



# **ProHarvest PRO480-8k (HiQ TS480-8k) Inverter System Installation & Safety Manual**





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## 1. Audience

These instructions are for use by qualified electricians or other personnel. Qualified personnel must meet all local and governmental code requirements for licensing and training for the installation of 3-phase electrical power systems with AC and DC voltage up to 1000 volts. They must also be familiar with communication networks. This will require knowledge of acquiring real-time and historical data via computers and other external devices.

## 2. Safety



*IMPORTANT SAFETY INSTRUCTIONS – Please read*

### SAVE THESE INSTRUCTIONS



This manual contains important safety instructions for the ProHarvest 480V inverter system, composed of inverter model PRO480V-8k and the Communications Gateway. These instructions shall be followed during installation and maintenance of the inverter system. The inverter system is designed according to North America safety requirements. As with any electrical equipment, certain precautions must be observed when installing this equipment. To reduce the risk of personal injury and to ensure safe installation and operation, carefully read and follow all instructions, cautions and warnings in this Installation Manual.

### 2.1. Symbols Used

The following symbols describe situations or procedures or practices which if not correctly performed or followed could result in damage or destruction of the described equipment or other components attached to the described equipment, or personal injury.

Symbol	Description
	<b>CAUTION: Hazard to Equipment</b> This type of notation indicates that the hazard may cause damage to the equipment.
	<b>NOTE:</b> This type of notation indicates that the information provided is important to understanding the operation and limits of the equipment. Failure to follow the recommendations in such a notation could result in improper or failed operation.

The following symbols are used as markings on this product with the following explanations:

Symbol	Description
	<b>WARNING — DANGEROUS VOLTAGE</b> This product incorporates high voltages. All handling of and operation of this product should closely follow the instructions included.
	<b>CAUTION — BEWARE OF HOT SURFACE</b> This product may become hot during operation. Contact should be avoided.

## 2.2. General Safety Provisions, Warnings, and Precautions

- Connection of the system must be to a 3-phase AC source which is 480 Vac nominal only.
- The ProHarvest 480V inverter is provided with DC circuit protection in accordance with the requirements for ungrounded systems as outlined in NEC 690.35(C).
- These systems meet the requirements of NEC 690.11 for DC arc-fault protection.
- All electrical installations must be performed in accordance with all applicable local, state and national requirements, including ANSI/NFPA 70.
- Inverters must be provided with an equipment ground according to NEC 690.43.
- All 5 circuits (L1, L2, L3, neutral, ground) must be connected and neutral must be bonded to earth ground. Failure to do so can damage the unit and void the warranty.
- The inverter components contain no user-serviceable parts. For all repair and maintenance always contact an authorized dealer or installation partner.
- The ProHarvest 480V inverter has inputs for two separate DC strings. Reversal of polarity of one or both string inputs will irreparably damage the unit.
- Before disconnecting DC cables, use a current clamp meter to measure the presence of current. If current is present, cover the portion of the array affected (following NEC 690.18).
- The inverter system is a utility-interactive system. Before connecting any solar power system to the grid, contact the local utility company. This connection should only be made by qualified personnel.
- PV arrays produce voltages that can present an electrical shock hazard. Wiring of PV arrays should be performed by qualified personnel following all manufacturer's guidelines.
- Be aware that the body of the inverter acts as a heat sink. Under normal operating conditions, the temperature of the exterior of the enclosure can reach more than 15°C above ambient. Under extreme conditions the exterior of the enclosures can reach a temperature of 80°C. To reduce risk of burns, use caution when working with the inverter system.
- Communications Gateway AC Connection Procedures
  - To connect: Plug the AC cable into the Gateway FIRST, then plug the other end into the wall outlet.
  - To disconnect: Unplug the cable from the AC wall outlet FIRST, then proceed to disconnect the cable from the Gateway device.
- In order to maintain the integrity of the watertight enclosures, all connectors must be properly and fully engaged.
- The utility connection can suffer from repeated disturbances depending on, atmospheric effects, utility abnormalities, local loads, and the physical location. These disturbances can damage equipment. It is recommended that an appropriate surge suppressor be installed near the point of common connection with the utility.
- Before installation, carefully read all instructions, cautions, and warnings in this manual.

### 3. Introduction

This instruction manual covers the ProHarvest 480V inverter system. A summary of features and functions is shown in the table.

Item	Inverter
Grid voltage	480 Vac, Wye configuration
Nominal power	8 kW
Maximum Power Point Tracking, MPPT	Per individual string
Monitoring	Per individual string
NEMA6, waterproof	✓
Arc detection	✓
Hand-holdable	24 lb
Mounting orientation	Any
No electrolytic capacitors	✓

#### 3.1. System Overview

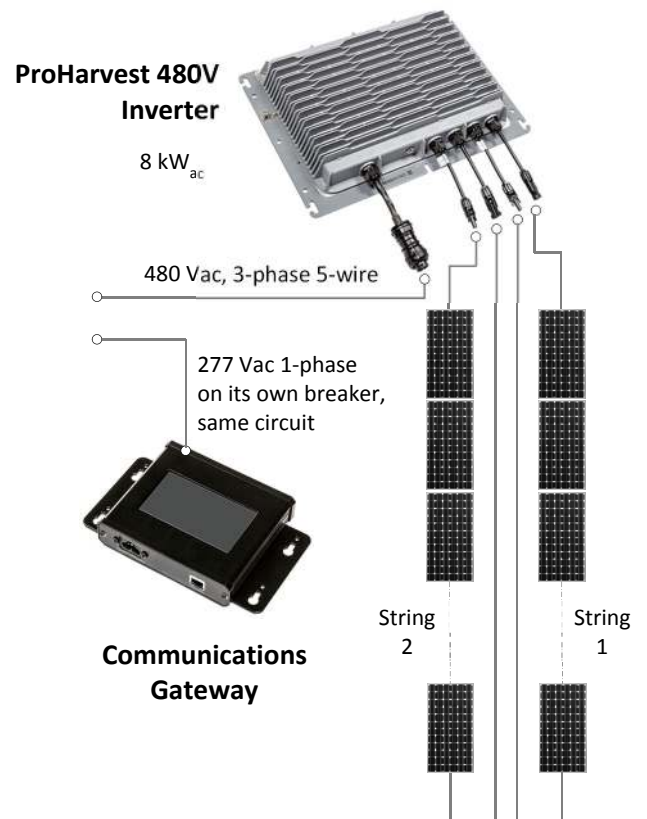
A typical layout is shown in Figure 1. Note that while the Communications Gateway provides detailed reporting and user control, it is optional. The system will generate power without it.

The ProHarvest 480V is an easy-to-install, modular system which is optimized specifically for commercial rooftop ungrounded solar array applications. Unlike other string inverters, each string is individually monitored and managed by the inverter.

The main components of the inverter system are described in the next section.

**Figure 1: System overview showing two strings of PV modules supplying a single 480 Vac inverter.**

**A Communications Gateway is shown connected to one 277 Vac phase.**




3.1.1. ProHarvest 480V Inverter

One inverter connects to up to two strings of PV modules, and in turn to the 3-phase, 480 Vac compatible utility connection on the installation site. The ProHarvest 480V inverter is shown in Figure 2. It is a non-isolated inverter for use with ungrounded DC systems.



Figure 2: ProHarvest 480V Inverter


	<p><b>NOTE:</b></p> <p>Multiple inverter outputs may be connected in parallel by a qualified electrician.</p>
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3.1.2. Communications Gateway

One Gateway module connects to a 277 Vac, 60 Hz branch that is connected to the same 3-phase, 480 Vac compatible utility connection supplied by the inverter(s). The Gateway module provides for system monitoring, logging and control. The Gateway module is shown in Figure 3 and is designed for indoor use only.



Figure 3: Communications Gateway





	<p><b>NOTE:</b></p> <p>Internet access should be provided to enable firmware updates and customer support functions.</p>
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## 4. System Ordering & Part Number Identification

A typical 8 kW system consists of:

- 1 ProHarvest 480V inverter
- 1 Communications Gateway which can be used with multiple inverters.

Inverter		
Item	Part Number	Description
 <p>Inverter, 8.0 kW, 480 Vac 3-phase</p>	ProHarvest: PRO480-8k (HiQ: TS480-8k)	Inverter with MC4-compatible connectors (1 each). MPPT per string, monitoring per string. Includes 10-year limited warranty. Does not include Gateway or AC cable. These items must be ordered separately.
<p>Inverter, 8.0 kW, 480 Vac 3-phase with RS485 communication and Aux connector</p>	ProHarvest: PRO480-8k-AUX (HiQ: TS480-8k-AUX)	Inverter with MC4-compatible connectors (1 each). MPPT per string, monitoring per string, RS485 communication and Aux connector. Includes 10-year limited warranty. Does not include Gateway or AC cable. These items must be ordered separately.
<p>System Warranty Extension to 25 years for 1 ProHarvest 480V inverter</p>	ProHarvest: PRO480-8k-W25 (HiQ: TS480-8k-W25)	Must be ordered at time of system purchase. Includes system Gateway(s).
 <p>480 Vac inverter AC Cable</p>	CBL-480A-05	5 ft. Includes 480 Vac mating connector; the other end is unterminated.
	CBL-480A-15	15 ft. Includes 480 Vac mating connector; the other end is unterminated.
	CBL-480A-30	30 ft. Includes 480 Vac mating connector; the other end is unterminated.
	CBL-480A-50	50 ft. Includes 480 Vac mating connector; the other end is unterminated.
 <p>Connector Tool Kit</p>	TOOL-KIT-1	<ul style="list-style-type: none"> <li>• AC Connector Unlatching Tool (1 each).</li> <li>• MC4-Compatible Connector Unlatching Tool (1 each).</li> </ul>
	ProHarvest: PROSPL-60 (HiQ: ACSPL-60)	AC combiner splice box, NEMA4 enclosure. Includes three gland fittings for up to three inverter AC cables. Inverter AC cables must be ordered separately.

Communications Gateway		
Item	Part Number	Description
<p>Communications Gateway</p> 	<p>ProHarvest: PROGW-A-277 (HiQ: GW-A-277)</p>	<p>GW-A Communications Gateway 277 Vac (1 each). Includes Ethernet Cable (1 each), memory card for logging and storage of results, and 277 Vac power cable.</p>
<p>Memory Card</p> 	<p>MCRD-A</p>	<p>Storage for Gateway results. Generic SD card (model and capacities supplied will vary).</p>
<p>Gateway Ethernet Cable</p> 	<p>CBL-RJ45-6</p>	<p>RJ45 8P8C plug on each end. Color and other details may vary.</p>
<p>Gateway AC Cable</p> 	<p>CBL-GW277A-6</p>	<p>Gateway 277 Vac cable with AC Plug.</p>

## 5. Design Guidelines

### 5.1. DC Stacking Ratio

The ratio of PV module STC power rating to inverter output power rating is often referred to as “Stacking Ratio.” Most PV installations are designed for a stacking ratio greater than 1, and less than 1.5. However, the only real limitation on stacking ratio for the inverter is the voltage and current limitations of the string inputs. The full power  $V_{mp}$  range for the string inputs is 425 to 850 Vdc. The specified maximum short circuit current of the DC source is 30A. Two strings with a  $V_{mp}$  of 850 Vdc and a short circuit current capability of 30A would yield a stacking ratio of almost 6.4 (6.375).

A more practical limitation is due to the power and current limits imposed by the inverter firmware. Input power is limited to 5 kW and input current is limited to 10A per string by the firmware. The total of these two strings exceeds the output power limit of 8 kW, so in reality something less than 5 kW would be harvested from each string.

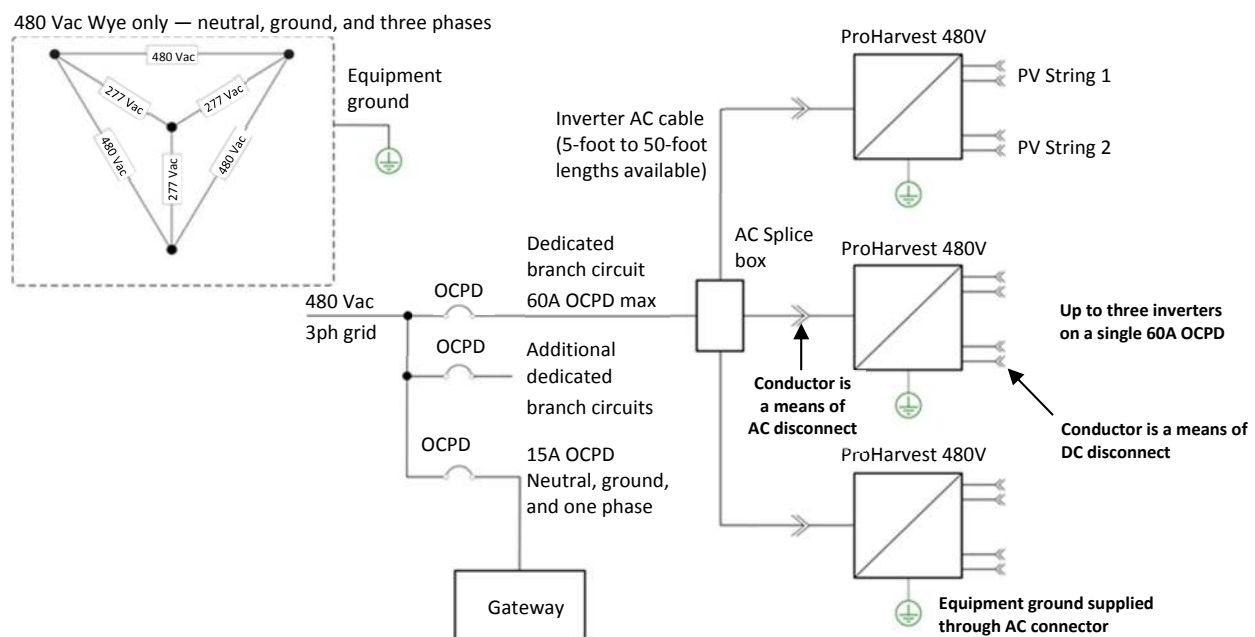
Ideal stacking ratio varies by installation. For the vast majority of installations, a stacking ratio between 1.25 and 1.5 makes perfect sense. Under some conditions (constant high irradiance) a lower stacking ratio may be preferred. A stacking ratio of 1.1 to 1.25 typically allows for energy harvest loss factors such as less than ideal module orientation, inverter efficiency losses, module soiling, module aging, etc. Nevertheless in some cases a stacking ratio of 1.5 or greater can be advantageous. For example, in the northern hemisphere a north-facing array or an east or west-facing array may justify a higher stacking ratio.

The system designer is responsible for specifying the string parameters to remain within the inverter ratings.

## 5.2. Notes on Location

The ProHarvest 480V is suitable for flat, commercial rooftops, carports, ground mounts, and other commercial installations. It may be placed using the self-ballasting metal casing, or alternatively may be attached to a PV module frame or roofing component using the provided attachment mechanisms.

A line diagram is shown in Figure 4. Note that the inverter requires a 480 Vac Wye grid configuration.



**Figure 4: Example line diagram**

- Note that up to three inverters may be connected on the same branch to one 60A OCPD if desired.
- A NEMA4 AC Splice junction box is available for use with three 480 Vac inverters if desired.

The following sections provide details on individual component placement guidelines and requirements.

### 5.2.1. Inverter Placement

The ProHarvest 480V inverter is NEMA6 rated and may be placed almost anywhere. Cooling is most efficient if the unit is mounted vertically in the shade, bolted to racking and with the connectors pointing downwards. However, any orientation is acceptable. Ideal placement is at least 1" above the roof, and with 4 to 5" clearance above the cooling fins to allow air to circulate.

Mounting hardware up to 5/16" will fit the baseplate mounting slots.

**Figure 5: Placement of the ProHarvest 480V inverter**



### 5.2.2. Gateway Placement

Internet access should be provided to enable firmware updates and customer support functions.

- The Gateway is rated for indoor installation only. Do not expose it to rain, extreme temperatures, or excessive dust. It must be mounted indoors. A utility closet or similar location physically close to the inverter system is ideal. It must be electrically connected to one of the three AC phases used by the inverter. Note that in large utility closets it is often easy to end up on an unrelated AC circuit accidentally, in which case communications are unlikely to be successful.



**CAUTION: Hazard to Equipment**

The Gateway Device is not rated for outdoor installation.

- Recommended: Add a 277 Vac outlet at the earliest entry point in the building to provide the best power line communication (PLC) signal possible. Ideally this would be a 277 Vac outlet next to the circuit breaker.
- Gateway should be protected by a 15A OCPD.
- A wired Ethernet network connection must be provided to the Gateway for proper data retrieval.
- If outdoor placement is required, the Gateway must be housed in a weatherproof enclosure.
- The Gateway has "keyhole" mountings on its baseplate. Each hole has a guide-hole above. It is intended that these four holes provide a template for mounting such that a pen or center punch can be inserted through and marks left on the wall to help accurate drilling of holes. Mounting can be performed using #8-sized screws.

**Figure 6: Gateway baseplate showing keyhole mounting and drilling guide hole.**



## 5.3. Notes on Wiring

### 5.3.1. AC Cable

The inverter AC cable has a TC-ER rating. The "-ER" signifies that the cable is sufficiently rugged to permit its use as exposed wiring, according to the NEC (section 336.10). Exposed wiring is wiring that is not installed in a tray, conduit or other raceway. It must be secured every 6 feet or less and protected from physical damage.

### 5.3.2. Grounding

The metal enclosure of the inverter must be grounded according to NEC 690.43. Equipment ground is provided through the AC connection. Optionally, grounding may be achieved also through attaching an Equipment Ground Conductor (EGC) to a lay-in lug (not provided) attached to the chassis as shown in Figure 7.

Grounding may also be achieved using the mounting bolts to any properly grounded metallic structure provided a paint-cutting washer is employed, such as a stainless steel star washer.



Figure 7: Example ground lug

### 5.3.3. Neutral

All 5 conductors (L1, L2, L3, neutral, ground) must be connected and neutral must be bonded to earth ground. Failure to do so can damage the unit and void the warranty. Note that particular care is required to ensure that an effective neutral connection is maintained when a transformer forms part of the installation.

The inverter exports power only on the “line” (hot) conductors. The neutral conductor is used solely for voltage sensing and power line communications.

### 5.3.4. Use with a Transformer

While ProHarvest inverters may be used with a transformer, care must be taken to ensure proper wiring.

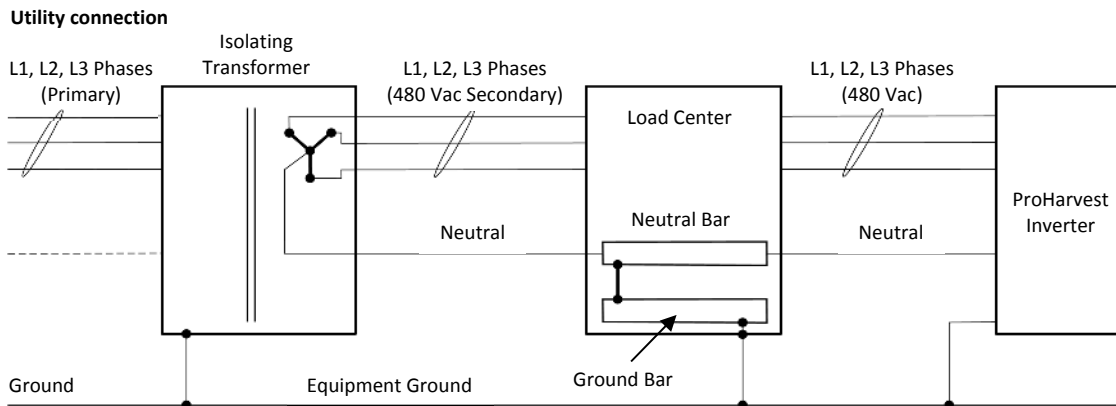


Figure 8: Use of the ProHarvest with an isolating transformer

	<p><b>CAUTION: Hazard to Equipment</b></p> <p>Neutral <b>MUST</b> be bonded to equipment ground or damage to the inverter may result.</p> <ul style="list-style-type: none"> <li>When an isolating transformer is inserted into the circuit, the neutral may lose any path to equipment ground that was provided elsewhere.</li> <li>Figure 8 shows an example where the load center bonds the neutral to equipment ground. Many other system configurations and methods are also possible.</li> </ul>
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### 5.3.5. Site Surge Suppression



	<p><b>CAUTION: Hazard to Equipment</b></p> <p>Depending on physical location, atmospheric effects, utility abnormalities, and local loads the utility connection can suffer from repeated disturbances which can damage equipment. It is recommended that an appropriate surge suppressor be installed near the Point of Common Connection with the utility.</p>
--	--

## 6. Installation

The ProHarvest 480V inverter employs industry standard connection methods. These include locking interconnects for PV module attachment, and standard 5-lead, 3-phase AC wiring compatibility. Careful adherence to these instructions is required.

### 6.1. Cautions

Make certain to follow all instructions.

	<p><b>CAUTION: Hazard to Equipment</b></p> <ul style="list-style-type: none"> <li>• The system must be connected to 480 Vac 3-phase wye 5-wire only.</li> <li>• The inverter must be provided with an equipment ground per NEC 690.43.</li> <li>• All five circuits (L1, L2, L3, neutral, ground) must be connected and neutral must be bonded to earth ground. Failure to do so can damage the unit and void the warranty.</li> <li>• The ProHarvest 480V inverter has inputs for two separate DC strings. Reversal of polarity of one or both string inputs will irreparably damage the unit. Use a voltmeter to carefully verify that the DC inputs are correct before connecting to the inverter DC inputs.</li> <li>• The Communications Gateway is for indoor use only.</li> <li>• In order to maintain the integrity of the watertight enclosures: <ul style="list-style-type: none"> <li>○ All connectors must be properly and fully engaged.</li> <li>○ Unused connectors must be sealed using appropriate weatherproof caps.</li> </ul> </li> <li>• Do not allow water to enter the AC or DC connectors or the warranty will be void.</li> </ul>
	<p><b>WARNING: Shock Hazard</b></p> <p>Before disconnecting DC cables, use a current clamp meter to measure the presence of current. If current is present, cover the portion of the array affected, according to NEC 690.18.</p>

## 6.2. Connection Outline

Connection occurs in the following order:

1. Connect an equipment ground to the inverter. This should always be done first.
2. Connect the inverter to the grid.
3. Connect the Communications Gateway to the same 480 Vac circuit as the inverter and the network.
4. Connect the PV module strings to the inverter inputs.

Disconnection uses these steps in reverse, with system ground being the last item to be disconnected.

## 6.3. Basic Connection Procedure

### 1. Ground the inverter.

Equipment ground is provided through the AC connection. Optionally, a grounding lay-in lug (not supplied) may be used (Figure 9), or the mounting method may be used if employing a paint-cutting washer such as a stainless steel star washer.



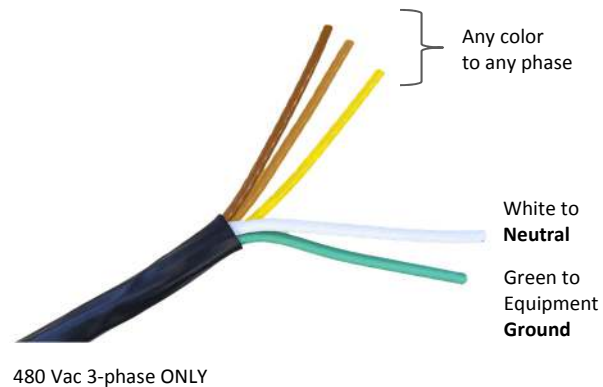
Figure 9: Example ground lug



### 2. Connect the inverter to the grid.

(a) Connect the inverter to the AC system in the usual way using the AC cable (supplied separately). See Figure 10.

This should only be carried out by qualified personnel.

Figure 10: Wiring identification on the inverter AC cable



	<b>NOTES</b> <ul style="list-style-type: none"> <li>The unit is only watertight when connectors are fully engaged.</li> <li>The inverter AC cables are TC-ER rated<sup>1</sup>.</li> </ul>
	<b>WARNING: Dangerous Voltage</b> This product incorporates high voltages.

<sup>1</sup> The “-ER” signifies that the cable is sufficiently rugged to permit its use as exposed wiring, by the National Electrical Code. Exposed wiring is wiring that is not installed in a tray, conduit or other raceway.



**(b)** Mate the male and female AC connector to connect the inverter to the AC system.

Use the AC tool to disconnect the male and female connectors. Follow steps 1 through 3 in the Disconnection section of Figure 11.

**Figure 11: Connecting and disconnecting of the inverter AC connection**



### 3. Connect the Communications Gateway.

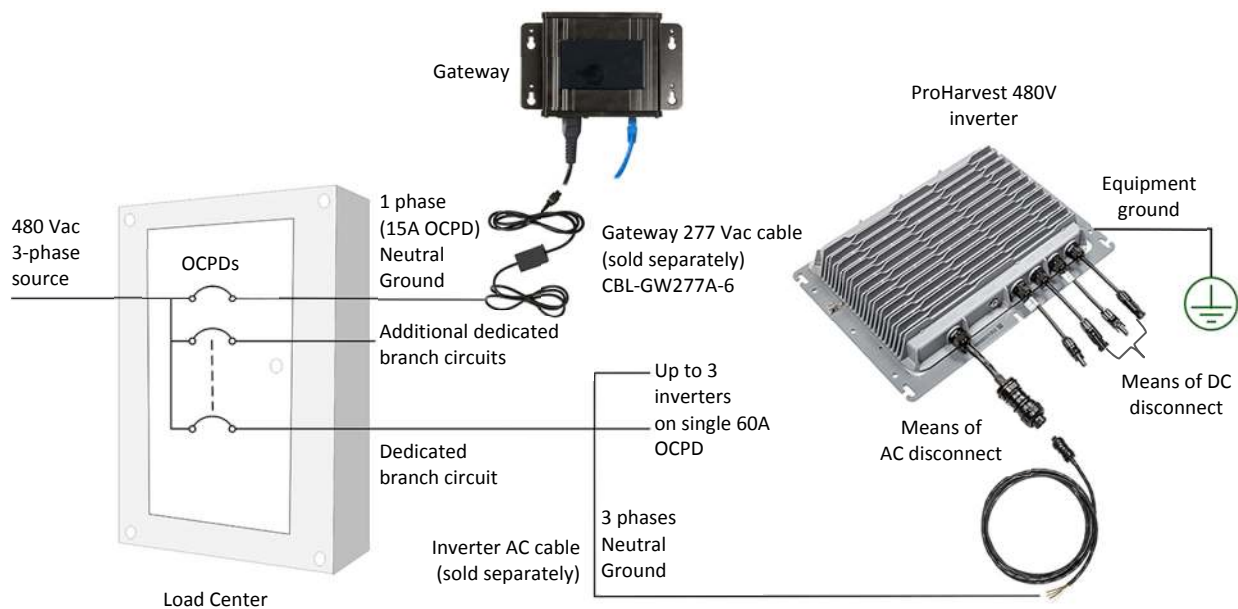


#### **CAUTION: Hazard to Equipment**

The Gateway Device is rated for indoor installation only.

**(a)** The Gateway should be **located indoors**, as near to the inverter(s) as possible for reliable communications. See Figure 12.

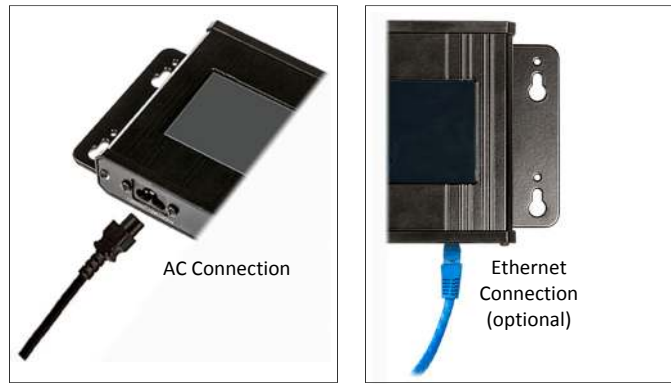
**Figure 12: Wiring of the Communications Gateway**





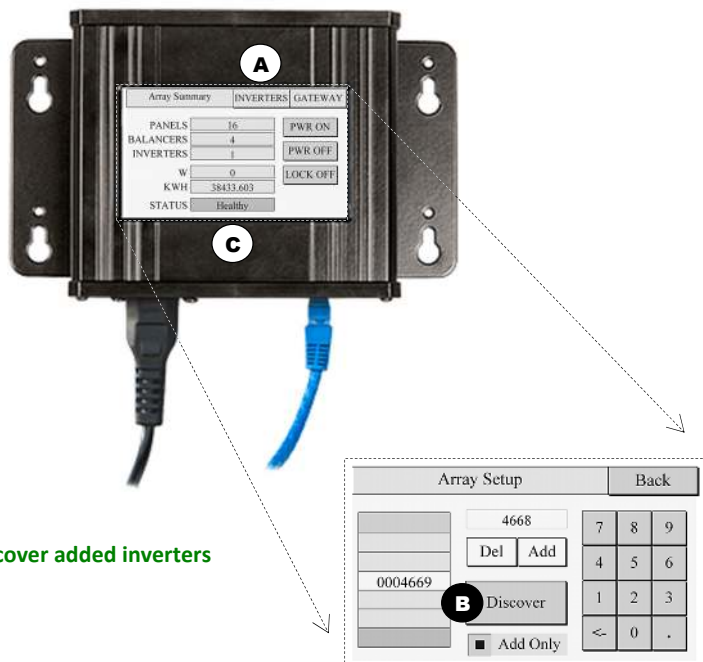
**(b)** Connect power to the Gateway using the appropriate AC cable (Figure 13). Ethernet may also be connected at this stage.

**Figure 13: Making Gateway connections**



**(c)** Turn on power to the inverter. On the Gateway screen, select the **Inverters** tab **A** at the top of the screen if the unit is not already on that tab. Press **<Setup>**, then the **<Discover>** button **B**.

The Gateway will search for all inverters. Confirm that they indicate **Healthy** status as shown in **C**.



**Figure 14: Having the Gateway auto-discover added inverters**

#### 4. Connect the strings of PV modules.

This may be done with the AC source on or off. This section assumes the source is off.

- Do not reverse the polarity of the DC inputs. This will cause irreparable damage to the ProHarvest inverter.
- All connectors must be fully mated to ensure weatherproofing.

Use the DC tool to disconnect the male and female connectors. Follow steps 1 and 2 in the Disconnection section of Figure 15.

With the AC off but PV voltage present, the inverter button will flash red and emit a short audible beep, indicating a fault. (See Table 2 on page 20.) This is normal when utility grid is not present.



**Figure 15: Connecting and disconnecting MC4-compatible module connectors**

## 5. Turn on the AC source.

This starts a 5-minute timer. When it expires, each inverter will perform a self-test and then begin generating. During the wait period, the inverter button will be solid green. (See Table 2 on page 20.) This does not apply if the system is in the **Off + Locked** state.

The **<Off + Unlock>** button **B** will unlock any inverters in the system. An individual inverter may be unlocked by pressing the inverter button three times.

To skip the 5-minute wait, press the **<Power On>** button **A**. The units will self-test and then begin generating. (See Table 2 on page 20 for the LED indications of self-test.)

Once self-test has been successfully completed, power generation begins.

For individual inverters, check the Gateway **Strings** screen using the **<Strings>** button **C** to verify all items indicate **Healthy**.

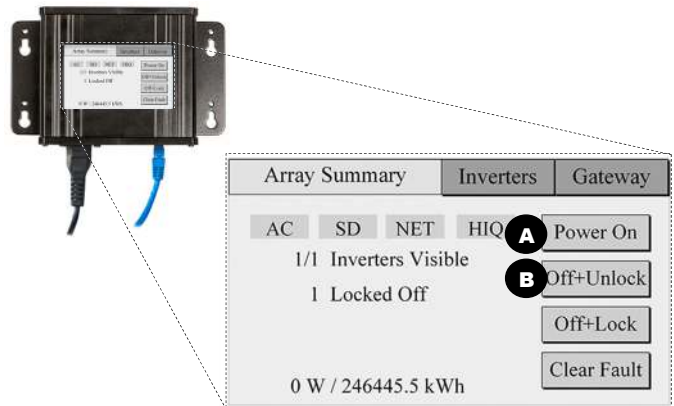


Figure 16: Power On and Unlock buttons

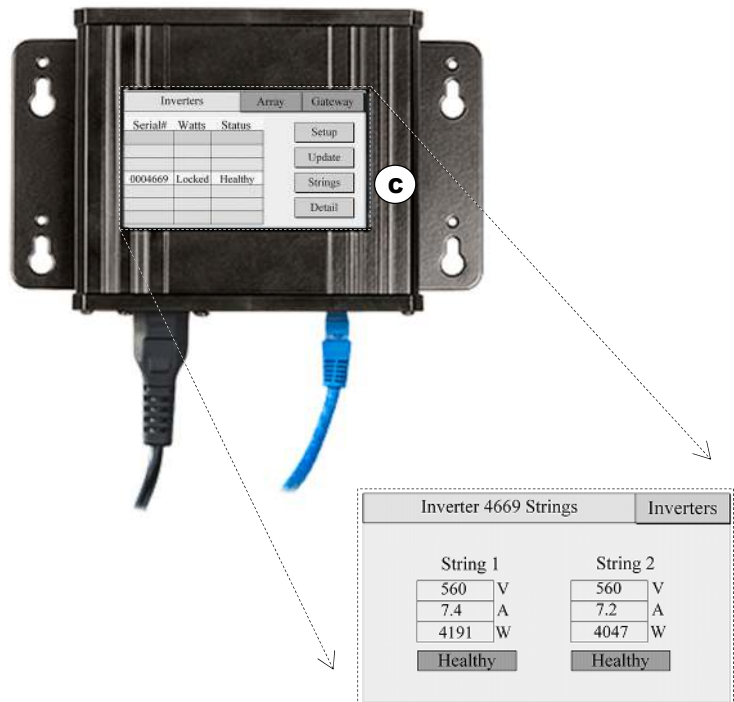


Figure 17: Verifying that all modules are operational using the Gateway















Connection is complete.

## 6.4. More Detailed Installation Information


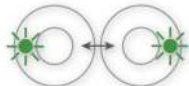




### 6.4.1. Meanings of Buttons & Indicators

While most installations will use a Communication Gateway to control and report, it is not mandatory. The inverter can be controlled using the button, as illustrated in Table 1. A brief press-and-release of the button counts as a button-push in the guide below. Indications given by the button illumination are shown in Table 2.



Inverter Button Push	Button Indication	Result
1 press 		<ul style="list-style-type: none"> <li>Make inverter beep (“are you alive?”)</li> </ul>
2 presses 		<ul style="list-style-type: none"> <li><b>Off &amp; Locked</b> (disabled)</li> <li>Unit will not begin the 5-minute self-start</li> </ul>
3 presses 		<ul style="list-style-type: none"> <li>Start generating immediately</li> <li>If locked, unlock and generate immediately</li> <li>If system is faulted, unit will unlock but will not generate</li> </ul>
Long press (>2 seconds) 	 (Brief flash)	<ul style="list-style-type: none"> <li>“Alternate functions” mode</li> <li>Ready to accept further button pushes; this times out after 10 seconds</li> </ul>
1 press (after long press) 		<ul style="list-style-type: none"> <li>Clear latched faults after (for example) an arc-fault test or RCD (residual-current device) test initiated a fault condition</li> </ul>
3 presses (after long press) 		<ul style="list-style-type: none"> <li>RCD-test activation; successful operation of RCD test should cause a fault condition (rapid red flashing) until cleared</li> </ul>
4 presses (after long press) 		<ul style="list-style-type: none"> <li>Arc-fault test activation; successful operation of arc-fault detection should cause a fault condition (rapid red flashing) until cleared</li> </ul>

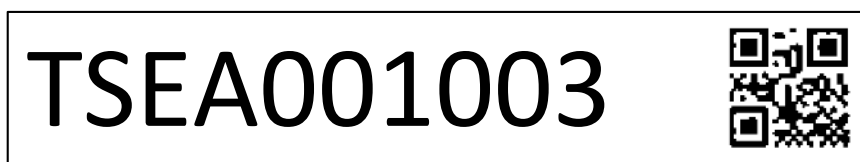
**Table 1: Inverter button actions and results**

Inverter Indicator State	Meaning
 Solid	<ul style="list-style-type: none"> <li>Powered up</li> <li>Not generating</li> <li>No faults</li> </ul>
 Left-right flash	<ul style="list-style-type: none"> <li>Power-on self-test (will take &lt;1 minute)</li> </ul>
 Green Chaser	<ul style="list-style-type: none"> <li>Powered up</li> <li>Generating, no faults</li> </ul>
 Rapid Flash	<ul style="list-style-type: none"> <li>Faulted</li> <li>Example: arc has been detected</li> </ul>
 Mostly On	<ul style="list-style-type: none"> <li><b>Off &amp; Locked</b></li> <li>Disabled</li> </ul>
 Mostly Off	<ul style="list-style-type: none"> <li>Sleeping</li> <li>Not generating</li> </ul>

**Table 2: Inverter indicator states and meanings**

#### 6.4.2. Manufacturing Date

The inverter and Gateway each have an individualized serial number label. An example is shown in Figure 18. The first 4 letters are for device model code; this is followed by the 6-digit serial number (for example, 001003). The manufacturing date code is available in the QR code, readable with common smartphone applications. The QR code will give the same information, appended with the date of manufacture, for example, TSEA001003 1341, where 13 is the year (2013), and 41 the calendar week number.



**Figure 18: Example serial number label with QR code containing the manufacturing date**

6.5. Gateway Information

This section covers common tasks and features associated with the Gateway.

6.5.1. Array Summary  
Screen Diagnostics

Pressing the <Array> tab **A** brings up the Array Summary screen. This screen has four diagnostic indicators that are normally shaded green as shown in Table 3. These four items will be shaded red if the Gateway detects an issue.

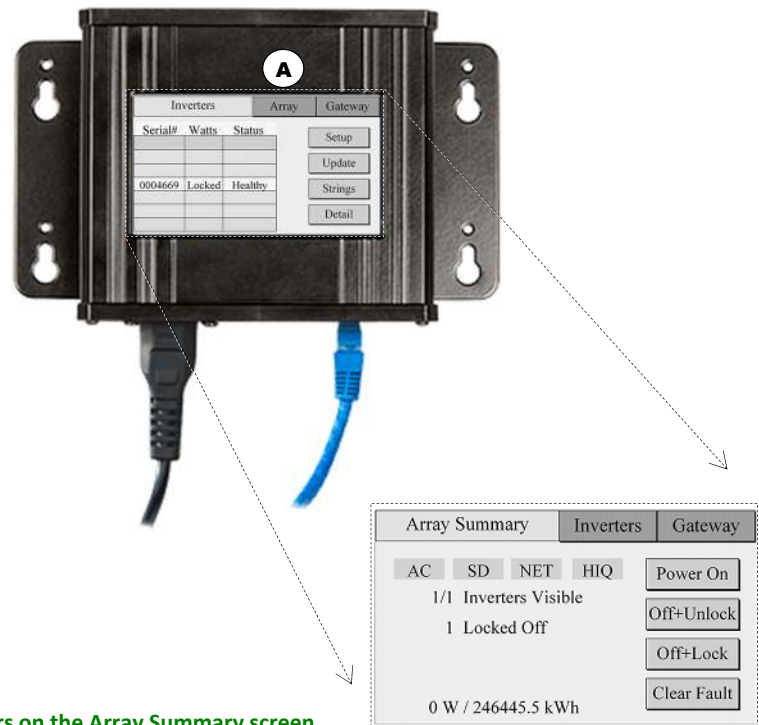


Figure 19: Status indicators on the Array Summary screen

Indication	Meaning
AC	The Gateway's AC source is correct. For example: the neutral connection is established, voltage is within tolerance, and no dangerous voltage spikes are present.
SD	The SD card is inserted and the file system is working.
NET	The network is connected. The cable connection is established and the Gateway has acquired an IP address.
HIQ	The Gateway was able to contact the server and upload data. The Indicator will be yellow while the Gateway attempts to make contact.

Table 3: Meanings of green indications on the Array Summary screen

6.5.2. The Memory Card

The Gateway is supplied with a memory card to allow long-term storage and retrieval of performance history. Make certain that it is fully inserted, as some functions are not available with the card not fully engaged. The card is pre-formatted with the FAT32 file system and is ready to be inserted into the Gateway as shown in Figure 20.

The **Array Summary** screen has an indication of the SD card status as shown in Table 3. This indicator will turn red if the card is not fully engaged.

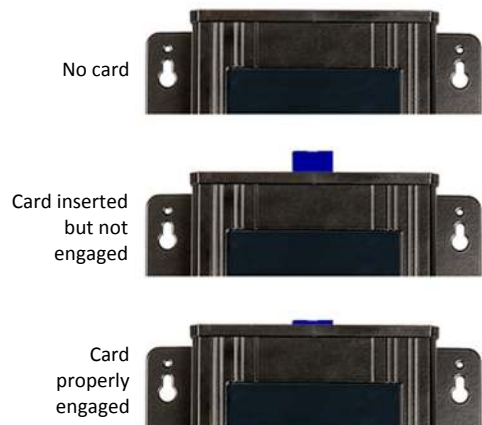


Figure 20: Insertion of the memory card



### 6.5.3. Methods of Accessing System Information

An overview of ways to access data is shown in Figure 21. The Gateway gathers data from inverters over a connected power line. The Gateway displays information on its touch screen. With a suitable Ethernet network connection, it is capable of acting as a web server, allowing a local computer or a remote computer with firewall access to see system performance as it is happening, displayed on a web page. Data is also transferred to servers to gather history, which can be accessed remotely. More details are given below.

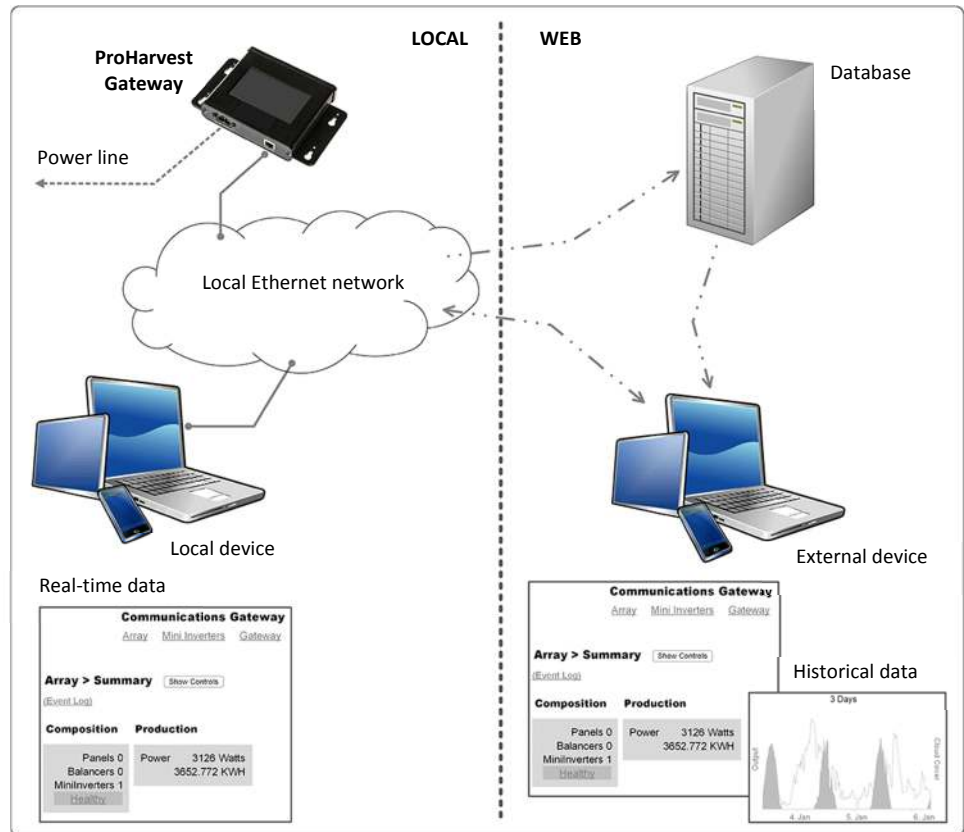


Figure 21: Methods of accessing data from inverters

### 6.5.4. Registering Inverters

The Communications Gateway is intelligent. When required to discover ProHarvest inverters, it will do so easily with the press of a button.

Occasionally it may be preferable to manually register inverters. This is also easy to achieve. Both procedures are described beginning below.

#### 6.5.4.1. Automatic Discovery of Inverters

The Gateway will search for any inverters in the local area. On the **Inverters** tab the **<Setup>** button **A** will open the **Array Setup** screen. Press the **<Discover>** button **B** to search. In most cases nothing else will be required. All available inverters will appear on the list in Figure 22.

**NOTE:** If discovery occurred previously, the **Add Only** box **C** is checked to speed up the process. (Only new inverters will be discovered.) Unchecking this box causes all inverters to be rediscovered from scratch.

Automatic discovery of inverters may also be achieved from the web interface as noted in Figure 23(c).

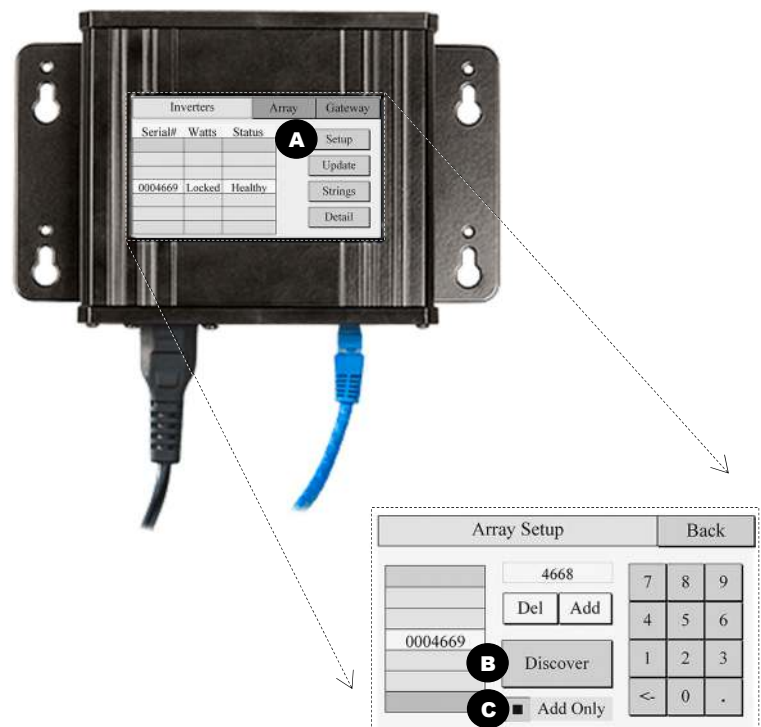



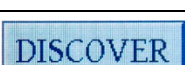


Figure 22: Automatic discovery of inverters

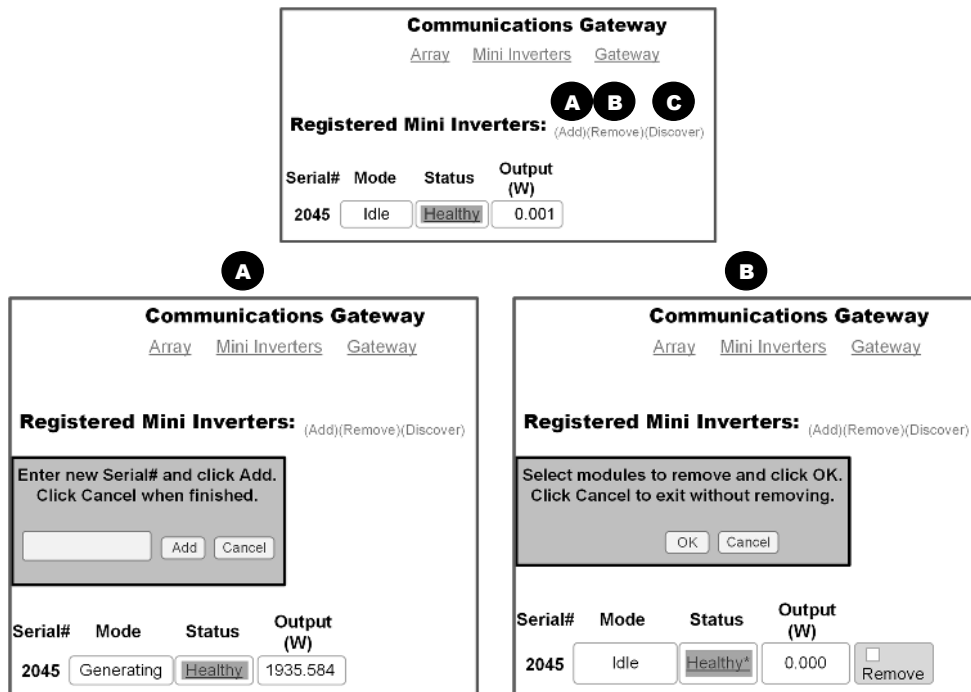
Button State	Meaning
	Initial state.
	Once pressed, a dark blue color indicates the Gateway is in the process of discovering inverters. It will return to the initial state with an empty serial number list if no inverters are found.
	A dark red color indicates an error was found. Examples: "signal strength is too low"; "too much background noise on circuit". The red color only clears when the user re-tries and the fault condition no longer applies.
	Once discovery has successfully occurred, the button returns to the original state.

**Table 4: Meanings of <Discover> button colors**

#### 6.5.4.2. Manual Registration of Inverters

Manual registration is accomplished using either the touch screen or the web interface. Figure 23 depicts the web interface. (This functionality is found under the top level of the **Mini Inverters** tab.) Manual registration gives the ability to add (A) and delete (B) inverters as desired. It is particularly useful if an inverter is replaced on a site where automatic discovery would take a long time.

Item C is used to enable automatic discovery of inverters.



**Figure 23: Adding and removing inverters manually using the web interface**

6.5.5. Gateway Touch Screen Menu Structure

The following menu tree shows how different screens and functions are related and accessed.

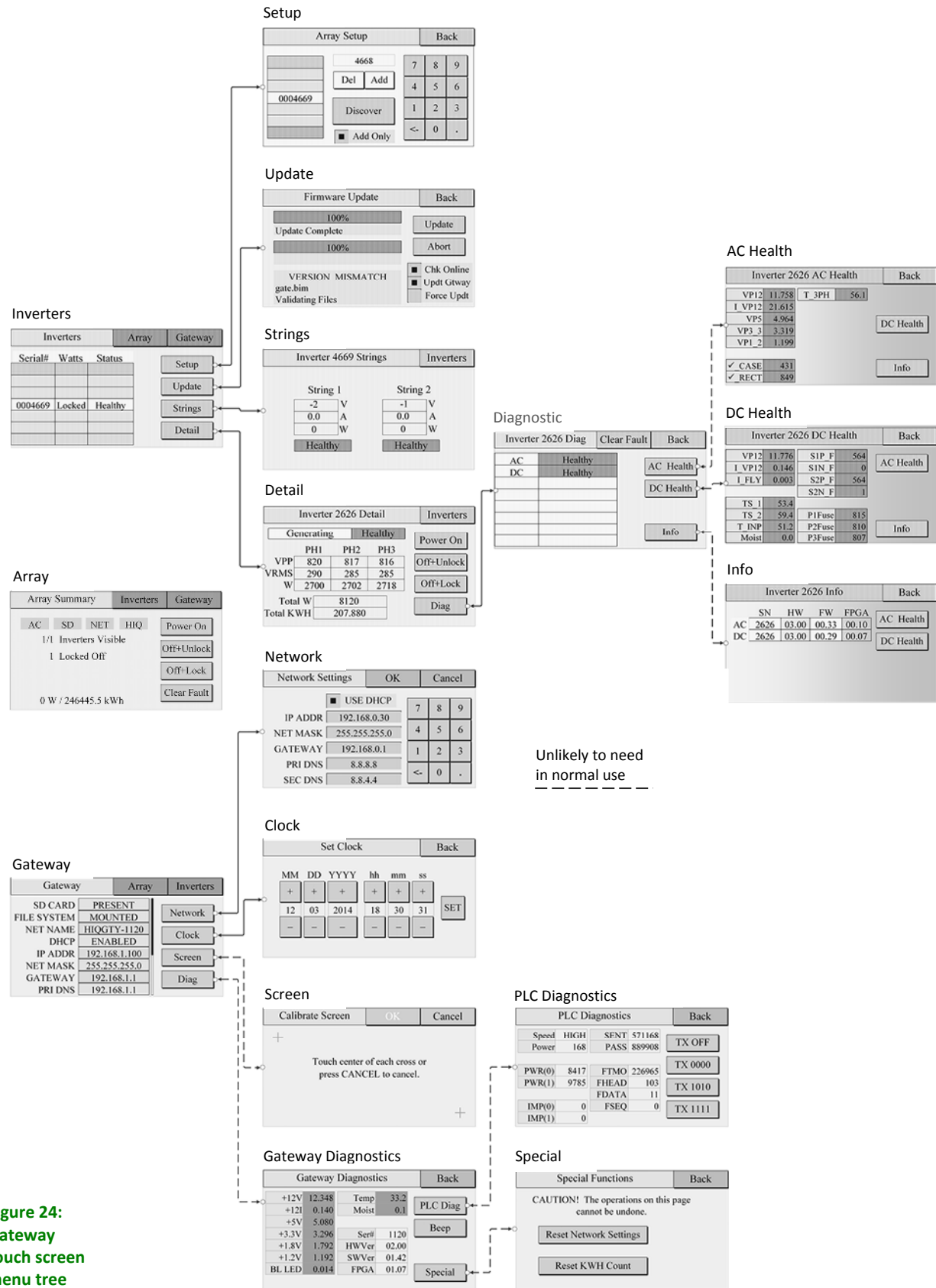


Figure 24:  
Gateway  
touch screen  
menu tree



6.5.6. Gateway Web Page Menu Structure

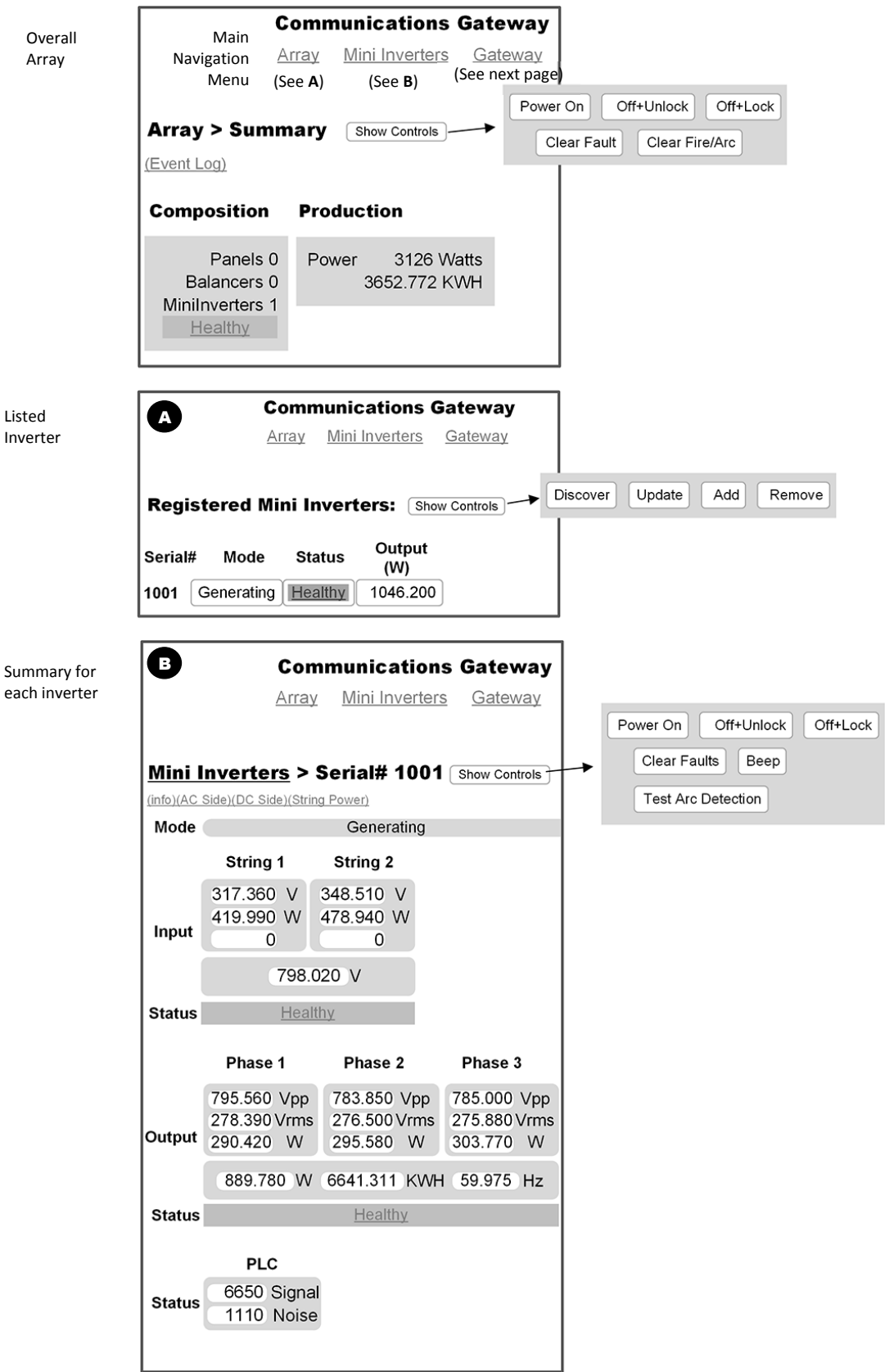


Figure 25: Array page and main inverter navigation

**Communications Gateway**  
 Array   Mini Inverters   Gateway

---

### Network Settings

<b>Name:</b>	HIQGTY-1040	<b>HTTP Port:</b>	80
<b>DHCP:</b>	ENABLED	<b>FTP Cmd Port:</b>	21
<b>IP Address:</b>	107.142.42.1	<b>FTP Data Port:</b>	8000
<b>Net Mask:</b>	255.255.255.248	<b>Diag Port:</b>	1000
<b>Gateway:</b>	107.142.42.6		
<b>Primary DNS:</b>	107.142.42.6		
<b>Secondary DNS:</b>	0.0.0.0		
<b>MAC Address:</b>	00:04:A3:51:FB:E5		

- [Change Network Settings](#)
- [Change Users and Permissions](#)

### Data Logging

- [Upload Status](#)
- [Upload Settings](#)
- [Polling Intervals](#)
- [Clock Settings](#)

### File System

- [File System Info](#)
- [FTP File Server](#)

### Gateway

- [Auto-Update Settings](#)
- [Gateway Diagnostics](#)
- [PLC Statistics](#)
- [Diagnostic Log](#)

Figure 26: Gateway summary page (primarily for service use)

### 6.5.7. Show or Hide Web Page Controls

A valuable feature of the system is the ability to view and control the system from a smartphone when local computer network settings allow (see Section 6.5.11 on page 30). Because phone screens are small, it might sometimes be possible to accidentally activate or disable functions inadvertently. To help avoid this, the Gateway web page has a button for **<Show Controls>** (A) and **<Hide Controls>** (B) near the top of some of the screens.

Figure 27: Showing or hiding controls on the Gateway web page

**Communications Gateway**  
[Array](#)   [Mini Inverters](#)   [Gateway](#)

**Array > Summary**   [Show Controls](#)

**Array > Summary**   [Hide Controls](#)

Power On

Off+Unlock

Off+Lock

Clear Fault

Clear Fire/Arc

6.5.8. Arc Detection

These products meet the requirements of NEC 690.11. If a fault occurs, the inverter will shut itself down. It will also indicate a fault with rapid red flashes of the inverter button. The web page and Gateway will also show system fault flags. (See Figure 28.)

Note that power cycling of the system will not clear such a fault. It must be cleared using the procedure outlined in Figure 28. A fault is cleared using either the Gateway touch screen or the web page.

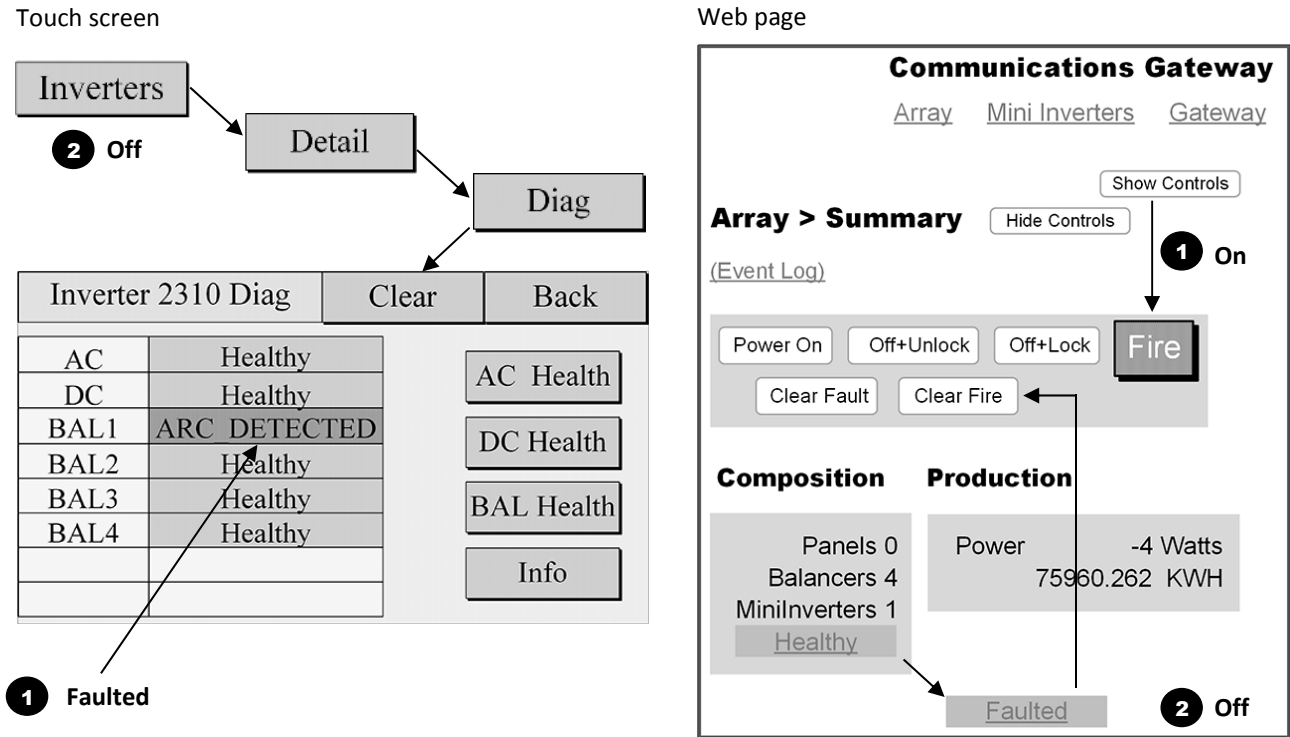


Figure 28: Arc fault indication and clearing procedures

### 6.5.9. Utility Protective Function – Adjustable Limits

The ProHarvest 480V inverter system is capable of operating beyond normal AC grid ranges when required to do so by the operating utility company.

***Changes in this area must only be carried out with the express written permission of the utility company, only setting values specified by the utility company.***

Changes are made through the web pages and cannot be accessed from the Gateway touch screen. When logged into a particular Gateway through the web portal, type the following into the browser URL address bar after the serial number:

‘/SAFETYLIMITS.htm’ (capitalization is important here). An example is: <http://hiqgty-1020/SAFETYLIMITS.htm>.

This will bring up the screen shown in Figure 29. An individual serial number of an inverter on that Gateway is entered into the **Serial #** field. Pressing <Get> will cause communication with the particular inverter. Its current values will populate in the web page. When desired changes have been completed, <Set> will write those values back to that same inverter.

Available ranges are given in the Specifications table of Section 8.1 near the end of this document.

**Communications Gateway**  
[Array](#)   [Mini Inverters](#)   [Gateway](#)

### Inverter Safety Settings

Serial #

Voltage Limits			
	VRMS	Cycles	
High	<input type="text" value="305"/> <small>(305-315)</small>	<input type="text" value="120"/> <small>(60-1200)</small>	
Low	<input type="text" value="245"/> <small>(220-245)</small>	<input type="text" value="120"/> <small>(60-1200)</small>	

Frequency Limits			
	Hz	Cycles	
High	<input type="text" value="60.5"/> <small>(60.5-62.0)</small>	<input type="text" value="6"/> <small>(6-18000)</small>	
Low	<input type="text" value="59.3"/> <small>(57.0-59.8)</small>	<input type="text" value="6"/> <small>(6-18000)</small>	

Reset Time

- Cycles are the number of 60 Hz cycles after the limit is violated before the inverter turns off (Clearing Time).

Figure 29: Utility protective adjustments dialog box

6.5.10. System Firmware Updates

System firmware is occasionally updated to add features and enhance reliability even further. Firmware updates may be accomplished through a network connection or using a memory card physically inserted into the card slot on the Gateway. Updates may be controlled through the Gateway touch screen or the Gateway web page.

Touch screen

Firmware Update		Back
<div><div></div>20%</div>		Update
Validating Files		
<div><div></div>45%</div>		Abort
gatex.bim		
NO ERRORS		<input checked="" type="checkbox"/> Chk Online
		<input checked="" type="checkbox"/> Updt Gtway
		<input type="checkbox"/> Force Updt

Firmware Update		Back
<div><div></div>100%</div>		Update
Update Complete		
<div><div></div>100%</div>		Abort
NO ERRORS		<input checked="" type="checkbox"/> Chk Online
		<input checked="" type="checkbox"/> Updt Gtway
		<input type="checkbox"/> Force Updt

Web page

**Communications Gateway**  
[Array](#) [Mini Inverters](#) [Gateway](#)

**Firmware Update**

Pressing Update will retrieve the latest firmware files from the web (if connected) then check and update each system in the list of Registered Mini Inverters.

- Data Collection will be suspended for the duration of the update.
- If a particular Mini Inverter requires an update, it will be locked off for the duration of its update.
- If the Gateway requires an update, it will reboot at the end of the update process.

☒ Check online for latest version  
☒ Update Gateway, if needed  
☐ Force update to released version

Abort Update

Example below where an update was initiated but the Gateway was unable to find a firmware file through the network connection or from the memory card.

Firmware Update		Back
<div><div></div>1%</div>		Update
Retrieving Manifest		
<div><div></div>0%</div>		Abort
COULD_NOT_GET_FILE		<input checked="" type="checkbox"/> Chk Online
Retrieving Manifest		<input checked="" type="checkbox"/> Updt Gtway
		<input type="checkbox"/> Force Updt

**Communications Gateway**  
[Array](#) [Mini Inverters](#) [Gateway](#)

**Firmware Update**

Pressing Update will retrieve the latest firmware files from the web (if connected) then check and update each system in the

### 6.5.11. Gateway Access Inside a Local Network

The following sections may be useful for a company's IT department.

Note that the Gateway's default state is to be in DHCP mode. This is the easiest mode for local access inside a network.

#### 6.5.11.1. Accessing Locally from a Windows Device

- Looking at the Gateway unit, use the touch screen and select the **Gateway** tab. Scroll the display to see the view below:

Gateway	Array	Inverters
SD CARD	PRESENT	
FILE SYSTEM	MOUNTED	
NET NAME	HIQGTY-1120	Network
DHCP	ENABLED	Clock
IP ADDR	192.168.1.100	Screen
NET MASK	255.255.255.0	Diag
GATEWAY	192.168.1.1	
PRI DNS	192.168.1.1	

Figure 30: Gateway screen showing the Net name and IP address

- Open a web browser. Type into the address bar the **NET NAME** ("HIQGTY-1120" in this example), or type in the listed IP address (here 192.168.1.100, but this will vary)<sup>2</sup>. This will bring up the web login screen. Unless otherwise altered, the following will apply (case sensitive):
  - Username: admin
  - Password: HiQSolar

This will open the home screen for that particular Gateway which should look like Figure 31.

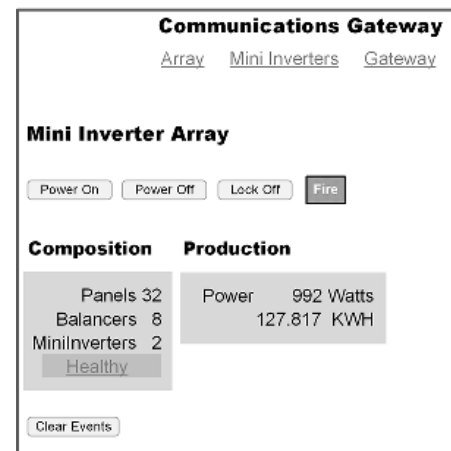


Figure 31: Web interface for the Gateway showing array statistics

#### 6.5.11.2. Accessing Locally from a Mac OS Computer or Device Including iPads & iPhones

Follow the instructions in 6.5.10.1. Note that **NET NAME** is not supported. The IP address will need to be typed into the browser address line.

<sup>2</sup> Note that this IP address is for the web page provided by the web server. The network connection the Gateway uses to communicate to a local router is the one further down the list labeled GATEWAY (192.168.1.1 in this example).

### 6.5.12. Accessing the Gateway from Outside the Local Network — LAN-side configuration

DHCP has a lease time after which it requests renewal. This is problematic if it ends up with a different IP address. A method must be used to make the IP address stay fixed. These methods include:

- i) Keep the Gateway in DHCP mode but force the router to allocate the same IP address each time. If this is supported by the router it is generally the most desirable option.
- ii) Change to a fixed IP address.

Router capabilities and user interfaces vary. This example uses a particular Cisco router.

Ideally the Gateway would be left in DHCP mode, and the router configured to keep assigning the same address. If this functionality is supported by the router it might look like Figure 32. In the figure it is labeled **DHCP Reservation**.

**Figure 32: DHCP Reservation on the example Cisco router**

The screenshot shows a web-based configuration interface for a Cisco router. On the left is a sidebar with 'Network Setup' and 'DHCP Server Setting'. The main area is titled 'Router Address' and contains fields for IP Address (192.168.1.1), Subnet Mask (255.255.255.0), and Device Name. Below this is the 'DHCP Server' section, which has 'Enabled' selected. A button labeled 'DHCP Reservation' is highlighted with a black box. Other fields include Start IP Address (192.168.1.100), Maximum Number of Users (50), IP Address Range (192.168.1.100 to 149), Client Lease Time (0 minutes), and Static DNS/WINS settings.

As can be seen in the above screenshot, the router has a defined range of 50 IP addresses it has reserved for DHCP allocation, between 100 to 149 for the last field in the address. The **DHCP Reservation** screen allows examination of the currently logged on devices, and the option of assigning an address in the allowed range to the Gateway. Alternatively, an address can be assigned outside the DHCP range but the Gateway must also be configured.

The screenshot of Figure 33 shows the DHCP reservation screen. In this example an address is assigned outside the range (ending in "37").



Figure 33:  
Assigning an IP  
address outside  
the router's DHCP  
reservation range

Client Reservation

Select Clients from DHCP Tables

Client Name	Interface	IP Address	MAC Address	Select
	LAN	192.168.1.37	00:04:A3:11:CA:25	<input type="checkbox"/>
	LAN	192.168.1.100	00:1E:8F:37:41:9B	<input type="checkbox"/>
	Wireless-N	192.168.1.101	88:87:17:BA:D6:1B	<input type="checkbox"/>
	LAN	192.168.1.102	40:61:86:F7:CF:1E	<input type="checkbox"/>
	Wireless-G	192.168.1.103	00:14:A5:A3:80:CB	<input type="checkbox"/>
	Wireless-N	192.168.1.104	9C:B7:0D:7D:1C:AB	<input type="checkbox"/>
	LAN	192.168.1.105	00:24:8C:D6:B9:24	<input type="checkbox"/>
	LAN	192.168.1.107	8C:89:A5:90:A0:A7	<input type="checkbox"/>
	LAN	192.168.1.108	00:21:6B:68:70:98	<input type="checkbox"/>
	LAN	192.168.1.142	00:E0:81:4C:4B:AE	<input type="checkbox"/>
	LAN	192.168.1.109	60:EB:69:5E:9A:CD	<input type="checkbox"/>
	LAN	192.168.1.110	14:DA:E9:2A:34:38	<input type="checkbox"/>
	Wireless-N	192.168.1.111	74:2F:68:3D:04:EA	<input type="checkbox"/>
	Wireless-N	192.168.1.112	10:40:F3:C2:27:1F	<input type="checkbox"/>
	LAN	192.168.1.113	00:22:68:6D:37:F7	<input type="checkbox"/>
	Wireless-N	192.168.1.114	00:21:5C:30:3E:7D	<input type="checkbox"/>
	LAN	192.168.1.115	E8:9A:8F:A1:A7:6F	<input type="checkbox"/>
	Wireless-N	192.168.1.116	F0:CB:A1:51:16:89	<input type="checkbox"/>
	LAN	192.168.1.117	04:0C:CE:CF:0D:46	<input type="checkbox"/>
	LAN	192.168.1.118	D8:30:62:A6:19:4D	<input type="checkbox"/>
	LAN	192.168.1.119	4C:0F:6E:34:15:64	<input type="checkbox"/>

1. Add Clients

Enter Client Name	Assign IP Address	To This MAC Address	
	192.168.1.0	00:00:00:00:00:00	Add

2.

Client Name	Assign IP Address	To This MAC Address	MAC Address
	192.168.1.37	00:04:A3:11:CA:25	Remove

Save Settings

Cancel Changes

Refresh

Close

Manually Add Client

Clients Already Reserved

Having decided upon an IP address, the next step is to configure the Gateway.

On the touch screen of the Communications Gateway, select the **Gateway** tab, then press the **<Network>** button. This will bring up the screen shown in Figure 34.

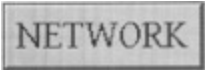




Figure 34: Network Setting screen on the Gateway

The **DHCP** check box indicates current status. It also allows parameters to be changed if DHCP is unchecked. When unchecked, the box looks like this:



Touching on one of the fields below the check box will activate it and allow changes to be made using the on-screen keypad.

In general:

- **NET MASK** (network sub mask) remains at 255.255.255.0 unless being used in certain large companies that might use something different.
- **GATEWAY** and **PRI DNS** (primary DNS) will be taken from the router screen.
- **SEC DNS** (secondary DNS) usually remains at 0.0.0.0.

### 6.5.13. Accessing the Gateway from Outside the Local Network – WAN-side configuration

In the example of the Cisco router, opening up a port for outside communication is achieved through the **Applications & Gaming** screen. (See Figure 35.) The intent is for communication to pass through the router, although there will usually be some translation of port labels between what the Gateway expects and what is presented to the outside world on the WAN side of the router.

There are 4 possible ports required to fully access the Gateway and inverters remotely. Access to the control web page alone requires only the first of those listed in Table 5 to be set up.

Label	Function	External (Customer-changeable as required)	Internal (what the Gateway expects to see)
HTTP	Allows access to the Gateway web page	8100	80
FTPC	FTP Control — allows access to the Gateway memory card and logs	2100	21
FTPD	FTP Data — the return port for files requested using FTPC to be transmitted through	8000 (Use this setting only)	8000
Diag	Diagnostic — Low level system access such as firmware updates for use by the manufacturer only	1000 (Use this setting only)	1000

Table 5: Port numbering assignments

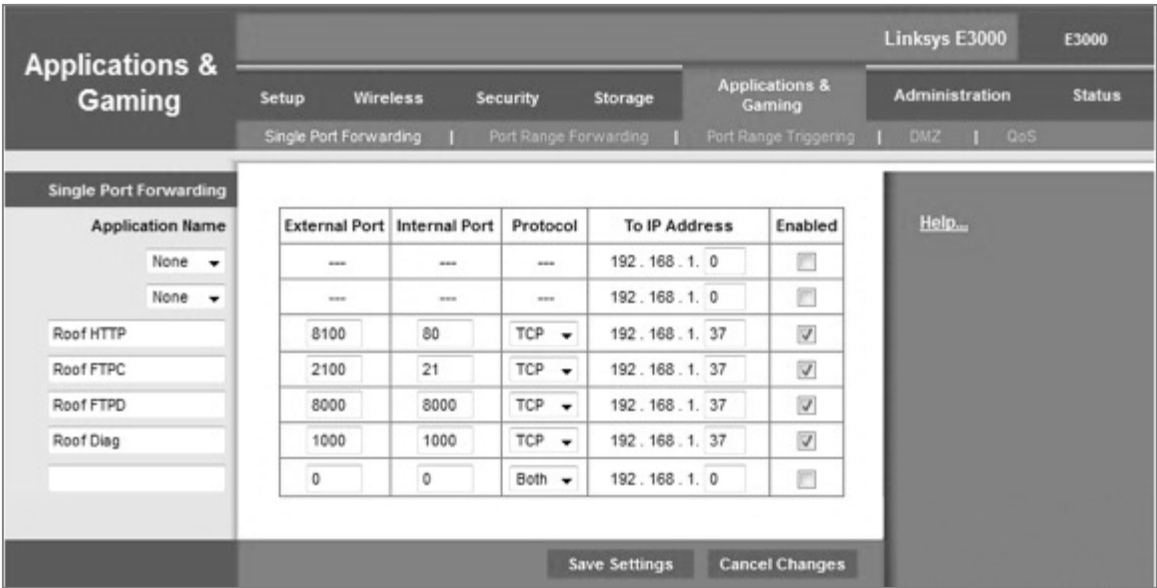


Figure 35: Port forwarding screen on the example Cisco router

Press the <**Save Settings**> button on the router page or else changes will be lost.

Note that not all routers offer port reassignment as described here. However, having different external port numbers is not strictly necessary; it is suggested as an extra security precaution to avoid using the well-known port assignments for web (80) and FTP (21) on the general Internet. The Gateway's web and FTP servers are both password protected, so the risks are low. In a case where no port forwarding is available, the Gateway direct port numbers (80, 21, 8000, 1000) would be used without specifying different external ports for 80 and 21.

## 7. Troubleshooting

The primary troubleshooting method is to use the Communications Gateway for indications of a problem. The Gateway can be viewed using the touch screen interface on the device, or accessing it using a web browser. Assuming the issue is not with communications, browser access has the advantage that a mobile device such as a phone can be used while physically on the roof. As detailed later, the inverter has an indicator light that will also provide insight.

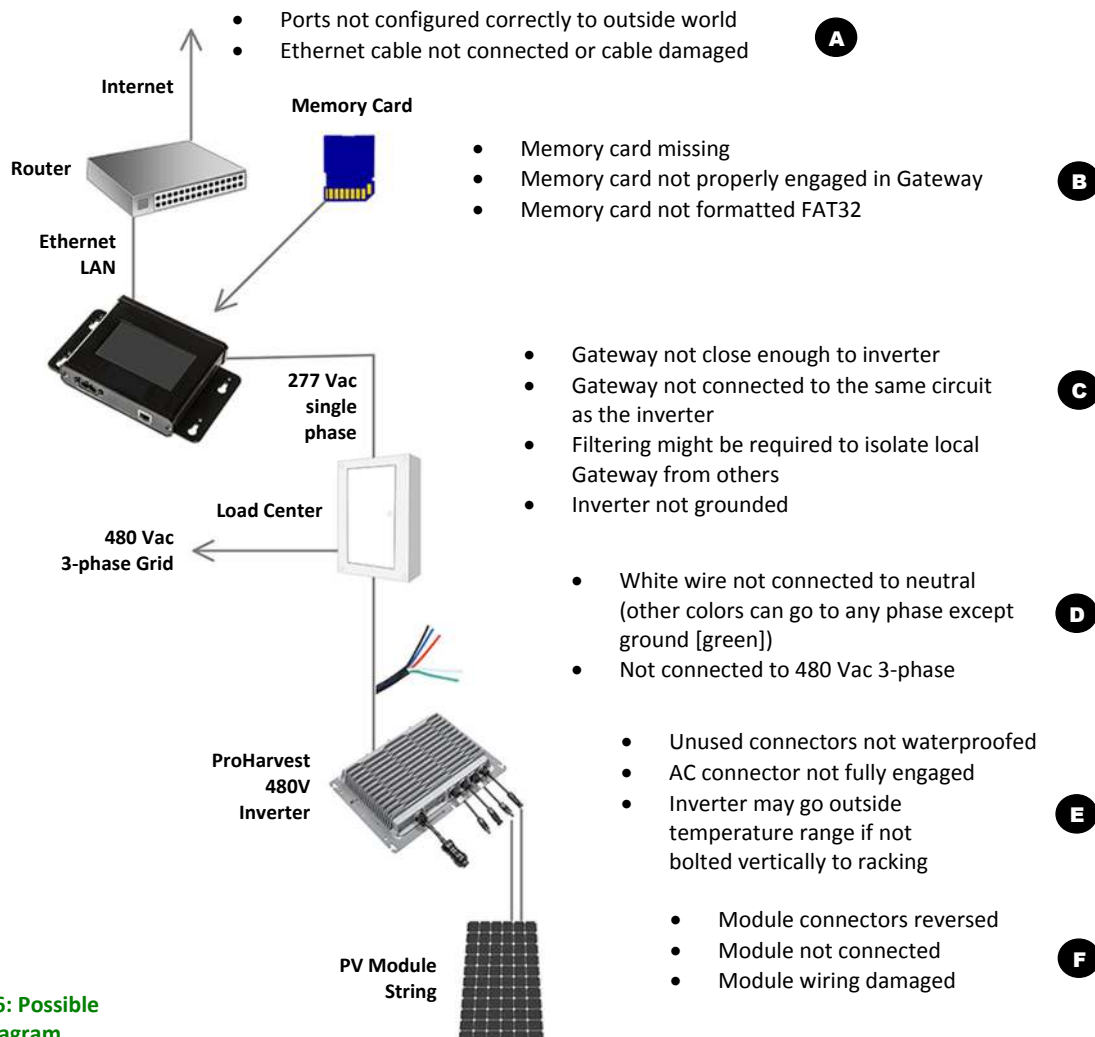


The troubleshooting section is divided up as follows:

- Overview of possible issues (picture).
- If this issue was present, it would look like these symptoms (table).
- If these symptoms occur, it could be one of these causes (table).
- More details on selected issues.

### 7.1. Overview of Possible Issues

Letters on the right (such as **A**) refer to issues and symptoms listed in sections 7.2 and 7.3.



**Figure 36: Possible issues diagram**

## 7.2. If this issue was present, it would look like these symptoms

Letters next to individual faults (such as **D**) refer to possible issues listed on page 35.

If this fault occurred, these symptoms would be present ....		Gateway Touch Screen	Web Interface	Inverter Button
AC Grid	<ul style="list-style-type: none"><li>AC output of inverter not connected to grid <b>(D)</b></li><li>AC connector not fully engaged <b>(D)</b></li></ul>	Missing figures in AC part of display	As touch screen	Rapidly flashing red
	<ul style="list-style-type: none"><li>One phase of AC Grid not connected <b>(D)</b></li><li>Neutral (white or grey) wire connected to a phase instead of neutral <b>(D)</b></li></ul>	One column of figures in AC part of display missing		
	<ul style="list-style-type: none"><li>Connected to wrong voltage system (for example, 208 Vac 3-phase) <b>(D)</b></li></ul>	Fault probably indicated		
Other	<ul style="list-style-type: none"><li>Unterminated connectors allow moisture to ingress <b>(E), (F)</b></li></ul>	Fault indicated		-
PV Module	<ul style="list-style-type: none"><li>PV module not connected <b>(F)</b></li><li>PV module wiring fault <b>(F)</b></li></ul>	Not treated as a fault — missing statistics in Panel figures		
	<ul style="list-style-type: none"><li>Arc fault detected and system shut down <b>(F)</b></li></ul>	System not generating, fault indicated	System not generating, <b>arc_fault</b> indicated	Red lights rapidly flashing on inverter
Gateway	<ul style="list-style-type: none"><li>The Gateway is wired into an unrelated AC circuit <b>(C)</b></li><li>The Gateway is too far away from an inverter <b>(C)</b></li><li>The Gateway is the wrong side of filtering on the AC circuit <b>(C)</b></li><li>Neutral (white or grey) wire connected to a phase <b>(D)</b></li><li>Inverter not grounded <b>(C)</b></li></ul>	<ul style="list-style-type: none"><li>No signal or information</li><li><b>AC</b> indicator on <b>Array Summary</b> screen shows red</li></ul>	No information, status <b>Unknown</b>	-
	<ul style="list-style-type: none"><li>No Ethernet connection <b>(A)</b></li></ul>	<b>NET</b> indicator on <b>Array Summary</b> screen shows red	Unable to connect from the web interface	
	<ul style="list-style-type: none"><li>Network router not configured correctly <b>(A)</b></li></ul>	<b>HIQ</b> indicator on <b>Array Summary</b> screen shows red (Gateway is unable to contact servers)		
	<ul style="list-style-type: none"><li>No memory card <b>(B)</b></li><li>Memory card not fully engaged <b>(B)</b></li><li>Memory card not formatted as FAT32 <b>(B)</b></li></ul>	<b>SD</b> indicator on <b>Array Summary</b> screen shows red	Retrieving long term history not possible	

Table 6: Faults and consequent symptoms

### 7.3. If these symptoms occur, it could be one of these causes

Letters next to individual faults (such as **D**) refer to possible issues listed on page 35.

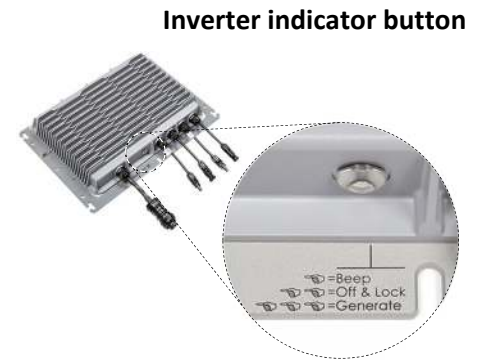
Symptoms			Possible Causes
Inverter Button Indicator	Gateway Touch Screen	Web Interface	
Button flashing red quickly	Missing information in AC display	As touch screen	<ul style="list-style-type: none"> <li>AC output of inverter not connected to Grid (<b>D</b>)</li> <li>AC connector not fully engaged (<b>D</b>)</li> </ul>
	Missing information in AC display		<ul style="list-style-type: none"> <li>One phase of AC Grid not connected (<b>D</b>)</li> <li>Connected to wrong voltage system (for example, 208 Vac 3-phase) (<b>D</b>)</li> </ul>
	Fault condition displayed		<ul style="list-style-type: none"> <li>Moisture has been allowed into the system, perhaps because unused connectors have been left un-terminated (<b>E</b>) (<b>F</b>)</li> </ul>
-	Missing PV Module information		<ul style="list-style-type: none"> <li>Missing PV module (<b>F</b>)</li> <li>Faulty wiring or connectors not fully engaged (<b>F</b>)</li> </ul>
	Less power output than expected		<ul style="list-style-type: none"> <li>Inverter in direct sun and temperature range exceeded, causing output to be reduced to maximize lifetime (<b>E</b>)</li> </ul>
	<b>SD</b> indicator on <b>Array Summary</b> screen shows red		<ul style="list-style-type: none"> <li>Memory card not fully engaged (<b>B</b>)</li> <li>Memory card not formatted as FAT32 (<b>B</b>)</li> <li>Memory card missing (<b>B</b>)</li> </ul>
	<b>AC</b> indicator on <b>Array Summary</b> screen shows red	No information on the web interface	<ul style="list-style-type: none"> <li>Gateway not connected to the same AC circuit as the inverter(s) (<b>C</b>)</li> <li>Gateway placed too far from the inverter(s) (<b>C</b>)</li> <li>Filtering present on the grid interfering with communication (<b>C</b>)</li> <li>Neutral (white or grey) wire connected to a phase (<b>D</b>)</li> <li>Inverter not grounded (<b>C</b>)</li> </ul>
	<b>NET</b> indicator on <b>Array Summary</b> screen shows red		<ul style="list-style-type: none"> <li>Ethernet cable not connected (<b>A</b>)</li> <li>Router external ports/ firewall not set up correctly (<b>A</b>)</li> </ul>

Table 7: Symptoms and possible causes

## 7.4. Notes on Selected Issues

### 7.4.1. Inverter Button Indicator States

If there is power to the inverter, the indicator on the inverter button will be indicating something. As described earlier, these have the following meanings and operations:



Inverter Button Push	Button Indication <sup>3</sup>	Result
1 press 		<ul style="list-style-type: none"> <li>Make inverter beep (“are you alive?”)</li> </ul>
2 presses 		<ul style="list-style-type: none"> <li><b>Off &amp; Locked</b> (disabled)</li> <li>Unit will not begin the 5-minute self-start</li> </ul>
3 presses 		<ul style="list-style-type: none"> <li>Start generating immediately</li> <li>If locked, unlock and generate immediately</li> <li>If system is faulted, unit will unlock but will not generate</li> </ul>
Long press (>2 seconds) 	 (Brief flash)	<ul style="list-style-type: none"> <li>“Alternate functions” mode</li> <li>Ready to accept further button pushes; this times out after 10 seconds</li> </ul>
1 press (after long press) 		<ul style="list-style-type: none"> <li>Clear latched faults after (for example) an arc-fault test or RCD (residual-current device) test initiated a fault condition</li> </ul>
4 presses (after long press) 		<ul style="list-style-type: none"> <li>Arc-fault test activation; successful operation of arc-fault detection should cause a fault condition (rapid red flashing) until cleared</li> </ul>

**Table 8: Inverter button functions and indicator meanings (repeat of Table 1)**

<sup>3</sup> Orientation may vary







Inverter Indicator State	Meaning
 Solid	<ul style="list-style-type: none"> <li>Powered up</li> <li>Not generating</li> <li>No faults</li> </ul>
 Left-right flash	<ul style="list-style-type: none"> <li>Power-on self-test (will take &lt;1 minute)</li> </ul>
 Green Chaser	<ul style="list-style-type: none"> <li>Powered up</li> <li>Generating, no faults</li> </ul>
 Rapid Flash	<ul style="list-style-type: none"> <li>Faulted</li> <li>Example: "arc has been detected"</li> </ul>
 Mostly On	<ul style="list-style-type: none"> <li><b>Off &amp; Locked</b></li> <li>Disabled</li> </ul>
 Mostly Off	<ul style="list-style-type: none"> <li>Sleeping</li> <li>Not generating</li> </ul>

Table 9: Inverter button functions and indicator meanings (repeat of Table 2)

## 7.4.2. Other Issues

### (A) Internet Connectivity Issues

- No Ethernet connection
- Network router not configured correctly
- Router external ports/ firewall not set up correctly

The Array Summary screen on the Gateway has four diagnostic indicators (**A**, **B**, **C**, and **D**). Normally these four items are shaded green, but will turn red if the Gateway detects an issue. Table 3 on page 21 describes the normal status for each indicator.

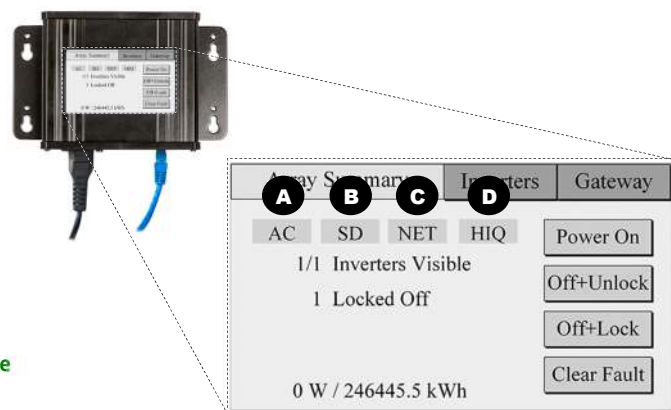


Figure 37: Status indicators on the Array Summary screen

The **SD** indicator (item **B** in Figure 37) shows that there is a problem with the Gateway memory card. This is described in the next section.



### (B) Gateway Memory Card Issues

- i) No memory card
- ii) Memory card not fully engaged
- iii) Memory card not formatted as FAT32

Logging of long-term performance data is saved to the memory card that was supplied with the Gateway. Note that the card is not required for the system to operate, only to retain historical information. If the card is in place but not fully engaged, the **SD** indicator (item **B** in Figure 37) will turn red.

The card is formatted with the FAT32 file system. If a different memory card than the one supplied is needed, it will need to be formatted similarly. This can usually be achieved on a personal computer. Consult the computer manual for details.

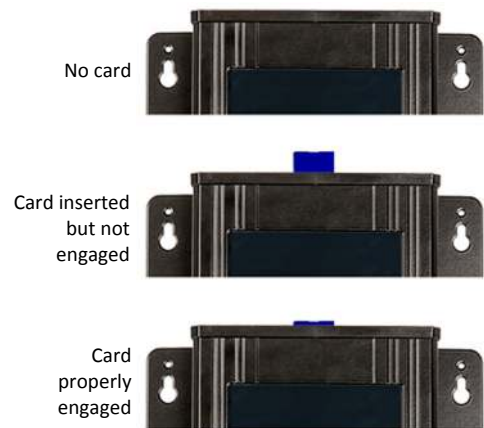


Figure 38: A memory card that is missing or not fully engaged

### (C) Gateway-to-Inverter Connectivity Issues

- i) The Gateway is wired into an unrelated AC circuit
- ii) The Gateway is too far away from inverter(s)
- iii) The Gateway is the wrong side of filtering on the AC circuit
- iv) Filtering present on the utility grid interfering with communication

The Communications Gateway connects to local inverters using Power Line Communications (PLC). For communication to work, the Gateway must receive a strong enough signal to exceed any line noise. It must be on the same electrical circuit as the PV system. This is not always easy to establish in a typical company electrical closet with many different circuits present.

Assuming the Gateway is on one phase of the correct PV system circuit, then issues are likely to arise if the signal strength is low. Issues are also likely to arise if equipment between the Gateway and PV system is interfering with or filtering the signal. In either case moving the Gateway closer to the PV system is likely to be the best answer.

It is also possible that two Gateways (or other inverter control devices from other manufacturers nearby) are interfering with each other. In this case an isolating filter to separate the inverter communications from the outside world might be required.

Note that a failure to establish communications can also occur if the neutral (white or grey) wire is connected incorrectly to one of the phases as discussed in the next section.

### (D) AC Wiring Issues

- i) AC output of inverter not connected to grid
- ii) AC connector not fully engaged
- iii) One phase of AC grid not connected
- iv) Neutral (white or grey) wire connected to a phase instead of neutral
- v) Connected to wrong voltage system (208 Vac 3-phase)

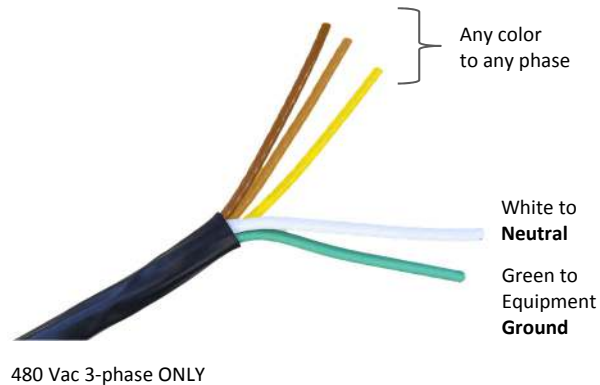


The inverter automatically senses the phases connected to it. When wiring the system to the utility grid it does not matter which of the red, blue or orange wires are connected to which phase. However, a fault will appear if the neutral (white or grey) wire is connected to one of the phases. This is the same fault that will appear if one of the three phases is disconnected. These conditions will not damage the inverter but should be corrected.

If one of the phases is not connected, the web and touch screen views will show one of the AC phases faulted rather than all three.

If the neutral is connected to one phase, the power line communications to the Gateway may not work.

**Figure 39: AC wiring scheme used for the ProHarvest 480V Inverter**



**CAUTION: Hazard to Equipment**

If the inverter is connected to the wrong voltage system, such as 208 Vac 3-phase, damage is likely to result. The system will need to be returned to the factory.

### (E) Inverter Installation Issues

- i) Underminated connectors allow moisture to ingress
- ii) Inverter in direct sun and temperature range exceeded, causing output to be reduced due to high internal temperatures. This protective feature helps to extend the lifetime of the inverter.

The inverter is NEMA6 rated and very robust. To maximize reliability and performance for the longest lifetime it should be mounted vertically in the shade and bolted to metal racking if available. However, it can be ballast-mounted in the shade. If the device is placed in a situation where it exceeds its rated temperature range it will reduce output power slightly until it is safely back within the operating temperature range.

As with all such devices, NEMA6 waterproof operation requires that all connectors, whether used or unused, be properly terminated. If this is not the case, moisture may ingress, causing the unit to eventually fail.

### (F) PV Module Wiring Issues

- i) PV module not connected
- ii) PV module wiring fault
- iii) Faulty wiring or connectors not fully engaged
- iv) Missing PV module

These are generally self-explanatory issues of connectors not engaged or damaged wiring.

## 8. Specifications

### 8.1. Power System Specifications

Inverter Specifications			
DC Input (2 identical inputs)			
Maximum open circuit voltage per String, V <sub>oc</sub>		1,000 Vdc	
Full power MPPT range, per string		425 to 850 Vdc	
PV start voltage		200 Vdc	
DC allowable stacking ratio (total, 2 inputs combined)		Must not exceed 6.375 under any circumstances <sup>4</sup>	
DC maximum input current, per DC input		10 A	
DC maximum source short circuit current		30 A	
DC maximum input source back feed current to input source		0 A	
DC disconnect means		The DC connector has been evaluated and approved for use as the load-break disconnect required by the NEC <sup>5</sup>	
AC Output			
AC maximum continuous output power to 45°C		8.0 kW <sub>ac</sub> max	
AC de-rate with temperature, 45 to +65°C		–150 W/°C	
AC nominal output current, per phase		9.6 A	
AC maximum continuous output current, per phase		9.6 A	
AC maximum output overcurrent protection		60 A	
AC 3-phase system compatibility		480 Vac Wye, 3 phases, neutral and ground	
AC voltage range, phase to phase (min / nominal / max)		422 / 480 / 528 V (Limits adjustable, see below)	
AC voltage range, phase to neutral (min / nominal / max)		244 / 277 / 305 V (Limits adjustable, see below)	
AC operating frequency range (min / nominal / max)		59.3 / 60 / 60.5 Hz (Limits adjustable, see below)	
Power Factor		>0.98	
AC output waveform		True sine wave	
AC lower frequency trip limit	Default	59.3 Hz	+/- 0.1 Hz
	Adjustment	57 to 59.8 Hz in 0.1 Hz increments	
	Clearing time default	0.16 s	+/- 2 cycles
	Clearing time adjustment	0.16 to 300 s	
AC upper frequency trip limit	Default	60.5 Hz	+/- 0.1 Hz
	Adjustment	60.5 to 62.0 Hz in 0.1 Hz increments	
	Clearing time default	0.16 s	+/- 2 cycles
	Clearing time adjustment	0.16 to 300 s	
AC lower voltage trip limit	Default	245 V	+/- 2 %
	Adjustment	220 to 245 Vac	
	Clearing time default	2 s	+/- 2 cycles
	Clearing time adjustment	1 to 20 s	
AC upper voltage trip limit	Default	305 Vac	+/- 2 %
	Adjustment	305 to 315 Vac	
	Clearing time default	1 s	+/- 2 cycles
	Clearing time adjustment	1 to 20 s	
AC reconnect delay	Default	5 min	+/- 1 s
	Adjustment	1 s to 10 min	

<sup>4</sup> Stacking: On the DC side of the inverter, each input limits at 5 kW and/or 10A. The combined total AC output is limited to 8 kW. Higher DC STC string powers may be applied. The inverter will limit as described above. Total stacking for inverter must not exceed 6.375 under any circumstances.

<sup>5</sup> NEC section 690.17, allowed by the exception of meeting requirements specified in 690.33.

AC synchronization in-rush current	0 A
Maximum output Fault current and duration	10 A, 0.5 ms
AC minimum wire gauge for the grid connection	14 AWG
AC disconnect means	The AC connector has been evaluated and approved for use as the load-break disconnect required by the NEC <sup>6</sup> .
<b>Other Specifications</b>	
Peak efficiency	98.6%
CEC efficiency	98%
Weight	11 kg (24 lb)
Operating temperature range	–40 to +65°C (–40 to +150°F)
Power consumption standby/ night	<4.5 W / <4.5 W
Cooling	Natural convection, no cooling fan
Communication	Power Line Communication
Environmental rating	Outdoor / rooftop, NEMA6, IP67
Certification, inverter	UL 1741 / IEEE 1547 (Utility Interactive), CSA C22.2 NO. 107.1, FCC Part 15 <sup>7</sup> . Meets the requirements of NEC 690.11
Included warranty	10 Years, optionally extendable

## 8.2. Communications Gateway Specifications

<b>Gateway Specifications</b>	
AC input voltage, min/nom/max	244 / 277 / 305 V
AC frequency, min/nom/max	59.3 / 60.0 / 60.5 Hz
Operating ambient temp range	–20 to +50°C
Power consumption	1.5 W typical (4 W max)
Mounting, environmental rating	Indoor — NEMA 1
Memory card	SD compatible, 4-32GB tested, FAT32 formatted
Communication with inverter	Proprietary Power Line Communication
LAN connection, Ethernet	10/100BASE, RJ45 8P8C modular plug
Limited warranty	15 years, optionally extendable
Compliance, certifications	UL 60950-1, CSA C22.2 No. 60950-1, FCC Part 15 <sup>7</sup>
Weight	1.3 lb

<sup>6</sup> NEC section 690.17, allowed by the exception of meeting requirements specified in 690.33

<sup>7</sup> Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

### 8.3. System UL 1741 Certificates



#### **MET Laboratories, Inc.**

*Safety Certification - EMI - Telecom - Environmental Simulation - NEBS*  
914 WEST PATAPSCO AVENUE • BALTIMORE, MARYLAND 21230-3432 • PHONE (410) 949-1802 • FAX (410) 354-3313

September 9, 2016

Mr. Marv Dargatz  
HiQ Solar  
Suite 101  
2030 Duane Avenue  
Santa Clara, CA. 95054  
U.S.A

Subject: Addition of Alternate Listee – Outback Power for the TS480-8k TS208-5k75 AC Splice Box  
Gateway, MET Reports 41585, 42256, 35411  
Listing Number E113740; MET Project Number 91941

Dear Mr. Dargatz:

Congratulations on successfully completing the MET Certification process for the addition of Outback Power as an Alternate Listee in the above mentioned reports. HiQ Solar may begin to apply the MET Mark on the above stated product at this time in accordance with the MET Mark Utilization Agreement or the MET Applicant Contract. The reports covering the above stated product will be forthcoming.

Thank you for the opportunity to perform this service for HiQ Solar. We look forward to future opportunities with your company.

*Sincerely,*

MET LABORATORIES, INC.

John O'Donnell  
Program Manager  
Safety Laboratory



*The Nation's First Nationally Recognized Testing Laboratory*  
*MET Laboratories, Inc. is accredited by OSHA and the Standards Council of Canada.*

**NRTL**

Canadian Certification has been granted under a System 3 program as defined in ISO Guide 67.

SAFI TEMP-160-0 Approval Letter for US CAN and MEX 1-18-14.doc

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**MET Laboratories, Inc.**

*Safety Certification - EMI - Telecom - Environmental Simulation - NEBS*  
914 WEST PATAPSCO AVENUE • BALTIMORE, MARYLAND 21230-3432 • PHONE (410) 949-1802 • FAX (410) 354-3313

October 15, 2015

Mr. Marv Dargatz  
HiQ Solar  
Suite 101  
2030 Duane Avenue  
Santa Clara, CA. 95054  
U.S.A

Subject: Amendment to HiQ Solar Inverter model TS480-8k  
-Addition of Alternate HiQ Solar Inverter model TS208-5k75  
Listing Number E113207; MET Project Number 86966  
Safety Standards: • UL 1741: Standard for Safety for Inverters, Converters, and  
Controllers for Use in Independent Power Systems, Second Edition  
• CSA C22.2 NO. 107.1-01 (R2011) Third Edition General Use Power  
Supplies

Dear Mr. Dargatz:

Congratulations on successfully completing the MET Certification process for the alternate HiQ Solar Inverter model TS208-5k75. HiQ Solar may begin to apply the MET Mark on the above stated product at this time in accordance with the MET Mark Utilization Agreement or the MET Applicant Contract. The reports covering the above stated product will be forthcoming.

Thank you for the opportunity to perform this service for HiQ Solar. We look forward to future opportunities with your company.

*Sincerely,*

MET LABORATORIES, INC.

Rick Cooper  
Director of Safety Business Line,  
Safety Laboratory



*The Nation's First Nationally Recognized Testing Laboratory*  
*MET Laboratories, Inc. is accredited by OSHA and the Standards Council of Canada.*

**NRTL**


Canadian Certification has been granted under a System 3 program as defined in ISO Guide 67.

SAFJ TEMP-160-0 Approval Letter for US CAN and MEX 1-18-14.doc

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## 8.4. Unit Rating Label

One of the following labels appears on the back of the unit baseplate.



**proharvest™**  
 by OutBack Power


Utility-Interactive 3 Phase Inverter


Model: TS480-8k

Part No: PRO480-8k Powered by  
HiQ Solar


S/N:

AC Maximum Continuous Output Power: 8.0 kW  
 AC Maximum Continuous Output Current: 9.6 A  
 3-Phase AC Output (min/nom/max): 422/480/528 V  
 Full Power MPPT Range, Per String: 425 to 850 VDC  
 DC Maximum Input Current: 10 A per input  
 Operating Frequency (min/nom/max): 59.3/60/60.5 Hz  
 Maximum Branch Circuit Overcurrent Protection: 60 A  
 Power Factor: >0.98  
 Operating Temperature Range: -40°C to +65°C  
 This Unit Incorporates AFCI Per NEC 690.11  
 This Unit Complies With NEC 690.35  
 This Unit Complies With FCC Part 15  
 Raintight Enclosure NEMA 6  
 Patents Pending

  
**E113207**

  
**E113207**

Complies with  
 UL 1741  
 CSA C22.2 NO 107.1




**HiQ  
Solar**


Utility-Interactive 3 Phase Inverter

Model: TS480-8k

S/N:

AC Maximum Continuous Output Power: 8.0 kW  
 AC Maximum Continuous Output Current: 9.6 A  
 3-Phase AC Output (min/nom/max): 422/480/528 V  
 Full Power MPPT Range, Per String: 425 to 850 VDC  
 DC Maximum Input Current: 10 A per input  
 Operating Frequency (min/nom/max): 59.3/60/60.5 Hz  
 Maximum Branch Circuit Overcurrent Protection: 60 A  
 Power Factor: >0.98  
 Operating Temperature Range: -40°C to +65°C  
 This Unit Incorporates AFCI Per NEC 690.11  
 This Unit Complies With NEC 690.35  
 This Unit Complies With FCC Part 15  
 Raintight Enclosure NEMA 6  
 Patents Pending

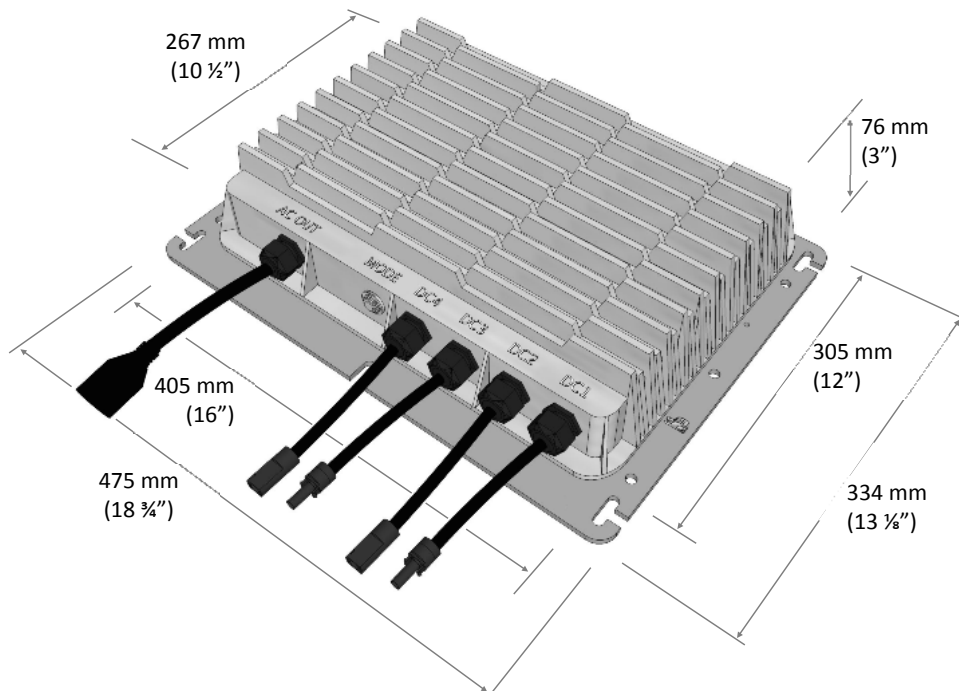
  
**E113207**

  
**E113207**

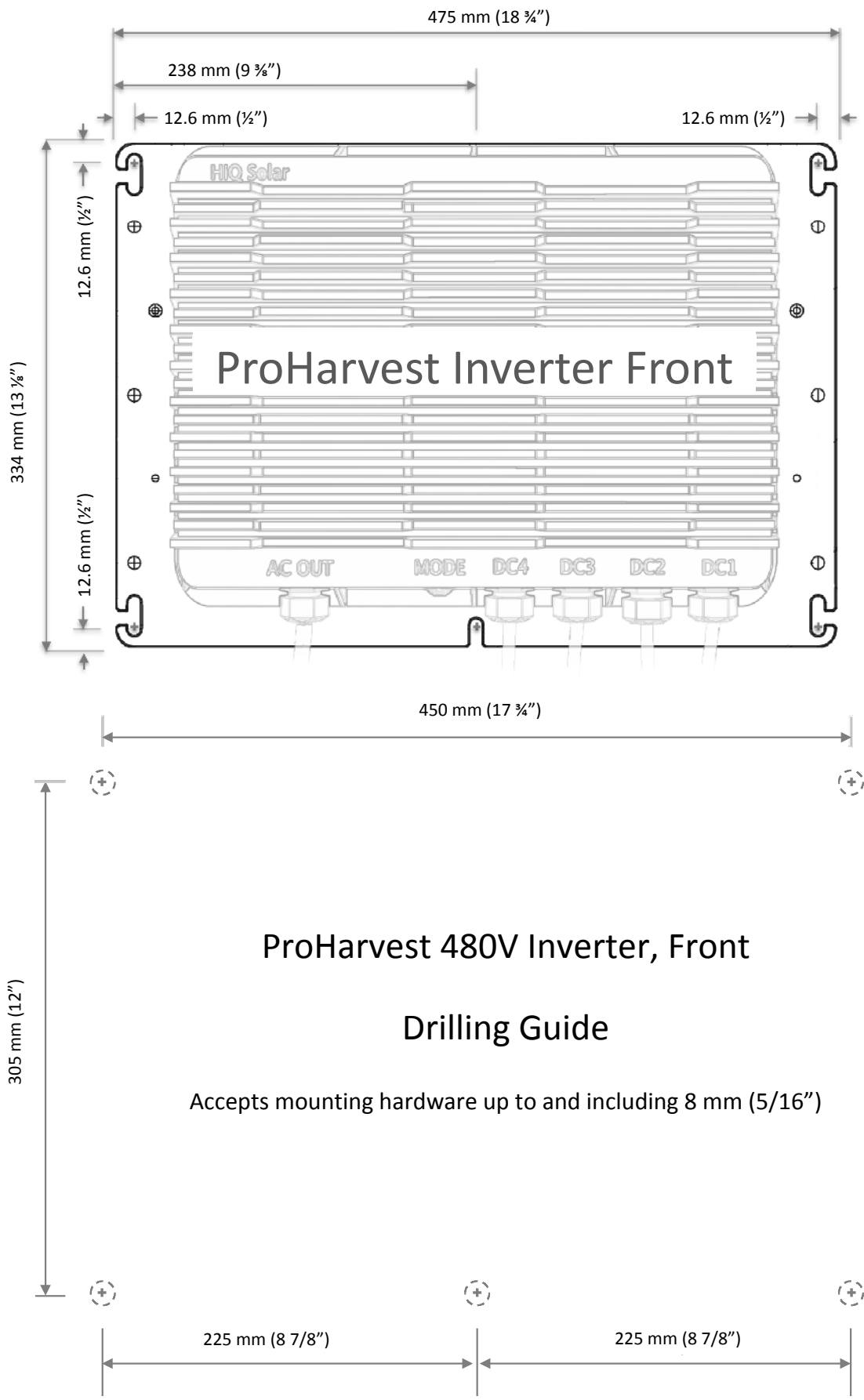
Complies with  
 UL 1741  
 CSA C22.2 NO 107.1

## 8.5. Physical Dimensions & Drilling Guides

### 8.5.1. ProHarvest 480V Inverter

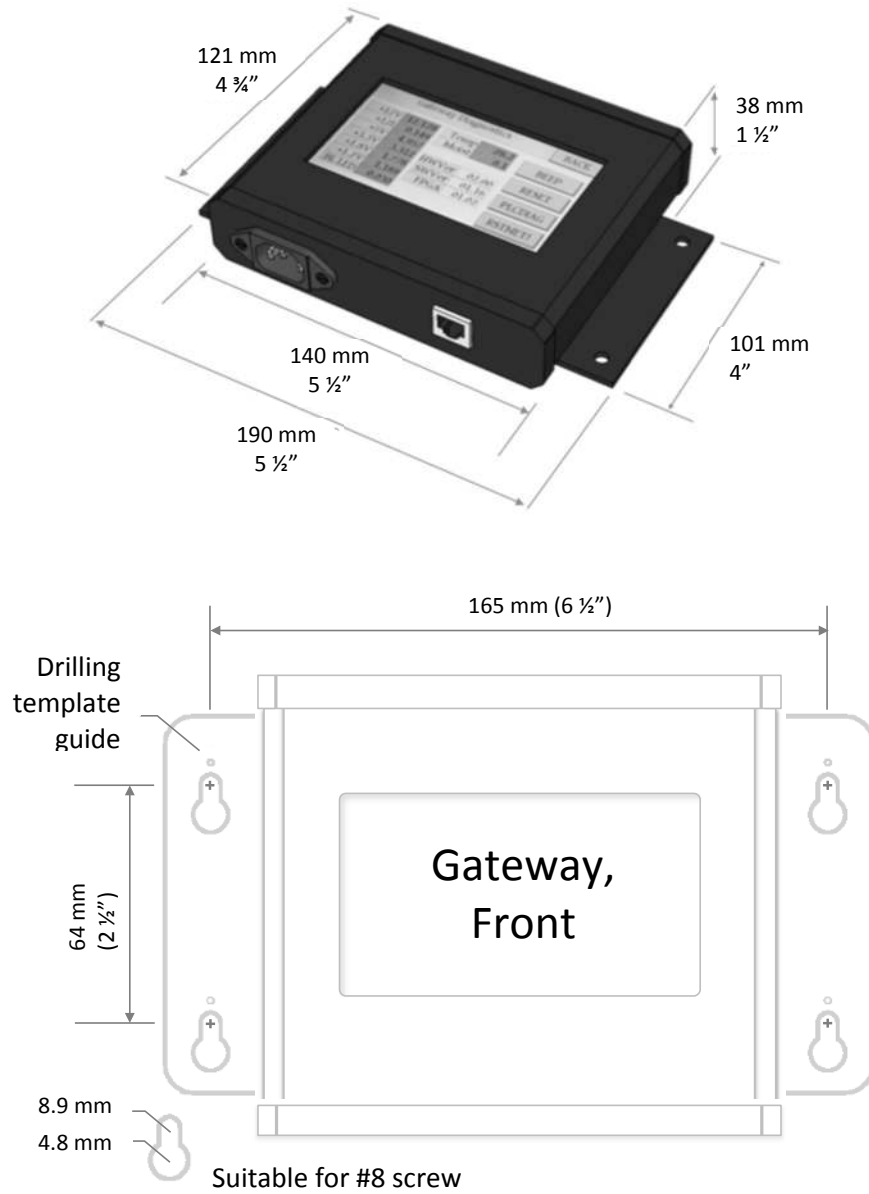








### 8.5.2. Gateway



Corporate Headquarters  
17825 – 59<sup>th</sup> Avenue N.E.  
Suite B  
Arlington, WA 98223 USA

<http://www.outbackpower.com>