Inverter Network Connectivity
Requirements and Troubleshooting
For Network Administrators

1 Overview
The primary audience for this document is the Network Administrator of the data network that will be hosting the PV Powered. Successfully connecting an Internet appliance to a corporate network can pose challenges due to various types and levels of security policies that exist on corporate IT networks. The PV Powered Commercial inverter operates as an Internet Appliance and requires a dedicated broadband connection to post data to the PV Powered Data Center. This document is intended to provide an overview of how the inverter communicates on the network, and what the network requirements are to enable the inverter to communicate with the PV Powered Data Center.

2 Inverter Internet Device Overview
All PV Powered commercial inverters come standard with an Ethernet port that is intended to be connected to the Internet. The inverter communicates with the PV Powered Data Center using https (Port 443). Communications is one-way: The inverter only communicates out to the PV Powered Data Center. Typically the inverter will post 1-2 kb of data via web service call to the PV Powered Data Center every 15 minutes. On occasion, the inverter will post data more frequently if the inverter experiences a fault condition.

Below is a list of requirements to establish inverter communications with the PV Powered Data Center. Connectivity must be established before the registration on www.mypvpower.com is attempted.

☑ Connect the inverter Ethernet port to a hub or router. Ethernet cable must meet T-568B wiring standard and must be less than 300 ft in length.

![Ethernet Wiring Diagram]

IMPORTANT: This wiring configuration complies with T-568B standards. It’s the only one that the PV Powered supports.

OTHER WIRING CONFIGURATIONS WILL NOT WORK.

☑ Provide DHCP server access to the inverter. The inverter requires DHCP to establish its IP address.

☑ Provide a path to the Internet for https (Port 443) from the inverter. The MAC address for the inverter can be found on the Ethernet port of the PVP30kW (upper right circuit board in upper right of cabinet), and can be found on the COM card circuit board on the
PVP75kW and PVP100kW inverters (NOTE: The COM card must be removed to see MAC address on the 75kw and 100kW inverters).

- Verify connectivity by
  - checking status light (should be on solid).
    - PVP30kW: The status light is located on the power distribution board which is vertically mounted on the right side of the upper cabinet. The communications section is on the lower right corner of the power distribution board (see image below) section of the control board.
    - PVP75kW and PVP100kW: The status light is located on the front cover of the COMM card in the right side of the upper (electronics) compartment.
  - verifying that an IP address was assigned to the inverter on your network;

3 Troubleshooting

The most common connectivity problems are related to 1) wiring, or 2) corporate security settings blocking the inverter from accessing the Internet.

3.1 Wiring

Wiring problems usually are the result of a bad crimp, wire that is too long, or pinched wires somewhere between the inverter and the hub or router. PV Powered recommends use of a pre-made cable wherever possible. If a cable must be hand-crimped, we recommend testing the cable with a cable tester such as a Fluke LinkRunner™ Pro Network Multimeter (LPRO1000). Verify cable integrity by connecting a laptop to the cable at the inverter and verifying that access to the Internet can be achieved.

3.2 Network

Network problems will always require support from the corporate IT department where the inverter is installed. IT Administrators: Provide a DHCP access for the inverter with Port 443 access to the Internet.
3.3 LED Status Light Operation

All PV Powered commercial inverters include four status LED lights to help troubleshoot system operation:

1. Link – Indicates presence of a hardware Ethernet connection
2. Activity (or ACT) – Indicate internet traffic
3. Status – Indicates communication status
4. Modbus – Indicate activity on the Modbus network

Location of Status Lights

30KW inverters: The four status lights are surface mount LEDs. The LEDs are located on the power distribution board (see picture below) which is vertically mounted on the right side of the upper cabinet between the Ethernet connector and the Modbus Slave Connector. Silkscreen labels on the board indicate the name of each LED light.

75KW and 100KW inverters: The status lights can be found in two places. The primary location is the face of the communication card which resides in the card cage in the right side of the upper cabinet. The additional set of LED status lights are on the ComX board which is located in the lower section of the AC distribution cabinet inside the right side door. The four lights on the ComX board are surface mount LEDs located near the Ethernet connector (see picture below). The lights in the lower cabinet are redundant and are synchronized with those in the upper cabinet.
Link LED Operation and Signaling
The link LED will remain on if a hardware Ethernet connection is found. The LED will be off if there is no hardware Ethernet connection. There are no blink codes for the Link LED.

Activity LED Operation and Signaling
The Activity LED (called ACT on some circuit boards) will flash to indicate the presence of internet traffic. There are no fault blink codes for the Activity LED.

Status LED Operation and Signaling
During the startup sequence the Status LED will be on solid for a few seconds, then flash quickly for several seconds while the communications device looks for an internet connection. After a few seconds flashing stops whether or not an internet connection is found and then flashes more slowly while it establishes serial communication with the inverter main processor. Once serial communication is established, the Status LED should remain on unless a fault occurs.

The Status LED will flash status codes if any problem is found. Each code is comprised of a series of three flashes, followed by a pause. Each flash can be either a short or long flash. A short flash is approximately 0.2 seconds, and a long flash is approximately 0.5 seconds. The pause between flashes is 1 second. Here is a list of those status codes and what they mean.

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<th>Status</th>
<th>Flash Code</th>
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<tr>
<td>Normal Operation</td>
<td>On steady, no flashing</td>
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<tr>
<td>Serial Communication Fault</td>
<td>Short-Long-Short</td>
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<tr>
<td>DNS Failure</td>
<td>Long-Short-Short</td>
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<td>Network Connection Fault</td>
<td>Short-Short-Long</td>
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Status LED Code Descriptions

Normal operation: Inverter communications are operating normally.

Serial Communication Fault: The communication board in the inverter communicates with the main inverter processor using serial communication. If the communication board cannot establish communication with the main processor, this Serial Communications Fault code will flash. (NOTE: It is normal for this status code to flash for a few seconds during startup.)

DNS Failure: The inverter uses a DNS (Domain Name Service) server to resolve the IP address of the PV Powered database when it posts the data once every 15 minutes. If the DNS server cannot be found, or does not return a valid IP address, the DNS Failure code will flash for a minute or so while the inverter is trying to post. After a few retries, the inverter will try to force a post to a hard-coded IP address. If that post succeeds, the LED will go back to normal operation, until the next post tries to connect to the DNS server again.

Network Connection Fault: This status code will flash when the inverter cannot post data to the PV Powered database server. The Network Connection Fault status code will only start flashing after the inverter has tried to post data to the PV Powered server. The Status LED may indicate normal operation before this occurs. This can happen in the following circumstances:
  • The network cable is not connected
  • The network does not have a DHCP server, or the DHCP server did not give a valid IP address to the inverter
  • The PV Powered server is down for maintenance
  • Any other network problem that does not allow the post to make it to the PV Powered server

Modbus LED Operation and Signaling
If the inverter is connected as a slave device to a modbus network, the Modbus LED will flash quickly whenever there is activity on the network. The quick flashes will be seen even if the modbus commands are not addressed to the inverter. These quick flashes enable the installer to troubleshoot the system by verifying that communications are occurring on the network. If the inverter sees and responds to a message that is addressed to it, the flashes will be longer in duration. A series of longer (slower) flashes indicates the inverter is responding to the modbus master interrogation.

Periodic short and long flashes will be seen on a modbus network that contains multiple modbus slave devices as the communications take place. If only short flashes are seen, then check the inverter modbus address switches and make sure they correspond to the address programmed into the modbus master. Also confirm that the baud rate and other communication parameters of the modbus master are set correctly. Reference the PV Powered Modbus Addendum further details about modbus network configuration.