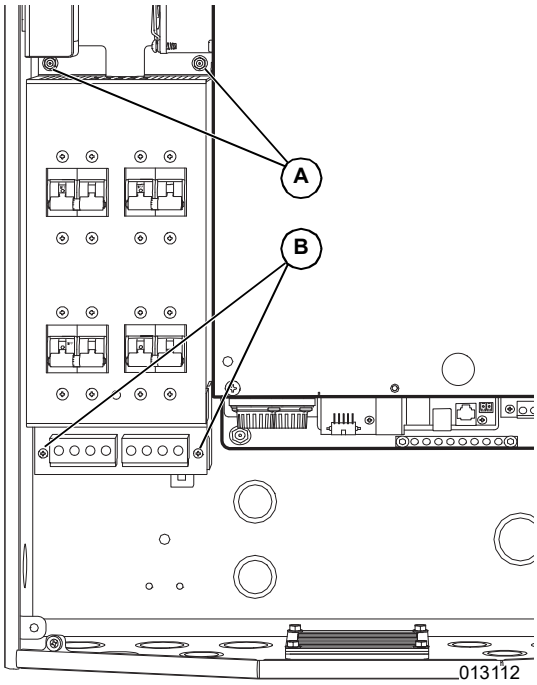


Figure 12-5. Remove Fasteners

3. See ***Figure 12-5***. Remove the indicated fasteners:
   - TOP (A): QTY 2 - 7 mm nuts
   - BOTTOM (B): QTY 2 - Phillips head screws (No. 1)

NOTE: Do NOT remove Phillips head screws from the face of the assembly baffle.

NOTE: Retrieve any dropped fasteners. Do not attempt to use other screws or nuts as replacement fasteners.

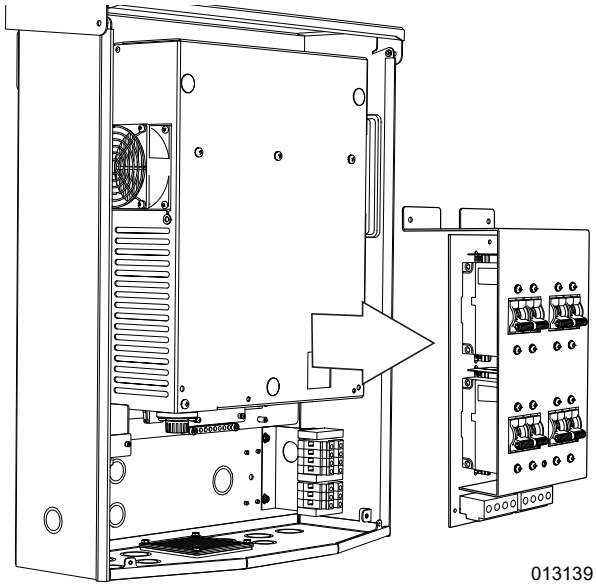


Figure 12-6.

4. Remove the DC breaker assembly (see note below) and replace with the new DC breaker assembly.

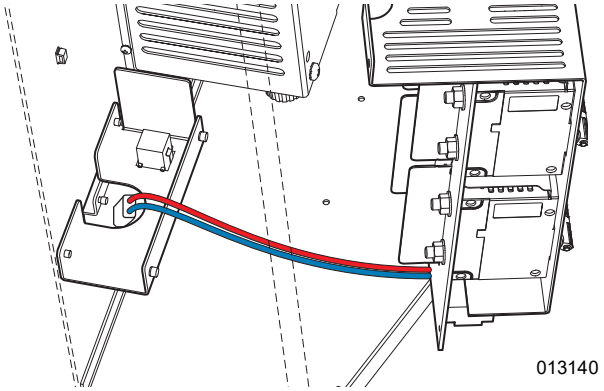


Figure 12-7.

NOTE: See ***Figure 12-7***. DC wiring assembly connector feeds through a hole built into inverter housing which may prevent the connector from being removed without handling.

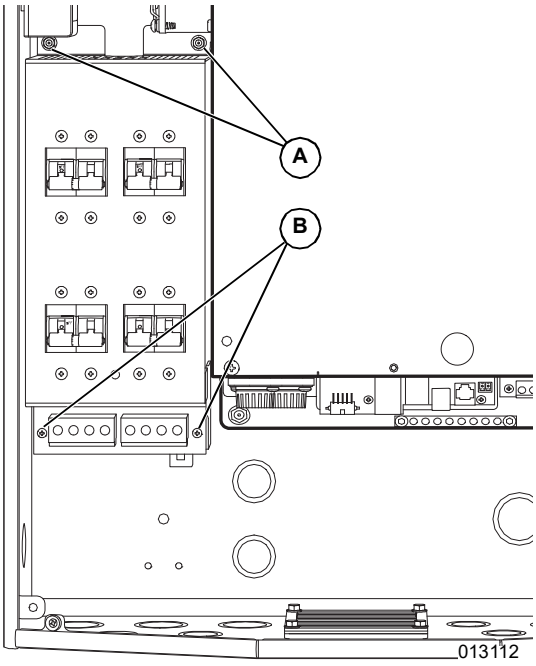


Figure 12-8.

5. See ***Figure 12-8***. Install the indicated fasteners:
   - TOP (A): QTY 2 - 7 mm nuts
   - BOTTOM (B): QTY 2 - Phillips head screws (No. 1)

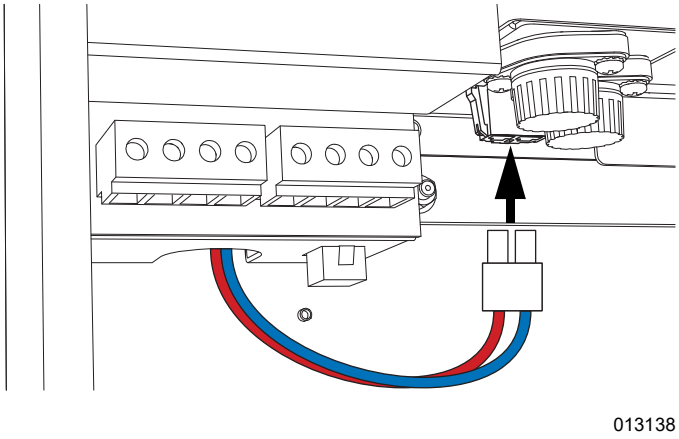


Figure 12-9.

6. Connect DC wiring connector to Power Core.

NOTE: This connector is a plug with red and blue wires coming from the DC breaker assembly to the Power Core.

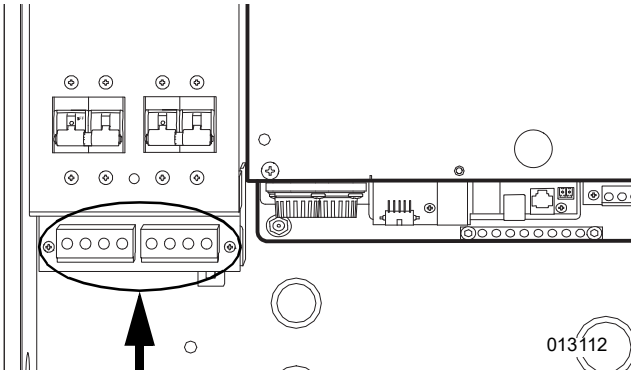


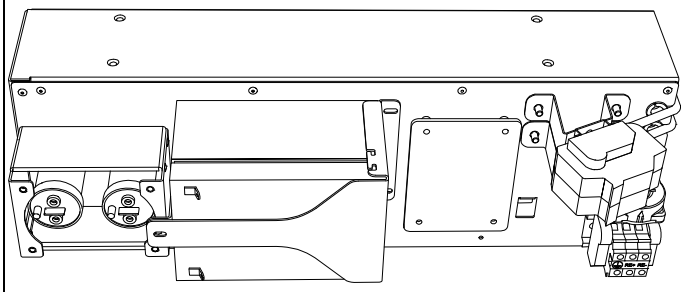
Figure 12-10.

7. Connect all REbus DC wiring connected to DC assembly terminal block.

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Section 13 PWRcell Battery BMU Replacement

Overview

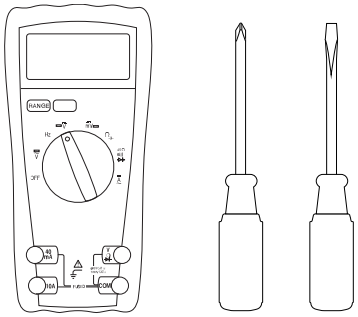


013141

Figure 13-1.

Replace the battery management unit (BMU) within the PWRcell Battery.

Required Tools



013142

Figure 13-2.

Required Tools:

1. Phillips Head Screwdriver (No. 2)
2. Slotted Screwdriver (4 mm)
3. Digital Multimeter (DMM)

Before You Start

Battery Mod. Settings Values

PLM Channel: _____(default = 1)
MinSoCAbs: _____(default = 2%)
MaxSoCAbs: _____(default = 100%)
MinSoCRsrv: _____(default = 30%)
MaxSoCRsrv: _____(default = 100%)

Retrieve battery settings from the Mod. Settings page. Record these values to program the new BMU.

NOTE: If battery settings cannot be retrieved, use the factory default settings or program custom settings based on site conditions.

Disable PWRcell Battery

⚠DANGER

Electrocution. Initiate a system-wide shutdown and turn the PWRcell DC Disconnect Switch OFF on all connected batteries before performing service. Failure to do so will result in death, serious injury, or equipment and property damage.

(000600)

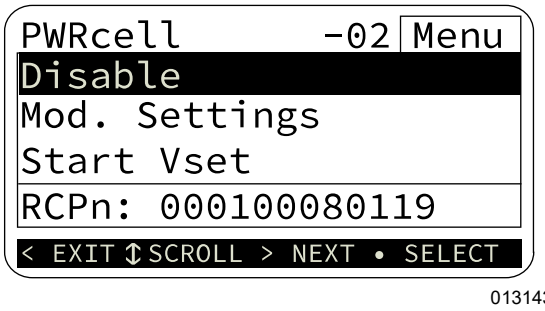


Figure 13-3.

1. Locate the PWRcell Battery device page on PWRcell Inverter LCD display. Disable and Confirm to command battery off.

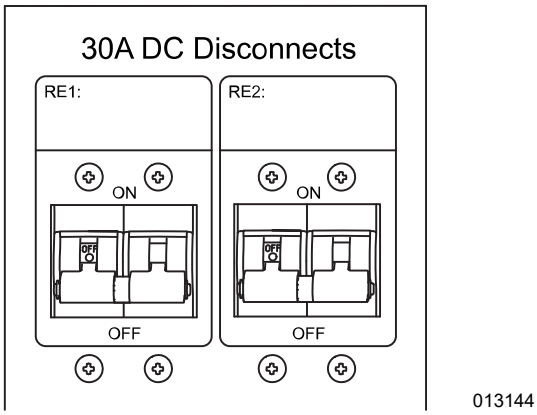


Figure 13-4.

2. Locate the PWRcell DC Disconnect that the battery is landed on and turn to OFF position.

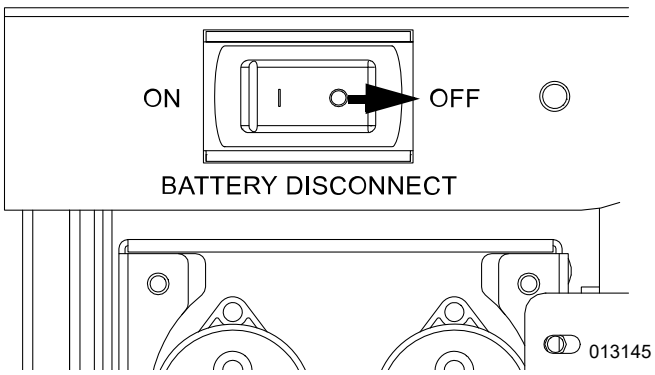


Figure 13-5.

3. Locate the PWRcell Battery Disconnect switch on top left corner of frame. Turn to OFF position.

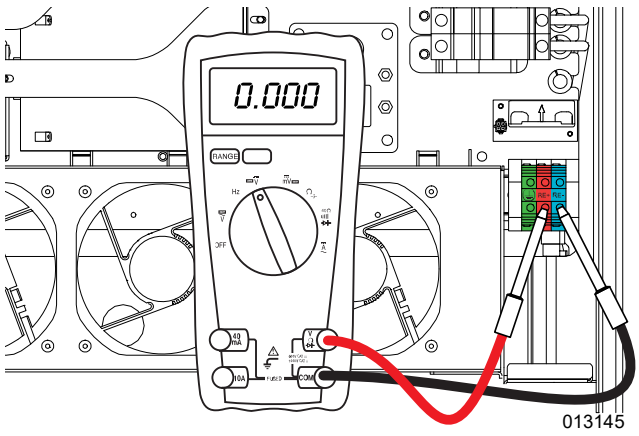


Figure 13-6.

4. Set a digital multimeter (DMM) to measure DC volts.
5. Check REbus connection inside PWRcell Battery.

NOTE: An indication of 0 VDC ensures that the connection between the PWRcell Battery and Inverter is safe to handle.

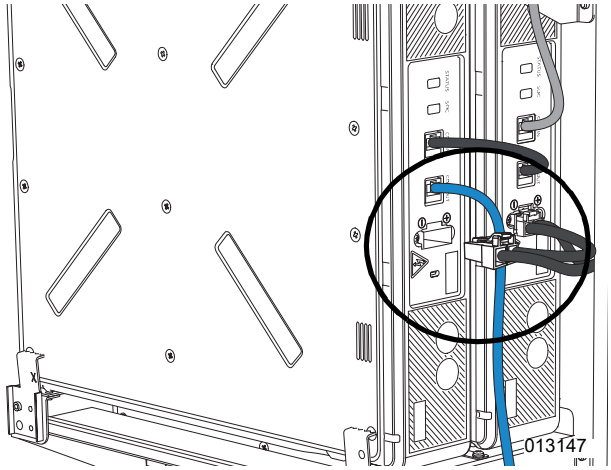


Figure 13-7.

6. Locate a DC connector on a battery module and remove. This will create an open in the series battery stack string.

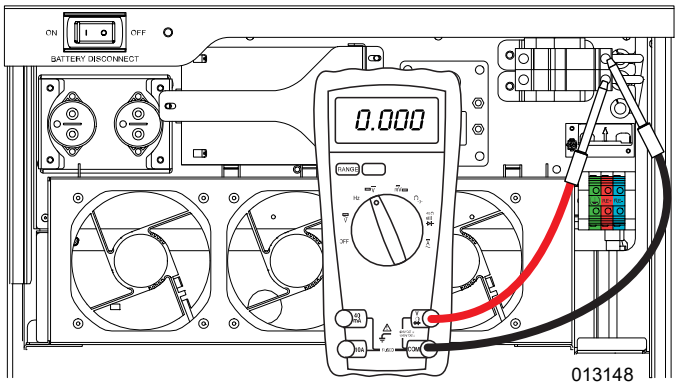


Figure 13-8.

7. Set a DMM to measure DC volts.
8. Measure for battery string voltage across the fuse block terminals.

NOTE: An indication of 0 VDC verifies that the battery string is open and is safe to handle at the top of the PWRcell battery frame.

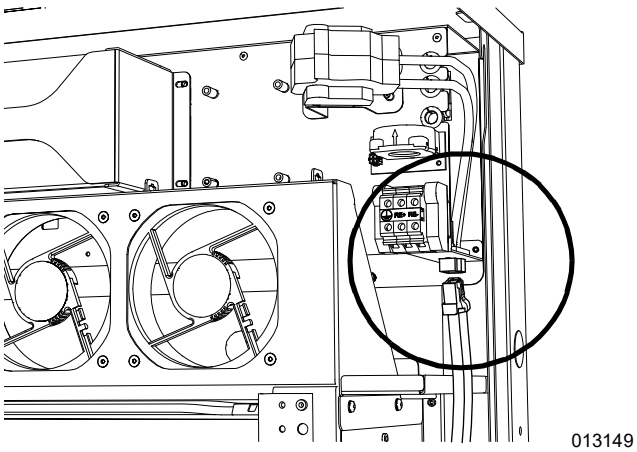


Figure 13-9.

9. Locate the battery string connector on the right side of PWRcell Battery frame. It is behind the REbus terminal blocks.

NOTE: If the battery module connector was removed and zero volts measured in Step 8, there will be no voltage present on this connector.

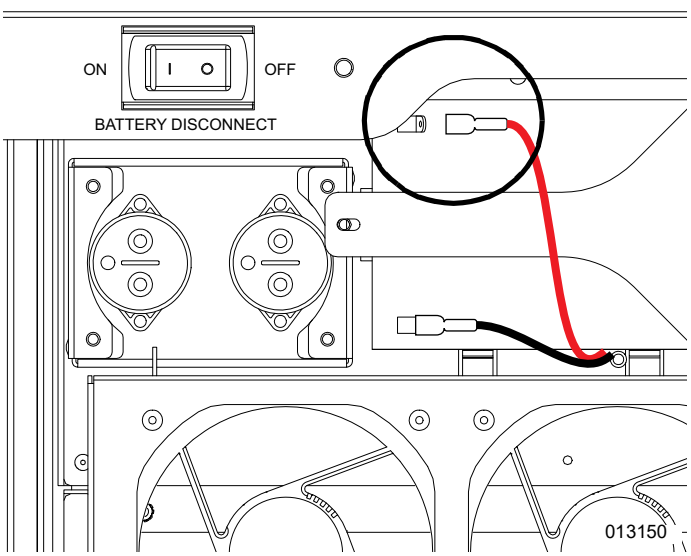


Figure 13-10.

10. Locate 12V positive lead on the BMU battery and disconnect.

NOTE: This is the final step in successfully powering down the PWRcell battery.

Prepare BMU for Removal

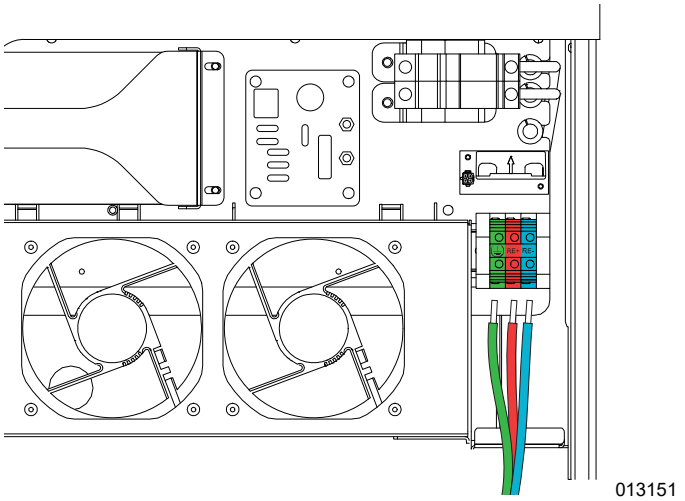


Figure 13-11.

1. Remove REbus wires from the terminal block.

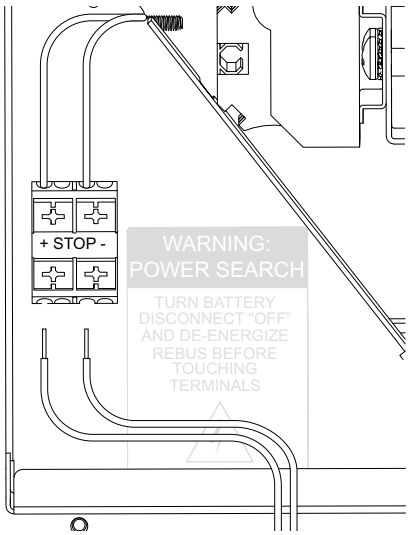


Figure 13-12.

2. Remove remote shutdown switch connections from the terminal block (if equipped).

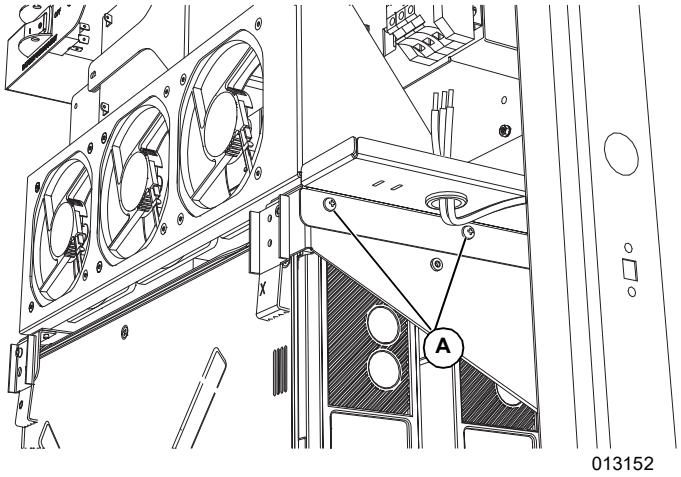


Figure 13-13.

3. Remove two Phillips screws (A) holding the sheet metal cover on the top right side of the PWRcell Battery frame.

NOTE: Let sheet metal cover hang by REbus wires. Secure sheet metal cover to avoid contact with other wires or painted surfaces. (Re-work)

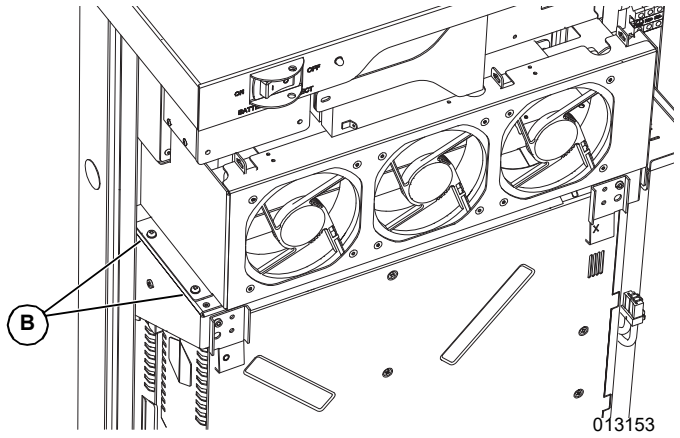


Figure 13-14.

4. Remove two Phillips screws (B) holding the left side of the fan assembly to the PWRcell Battery frame.

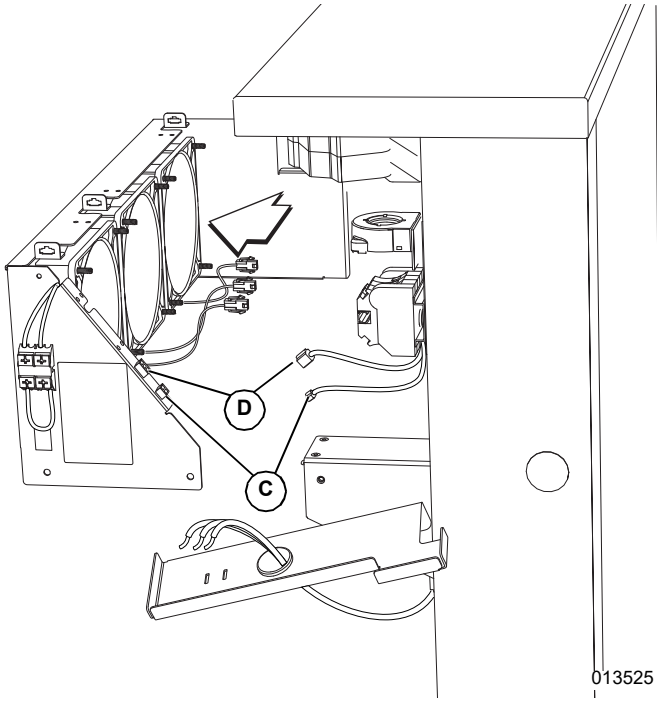


Figure 13-15.

5. Disconnect the 2-pin connector (C) and (if equipped) 3-pin connector (D).
6. Pull fan assembly straight out.

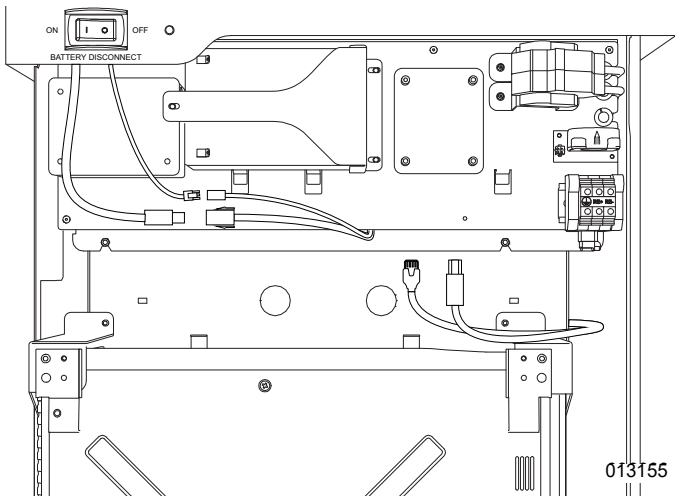


Figure 13-16.

7. Disconnect red 4 pin connector for master switch assembly from BMU.
8. Disconnect black 3 pin connector for led indicator.
9. Disconnect gray CAT5 cable for battery modules from underside of BMU.
10. Disconnect USB-B connector for service cable from underside of BMU. (show USB and CAT5 cables

Remove BMU from PWRcell Battery Frame

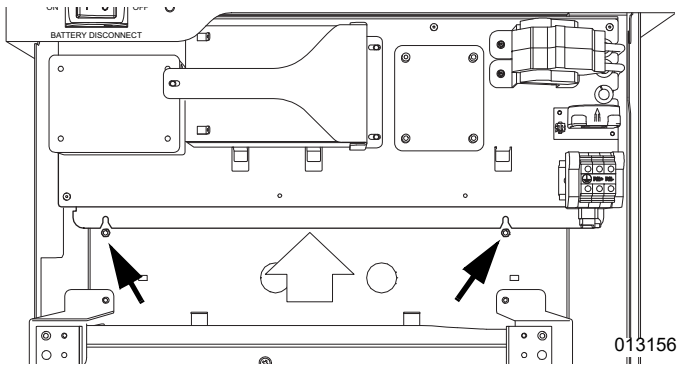


Figure 13-17.

1. Locate and remove two retaining fasteners on bottom of BMU bracket.
2. Lift BMU assembly up off of fasteners and remove assembly.

Install BMU to PWRcell Battery Frame

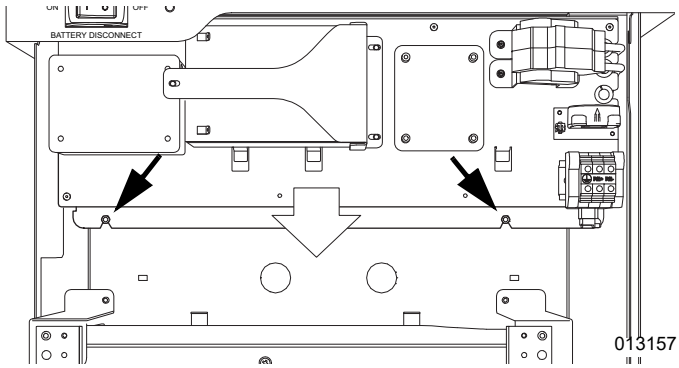


Figure 13-18.

Reverse order of removal.

1. Slide BMU assembly down on hangers and fasten with two retaining screws or nuts.

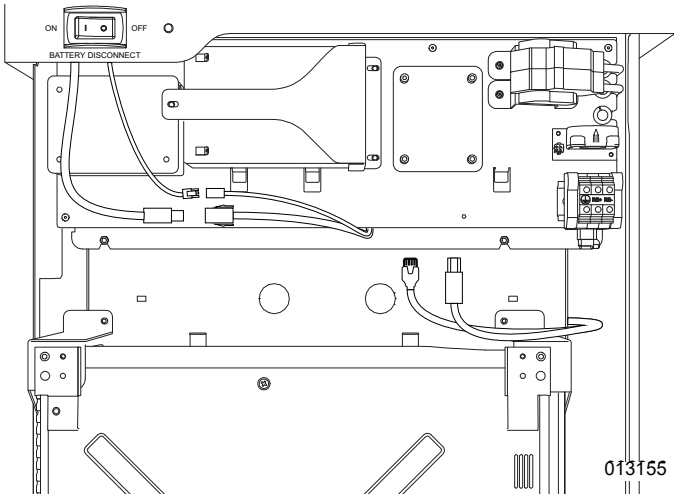


Figure 13-19.

2. Install USB cable.
3. Install CAT5 network cable.
4. Connect LED indicator 3 pin black connector.
5. Connect 4 pin red master switch connector.

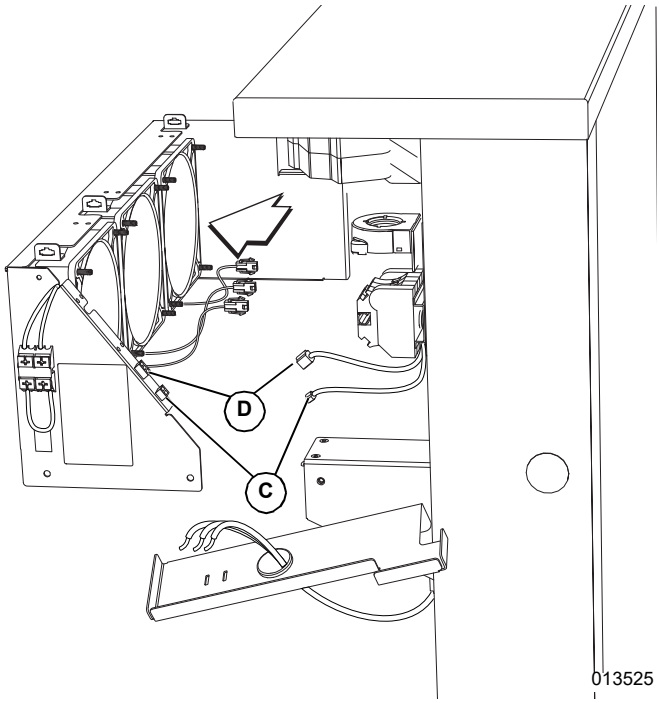


Figure 13-20.

6. Slide fan assembly in place.
7. Connect 2-pin connector (C) and (if equipped) 3-pin connector (D).

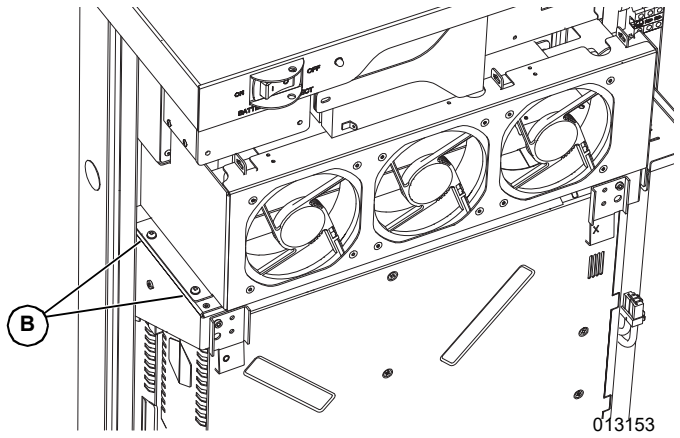


Figure 13-21.

8. Install two Phillips screws (B) holding the left side of the fan assembly to the PWRcell Battery frame.

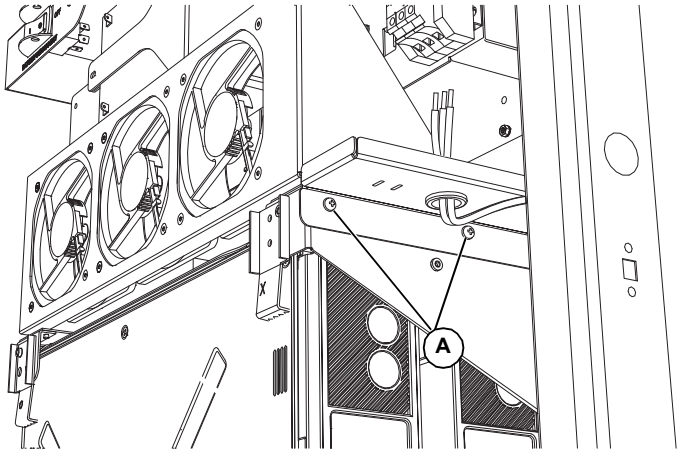


Figure 13-22.

9. Fasten fan assembly and right side sheet metal cover with Phillips screws.
10. Land REbus wires on terminal block.
11. Connect battery string connector on top right side to BMU assembly.
12. Connect battery string connector into the DCB module where it was removed from.
13. Connect 12V battery positive lead.

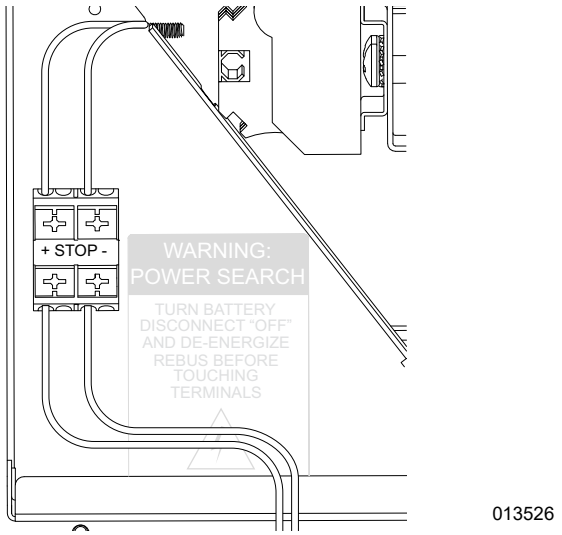


Figure 13-23.

14. Connect remote shutdown switch connections to the terminal block (if equipped).

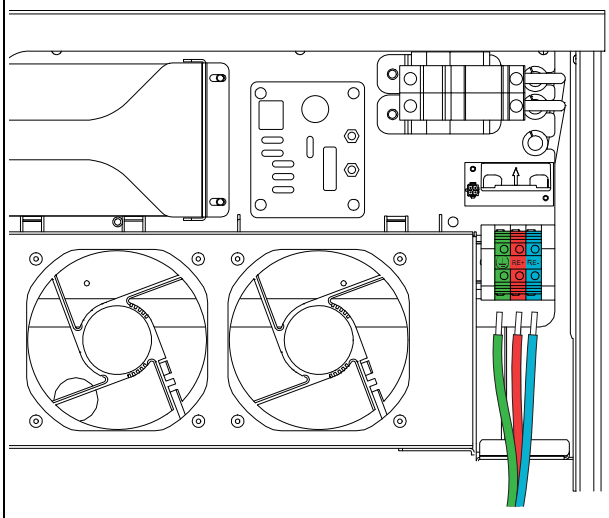


Figure 13-24.

15. Connect REbus wires to the terminal block.

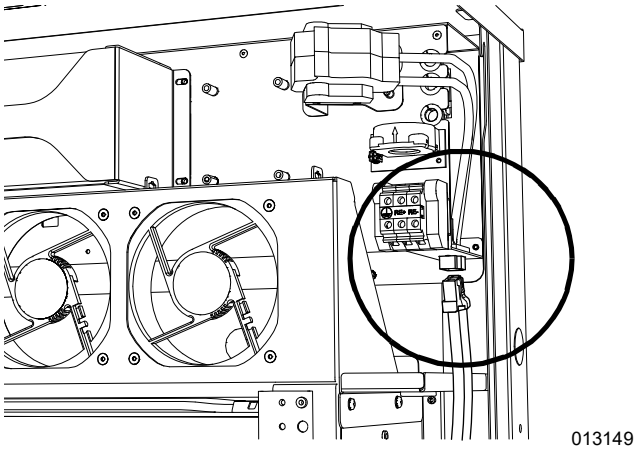


Figure 13-25.

16. Connect the battery string connector on the right side of PWRcell Battery frame. It is behind the REbus terminal blocks.

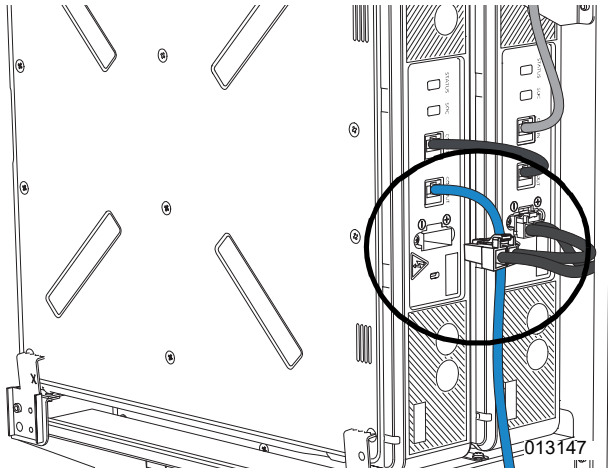


Figure 13-26.

17. Connect DC connector on battery module.

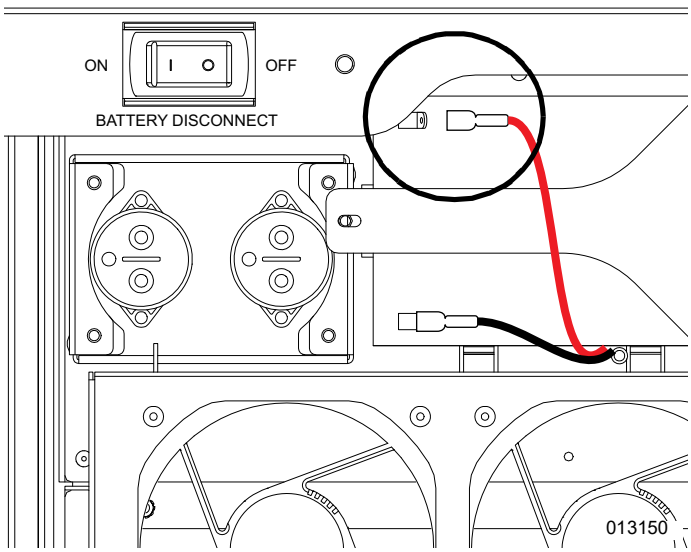


Figure 13-27.

18. Connect 12V positive lead to the BMU battery.

Enable PWRcell Battery

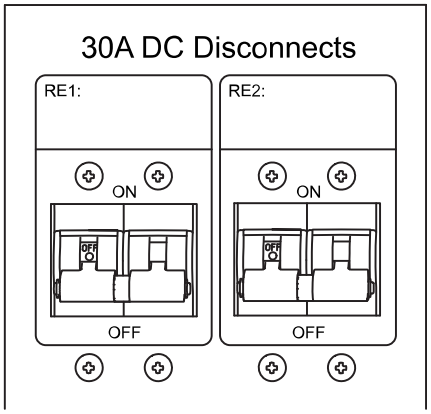


Figure 13-28.

1. Locate the PWRcell DC Disconnect that the battery is landed on and turn to ON position.

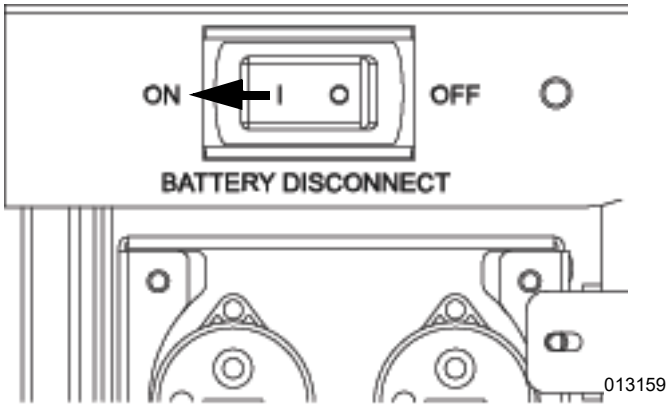


Figure 13-29.

2. Locate PWRcell Battery master switch on top left corner of frame. Turn to ON position.

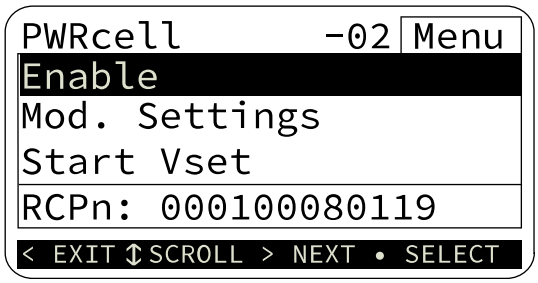


Figure 13-30.

3. Locate Generac PWRcell Battery page on inverter control panel.
4. Using the center button, open the device menu to select ‘Enable’, then ‘Confirm’ to command the battery on.

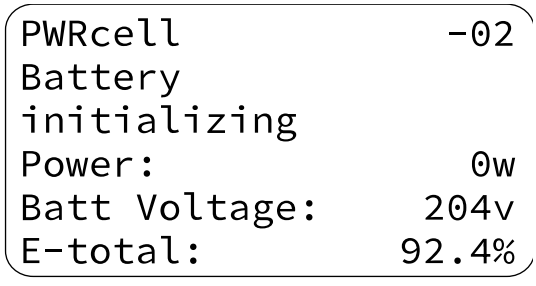


Figure 13-31.

The PWRcell Battery will automatically go to ‘initializing’ within a few seconds.

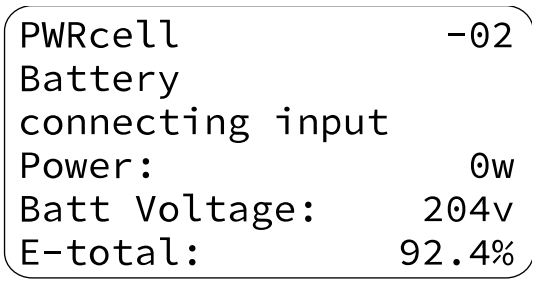


Figure 13-32.

The PWRcell Battery will then go to 'connecting input.'

After several seconds, unless an error is detected, the PWRcell Battery will close its contactors and display 'battery connected.'

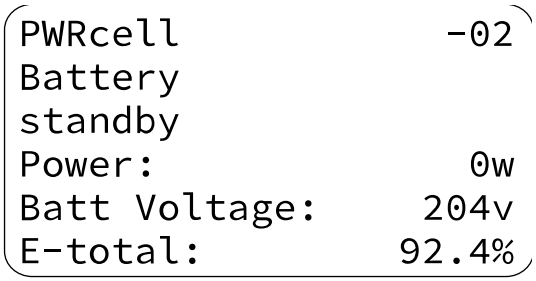


Figure 13-33.

The PWRcell Battery will then go to 'standby' if it is ready to function.

NOTE: Depending on available PV energy and system mode selected for PWRcell system, the PWRcell Battery may start charging or discharging after entering standby.

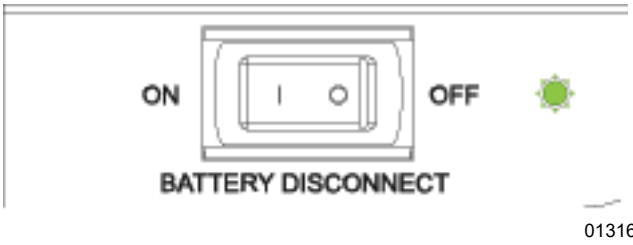


Figure 13-34.

Confirm that the PWRcell Battery LED indicator is lit or flashing green.

NOTE: LED indicator will flash a different sequence if the battery is waiting in standby, charging, or discharging.

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Section 14 Frequently Asked Questions

Applications

Q: Can PWRcell battery be used with other mainstream inverters such as SolarEdge, Delta, or Enphase?

A: No, the PWRcell battery is designed to work only with the Generac PWRcell Inverter. This ensures the best customer experience.

Q: What type of solar panels can the PWRcell system support?

A: The PV Link substring optimizers work with the majority of DC output ungrounded solar panels. The system will not work with AC output modules (i.e. panels with an integrated micro-inverter, or negatively-grounded solar panels).

Q: Can the PWRcell System integrate with a generator?

A: The PWRcell system cannot directly couple to a generator at this time.

Q: Can multiple inverters be installed in one system?

A: Contact the Generac Clean Energy Inside Sales team at 888-436-3722 x1861 to discuss system configuration options for larger projects.

Q: Can the PWRcell Battery Energy Storage System be used for off-grid applications?

A: The PWRcell Battery Energy Storage System cannot be used for off-grid applications at this time.

Q: Do I need to purchase and install PWRview monitoring technology with my PWRcell system to get home energy monitoring capabilities?

A: The PWRcell system comes standard with the PWRview monitoring technology. When CTs are properly installed, monitoring can be done through the PWRview for PWRcell application available for Apple phones in the App Store and Google Play Store from Android phones.

Q: Can I use the PWRcell Battery Energy Storage System if I already have a solar power system installed?

A: The PWRcell Battery Energy Storage System cannot be AC-coupled to existing solar systems at this time. PWRcell solar plus storage can be installed at sites with existing solar for certain applications. Contact the Generac Clean Energy Inside Sales team at 888-436-3722 x1861 to discuss system configuration.

Q: Can the PWRcell Battery Energy Storage System be used to replace existing PV inverters to add battery backup?

A: While it is technically possible to replace existing grid-tied components with the PWRcell Battery Energy Storage System, there are some practical implications that might not make such a solution viable (e.g. only the PV modules and racking would be reusable, the upgrade may nullify existing PPAs or other programs and or credits, the old system may need to be brought up to new code standards, etc.).

Q: Can the PWRcell Energy Storage System store electricity from the electric grid (local utility) during non-peak times, and deploy that energy during peak demand times?

A: Yes, the PWRcell Battery Energy Storage System can store energy from the electric grid (local utility), which can be deployed during peak demand times. This application can help customers reduce their electric utility bills.

Q: Is a solar power system installation required to have the PWRcell Energy Storage System?

A: The PWRcell Energy Storage System does not require the installation of solar. Customers that do not have a solar power system can tie the PWRcell Energy Storage System to the electric grid (local utility), and capture energy during non-peak hours, and use the stored energy during peak demand times or during power outages to power their home/ business.

Q: Can optimizers from another manufacturer be used with the PWRcell Inverter?

A: The PV Link is required if the customer wants to install solar with the system. The proprietary protocol that improves performance and efficiency of the system requires that only PV Link substring optimizers be used with the PWRcell inverter and battery products.

Q: Is the PWRcell Battery Energy Storage System capable of selling power back to a local utility?

A: Yes it is.

Q: Does the PWRcell Battery Energy Storage System allow you to take advantage of peak and off-peak pricing from the electric utility?

A: Yes, the system can be configured to charge/ discharge energy at certain times. This allows customers to participate in Time of Use (TOU) programs and minimize the amount of electricity they have to buy from the utility.

Warranty

Q: What's the average lifespan on a PWRcell Energy Storage System?

A: There is not a time-dependent specified end of life on the PWRcell Energy Storage System. The warranty for the battery modules is 10 years or 7.56 MWh of throughput per module. The battery cabinet and inverter will also carry a 10-year warranty and the PV Link and SnapRS products will carry a 25 year warranty. The product may still be functional beyond this point, but product life will vary based on use and environmental conditions.

Regulatory

Q: Is a permit required to install the PWRcell system?

A: Yes.

Q: Are SnapRS in-line disconnect devices required on all PV systems?

A: SnapRS products are only required in jurisdictions that require compliance with the 2017 and newer editions of the NEC for rapid shutdown inside the PV array boundary. The PV Link product is able to satisfy string-level rapid shutdown compliance.

Maintenance

Q: What is the recommended maintenance for the PWRcell Energy Storage System?

A: Recommended maintenance includes cleaning the intake filters on the battery cabinet and inverter, and inspection of system components. A full list of the recommended maintenance items and schedule is provided in the battery and inverter manuals.

Support

Q: Who should we contact for tech support?

A: Generac PWRcell Technical Support 1-855-635-5186

Q: How do I register my PWRcell products?

A: PWRcell products can be registered at ***https://pwrfleet.generac.com/*** or by calling 1-888-GENERAC (888-436-3722).

Technical Specs

Q: Is a transfer switch required to be installed with a PWRcell Battery Energy Storage System?

A: The system can be installed with a protected loads panel and has an internal transfer mechanism to isolate from the utility in the event of a power outage, no external transfer switch required. A transfer switch is required when installing a whole home backup solution.

Q: Does the system support PV operation when the grid is off-line?

A: Yes, since the solar and battery are DC-coupled, the system can isolate from the utility and continue to provide power to a protected loads panel in the event of a utility power outage.

Q: Is any rapid shutdown built in?

A: When paired with a suitable PV rapid shutdown initiator, the PV Link achieves string-level rapid shutdown requirements and the SnapRS product achieves module-level rapid shutdown requirements.

NOTE: For Generac recommendations for PV rapid shutdown initiation options, please refer to Rapid Shutdown Applications Note DAPP00002 for more information. [This document is currently available on our website]

Q: Can the PWRcell Battery Energy Storage System expand beyond the single 18 kWh battery cabinet?

A: Yes, the system is currently designed to parallel up to 2 battery cabinets for a total usable capacity of 36 kWh of energy.

Q: How many hours or days can the PWRcell Energy Storage System provide power without needing to be recharged?

A: The runtime of the battery is highly dependent on what loads are on at any given time. If we assume that a 1500sq ft house has an average load of 1.5kW, then a 17.1kWh system would last for a little over 11 hours. Once the sun starts shining, it will support the loads and recharge the batteries.

Appendix A Definitions

The following is a limited definition of terms and acronyms that define the technology used with a Generac PWRcelll system. Understanding these terms is important for proper and successful diagnosis of connectivity issues.

Term / Acronym	Description
AC-Coupling	Commonly refers to an energy storage system being wired to the AC side of a solar output.
Black Start	To manually enable the battery and energize REbus using the battery disconnect switch—typically done when no utility grid power is available.
Black Start Battery	The small 12V lead/acid battery located left-center on the Battery Management Unit (BMU). Required for performing a system black start.
DC-Coupling	Commonly refers to energy storage being wired to the DC side of an inverter along with PV power from the solar array.
DCB	Panasonic Battery Module
DHCP	Dynamic Host Configuration Protocol
High-Voc	Typically refers to 96 cell type solar panels (as opposed to lower Voc of 60 cell type solar panels).
MC4	Common connectors for connecting solar panels and other components in a solar array.
MPPT	Maximum Power Point Tracking
Parallel Circuit	Components are connected between the same set of electrically common points (e.g. positive gets connected to positive and negative gets connected to negative). Current flowing through each component will increase to be the sum of each component, while voltage will remain the same across the circuit.
PLM	Power Line Modem
Protected loads	House or building loads that will be isolated from the grid and energized by the PWRcell system during an outage.
PV	Abbreviation for photovoltaic. Commonly used as shorthand to describe power from solar panels.
PV Link Optimizers	Generac's substring solar optimizers—DC to DC converters that optimize for MPPT, detect arc fault/ground fault, and facilitate the PVRSS.
PVRSS	Photovoltaic Rapid Shutdown System
Racking	Metal rails mounted on a roof or ground mount to hold solar panels
RCPn	REbus Control Protocol Number
REbus	Renewable Energy bus—Generac's patented bi-directional DC bus for PWRcell equipment.
REbus Home run	A set of three wires (positive, negative, and ground) landed at one of the four DC disconnects at the inverter. May be wired to one battery or up to three PV Links on the other end.
Series Circuit	Components are connected end-to-end to form a single path for current to flow. Current flowing through each component will remain the same, while voltage will increase to equal the sum of the voltages across each component.

SnapRS	Normally open frequency controlled switch used to achieve module-level shutdown for the PVRSS
String	One REbus home run and up to three paralleled substrings (three PV Links each with their own substrings connected in parallel to one home run).
Substring	A grouping of solar modules wired to the PV input of one PV Link
Voc	Open circuit voltage

Appendix B Inverter

Menu System Navigation

The PWRcell system is controlled through the PWRcell inverter control panel. The inverter control panel is used for adjusting system settings and for interacting with devices.

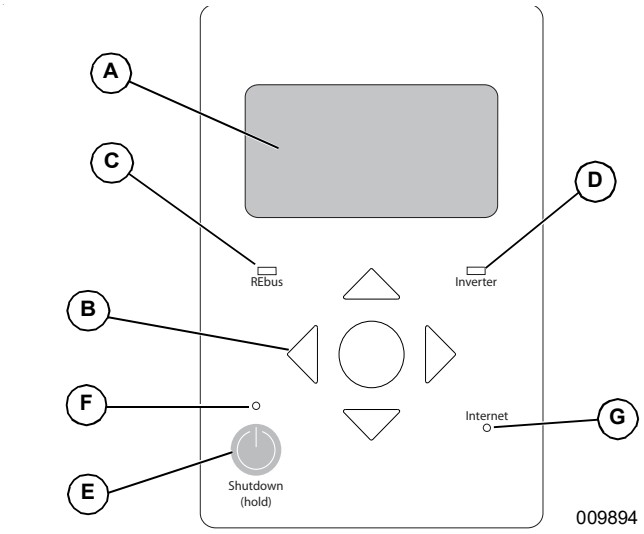


Figure B-1. Inverter Control Panel

- **A** LCD display
- **B** Navigation keys
- **C** REbus status LED
- **D** Inverter LED
- **E** Shutdown
- **F** Shutdown LED
- **G** Internet LED

REbus Status LED

REbus Status LED (C) communicates REbus nanogrid status through LED color.

LED Color	Rebus Status
Green	All devices are enabled and functioning normally on REbus.
Yellow	One or more devices are disabled, or no devices are detected.
Red	A serious fault has been detected on a device or the REbus wiring.

Inverter LED

Inverter LED (D) communicates the status of the utility grid and / or inverter through LED color and state.

LED Color	Inverter Status
Green	Utility is connected and within normal operational voltage and frequency.
Green Blinking	Inverter is in Island Mode due to a utility service interruption. Utility is not within normal operational voltage and frequency.
Yellow	Inverter is disabled or powering up.
Yellow Blinking	Inverter is waiting to connect to the grid, in the process of connecting to REbus, or waiting to connect to REbus.
Red	Inverter is overloaded, or a serious fault has been detected on the inverter. Manual intervention is likely required before the equipment will resume operation.
No Light	Inverter is powered down.

Adjusting Inverter Settings

1. Navigate to the inverter device page using the right arrow key (next page right of the home screen).
2. Push the center button.
3. Select Mod. Settings using the down arrow to scroll and the center button to select.
4. Scroll through the settings using the up/down arrow keys.
5. Use the center button to select a setting.
6. Use the up/down arrow keys to change the value of a setting.
7. Use the center button to deselect a setting.
8. Scroll down and save all changes before exiting the Mod. Settings menu.
9. Select Mod. Settings again to verify changes were saved.

Table B-1. Inverter Settings

Setpoint	Range	Default	Description
PLM_Channel	0 – 12	1	Channel for REbus communications. All devices in a system must use the same channel (except REbus Beacon). Do not set equipment to channel 0 unless performing ***Commissioning Multiple Inverter Systems***.
TargMaxImprtP	-30,000 to +30,000 Watts	0	Maximum Threshold for importing power before the battery will discharge in Self Supply Mode to offset.
TargMinImprtP	-30,000 to +30,000 Watts	0	Minimum power import maintained by charging the battery from the grid in Self Supply Mode.
EnaIslanding	on / off	on	Allows system to go into island mode, providing backup power during a utility service interruption. Turn this setting off for PV only installations.
NumTranSwtchs	0 / 1 / 2	0	Defines the number of external automatic transfer switches installed and enables transfer switch controls. For AC Coupled PV, this must be 1.
ExtTransVolt	80 – 140 Volts	95	Minimum voltage from the utility that must be present for the inverter to reconnect back to the grid. If an ATS is installed, this will be the voltage required for the inverter to control the ATS back to the normal (utility) position.
ExportOverride	on / off	off	Formerly called Zero Export, this setting will inhibit the PWRcell system from exporting power to the grid. This setting is for temporary use and will not satisfy CRD200 Import Only Compliance. See ***Export Override***.
CalOverride	on / off	off	Overrides inverter logic for automatic detection of included Generac current transformers (CTs).
CTTurnsRatio	1,500 – 3,000 Turns	1,500	Allows a different turns ratio to be set for specific CTs.
EnaLoadShed	0 / 1 / 2	0	Select 1 if using SMM devices to shed loads. Select 2 if using the PWRcell ATS Controller to shed loads (with or without SMMs).
GridParInvrtrs	1 – 2	1	This setting allows for two inverters to share one set of CTs. Set to 2 if daisy chaining CTs between two inverters.
ACPVPower	0 – 7.6 kW	0	Power rating of the attached AC coupled PV array. If no AC coupled PV array is attached leave at 0. Set this value to the cumulative power rating of all AC coupled PV systems connected to this inverter. This value must not exceed 7.6 kW. An incorrect higher value will result in insufficient charging of the batteries, an incorrect lower value will result in the possibility of an over-voltage event.
GenPower	0 – 24 kW	0	Reserved for future functionality.
GenCtrlMode	0 / 1 / 2	0	Reserved for future functionality.

Commissioning the System

NOTE: See the Generac PWRcell Commissioning Quick Start Guide for more information.

Before powering up the system for the first time:

- Verify AC voltage is within the specified range for system configuration.
  – 240 V split-phase (110-128 VAC Line to Neutral)
  – 208 V 3-phase (110-128 VAC Line to Neutral)
- Verify all wiring terminations are tight and secure.
- Verify DC wiring field terminations are secure and polarity is correct.
- Verify DC disconnects for all connected devices are turned ON.

Commissioning Steps:

1. Connect to High Speed Broadband Internet.
2. Register System.
3. Connect PWRcell Inverter to AC Power.
4. Select Inverter System Mode.
5. Configure Inverter Settings.
6. Enable REbus Devices.
7. Test Island Mode.
8. Configure Time of Use (optional).
9. Access Installer Configuration Tool (for steps 10 – 11).
10. Set Inverter Grid Compliance (optional).
11. Set Import / Export Compliance (optional).

Commissioning Multiple Inverter Systems

NOTE: Do not energize two or more inverters before commissioning. Energizing two or more inverters prior to commissioning will result in cross-talk.

PWRcell inverters are manufactured with some common default parameters. One of these default parameters is the default Power Line Modem (PLM) channel. PWRcell inverters use the PLM channel to communicate with and send commands to REbus-powered devices. In this way, a PWRcell inverter behaves like a master device. If two or more master devices are communicating on the same PLM channel, REbus devices become unable to respond properly to the intended master device and the master devices will attempt to provide control for the other, often leading to communication and reporting issues. This is referred to as cross-talk.

How to identify PLM Cross-talk

Cross-talk can be easily identified by navigating to the device pages on an inverter control panel. If two inverter device pages exist, or if devices connected to one inverter show up on the other, cross-talk has occurred.

NOTE: To differentiate one device page from another, confirm the RCP numbers via the device page sub-menu.

NOTE: It is recommended to keep a list of which REbus devices are connected to specific inverters at multi-system sites.

Multiple Inverter System Pre-Commissioning Checklist

Before commissioning multiple inverter systems, confirm the following:

- Inverter systems (including PV Links and PWRcell batteries) have been installed per manufacturer instructions and to local and state code requirements.
- PWRcell batteries have their Battery Disconnect switches in the OFF position.
- PWRcell inverters are de-energized with no voltage present at their AC Grid input terminals. Use an appropriately rated digital multimeter (DMM) to verify if AC voltage is present at the AC Grid terminals.

NOTE: To determine if the inverter is de-energized, check the inverter control panel and the system backfeed breaker. If de-energized, the inverter control panel will be powered off and the inverter backfeed breaker will be OPEN.

Multiple Inverter System Commissioning Procedure

NOTE: Throughout this process, it is important that only one inverter is energized at any time. If two or more inverters are energized at any point during this process, the inverters will cross-talk. To resolve cross-talk, see ***PLM Cross-talk Recovery Procedure***. After resolving cross-talk, the commissioning process will need to be restarted for the cross-talked inverters.

1. Close the AC backfeed breaker to supply AC power to one PWRcell Inverter AC Grid Input/Output Terminals. This will allow the inverter to energize and illuminate the Inverter control panel.
2. Perform ***Commissioning Multiple Inverter Systems*** steps 1-8.
3. Modify the PWRcell inverter PLM Channel to 0.

NOTE: PLM Channel 0 is a catchall channel. Only use for inverters during programming. Do not set REbus devices to channel 0. Do not leave inverter on channel 0.

4. Choose a channel from 2–12 to use as the only number for addressing all devices on the system. The goal is to address the system to its own unique channel across all devices.

NOTE: Do not leave any device, including the inverter, on channel 0 or channel 1 by the end of the process.

5. Use arrow keys to navigate to all REbus devices (expect REbus Beacon) to change the PLM channel.
6. Access Mod. Settings for each device and change the PLM channel to the chosen channel (step 4) for that system. See device installation manual for specific instructions.
7. Modify the PLM channel setpoint for the PWRcell inverter to match the PLM channel its REbus devices were set to in the previous step.

NOTE: Be sure to click Save at the bottom of the menu after modifying the channel on each device.

8. De-energize inverter. Once the inverter is de-energized, repeat steps 1–7 for the next system.

NOTE: It may take a few seconds for the inverter screen to power off due to capacitance in the power core. Wait until the screen goes blank before energizing the next inverter system.

9. After programming each system separately, re-energize all PWRcell inverters by closing their AC Grid backfeed breakers, enable the inverters, and all REbus devices.

PLM Cross-talk Recovery Procedure

For each PWRcell Inverter that has cross-talked, perform the following procedure to clear the foreign devices from the display:

1. De-energize all but one inverter.
2. Access the Installer Configuration Tool using the instructions below.
3. Navigate to the ‘Inverter’ using the Installer Tool and select PWRcell Configuration.
4. Select Clear Display to wipe the screen of that inverter of unwanted devices from other systems on site.
5. Follow steps 1- 8 for Multiple Inverter System Commissioning. See ***Multiple Inverter System Commissioning Procedure*** for more information.
6. Proceed to next cross-talked inverter and repeat the procedure.

Appendix C CTs

Table C-1. Automatic Detection Troubleshooting Table

Event Name	Event Code	Description
ct cal = 1	0x8061	Line 1 doesn't have a valid CT calibration
ct cal = 2	0x8062	Line 2 doesn't have a valid CT calibration
ct cal = 3	0x8063	Line 1 & 2 don't have a valid CT calibration
ct cal = 4	0x8064	Line 3 doesn't have a valid CT calibration
ct cal = 5	0x8065	Line 1 & 3 don't have a valid CT calibration
ct cal = 6	0x8066	Line 2 & 3 don't have a valid CT calibration
ct cal = 7	0x8067	Line 1 & 2 & 3 don't have a valid CT calibration
ct cal = 9	0x8069	Line 1 has multiple CTs on it (or a CT is on the neutral wire)
ct cal = A	0x806A	Line 2 has multiple CTs on it (or a CT is on the neutral wire)
ct cal = B	0x806B	Lines 1 and 2 have multiple or missing CTs on them (or a CT is on the neutral wire)
ct cal = C	0x806C	Line 3 has multiple CTs on it (or a CT is on the neutral wire)
ct cal = D	0x806D	Lines 1 & 3 have multiple or missing CTs on them (or a CT is on the neutral wire)
ct cal = E	0x806E	Lines 2 & 3 have multiple or missing CTs on them (or a CT is on the neutral wire)
ct cal = F	0x806F	Lines 1 & 2 & 3 have multiple or missing CTs on them (or a CT is on the neutral wire)
ct cal success	0x8070	Calibration was successful

Table C-2. CT Setpoints

Setpoint	Behavior	Default	Units
CalOverride	• Overrides CT calibration. • When set to OFF, the inverter detects the CTs number and direction of CTs. • A value of ON assumes a specific orientation and direction of CTs.	OFF	N/A
CTTurnsRatio	• Turns ratio of the CTs installed. • Default turns ratio of 1,500 is compatible with included clamp type CTs. • If installation restriction requires larger accessory CTs, set point shall be adjusted to 3,000. Verify turn ratio of CTs before modifying this setting.	1,500	Turns
GridParInvtrs	• Allows two inverters to share one set of CTs. • If set to "1", only one inverter should be using a single set of CTs. • If set to "2", two inverters can share one set of CTs.	1	N/A

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Appendix D PV Link

Table D-1. PV Link Settings

Setpoint	Range	Default	Description
PLM Channel	1-12	1	Channel for REbus communications. All devices in a system must use the same channel (except REbus Beacon).
Vin Startup	60-135 Volts	135	Minimum input voltage from the PV substring for the PV Link to make power.
String Count	1-2	1	Number of substrings plugged into the input of a PV Link. Set to a value of 2 if paralleling two substrings for 96 cell type solar panels.
Enable PVRSS	on/off	off	Enables the photovoltaic rapid shutdown system (PVRSS). Turn this setting on by selecting to 'Enable w/PVRSS' if SnapRS are installed.
SnapRSInstalled	0-10	0	This is the number of SnapRS that are counted and stored upon the first successful count of SnapRS.
SnapRSDetected	0-10	0	This is the number of SnapRS that are detected after each subsequent count. Counts occur daily. This count is not user adjustable.
Override PVRSS	on/off	off	This setting overrides the PVRSS, closing the SnapRS devices without requiring a count. Do not leave override 'on.' Use only for troubleshooting purposes.

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Appendix E Battery

Table E-1. Battery Settings

Setpoint	Range	Default	Description
PLM Channel	1-12	1	Channel for REbus communications. All devices in a system must use the same channel (except REbus Beacon).
MinSoCAbs	0-20%	2	Minimum state of charge (SOC) absolute. This is the percentage of charge the battery will discharge to while the system is islanded.
MinSoCAbs	10-100%	100	Maximum state of charge (SOC) absolute. This is the percentage of charge the battery will charge to.
MinSoCRsrv	0-90%	30	Minimum state of charge (SOC) reserve. This is the percentage of charge the battery will discharge to using Self Supply Mode.
MinSoCRsrv	10-100%	100	Maximum state of charge (SOC) reserve. Allows system to manage battery capacity by prioritizing where PV power goes. When battery SoC reaches this value, PV power is diverted from charging the battery to powering local loads.
DschgCurLim	0-35 Amps	35	The battery stack will discharge to the BMU up to this current limit.
ChgCurLim	0-35 Amps	35	The battery stack will charge up to this current limit.
Sleep Time	1-720 Minutes	60	Length of time the battery will sleep for upon reaching its MinSocAbsl while islanded. Battery will periodically wake up on this interval to power search.
PowSrch Time	10-900 Seconds	240	Length of time the battery will wake up from sleeping to search for PV power on REbus for charging.
Module Vset	40.0-55 Volts	46.5	Voltage level the battery will drain its modules to upon initiating the Vset procedure. See ***Vset to Equalize Battery Module Voltages***.

Battery Status LED

Table E-2. Battery Status LED (On Battery Cabinet)

LED Color / Interval	LED	Battery Status
Orange, solid	●	Disabled
Orange, strobe (2s)	●	Waiting
Green / Orange, alternating	●●●●	Initializing
Green, solid	●	Charging
Green, rapid blinking (0.5s)	◆	Discharging
Green, strobe (2s)	◆	Standby
Red, rapid blinking (0.5s)	◆	Error
Red, strobe (8s)	◆	Sleeping

Module Status LED

Table E-3. Module Status LED

State	LED	Description
Standby	●	Orange ON
Ready	●	Green ON
Discharging	◆	Green Blink (2Hz)
Charging	◆	Green Blink (1Hz)
Full Charge	●→◆	Green ON [3 sec] Blink (1Hz) [1 sec]
Alarm	●	Red ON
Error	◆	Red Blink (2Hz)
Shutdown	○	OFF

Module SOC LED

Table E-4. Module SOC LED

State	LED	Description
80.1–100	●	Green ON
60.1–80	◆	Green Blink (1Hz)
40.1–60	●	Orange ON
20.1–40	◆	Orange Blink (1Hz)
10.1–20	●	Red ON
0–10	◆	Red Blink (1Hz)
Shutdown	○	OFF

Battery Wiring Sequence Diagrams

- **A** Gray CAT5
- **B** Blue CAT5
- **C** Orange CAT5
- **D** Black CAT5 Jumpers
- **E** Empty Com Out Port

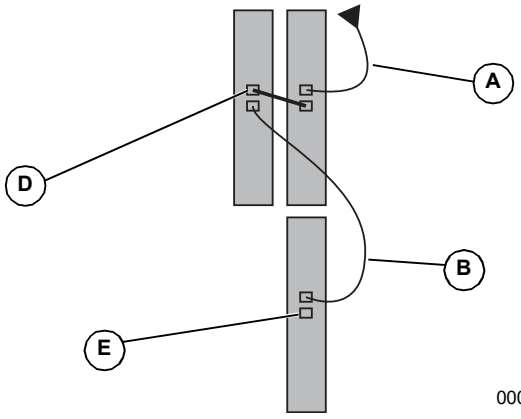


Figure E-1. Battery Comms Wiring Diagram - 3 DCBs

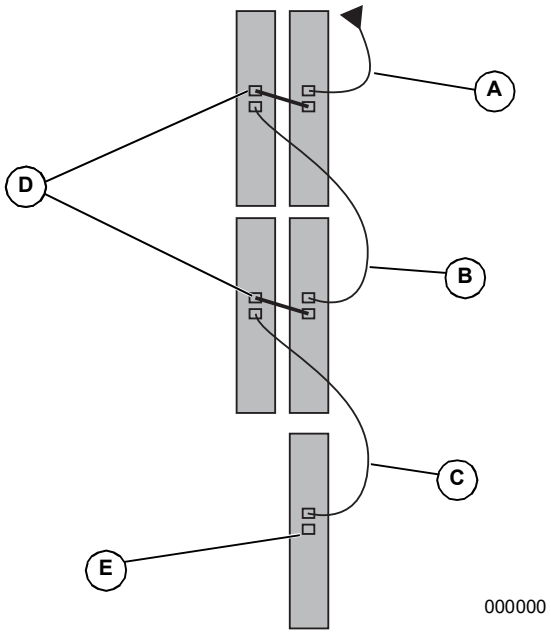


Figure E-3. Battery Comms Wiring Diagram - 5 DCBs

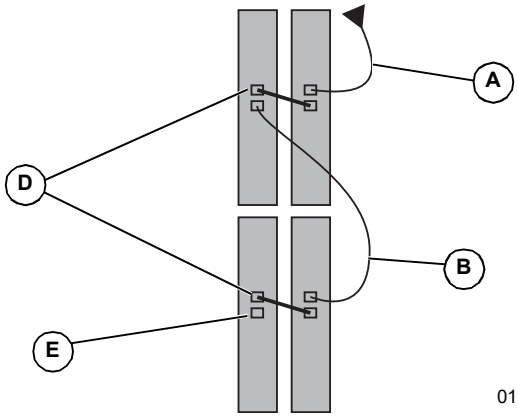


Figure E-2. Battery Comms Wiring Diagram - 4 DCBs

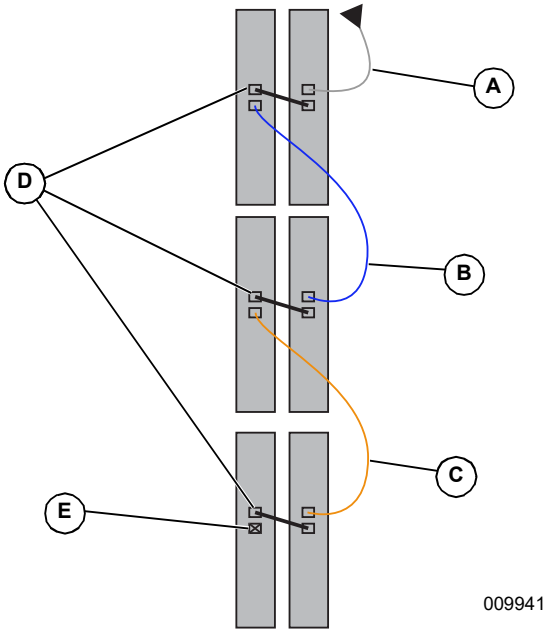


Figure E-4. Battery Comms Wiring Diagram - 6 DCBs

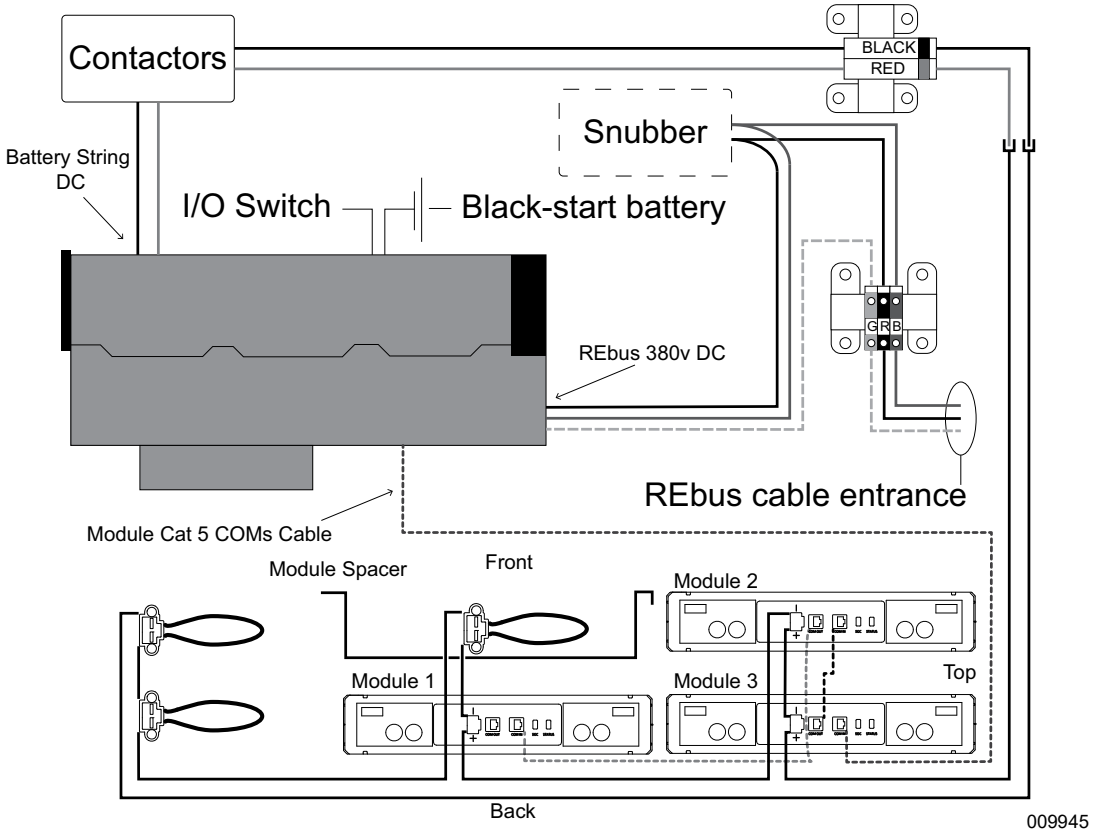


Figure E-5. Battery Power Wiring Diagram - 3 DCBs

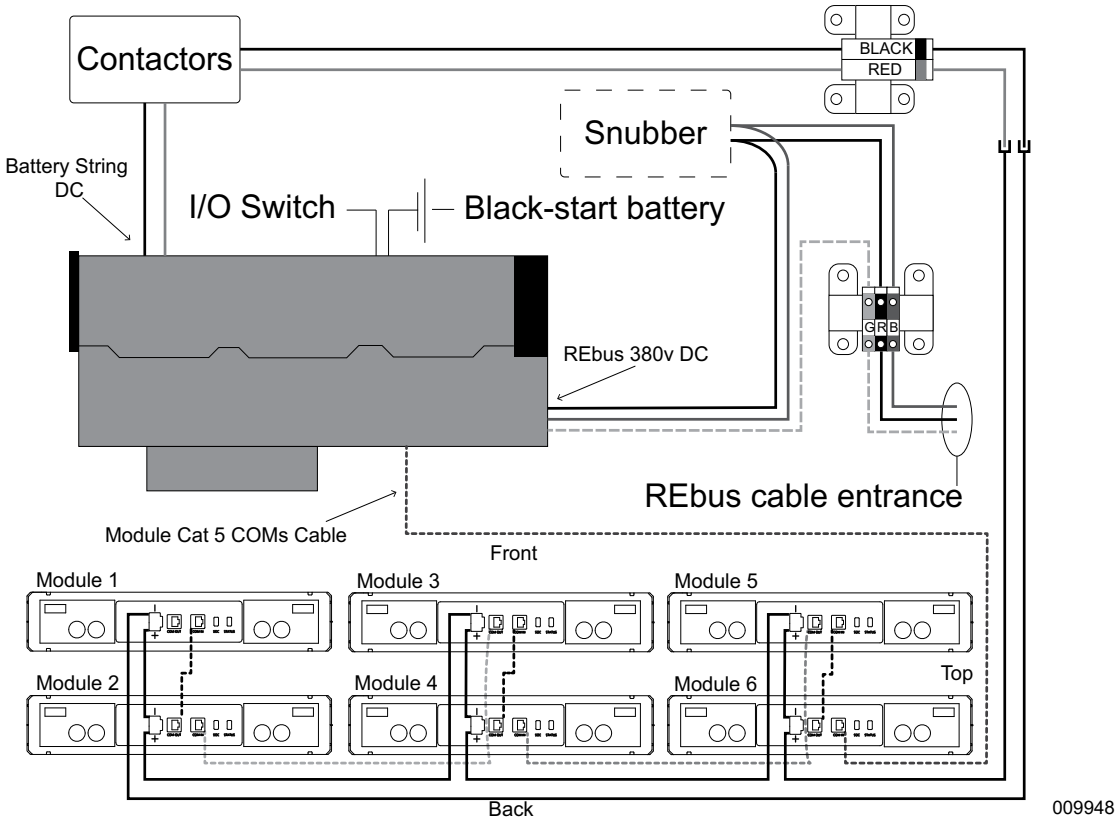


Figure E-6. Battery Power Wiring Diagram - 6 DCBs

Vset to Equalize Battery Module Voltages

Improper cell balance leads to lower power capacity of a PWRcell system. When adding a new battery module to an existing PWRcell system all of the module voltages must be equalized.

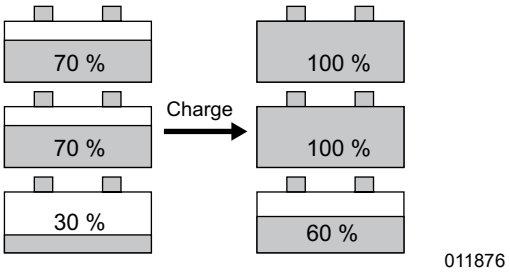


Figure E-7. Improper cell balance leads to lower power capacity of the system

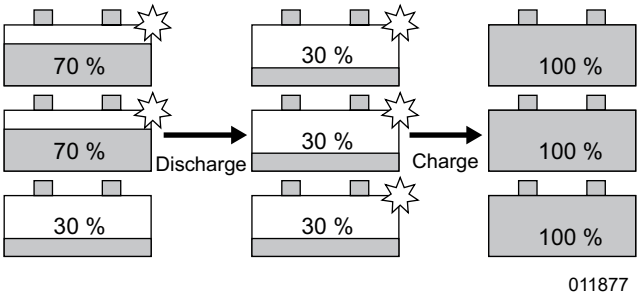


Figure E-8. Proper cell balance ensures maximum power capabilities from system

Using Vset Function

NOTE: Perform Vset before installing new modules.

NOTE: To perform Vset, the existing battery modules must be at higher voltages than the new modules. Vset procedure works by discharging existing battery modules to match new module voltage(s).

1. Ensure inverter system is set to Priority Backup or Clean Backup system mode.
2. Prior to installing, measure the voltage of each new battery module at the module main power terminals using a digital multimeter and record the voltage values for each.

NOTE: If installing more than one module, where those module's voltages differ by more than 300 mV (0.3 Volts) from each other, perform the Vset procedure individually for each module to ensure proper cell balancing.

3. Navigate to the PWRcell Battery device page and press the center button to access the main menu; then select 'Mod. Settings.'
4. Navigate to the last setting, 'Module Vset', and select using the center button.
5. Enter the voltage value measured from the new module(s) if different from the default value and 'Save' changes.
6. From the PWRcell Battery device page, press the center button.
7. Select 'Start Vset' from the PWRcell Battery main menu.
8. The battery will start discharging. Look for the Battery Status LED to be green, rapid flashing.

NOTE: The system will automatically stop discharging and disable the battery once the existing modules discharge to the voltage set.

9. Once Vset has finished, check existing module voltages at their module main power terminals with a digital multimeter to ensure they match the voltages of the new module(s).
10. Add the new battery module(s) to the stack by connecting the battery power harness and appropriate CAT5 communication cables. See **PWRcell Battery Installation and Owner's manual** for more information.

Maximizing Battery Capacity After Upgrade

To maximize battery capacity after adding new battery modules, allow the battery to charge to 100%. Leave the system set to Priority Backup or Clean Backup system mode for several days to allow the battery cells to balance.

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Appendix F State and Event Codes

PWRcell™ Inverter State and Event Codes

Valid for HW Versions 1002, 1010 FW Version 13590

Inverter States

Display texts for states will be steady and viewable on the inverter device page at the inverter control panel, unless listed below as transient.

Refer to diagnostic procedures in the right most column as necessary. Refer to the inverter section of the PWRcell Diagnostic Repair Manual for detailed descriptions of diagnostic procedures. If unable to resolve functionality, please call PWRcell Technical Support at 1 (855) 635-5186.

Faults: Low = low impact to performance, device will recover; Med = noticeable impact to performance but still recoverable; High = high impact to performance or could render device inoperable - device will try to recover.

Errors: Requires manual intervention before device can operate.

Table F-1. Inverter States

Code	Display Text	Transient/ Steady	Severity	Description	Diagnostics
0x0010	disabled	Steady	Normal	Inverter is disabled	N/A
0x0020	e-stop active	Steady	Normal	The ESTOP is active and inhibiting the inverter	- Close ESTOP circuit - Exit shutdown mode
0x0100	initializing	Transient	Normal	Inverter is initializing after enable command	N/A
0x0110	powering up	Transient	Normal	Inverter is waiting on supply voltage	N/A
0x0120	connecting to REbus	Transient	Normal	Inverter is waiting on internal and external DC voltages to equalize before closing REbus relays	N/A
0x0140	testing REbus…	Transient	Fault (Med)	Inverter is determining if/ where a DC bus fault occurred	N/A
0x0200	low REbus voltage	Steady	Fault (Low)	REbus voltage too low for operation. AC power may be disconnected or mis- wired.	- Check AC Wiring - Check REbus Fuses - Check REbus Wiring - Basic Function Test
0x0200	low REbus voltage	Continued	From	Above	- Check PWRcell Battery - Check PV Links
0x0300	standby	Transient	Normal	Non-switching state Inverter is connected to the bus and ready to move power	- Check AC Wiring - Check Inverter Settings
0x0310	waiting	Transient	Normal	Inverter is waiting for internal timer to expire, or an external condition (voltage, frequency, temp) to come into specification	- Check AC Wiring - Check REbus Voltage
0x0330	heartbeat lost	Steady	Fault (High)	Inverter is waiting to detect the REbus heartbeat	- Check ICM Cable - Check Beacon USB
0x0800	connecting grid	Transient	Normal	Inverter is connecting to the grid	N/A

Table F-1. Inverter States

Code	Display Text	Transient/ Steady	Severity	Description	Diagnostics
0x0810	disconnecting grid	Transient	Normal	Inverter is connected to REbus and disconnecting from its grid connection	N/A
0x0820	grid connected	Steady	Normal	Inverter is connected to the grid	N/A
0x0830	islanded	Steady	Normal	Inverter is islanded / disconnected from the grid	N/A
0x4200	REbus over voltage	Steady	Fault (Low)	REbus is too high for the inverter to operate safely	- Check Inverter Settings - Check REbus Devices
0x7000	error	Steady	Error	General error state	- Disable / Enable
0x700F	error	Steady	Error	General error state/ inverter did not enter a state of operation	- Disable / Enable - Power Cycle - Basic Function Test
0x7510	Error: REbus fault	Steady	Error	Inverter experienced a fault on REbus and stopped moving power	- Check REbus Wiring - Check REbus Fuses - Basic Function Test - Check REbus Devices
0x7520	Error: int DC fault	Steady	Error	Inverter experienced a fault on its internal DC bus and stopped moving power	- Check REbus Wiring - Check REbus Fuses - Basic Function Test - Check REbus Devices
0x7705	Configuration Error	Steady	Error	The inverter is configured to use a transfer switch but not allowed to island	- Check Inverter Settings
0x770B	Configuration Error	Steady	Error	A 3 Phase inverter has been installed on split phase grid	- Check Inverter HW Type - Check AC Wiring
0x770C	Configuration Error	Steady	Error	The inverter is not configured to calibrate its CTs but is configured to enforce Export Override, which requires CTs	- Check Inverter Settings
0x7710	Bad Reset Error	Steady	Error	The inverter experienced a bad reset error after losing power or updating firmware	- Contact PWRcell Technical Support

Inverter Events

When the inverter experiences an event, or a sequence of events, it will change states accordingly. Display texts for events are transient. Display texts can be viewed at the inverter device page only at the time the event is experienced. Refer to inverter states table for troubleshooting.

To view the last known event, logon to the Installer Configuration Tool by accessing the local Wi-Fi signal from the Generac REbus Beacon. Navigate to 'Inverter' then select 'REbus Status.' To view the last four events, select 'Inverter Split Phase' and reference event codes.

Faults: Low = low impact to performance, device will recover; Med = noticeable impact to performance but still recoverable; High = high impact to performance or could render device inoperable - device will try to recover.

Errors: Requires manual intervention before device can operate.

Table F-2. Inverter Events

Code	Display	Severity	Description
0x8010	power up	Normal	Successful internal voltage power on
0x8020	Supply under voltage	Fault (High)	Internal supply voltage issue. Expected during a power cycle. Fault if it occurs during operation.
0x8030	daily event	Normal	Daily event code/ daily check-in
0x8040	firmware received	Normal	Remote firmware update received
0x8060	ct cal = success, 1, 2, 3, 4, etc.	Normal	CT calibration was manually requested- refer to inverter manual for CT calibration table.
0x8080	ct cal fault	Fault (Low)	CT calibration failed due to disconnected or broken CT
0x8100	enable	Normal	Inverter received enable command
0x8200	disable	Normal	Inverter received disable command
0x8220	external estop	Normal	ESTOP was activated and system shut down
0x8300	sysmode change	Normal	System operating mode was changed
0x8400	unauthorized sysmode	Fault (Low)	Device was asked to change to a system operating mode that may have been locked to the user
0x8FF0	hardware version mismatch	Error	Hardware version does not match firmware. Contact PWRcell Technical Support.
0x9000	interrupt fault	Error	Attempt to power cycle the inverter. If persistent, contact PWRcell Technical Support.
0x9200	int. timer fault	Error	Internal processor issue. Contact PWRcell Technical Support.
0x9300	mux Stuck	Error	Internal processor issue. Contact PWRcell Technical Support.
0x932A	relay fault	Fault (High)	The inverter was backfeeding the grid on Line 1. The hardware could be damaged, or the configuration of the system is wrong (has a transfer switch but not configured for one).
0x932B	relay fault	Fault (High)	The inverter was backfeeding the grid on Line 2. The hardware could be damaged, or the configuration of the system is wrong (has a transfer switch but not configured for one).
0x932C	relay fault	Fault (Low)	The grid frequency went out of spec while the inverter was trying to drive the relays inactive, this can happen with grid outages.

Table F-2. Inverter Events

Code	Display	Severity	Description
0x932D	relay fault	Fault (Low)	The grid frequency went out of spec while the inverter was trying to drive the relays active, this can happen with grid outages.
0x932E	relay fault	Fault (Med)	The inverter detected a voltage imbalance when trying to connect its output. This can happen if the bus cannot pre-charge correctly or if the bus is too far off from the peak grid voltage.
0x932F	relay fault	Fault (Med)	The inverter detected a voltage imbalance when trying to connect its output. This can happen if either REbus or the internal bus cannot pre-charge correctly.
0xA100	over temp shutdown	Fault (Med)	Over temperature detected within device
0xB000	REbus fault	Fault (Med)	Inverter was unable to bring up REbus- likely due to a short
0xB020	precharge fail	Fault (Med)	Could not connect to REbus- typically follows a REbus fault
0xB100	REbus over voltage	Fault (Med)	Excessive REbus voltage detected
0xB110	REbus under voltage	Fault (Low)	Insufficient REbus voltage detected
0xC000	ground fault	Error	Ground fault current detected
0xD003	grid fault	Fault (Low)	The grid-type detected does not match the grid-type that the inverter was configured for.
0xD008	grid fault	Fault (Low)	Advanced inverter grid settings table is invalid
0xD00B	grid fault	Fault (Low)	The grid appears to be open (high impedance)
0xD00E	grid fault	Fault (Med)	Inverter was unable to determine the grid type
0xD010	grid over voltage	Fault (Low)	Grid voltage went too high
0xD020	grid over current	Fault (Med)	AC over current
0xD030	grid over frequency	Fault (Low)	Grid frequency went to too high
0xD040	grid under voltage	Fault (Low)	Grid voltage went too low
0xD050	grid under frequency	Fault (Low)	Grid frequency went too low
0xD060	grid overvoltage fast	Fault (Low)	Grid voltage went too high (large, short term spike)
0xD070	grid high impedance	Fault (Low)	Grid high impedance detected
0xD111	island overload	Fault (Med)	Line 1 brownout event. Voltage on that line dropped below 96 V.
0xD112	island overload	Fault (Med)	Line 2 brownout event. Voltage on that line dropped below 96 V.
0xD113	island overload	Fault (Med)	Line 1 and line 2 brownout event. Voltage on both lines dropped below 96 V.
0xD115	island overload	Fault (Med)	Line 1 experienced an overload in current (>35A) for more than 6s. If installed, the inverter will trigger SMMs to shed loads. Otherwise, loads should be shed manually.
0xD116	island overload	Fault (Med)	Line 2 experienced an overload in current (>35A) for more than 6s. If installed, the inverter will trigger SMMs to shed loads. Otherwise, loads should be shed manually.

Table F-2. Inverter Events

Code	Display	Severity	Description
0xD117	island overload	Fault (Med)	Line 1 and line 2 experienced an overload in current (>35A) for more than 6s. If installed, the inverter will trigger SMMs to shed loads. Otherwise, loads should be shed manually.
0xD118	island overload	Fault (Med)	The inverter timed out attempting to validate hardware and exited islanding.
0xD119	island overload	Fault (Med)	The inverter timed out attempting to validate hardware due to low bus voltage and exited islanding.
0xD11A	island overload	Fault (Med)	The inverter was unable to determine whether the connection to line 1 was open or closed.
0xD11B	island overload	Fault (Med)	The inverter was unable to determine whether the connection on line 2 was open or closed.
0xE100	EEPROM failure	Error	Internal processor issue. Contact PWRcell Technical Support.
0xE200	FLASH fault	Error	Internal processor issue. Power cycle inverter. If persistent, contact PWRcell Technical Support.
0xE500	event pattern lockout	Normal	Expected behavior during normal operation
0xE600	bad reset error	Error	Internal processor issue. Contact PWRcell Technical Support.
0xE700	PLM fault	Fault (High)	Internal communication issue. Contact PWRcell Technical Support.
0xF000	default trap	Fault (High)	Internal processor issue. Contact PWRcell Technical Support.
0xF010	address error trap	Fault (High)	Internal processor issue. Contact PWRcell Technical Support.
0xF020	stack error trap	Fault (High)	Internal processor issue. Contact PWRcell Technical Support.
0xF030	osc. fail trap	Error	Internal processor issue. Contact PWRcell Technical Support.
0xF040	math error trap	Fault (High)	Internal processor issue. Contact PWRcell Technical Support.
0xF050	dmac error trap	Fault (High)	Internal processor issue. Contact PWRcell Technical Support.

Generac PV Link™ State and Event Codes

Valid for HW Version 634 FW Versions 13550, 13556

PV Link States

Display texts for states will be steady and viewable on PV Link device pages at the inverter control panel, unless listed below as transient.

Refer to diagnostic procedures in the right most column as necessary. Refer to the PV Link and SnapRS™ section of the PWRcell Diagnostic Repair Manual for detailed descriptions of diagnostic procedures. If unable to resolve functionality, please call PWRcell Technical Support at 1 (855) 635-5186.

Faults: Low = low impact to performance, the device will recover; Med = noticeable impact to performance but still recoverable; High = high impact to performance or could render device inoperable - device will try to recover.

Errors: Requires manual intervention before device can operate.

Table F-3. PV Link States

Code	Display Text	Transient/ Steady	Severity	Description	Diagnostics
0x0010	disabled	Steady	Normal	PV Link is disabled	N/A
0x0110	powering up	Transient	Normal	Initializing power supply	- If persistent call PWRcell Technical Support
0x0120	connecting to REbus	Transient	Normal	PV Link is connecting to REbus	- If persistent call PWRcell Technical Support
0x0200	low REbus voltage	Steady	Fault (Med)	PV Link is reading a low REbus voltage	- Refer to inverter low REbus voltage diagnostics
0x0310	waiting	Steady	Fault (Low)	PV Link is inhibiting without a place to send power, or a recent fault has occurred.	- If persistent call PWRcell Technical Support
0x1010	testing input	Transient	Normal	Checking for correct, balanced input voltage	N/A
0x1100	connecting input	Transient	Normal	Connecting the PV array to the PV Link	N/A
0x2010	making power	Steady	Normal	PV Link is converting power from the PV array to REbus	N/A
0x2020	limiting power	Steady	Fault (Low)	PV Link is limiting power output due to high temperature	- If persistent call PWRcell Technical Support
0x3100	low sun	Steady	Normal	PV Link does not see enough input voltage to start making power. This will happen every night.	- Check PV Panel Configurations - Check PV Link Settings - Measure Substring Voltage - Override PVRSS - Check PV Wiring - SnapRS Health Check
0x4000	ground fault	Transient	Fault (Med)	A ground fault has been detected	- Disable/ Enable - Check PV Wiring
0x4010	insulation fault	Transient	Fault (High)	An insulation fault has been detected	- Disable/ Enable - Check PV Wiring
0x4020	ground fault lockout	Steady	Fault (High)	Multiple ground faults have been detected and PV Link is locked out.	- Disable/ Enable - Check PV Wiring

Table F-3. PV Link States

Code	Display Text	Transient/ Steady	Severity	Description	Diagnostics
0x4100	arc fault	Transient	Fault (Med)	An arc fault has been detected.	- Disable/ Enable - Check PV Wiring
0x5000	test success	Transient	Normal	This is a generic test success state.	N/A
0x5010	test failure	Transient	Fault (Med)	This is a generic test failures state.	- Disable/ Enable - Check PV Link Settings
0x5020	testing AFD	Transient	Normal	PV Link is performing its self-test for arc fault detection functionality	N/A
0x5030	testing PVRSS	Transient	Normal	PV Link is performing its self-test for PVRSS functionality.	N/A
0x5040	testing GFD	Transient	Normal	PV Link is performing its self-test for ground fault detection functionality.	N/A
0x5110	PVRSS selftest failed	Transient	Fault (Low)	SnapRS count not completed in time.	- Disable/ Enable - Check PV Link Settings
0x5120	PVRSS fail: low input	Transient	Fault (Low)	PV Link unable to read array substring voltage. Will lead to “low sun” to state.	- If persistent call PWRcell Technical Support
0x5130	PVRSS count mismatch	Transient	Fault (Med)	SnapRS installed doesn't match SnapRS detected.	- Disable/ Enable - Check PV Link Settings - Override PVRSS - Measure Substring Voltage w/ SnapRS - Check PV Wiring - SnapRS Health Check
0x5140	PVRSS fail: hi input	Transient	Fault (Med)	PV Link reading high voltage based on incorrect setting. PVRSS may be configured ON without SnapRS installed.	- Disable/ Enable - Check PV Link Settings
0x5150	PVRSS fail: timeout	Transient	Fault (Med)	SnapRS count not completed in time.	- Disable/ Enable - Check PV Link Settings
0x5160	AFD selftest failed	Transient	Fault (Med)	Built-in self-test for arc fault detection failed.	- Disable/ Enable - Check PV Wiring - If persistent call PWRcell Technical Support
0x5170	GFD selftest failed	Transient	Fault (Med)	Built-in self-test for ground fault detection failed.	- Disable/ Enable - Check PV Link Settings - If persistent call PWRcell Technical Support
0x5180	PVRSS not configured	Transient	Fault (Med)	PVRSS is enabled but the installed SnapRS count is zero, or PVRSS is disabled and the installed SnapRS count is non-zero.	- Disable/ Enable - Check PV Link Settings
0x7000	error	Steady	Error	General error state	- Disable/Enable - Check REbus DC Wiring - Check PV Wiring

Table F-3. PV Link States

Code	Display Text	Transient/ Steady	Severity	Description	Diagnostics
0x7010	input over voltage	Steady	Error	PV Link input voltage was measured high out of range.	- Check PV Panel Config. - Check PV Wiring - Measure Substring Voltage
0x7300	arc fault lockout	Steady	Error	PV Link has gotten too many arc fault events in the last 24 hours and is in a locked-out state.	- Disable/ Enable - Check PV Wiring
0x7400	input reversed	Steady	Error	PV Link detected a reverse polarity on its input.	- Disable/ Enable - Check PV Wiring

PV Link Events

When the PV Link experiences an event or a sequence of events, it will change states accordingly. Display texts for events are transient. Display texts can be viewed at the battery device page only at the time the event is experienced. Refer to the S2502 PV Link states table for troubleshooting.

To view the last known event, logon to the Installer Configuration Tool by accessing the local Wi-Fi signal from the Generac REbus Beacon. Navigate to 'PV' then select 'REbus Status.'

Faults: Low = low impact to performance, the device will recover; Med = noticeable impact to performance but still recoverable; High = high impact to performance or could render device inoperable - device will try to recover.

Errors: Requires manual intervention before device can operate.

Table F-4. PV Link Events

Code	Display Text	Severity	Description
0x8010	power up	Normal	Happens on startup. If persistent call PWRcell Technical Support.
0x8021	supply under voltage	Fault (low)	Power supply measurements were out of range. PV Link will wait for valid power supply voltage to operate.
0x8030	daily event	Normal	Daily event code to show the PV Link is still communicating.
0x8041	firmware received	Normal	PV Link received firmware update
0x8102	enable	Normal	PV Link was enabled
0x8202	disable	Normal	PV Link was disabled
0x8300	sysmode change	Normal	Sysmode change to Shutdown Mode
0x8301	sysmode change	Normal	Sysmode change to Grid Tie
0x8302	sysmode change	Normal	Sysmode change to Self Supply
0x8303	sysmode change	Normal	Sysmode change to Clean Backup
0x8304	sysmode change	Normal	Sysmode change to Priority Backup
0x8305	sysmode change	Normal	Sysmode change to Remote Arbitrage
0x8306	sysmode change	Normal	Sysmode change to Sell
0x8400	unauthorized sysmode	Fault (Low)	PV Link instructed to enter an unauthorized sysmode.
0x850B	debug trace recorded	Normal	Diagnostic trace recorded in device memory
0x8FF1	hardware version mismatch	Error	The hardware version in configuration does not match with the hardware version of device firmware
0x900A	interrupt fault	Fault (Med)	May indicate an internal processor issue. Contact PWRcell Technical Support.
0x9900	transistor failure	Error	Damage to the internal switching mechanism has occurred. Contact PWRcell Technical Support.

Table F-4. PV Link Events

Code	Display Text	Severity	Description
0xA101	over temp shutdown	Fault (High)	High temperature detected by internal electronics.
0xB001	REbus fault	Fault (Low)	REbus voltage measurement was detected low out of range.
0xB011	REbus no load	Fault (Med)	PV Link was unable to push current to REbus.
0xB101	REbus over voltage	Fault (Med)	REbus voltage measurement was detected high out of range
0xB201	REbus over current	Fault (Med)	REbus current measurement was detected high out of range
0xB411	RSS fault	Fault (Med)	PVRSS self-test failed to get accurate count of SnapRS or PVRSS was misconfigured.
0xC001	ground fault	Fault (Med)	PV Link detected ground fault or was unable to verify through self-test.
0xC011	ground fault lockout	Fault (High)	PV Link detected ground fault events and is locked out for 24 hours.
0xC301	input over current	Fault (High)	PV Link measured current on PV Positive high out of range.
0xC302	input over current	Fault (High)	PV Link measured current on PV Negative high out of range.
0xC600	arc fault	Fault (Med)	PV Link detected an arc fault or was unable to verify through self-test.
0xC611	arc fault lockout	Error	PV Link detected successive arc fault events and is locked out for manual intervention. Contact PWRcell Technical Support.
0xC901	Input over voltage	Fault (High)	PV Input overvoltage, voltage measurement is sampled fast. Unit will disconnect from PV input and timeout for 1 minute before trying again.
0xE100	EEPROM failure	Error	Internal processor issue. Contact PWRcell Technical Support.
0xE200	FLASH fault	Error	Internal processor issue. Contact PWRcell Technical Support.
0xF000	default trap	Fault (High)	Internal processor issue. Contact PWRcell Technical Support
0xF010	address error trap	Fault (High)	Internal processor issue. Contact PWRcell Technical Support.
0xF020	stack error trap	Fault (High)	Internal processor issue. Contact PWRcell Technical Support.
0xF030	osc. fail trap	Error	Internal processor issue. Contact PWRcell Technical Support.
0xF040	math error trap	Fault (High)	Internal processor issue. Contact PWRcell Technical Support.
0xF050	dmac error trap	Fault (High)	Internal processor issue. Contact PWRcell Technical Support.

PWRcell™ Battery State and Event Codes

Valid for HW Versions 1217, 12171 FW Version 12940

Battery States

Display texts for states will be steady and viewable on the PWRcell Battery device page at the inverter control panel, unless listed below as transient.

Refer to diagnostic procedures in the right most column as necessary. Refer to the PWRcell Battery section of the PWRcell Diagnostic Repair Manual for detailed descriptions of diagnostic procedures. If unable to resolve functionality, please call PWRcell Technical Support at 1(855) 635-5186.

Faults: Low = low impact to performance, the device will recover; Med = noticeable impact to performance but still recoverable; High = high impact to performance or could render device inoperable - device will try to recover.

Errors: Requires manual intervention before device can operate.

Table F-5.

Code	Display Text	Transient/ Steady	Severity	Description	Diagnostics
0x0010	disabled	Steady	Normal	B-Link is disabled	N/A
0x0110	powering up	Transient	Normal	B-Link is initializing, or supply voltage is low	- If persistent call PWRcell Technical Support
0x0120	connecting to REbus	Transient	Normal	B-Link connecting to REbus	- If persistent call PWRcell Technical Support
0x0300	standby	Steady	Normal	B-Link is connected to REbus but is not charging/ discharging	N/A
0x0310	waiting	Transient	Fault (Med)	B-Link is inhibited	- Battery Disconnect Switch - Battery Fuses - Battery Power Wiring - Battery Module CAT5 wiring - Battery Module Check
0x0330	waiting: no heartbeat	Steady	Fault (Med)	B-Link is inhibited, waiting on heartbeat	- Ensure inverter is enabled
0x1100	connecting input	Transient	Normal	B-Link is connecting input to the batteries	- If persistent call PWRcell Technical Support
0x6000	charging	Steady	Normal	Battery is charging	N/A
0x6040	discharging	Steady	Normal	Battery is discharging	N/A
0x6300	cell imbalance	Steady	Fault (High)	There is a voltage or temperature imbalance between the battery cells	- Battery Module Check
0x7000	error	Steady	Error	B-Link is in an error state	- Disable/ Enable - REbus Power Cycle - Reference events

Battery Events

When the battery experiences an event, or a sequence of events, it will change states accordingly. Display texts for events are transient. Display texts can be viewed at the battery device page only at the time the event is experienced. Refer to battery states table for troubleshooting.

To view the last known event, logon to the Installer Configuration Tool by accessing the local Wi-Fi signal from the Generac REbus Beacon. Navigate to 'Battery' then select 'REbus Status.'

Faults: Low = low impact to performance, the device will recover; Med = noticeable impact to performance but still recoverable; High = high impact to performance or could render device inoperable - device will try to recover.

Errors: Requires manual intervention before device can operate.

Table F-6.

Code	Display Text	Severity	Description
0x8007	unknown event	Normal	B-Link microprocessor reset
0x800F	unknown event	Fault (High)	B-Link is in undefined state/misconfigured state
0x8011	power up	Normal	B-Link powered up
0x8020	supply under voltage	Fault (Med)	Power supply measurements were out of range. B- Link will wait for valid power supply voltage to operate.
0x8030	daily event	Normal	Daily event code to show the battery is still communicating
0x8040	firmware received	Normal	B-Link received firmware update
0x8100	enable	Normal	B-Link was enabled
0x8200	disable	Normal	B-Link was disabled
0x8220	external estop	Normal	B-Link external E-stop was activated
0x8300	sysmode change	Normal	B-Link sysmode change
0x8330	heartbeat lost	Fault (Med)	B-Link lost the heartbeat and will not move power until it returns
0x8400	unauthorized sysmode	Fault (Med)	B-Link current sysmode is invalid
0x8FE0	SPT error	Fault (Med)	B-Link has mismatched setpoint versions
0x8FF0	hardware version mismatch	Fault (High)	The hardware version in configuration does not match with the hardware version of device firmware.
0x9000	interrupt fault	Fault (Med)	False positives may be associated with turning the battery disconnect switch off while running, otherwise may indicate an internal processor issue. Contact PWRcell Technical Support.
0xA100	over temp shutdown	Fault (Med)	The B-Link measured a high temperature
0xA110	fan failure	Fault (Med)	The B-Link fan has failed to operate when it should
0xA200	miswiring	Fault (Med)	The B-link noticed an anomaly in voltage/ current measurement compared to its expected wiring state

Table F-6.

0xB022	precharge fail	Fault (Med)	Pre-charge failed
0xB103	REbus over voltage	Fault (Med)	REbus voltage exceeded limit
0xB111	REbus under voltage	Fault (Med)	B-Link is unable to enable because it lacks sufficient bus voltage or an attempt to blackstart has failed
0xB300	internal over voltage	Fault (High)	B-Link measured internal overvoltage
0xB821	battery not ready	Fault (Med)	B-Link timed out while trying to connect input to the battery. Possible wiring issues.
0xB822	battery not ready	Fault (Low)	Unknown battery type configuration
0xB823	battery not ready	Fault (Low)	No battery modules were detected
0xB824	battery not ready	Fault (Med)	Battery communications are not functional
0xB826	battery not ready	Fault (Med)	Batteries charging or discharging is inhibited
0xB827	battery not ready	Fault (Med)	Battery temperature went too low. Shutdown and wait for temperature to come back up.
0xB830	battery connected	Normal	B-Link contactors closed successfully, and battery is connected.
0xB840	battery disconnected	Normal	B-Link contactors opened, and the battery is disconnected.
0xB850	battery under charge	Fault (Low)	Batteries went too low in SoC, will wait and attempt to reconnect.
0xB861	battery over charge	Fault (Low)	Batteries went too high in SoC, will wait and attempt to reconnect.
0xB930	BMS error	Fault (High)	Battery modules reported an error
0xC000	Ground fault	Fault (High)	Ground fault has occurred
0xC201	CSzero error	Fault (Med)	Current sensor zero is out of range
0xC301	input over current	Fault (Med)	Current input or output for the battery exceeded its limit
0xC502	input high	Fault (Med)	Battery voltage has exceeded limit
0xE601	Bad reset error	Fault (Low)	B-Link internal processor issue. Contact PWRcell Technical Support if persistent.

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