



**TrueString TSXL380-8k-VN**  
**Grid-Interactive Inverter**  
**Installation & Operators Manual**



## About HiQ Solar

HiQ Solar is a leader in advanced energy conversion technology. HiQ products include compact high efficiency commercial power converters for utility interconnection of solar and battery energy systems.

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## Important Safety Instructions

# READ AND SAVE THESE INSTRUCTIONS!



This manual contains important safety instructions for the TrueString inverter system. The inverter system is designed according to North America safety requirements and has software configuration and firmware adjusted to meet the Vietnamese Utility Grid 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 manual.

## Symbols Used



	<b>WARNING: Hazard to Human Life</b> This type of notation indicates that the hazard could be harmful to human life.
	<b>CAUTION: Hazard to Equipment</b> This type of notation indicates that the hazard may cause damage to the equipment.
	<b>IMPORTANT:</b> This type of notation indicates that the information provided is important to the installation, operation and/or maintenance of the equipment. Failure to follow the recommendations in such a notation could result in voiding the equipment warranty.
	<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.

## Product Labels







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

	<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>WARNING: Beware of Hot Surface</b> This product may become hot during operation. Contact should be avoided.

## General Safety

	<b>WARNING: Limitations on Use</b> This equipment is NOT intended for use with life support equipment or other medical equipment or devices.
	<b>WARNING: Reduced Protection</b> If this product is used in a manner not specified by TrueString product literature, the product's internal safety protection may be impaired.

# Important Safety Instructions

	<p><b>WARNING: Shock Hazard</b></p> <ul style="list-style-type: none"> <li>❖ 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.</li> <li>❖ 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.</li> </ul>
	<p><b>WARNING: Burn Hazard</b></p> <p>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.</p>
	<p><b>CAUTION: Equipment Damage</b></p> <ul style="list-style-type: none"> <li>❖ Only use components or accessories recommended or sold by HiQ Solar or its authorized agents.</li> <li>❖ <b>Do not carry inverter by cables.</b></li> <li>❖ Connection of the system must be to a 3-phase AC source which is 380 Vac nominal only.</li> <li>❖ Inverters must be provided with an equipment ground.</li> <li>❖ All five circuits (L1, L2, L3, neutral, ground) must be connected. Neutral must be bonded to earth ground. Failure to do so can damage the unit and void the warranty.</li> <li>❖ The inverter has inputs for two separate DC strings. Reversal of polarity of one or both string inputs will irreparably damage the unit.</li> <li>❖ Do not allow water to enter the AC or DC connectors. Water entry can damage the unit and void the warranty.</li> <li>❖ In order to maintain the integrity of the watertight enclosures, all connectors must be properly and fully engaged.</li> <li>❖ 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.</li> </ul>
	<p><b>IMPORTANT:</b></p> <ul style="list-style-type: none"> <li>❖ All electrical installations must be performed in accordance with all applicable local, state and national requirements.</li> <li>❖ The inverter system is a utility-interactive system. Before connecting any PV system to the utility grid, contact the local utility company. This connection should only be made by qualified personnel.</li> <li>❖ The inverter components contain no user-serviceable parts. For all repair and maintenance, always contact an authorized dealer or installation partner.</li> </ul>
	<p><b>IMPORTANT: Gateway AC Connection Procedures</b></p> <ul style="list-style-type: none"> <li>❖ To connect: Plug the AC cable into the Gateway FIRST, and then energize the circuit by turning on the breaker or plugging in the wall plug.</li> <li>❖ To disconnect: De-energize the circuit by turning off the breaker or unplug the cable from the AC wall outlet FIRST, and then proceed to disconnect the cable from the Gateway device.</li> </ul>
	<p><b>NOTES:</b></p> <ul style="list-style-type: none"> <li>❖ Before installation, carefully read all instructions, cautions, and warnings in this manual.</li> </ul>

# Introduction

Thank you for purchasing a TrueString inverter system. The TSXL380-8k-VN is an easy-to-install, modular system which is optimized specifically for the Vietnam C&I and Utility Solar Market, for rooftop, ground mount and car port parking and shade structures. The TrueString inverter is sealed and waterproof and well suited to harsh environments including coastal, desert and high-altitude locations. Inverters may be mounted at any orientation, under modules, on racking without extra strengthening which reduces risk of liability from vandalism. Unlike other string inverters, each string is individually monitored and managed by the inverter.

## Audience

This manual provides instructions for installation, setup, and operation of the inverter and communication gateway products. These instructions are for use by qualified personnel who meet all local and governmental code requirements for the installation of three-phase 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. Failure to install or use this equipment as instructed in the literature can result in damage to the equipment that may not be covered under the limited warranty. This product is only serviceable by qualified personnel.



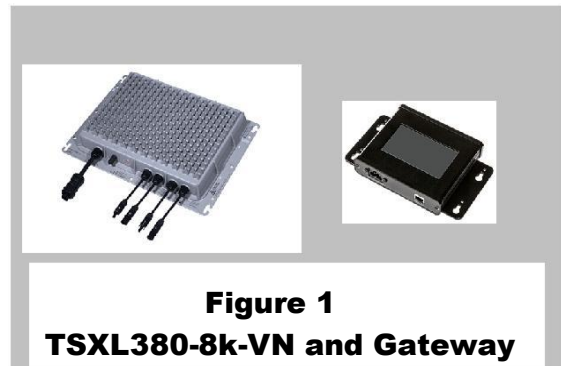
### IMPORTANT:

This manual provides safety guidelines and installation information for the TrueString inverter. It does not provide information about specific brands of PV modules.

## Features

The TSXL380-8k-VN inverter system has the following features.

- o Rugged 3-phase 380V plug & play system
- o Small and light (hand holdable, 30.6 lb.)
- o Non-isolated inverter for use with ungrounded DC systems
- o Peak 97.8% efficiency
- o 200-850V DC MPP voltage range for 600V and 1,000V systems
- o 7.9 kW AC full power MPP voltage range 450-850V
- o Two DC string inputs with independent monitoring and MPPT management.
- o Waterproof NEMA6, silent convection cooling enclosure
- o Designed for high reliability, uses no electrolytic capacitors
- o Wide temperature range, -40 to +65°C
- o Configured for Vietnam Utility Grid Compliance



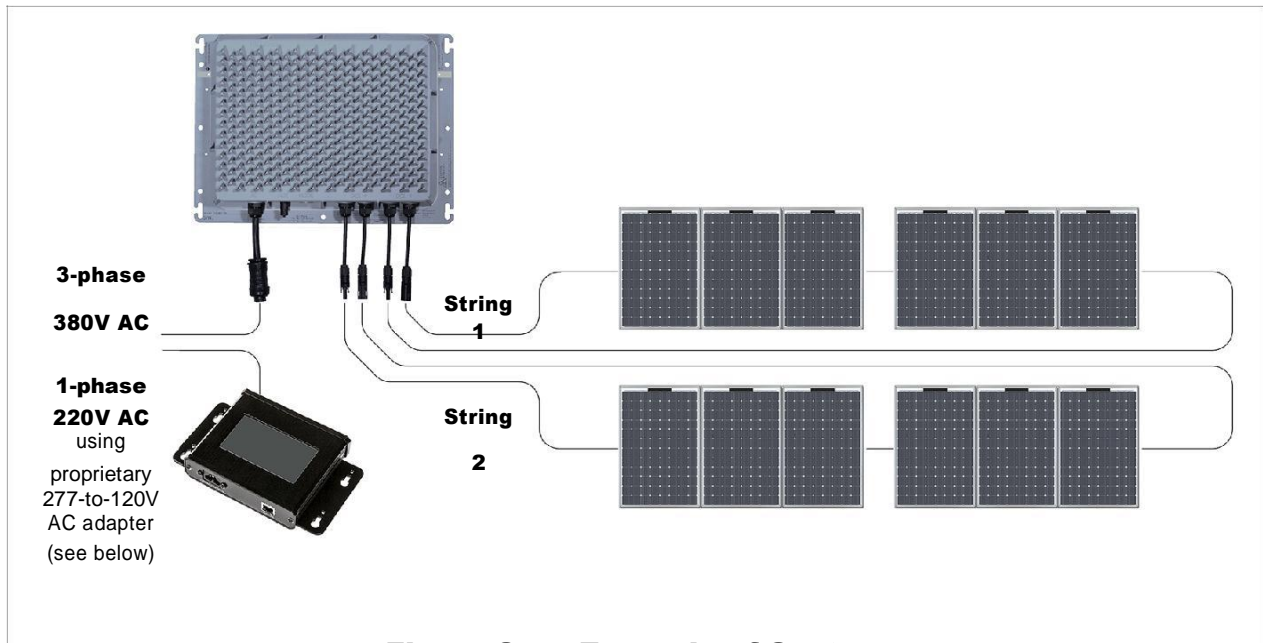
## Components and Accessories

- o One TSXL380-8k-VN inverter connects to up to 2 strings of PV modules. It also connects to the three-phase, 380V / 50Hz AC-compatible utility connection on the installation site. The TrueString inverter is a non-isolated inverter for use with ungrounded DC systems.  
Multiple inverter outputs may be connected in parallel using the splice box ACSPL-60.
- o One Gateway module connects to a 220V / 50Hz AC line-to-neutral branch of the utility connection used for the TrueString inverter (three-phase, 380V AC-compatible). The Gateway module provides for system monitoring, logging and control. The Gateway is designed for indoor use only. The gateway is sold separately  
Internet access should be provided for the Gateway to enable firmware updates and to provide customer support functions.

## System Overview







The TSXL380-8k-VN is an easy-to-install, modular system which is optimized specifically for commercial and industrial rooftop, ground mount and car port, parking and shade structures solar array applications. Unlike other string inverters, each string is individually monitored and managed by the inverter.

A typical layout is shown in Figure 2. It depicts two strings of PV modules supplying a single inverter. A Gateway is shown connected to one 220V AC phase. Note that while the Gateway provides detailed reporting and user control, it is optional. The system will generate power without it.



**Figure 2 Example of System**

**Table 1 System Ordering and Part Numbers**

Item	Part Number	Description
Inverter, 7.9 kW, 380V AC 3-phase 	TSXL380-8k-VN	Inverter with MC4-compatible connectors (1 each). Includes 10-year limited warranty. Does not include Gateway or AC cable. These two items must be ordered separately.
480V AC inverter AC Cable 	CBL-480A-05 CBL-480A-15 CBL-480A-30 CBL-480A-50	5 ft, 15 ft, 30 ft, and 50 ft. Each includes one 480V AC mating connector; the other end is unterminated.
Connector Tools 	TOOL-KIT-1	MC4-Compatible Connector Unlatching Tool (10 each), plus AC Connector Unlatching Tool (10 each)
AC Splice Box 	ACSPL-60	AC combiner splice box, NEMA4 enclosure. Includes 3 gland fittings for up to 3 inverter AC cables. Inverter AC cables must be ordered separately.
Gateway 	GW-A-277	GW-A Gateway (1 each). Includes 277-to-120V AC adapter and ethernet cable (1 each). Also includes memory card for logging and storage of results.
Ballast Roof-Mount System 	MNT-TS1-01	Mounting system for one inverter. Includes mounting feet (4 each) and associated hardware.





# Planning

## Design Guidelines

### 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 limitations on stacking ratio for the TrueString inverter are the voltage and current limitations of the string inputs. The full power maximum power point tracking voltage range for the string inputs is 450 to 850V DC. The specified maximum short circuit current of the DC source is 30A DC. However, the specified stacking ratio is a maximum of 4.0.

A more practical limitation is due to the power and current limits imposed by the inverter firmware. Input power is limited to 6 kW per string and input current is limited to 12A DC per string.

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

Also, as PV modules soil and age, their power output decreases. In addition, the STC rating of modules is typically very optimistic. In reality, most modules produce approximately 85 to 90% of their STC rating. The system designer is responsible for specifying the string parameters to remain within the inverter ratings. Simulation software can help determine the best design.

### Location

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

### Inverter Placement

The TSXL380-8k-VN inverter is NEMA Type 6 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.

### Clearances

Provide the following minimum space between the inverter and other inverters, or other surfaces.

- 1” on all sides
- 4 to 5” from the heat sink (in any direction) to allow air circulation around the cooling fins
- 1” from the main mounting surface (using the ballast roof-mount system, Unistrut mounting, etc.)

## Introduction

### Gateway Placement

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

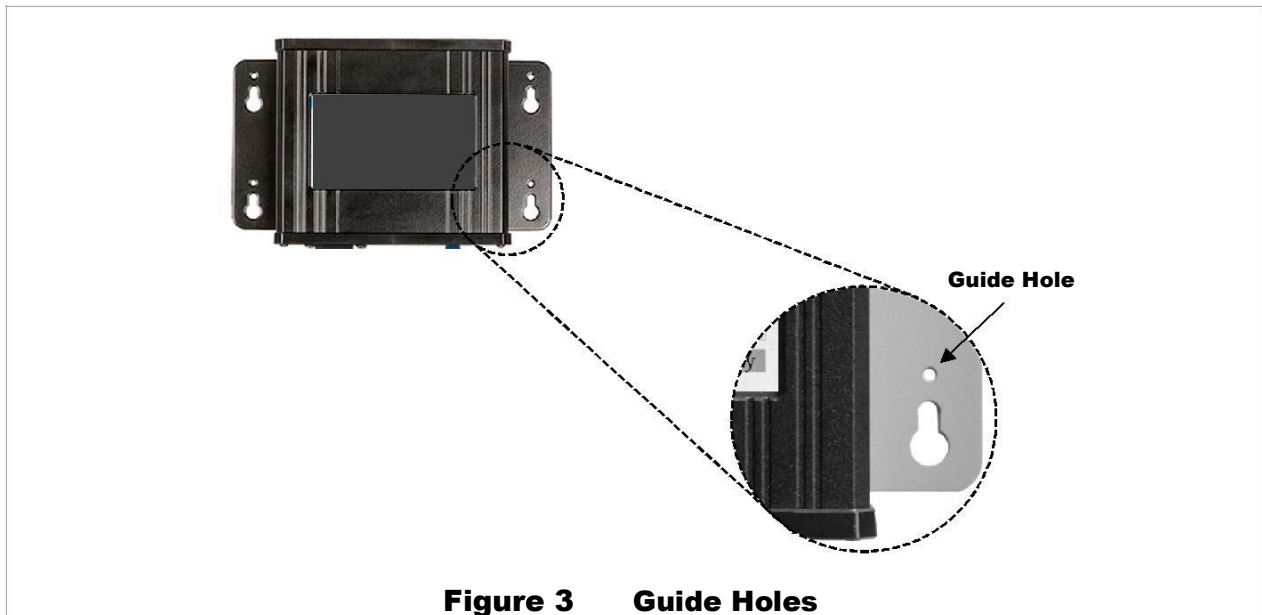


#### **CAUTION: Equipment Damage**

The Gateway is not rated for outdoor installation.

**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. If outdoor placement is required, the Gateway must be housed in a weatherproof enclosure.**

- The Gateway 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 accidentally connect to an unrelated AC circuit.
- The Gateway should be protected by a 15A AC overcurrent protection device (OCPD).
- To provide the best power line communication (PLC) signal possible, it may be useful to add a 220V AC outlet at the earliest entry point in the building. The ideal outlet location would be next to the circuit breaker.
- A wired Ethernet network connection must be provided to the Gateway for proper data retrieval.
- The Gateway has 'keyhole' mountings on its baseplate. Each hole has a guide hole. (See Figure 3.) These four holes can provide a template for mounting such that a pen or center punch can be inserted to mark the wall and ensure accurate drilling of holes. The Gateway can be mounted using #8 screws.



**Figure 3 Guide Holes**

### Surge Suppression



#### **CAUTION: Equipment Damage**

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. Surge caused damage is not covered by the warranty terms.

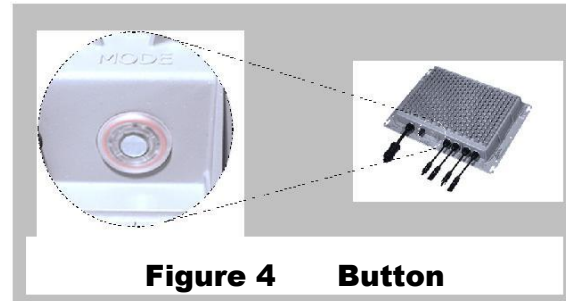
# Installation

The TrueString TSXL380-8k-VN employs industry-standard connection methods. These include locking interconnects for PV module attachment and standard 5-lead, three-phase AC wiring compatibility. Make certain to follow all instructions carefully.

## Buttons and Indicators














While most installations will use a Gateway to control and report, it is not mandatory. The TrueString has a single button with eight LED indicators to give responses and operating states. The inverter can be controlled using the button as shown in Table 2. Other TrueString status messages provided by button illumination are shown in Table 3 on the next page.

The LED indicators will not become active until the inverter receives power. See the **Connection Outline** section beginning on page 13 for power-up.




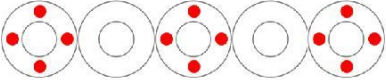
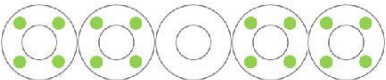



**Figure 4 Button**

**Table 2 Inverter Commands (Button)**

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

**Table 3 Inverter States (Button)**

Inverter Indicator State	Button Indication
Green solid 	<ul style="list-style-type: none"> <li>o Powered up</li> <li>o Not generating</li> <li>o No faults</li> </ul>
Green, left-right alternating flash 	<ul style="list-style-type: none"> <li>o Power-on self-test or Grid monitoring (will take &lt;5 minute)</li> </ul>
Green, clockwise circular flash 	<ul style="list-style-type: none"> <li>o Powered up</li> <li>o Generating</li> <li>o No faults</li> </ul>
Red rapid flash 	<ul style="list-style-type: none"> <li>o Fault condition</li> </ul> Examples: <ul style="list-style-type: none"> <li>• DC side: RCD or Arc has been detected</li> <li>• AC side: Grid voltage or frequency out of range</li> </ul>
Green flash, mostly on 	<ul style="list-style-type: none"> <li>o <b>Off &amp; Locked</b></li> <li>o Disabled</li> </ul>
Green flash, mostly off 	<ul style="list-style-type: none"> <li>o Sleeping</li> <li>o Not generating</li> </ul>

# Connection Outline



## CAUTION: Equipment Damage

- ❖ The system must be connected to 380V / 50Hz AC 3-phase wye 5-wire only.
- ❖ The inverter must be provided with an equipment ground according. **Do not apply DC or AC voltage before properly grounding.**
- ❖ 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.
- ❖ The TrueString inverter has inputs for two separate DC strings. Reversal of polarity of one or both string inputs or across both inputs will not allow the unit to operate. Use a voltmeter to carefully verify that the DC inputs are correct before connecting to the inverter DC inputs.
- ❖ The Gateway is for indoor use only.
- ❖ **Do not carry inverter by cables. Damage is not covered by warranty terms.**
- ❖ Use best cable installation practices. **Do not over stress, tension, or bend cables.**
- ❖ In order to maintain the integrity of the watertight enclosures:
  - ✓ All connectors must be properly and fully engaged.
  - ✓ Unused connectors must be sealed using appropriate weatherproof caps.
  - ✓ Do not allow moisture to enter the AC cable wires through the Splice box.
- ❖ Never mate inverter cables that have been left disconnected and exposed to wet conditions. This voids the warranty.
- ❖ Make certain the Gateway is kept within the specified temperature range of -20 to +50 °C. In extreme cold conditions, a heater may be needed.



## NOTE:

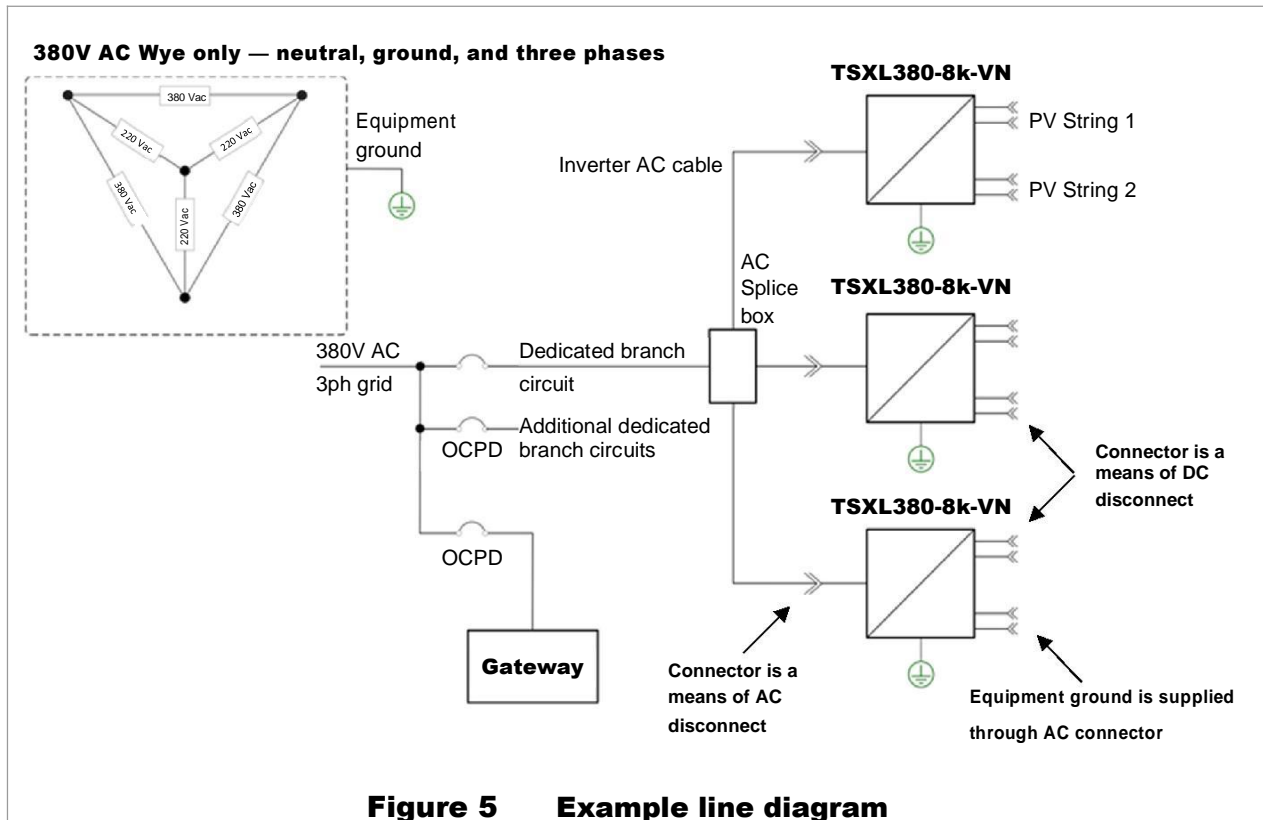
- ❖ Up to five inverters may be connected on the same branch to a single 80A AC OCPD.
- ❖ HiQ offers a NEMA4 AC Splice junction box to connect up to three inverters. A certified splice box that meets local safety codes must be used.
- ❖ Perform all electrical installations in accordance with all applicable local electrical codes.

# Connection Order

## Make connections in the following order:

- A.** (Page 14) Connect an equipment ground to the inverter. This step should always be performed first.
- B.** (Page 15) Connect the inverter to the utility grid, leaving the connection turned off.
- C.** (Page 17) Connect the PV module strings to the inverter inputs.
- D.** (Page 18) Turn on the AC source.
- E.** (Page 19) Connect the Gateway to one 220V AC (line-to-neutral) branch of the same 380V AC circuit as the inverter and the network. Observe the inverter's operation.
- F.** (Page 21) Unlock any inverters that powered up in the **Locked Off** state.

# Installation



## Connection Steps

### A. Grounding

This connection should always be established before taking any other steps.

#### To establish a ground connection:

1. Connect the metal enclosure of the inverter to earth ground.
  - The equipment ground is provided through the AC connection. The system may also be grounded using the mounting bolts to any properly grounded metallic structure. A paint-cutting washer, such as a stainless steel star washer, must be used.
  - The inverter case may be grounded by connecting a ground conductor to a lay-in lug (not provided) attached to the chassis. See Figure 6.







#### **CAUTION: Equipment Damage**

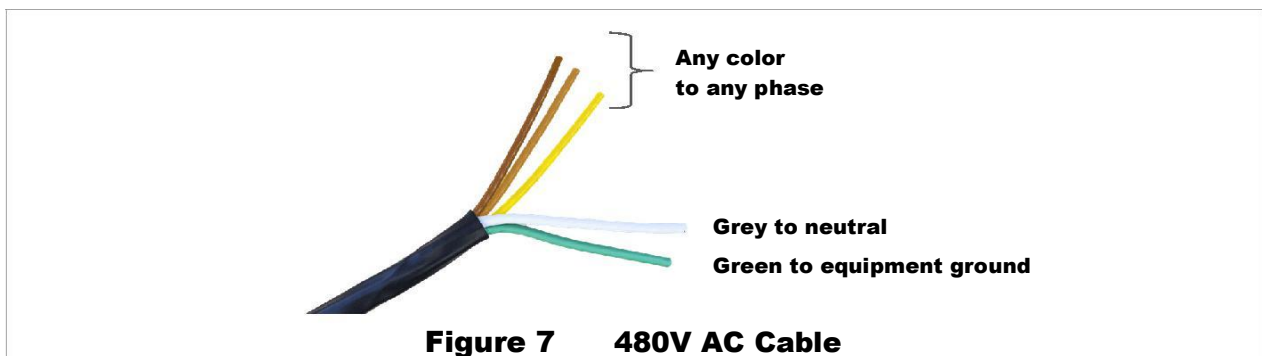
Do not connect any DC or AC voltage unless the inverter is properly grounded

## B. AC Wiring

To connect the inverter to the utility grid:

	<p><b>WARNING: Shock Hazard</b> This product incorporates high voltages.</p>
	<p><b>CAUTION: Equipment Damage</b> The neutral must be bonded to earth ground. Failure to do so can damage the unit and void the warranty. <b>Do not carry unit by cables as it will damage it and void the warranty.</b></p>
	<p><b>IMPORTANT:</b> The unit is only watertight when connectors are fully engaged. If connectors are left unconnected, they must be protected from moisture. Do not tightly bend cables.</p>
	<p><b>NOTE:</b> The inverter AC cables are TC-ER rated<sup>1</sup>.</p>

- Connect the inverter AC cable (sold separately) to the 380V / 50Hz AC circuit. Follow the wiring conventions shown in Figure 7.
  - All five conductors (L1, L2, L3, neutral, ground) must be connected. Note that particular care is required to ensure that an effective neutral connection is maintained when a transformer is part of the installation. See page 16.
  - The inverter exports power only on the “line” (hot) conductors. The neutral conductor is used solely for voltage sensing and power line communications.



- Connect the inverter to the AC system by connecting the AC cable plug to the inverter plug as shown in Figure 8. Lock the cable by rotating the collar of the whip cable into the locked position.

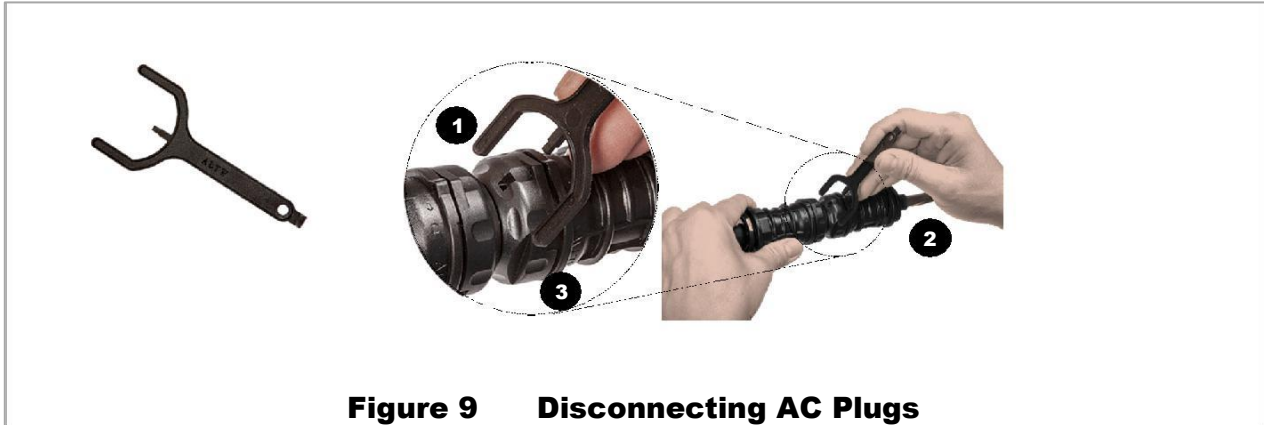


- Do not turn on AC power to the inverter until instructed in Step **D** on page 21.

<sup>1</sup> The “-ER” signifies that the cable is sufficiently rugged for the NEC (section 336.10) to permit its use as “exposed wiring”. This refers to wiring not installed in a tray, conduit or other raceway. It must be secured every 6 feet or less and protected from physical damage.

## Installation

### Disconnecting the AC Plugs



The AC connector can be unlocked by inserting the tool into the whip cable connector hole and rotating the collar.

The TSXL380-8k-VN comes in a connector-less version for installation locations which have another form of AC disconnecting means or do not require it, per local electrical codes. For this instance, in addition to the retaining as mentioned above, the AC cable must be secured within 3 feet of the unit.

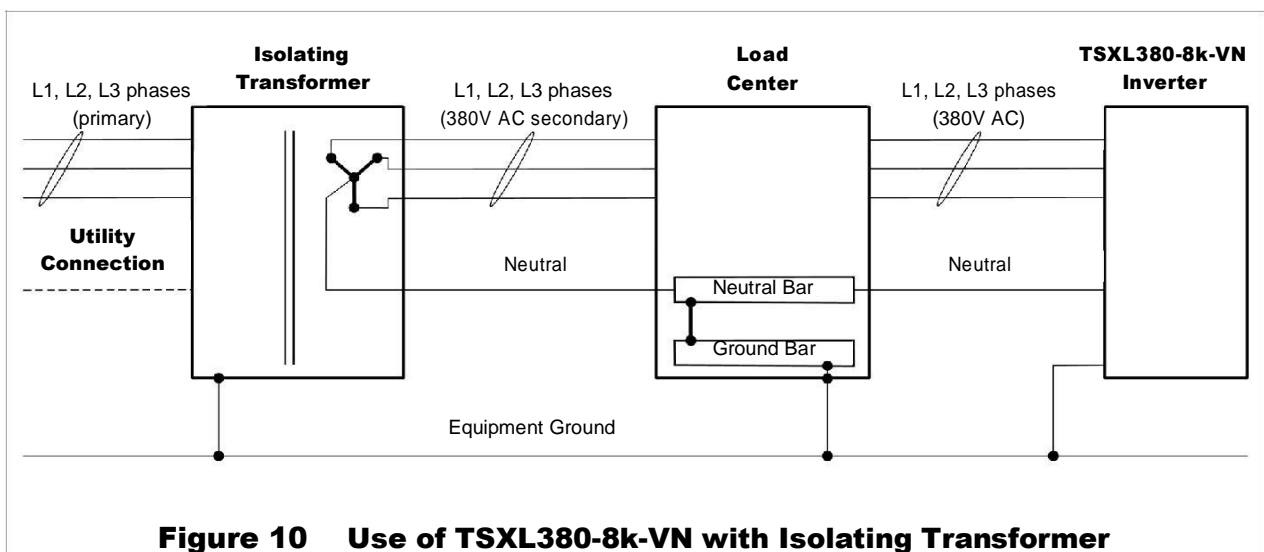
### Using a Transformer

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



#### **CAUTION: Equipment Damage**




The neutral must remain bonded to earth ground. When an isolating transformer is inserted into the circuit, the neutral may lose any path to equipment ground that was provided elsewhere. Make sure a neutral-ground bond is established on the inverter side of the transformer. An example of bonding in the load center is shown in Figure 10.





## C. PV Module Connection

To connect the strings of PV modules:

	<p><b>CAUTION: Equipment Damage</b> Do not exceed 1000V on the DC inputs. This will cause irreparable damage to the TrueString inverter and is not covered by the warranty terms. Do not carry unit by the cables as it will damage it.</p>
	<p><b>IMPORTANT:</b> The unit is only watertight when connectors are fully engaged. If connectors are left unconnected, they must be protected from moisture. Do not tightly bend cables.</p>
	<p><b>NOTE:</b> Connection may be made with the AC source on or off. This section assumes the source is off.</p>

1. Connect the male and female plugs, inserting them together by hand as shown in Figure 11. Make sure the connectors are fully locked and will not pull apart.
2. With DC voltage present (but AC power turned off), the inverter button will flash red. (See page 11.) This is normal when no grid is present.



**Figure 11 Connecting PV Plugs**

### Disconnecting the PV Plugs

1. Use the DC tool to disconnect the male and female connectors. Follow steps **1** and **2** in Figure 12. Before disconnecting, make sure there is no current present with a DC clamp meter.

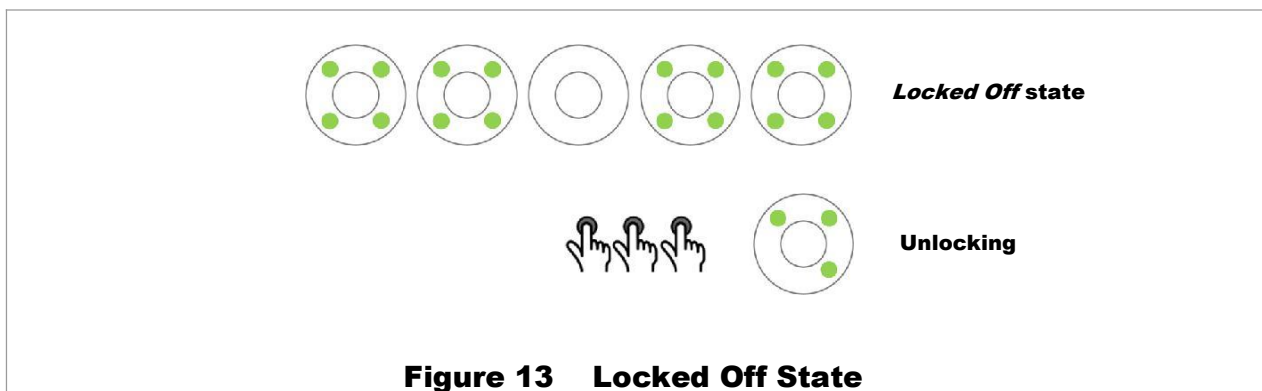


**Figure 12 Disconnecting PV Plugs**

## D. AC Power-Up



### To power up the inverter:

1. Turn on the utility grid connection. This starts a 5-minute timer. While this timer runs, the inverter tests the grid power to ensure all requirements are met. When this timer expires, each inverter will perform a self-test and then begin generating.
  - To skip the 5-minute timer, see page 21.
2. Observe the inverter button LED indicators. (See page 11.) During the wait period, the green lights will be flashing back and forth. Once the period expires and the inverter begins generating power, the green lights will flash in a clockwise circular motion.
  - This does not apply if the inverter is in the **Locked Off** state. (See page 21.) In this state, the TrueString inverter is active but is prohibited from generating power. The locked state is indicated by all green indicators on and flashing off momentarily repeatedly.
  - An individual inverter may be unlocked and turned on to begin generating by pressing the inverter button three times (Figure 13).
  - The Gateway can unlock multiple inverters at the same time. See page 21.

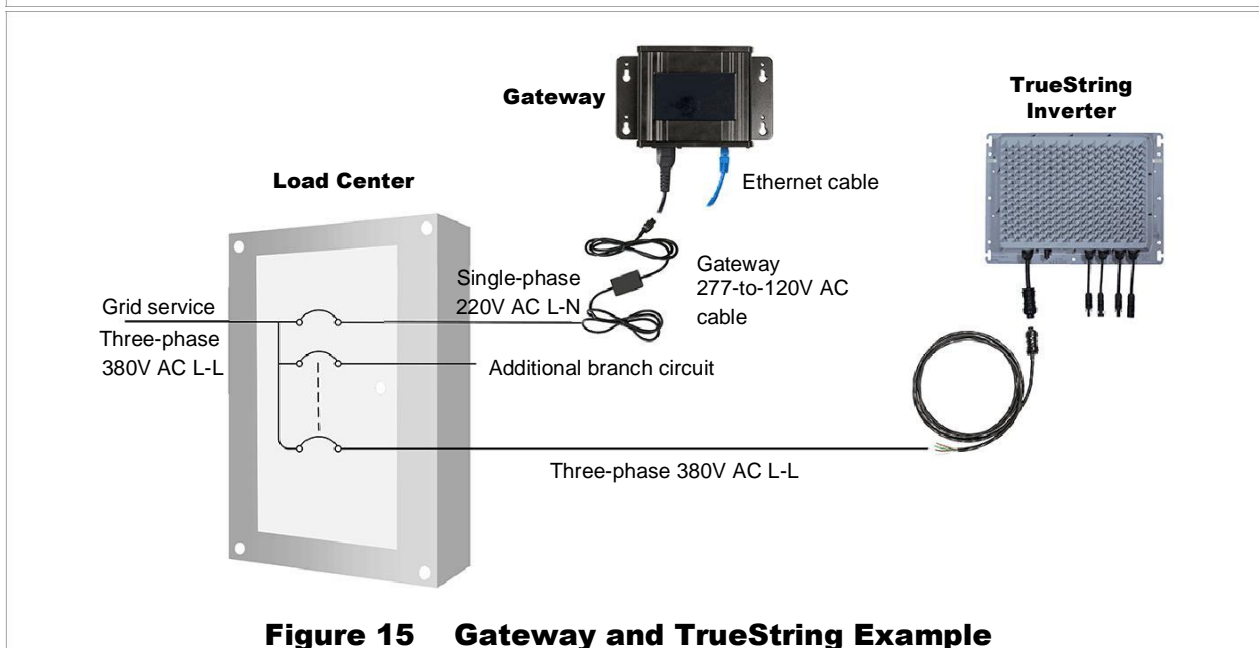
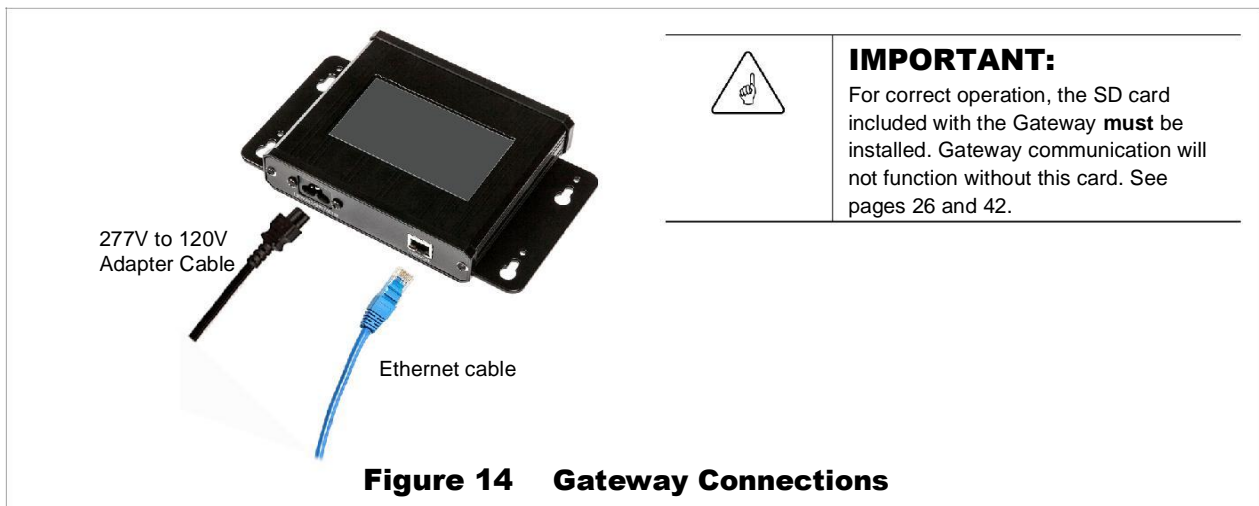


## E. Gateway Connection

**To connect the Gateway:**

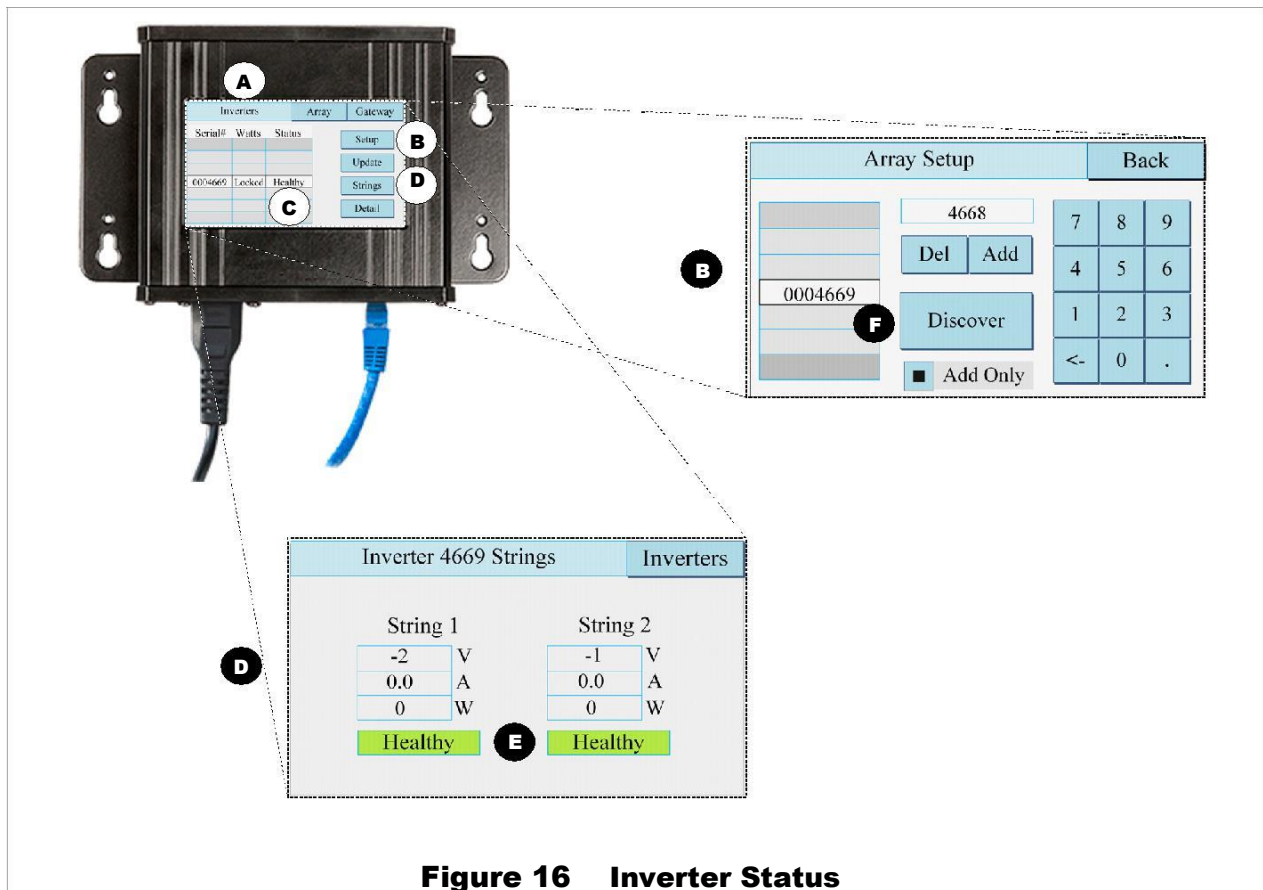
	<p><b>CAUTION: Equipment Damage</b></p> <p>The Gateway is rated for indoor installation only.</p>
	<p><b>NOTE:</b></p> <p>The Gateway should be located as near to the inverter(s) as possible for reliable communication. An electrical connection in the same subpanel as the inverter branch circuit breakers is recommended.</p>

1. Connect the Gateway 277V to 120V adapter cable to one 220V AC (line-to-neutral) branch of the same 380V AC circuit as the inverter and the network. The maximum branch overcurrent protection is 15A. Plug the adapter cable into the gateway.
2. An Ethernet connection may also be made at this stage.



## Installation

- Turn on AC power to the Gateway and wait for the screen to illuminate.
- On the Gateway screen, select the **Inverters** tab **A** at the top of the screen if it is not already selected. (See Figure 16. Also, see pages 23 and 26 for Gateway navigation and inverter states.)
  - To check inverter status, press the **Setup** button **B**. On the **Array Setup** screen, press the **Discover** button **F**. The Gateway will search for all inverters. Confirm that they indicate **Healthy** status as shown in **C**. If the Discover does not find any or some of the inverters, they can be manually entered by entering the numeric part of the serial number into the box using the number pad and pressing the **Add** button.
  - To check the status of the PV strings connected to each inverter, press the **Strings** button **D**. On the **Inverter Strings** screen, confirm that they indicate **Healthy** status as shown in **E**.



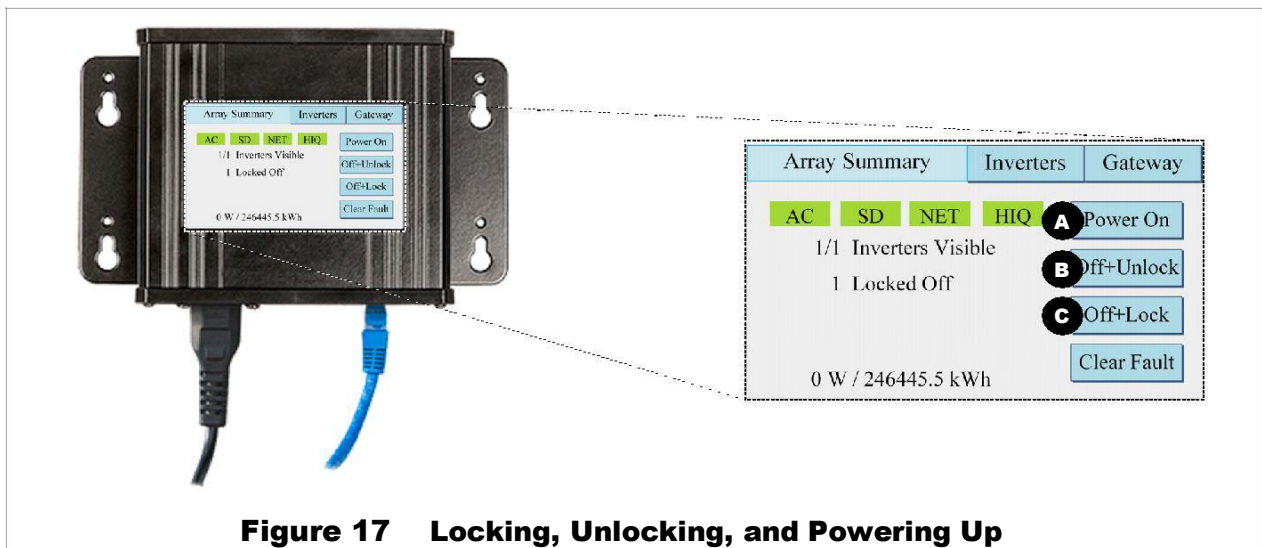
**Figure 16 Inverter Status**

## F. Unlocking and Locking Inverters

On page 18, when AC power is applied, the inverter will begin a 5-minute timer to test the utility grid then start generating or the inverter may power up in the **Locked Off** state. If it powers up in the locked state, this prevents the system from generating power when not desired.

### To unlock inverters in the **Locked Off** state:

- To unlock an individual inverter, press the inverter button three times. See pages 11 and 18.
- To unlock multiple inverters, open the Gateway's **Array** tab. The **Off+Unlock** button **B** will unlock all inverters in the system. (See Figure 17. Also, see pages 23 and 26 for Gateway navigation and inverter states.)
- To turn on all of the inverters, press the **Power On** button **A**. The units will self-test and then begin generating. (See Table 3 on page 12 for the LED indications of self-test.) Once self-test has been successfully completed, power generation begins.
- To place all of the inverters in the locked state, press the **Off+Lock** button **C**.



**Figure 17 Locking, Unlocking, and Powering Up**

**Connection is complete.**

## Disconnection

When disconnecting the TSXL380-8k-VN, perform the lettered steps (from pages 14 through 19) in reverse. (See Figure 9 on page 16 and Figure 12 on page 17.) The ground is the last item to be disconnected.



### **WARNING: Shock Hazard**

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.



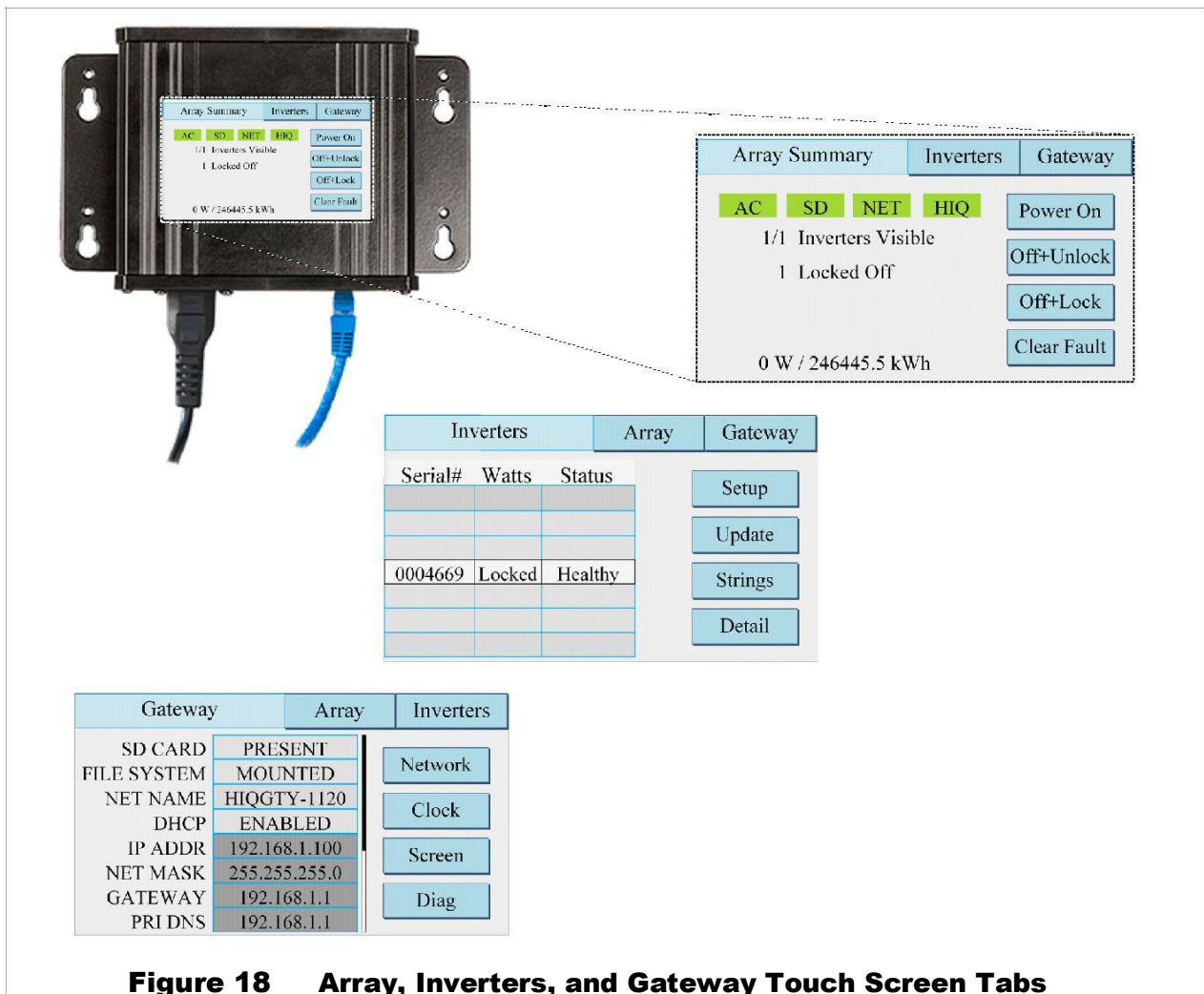
# Gateway Operation

The Gateway (sometimes referred to as the Communications Gateway) is a module used for interface and communication with TrueString inverters.

- o The Gateway uses power line communication (PLC) to communicate with the TrueString.
- o The user can check status and change settings on the Gateway using a touch screen. If Ethernet communication is enabled, the user can access these functions on a web page.
- o The Gateway can also archive performance history on a memory card.

## Touch Screen

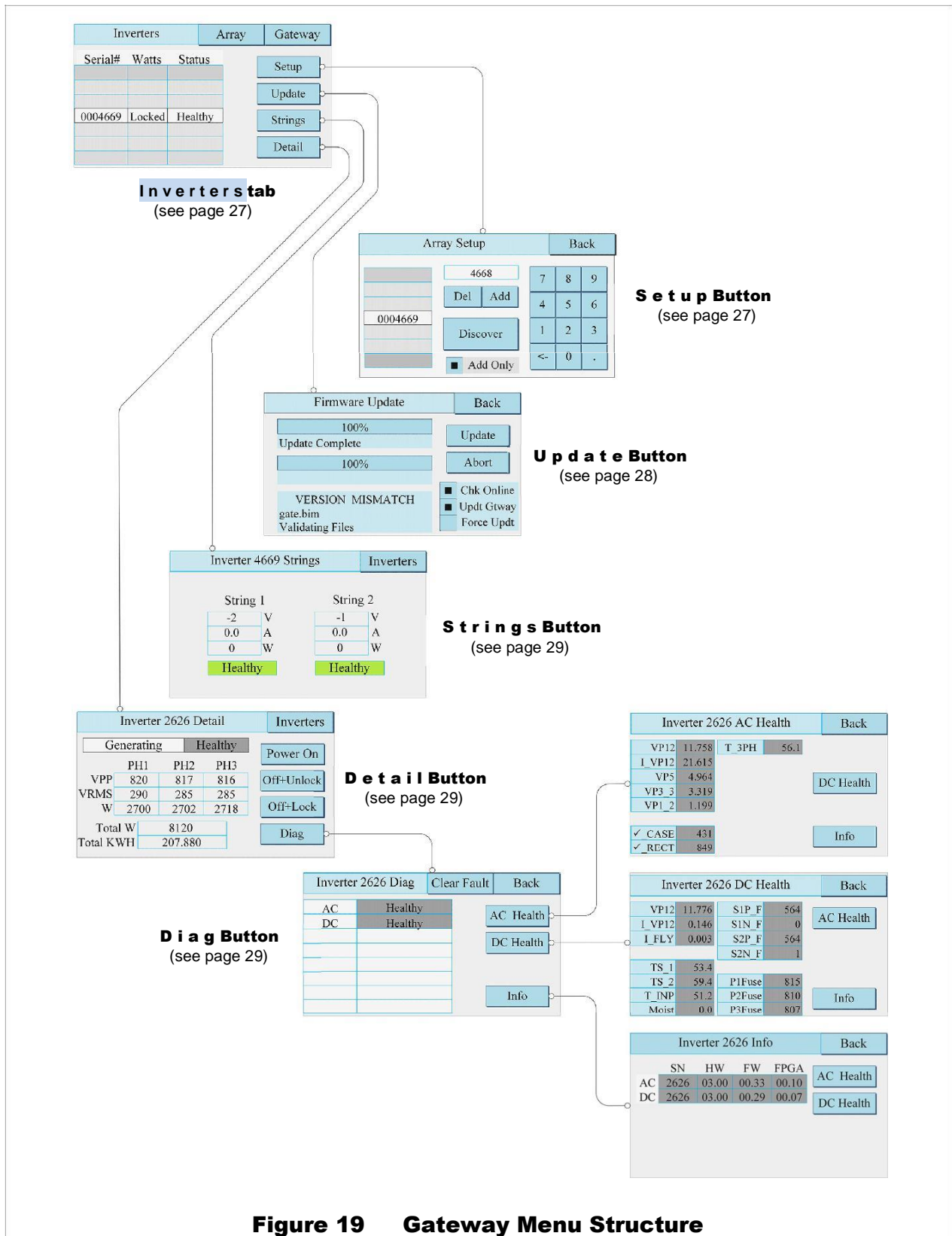
The Gateway touch screen has three tabs: **Array**, **Inverters**, and **Gateway**. When selecting any tab, it moves to the left side of the screen and opens a new series of options. The names of some selections may expand when pressed.



**Figure 18 Array, Inverters, and Gateway Touch Screen Tabs**

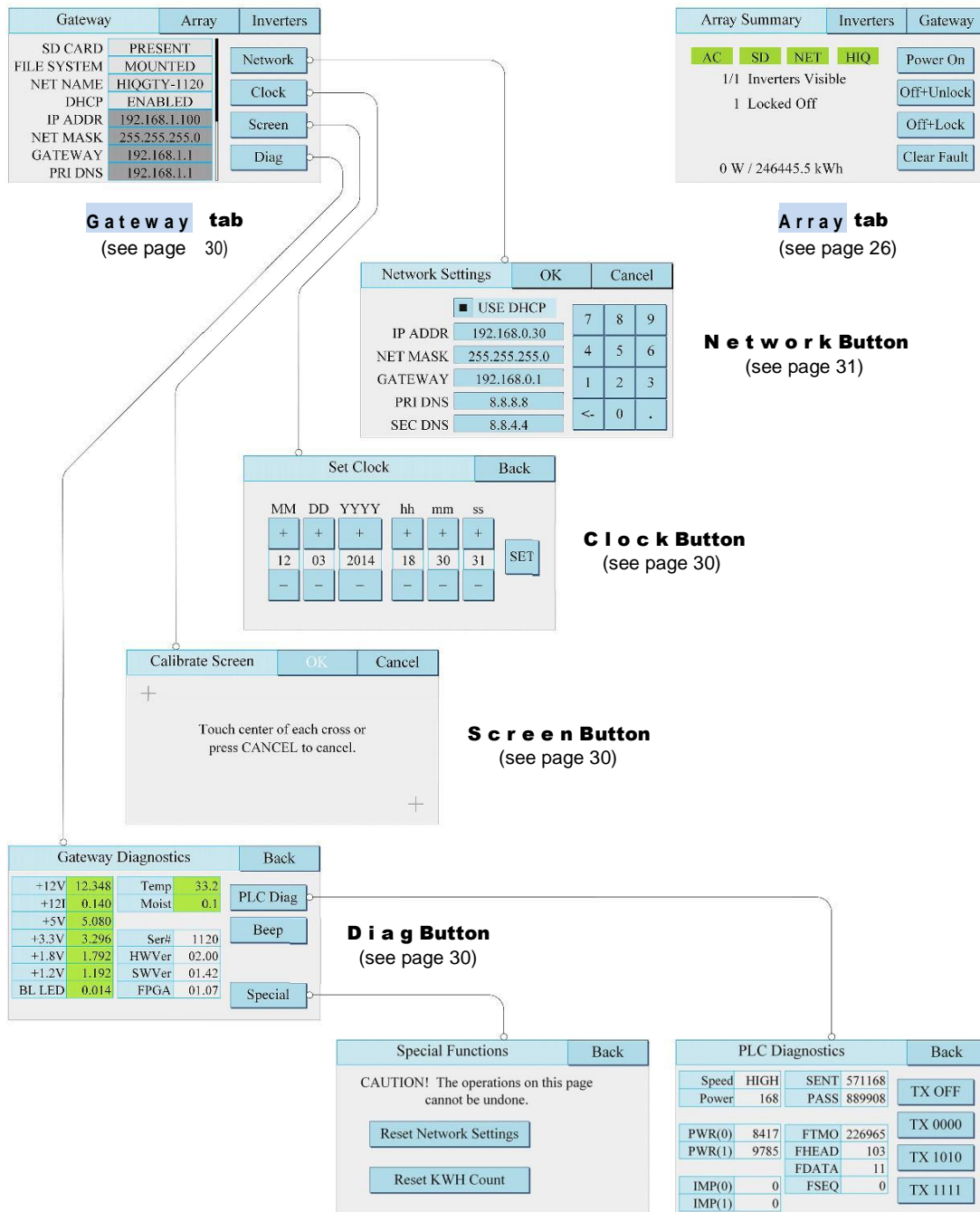


# Menu Map



**Figure 19 Gateway Menu Structure**





**Figure 20 Gateway Menu Structure (continued)**

## External Access

The Gateway gathers data from inverters using PLC and displays information on its touch screen. With a suitable Ethernet connection, it is capable of acting as a web server, allowing a local computer or a remote computer with firewall access to see real-time system performance displayed on a web page. Data is also transferred to servers to gather history, which can be accessed remotely. See **Accessing the Gateway** on page 31 for login instructions.

## Array Tab (Array Summary Screen)

The **Array** tab opens the **Array Summary** screen, which features several TrueString status indications. Despite the name, most of these indicators do not show the status of the PV array. This screen also features four buttons.

**Power On** : This button orders all inverters to begin generating (harvesting and selling PV power). See page 21.

**Off+Unlock** : If the inverters are locked, this button will unlock and set the mode to off. If the inverters are on, this button will turn them to the off mode. After this button is used, the **Power On** button will need to be used to enable the inverters to generate power. Note that if the inverters are in the off mode, a power cycle might start them up again.

**Off+Lock** : This button orders all TrueString inverters to stop generating. The inverters are “locked” and will not generate until the **Off+Unlock** and **Power On** buttons are pressed.

**Clear Fault** : If an Arc fault or RCD (ground fault) occurs, once the cause is remedied, this button clears the fault condition. This takes effect on all inverters. The **Clear Fault** button has the same effect (“clear latched faults”) as the physical button located on each inverter (see page 11). However, the inverter button only clears faults on that particular inverter.

The four indicator flags show different aspects of TrueString or Gateway operation. All items will be shaded green if the statements below are true. If any item is not correct, it will be shaded red.

**AC**: The Gateway's AC source is correct and has detected that the ground connection is present, 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 Ethernet cable is connected.

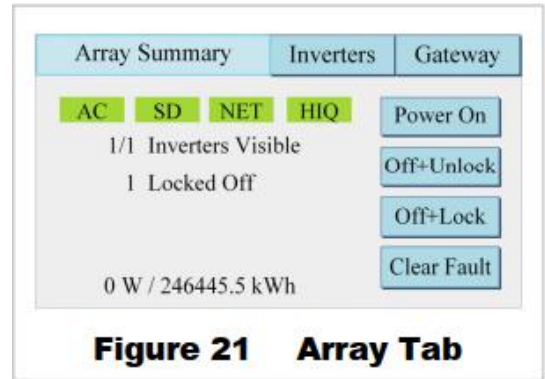
**HIQ**: The Gateway was able to contact the HiQ server.

These items may be shaded yellow momentarily while the Gateway attempts to test.

Two more status messages are shown. The first has two numbers. **Inverters Visible** shows the number of inverters communicating as compared to the number discovered or manually added in the **Inverters Setup** screen (see page 27).

The message **Unknown** may indicate an inverter communication problem.

This screen also shows present PV power generated (in watts) and lifetime energy (in kilowatt-hours).

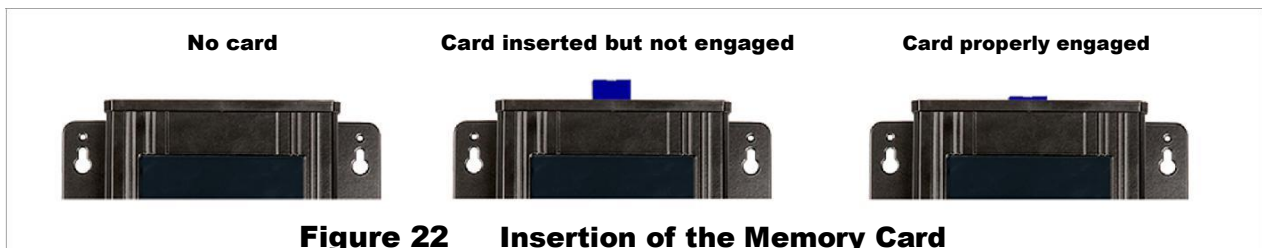


**Figure 21 Array Tab**

## 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 22.

The Array Summary screen has an indication of the SD card status as shown in Figure 21. This indicator will turn red if the card is not fully engaged.



**Figure 22 Insertion of the Memory Card**

## Inverters Tab

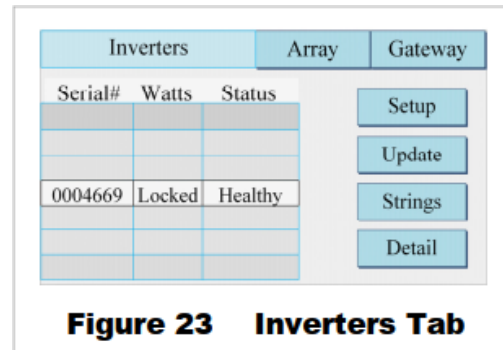
The **Inverters** tab opens the *Inverters* screen, which shows the status of all TrueString inverters. Units are listed by serial number and display the present power generation and general status. This screen also features four buttons.

**Setup** : This button leads to the *Array Setup* screen, allowing inverters to be added or deleted from the Gateway. See below.

**Update** : This button leads to the *Firmware Update* screen. See page 28.

**Strings** : This button leads to the *Strings* screen, showing PV status for each inverter. See page 29. (This screen was previously referenced on page 20 as part of the power-up procedure.)

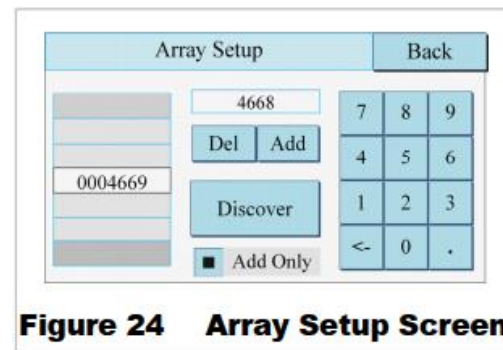
**Detail** : This button leads to the *Detail* screen, showing real-time information for a single inverter. See page 29. This screen also leads to a series of diagnostic screens for troubleshooting.



**Figure 23 Inverters Tab**

## Setup

The **Setup** button opens the *Array Setup* screen. (This screen has nothing to do with the PV array.) To search for inverters, press the **Discover** button. This function uses PLC to locate all inverters in the immediate area. (These are usually inverters on the local side of an isolation transformer, though conditions vary.) In most cases nothing else is required. All available inverters will appear on the list in Figure 24. Inverters may also be automatically discovered from the web interface. (See Figure 25.)



**Figure 24 Array Setup Screen**

The **Discover** button is normally shaded light blue. While discovering inverters, it changes to dark blue. It will turn red if PLC problems occur, such as too much background noise. The button must be pressed again once conditions have been corrected. Once discovery is complete, the button will return to a light blue color. A list of serial numbers of all inverters discovered (if any) will be displayed.

**NOTE:** If discovery occurred previously, check the **Add Only** box to speed up the process. (Only new inverters will be discovered.) Unchecking this box causes all inverters to be rediscovered from scratch. Occasionally it may be preferable to manually add inverters to the list. It is particularly useful if an inverter is replaced on a site where automatic discovery would take a long time. Inverters can be added (or deleted) with the touch screen **Add** or **Del** buttons.



**Figure 25 Adding and Removing Inverters using Web Interface**

Using the web interface, inverters can be added (**B**) or deleted (**C**) using the onscreen options. Option **A** enables automatic discovery. (See page 31 for more information on the web interface.)

## Update

The **Update** button opens the **Firmware Update** screen. System firmware is occasionally updated to add features and enhance performance. Updates may be performed through a network connection or using a memory card physically inserted into the Gateway. (See page 26.)

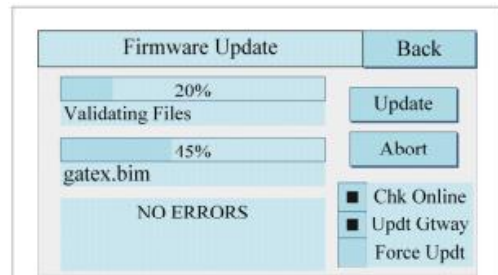
Updates may be performed through the touch screen as shown in Figure 28. Pressing the **Update** button begins a check for available files on the server, which are streamed directly to all inverters. Meter bars indicate the progress.

**Chk Online** must be selected for the Gateway to perform a network search. If **Updt Gtway** is selected, the Gateway's own firmware will be updated as part of this process.

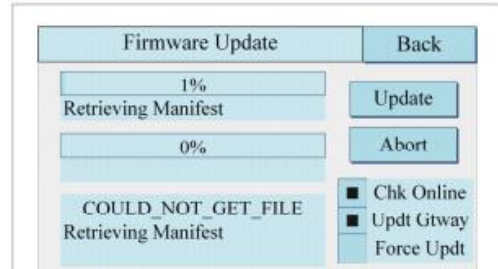
**Force Updt** downloads inverter files to the Gateway, which then completes the inverter updates. This avoids any potential interruptions due to internet connectivity problems. When complete, the screen shows 100% on both meters and **NO ERRORS**. The **Abort** button can stop the update if necessary.

If the Gateway was unable to locate a file on either the network or the memory card and cannot perform the update, it will display **COULD\_NOT\_GET\_FILE** as shown in Figure 27.

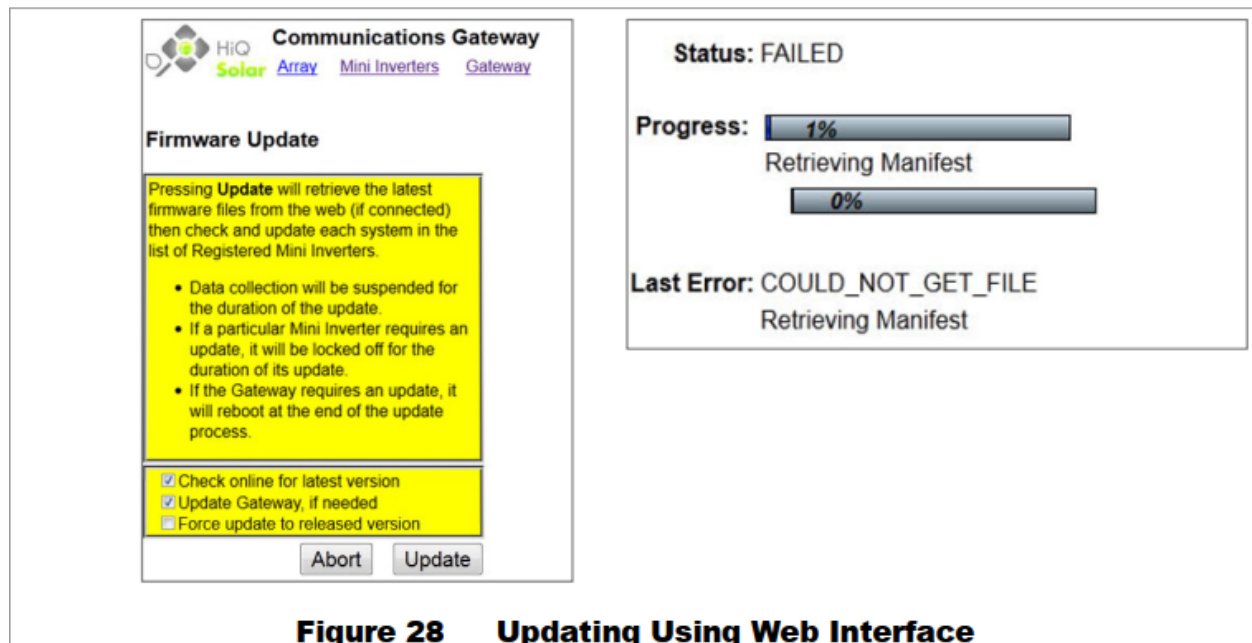
Figure 28 depicts a firmware update using the web interface. The second panel shows an update that failed because the file was not available. (See page 31 for more information on the web interface.)



**Figure 26**  
**Firmware Update Screen**



**Figure 27** **Failed Update**



**Figure 28** **Updating Using Web Interface**



## Strings

The **Strings** button opens the **Strings** screen for a particular TrueString inverter (indicated by serial number under the **Inverters** tab and selected on the touch screen).

This screen displays the present status of both strings of PV modules on that inverter. It displays real-time voltage, current, and power. If no problems are detected, the screen reads **Healthy**. (**Fault** may indicate a ground fault or arc fault shutdown. **Unknown** may indicate a communications problem.)

The **Inverters** tab returns to the **Inverters** screen when selected.

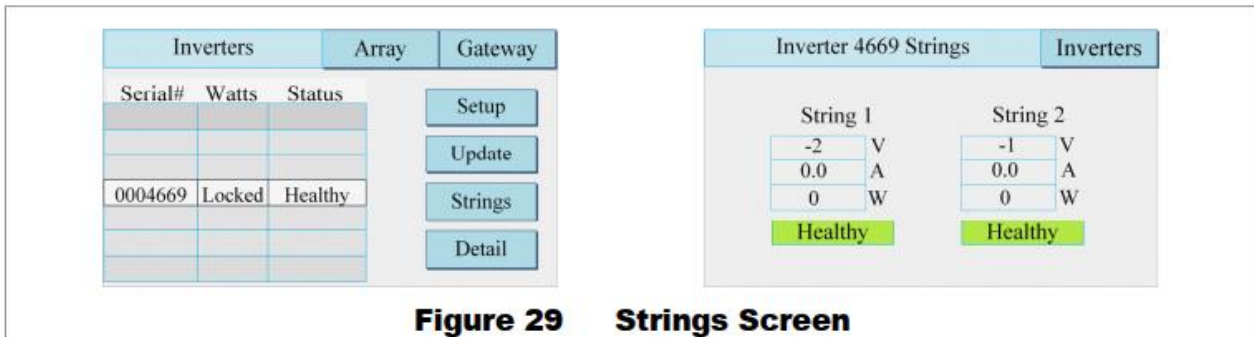


Figure 29 Strings Screen

## Detail

The **Detail** button opens the **Detail** screen to display real-time AC information for a particular TrueString inverter (indicated by serial number under the **Inverters** tab and selected on the touch screen). It displays peak-to-peak voltage, RMS voltage, and power delivered by each phase. If no problems are detected, the screen reads **Healthy**. See Figure 32 if **Fault** appears. **Unknown** may indicate a communications problem.

This screen also shows present PV power harvested (in watts) and lifetime harvest (in kilowatt-hours).

The **Inverters** tab returns to the **Inverters** screen when selected (as in Figure 29).

The **Power On**, **Off+Unlock**, and **Off+Lock** buttons on page 26 are used here for a single inverter. The **Diag** button opens that inverter's diagnostic screen. If the status is not **Healthy**, one of two faults may appear. See Figure 32.

**NOTE:** The **AC Health** and **DC Health** buttons are normally used only by HiQ Technical Support when troubleshooting the inverter.

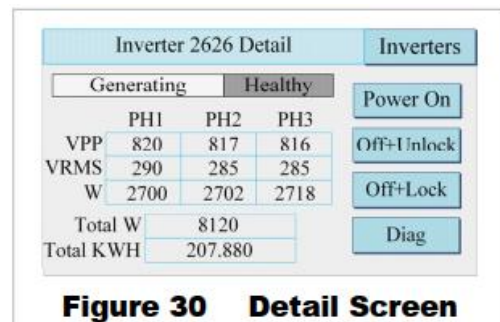


Figure 30 Detail Screen

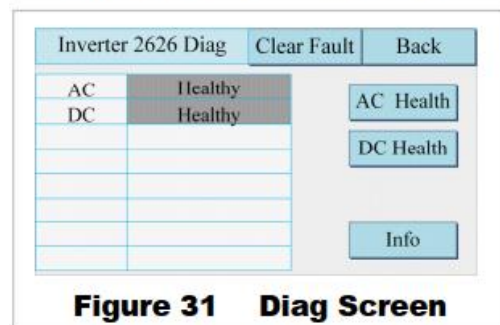


Figure 31 Diag Screen

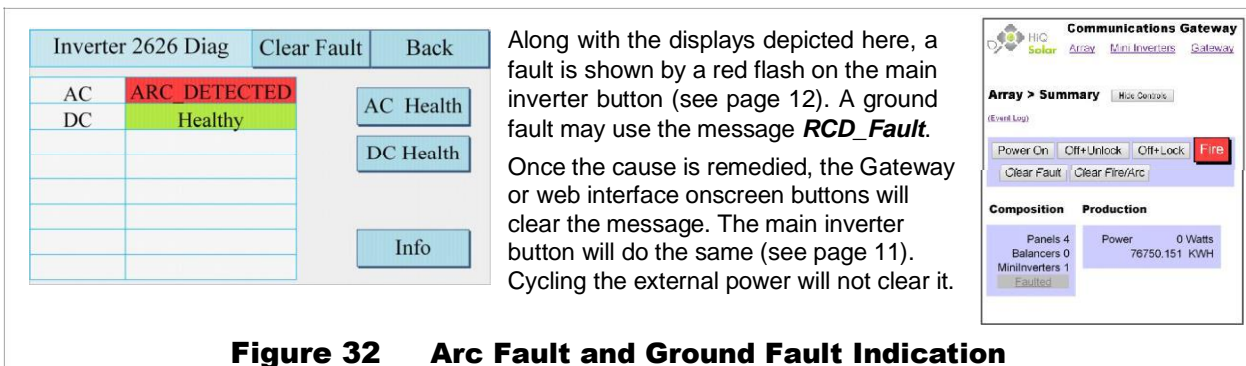


Figure 32 Arc Fault and Ground Fault Indication

Along with the displays depicted here, a fault is shown by a red flash on the main inverter button (see page 12). A ground fault may use the message **RCD\_Fault**.

Once the cause is remedied, the Gateway or web interface onscreen buttons will clear the message. The main inverter button will do the same (see page 11). Cycling the external power will not clear it.

## Gateway Tab

The **Gateway** tab opens the **Gateway** screen, which provides settings and other critical networking information. This screen also features four buttons.

**Network** : This button opens the **Network Settings** screen. See page 31.

**Clock** : This button opens the **Set Clock** screen.

**Screen** : This button opens **Calibrate Screen**. This screen is used to adjust the appearance of the Gateway touch screen.

**Diag** : This button opens the **Gateway Diagnostics** screen. This screen is normally used only by HiQ Technical Support when troubleshooting the Gateway. The same is true for the **PLC Diag**, **Beep**, and **Special** buttons that appear here.

## Network

The **Network** button opens the **Network Settings** screen. The items on this screen are addressed in **Accessing the Gateway Online** beginning on page 31.

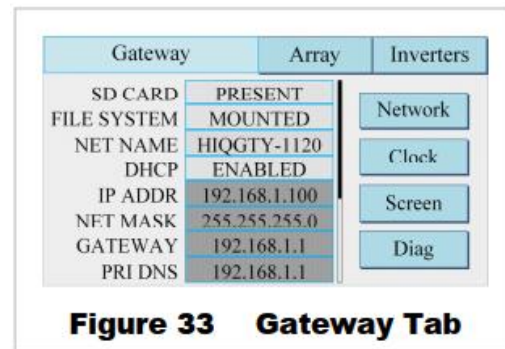
## Clock

The **Clock** button opens the **Set Clock** screen. This allows both the time and the date to be set. The Gateway uses a 24-hour clock. Note that the **ss** (seconds) item cannot be set even though its controls are shown.

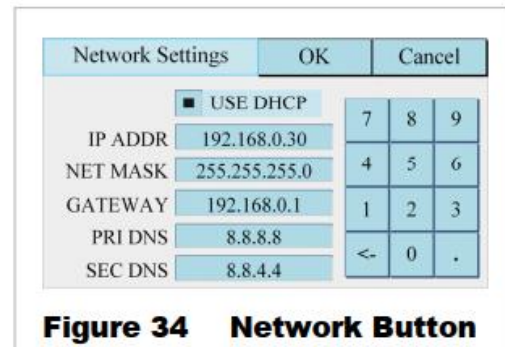
Settings can be changed freely. However, any change causes the clock to immediately stop so that more changes can be made without conflict. Once the setting is complete, press the **Set** button to restart the clock and establish the changes.

## Screen

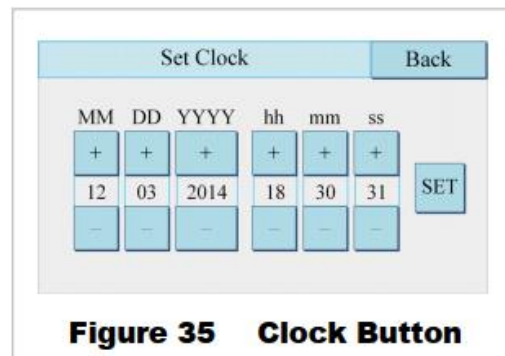
The **Screen** button opens **Calibrate Screen**. This allows the display to automatically recalibrated if necessary. Follow the instruction **Touch center of each cross or press CANCEL to cancel**. Pressing both crosses causes the message **Press OK to save calibration** to appear. Pressing either **OK** or **Cancel** will return the display to the Gateway screen.



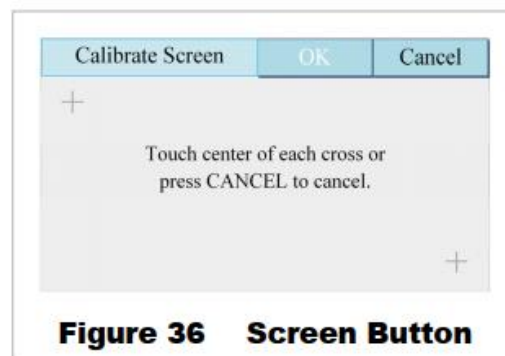
**Figure 33 Gateway Tab**



**Figure 34 Network Button**



**Figure 35 Clock Button**

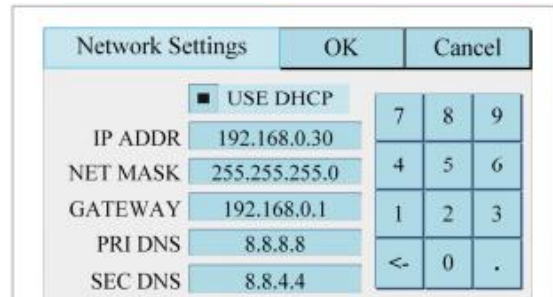


**Figure 36 Screen Button**

# Accessing the Gateway Online

Online access requires the **Network Settings** screen, which is accessed with the Gateway **Network** button. This screen contains items that can be edited with the touch pad if necessary. These items are also visible once the online interface is established, as shown in Figure 38.

- o **USE DHCP**  
This is a box that can be selected or unselected. It is selected by default.
- o **IP ADDR**
- o **NET MASK**
- o **GATEWAY**
- o **PRI DNS**
- o **SEC DNS**



**Figure 37**  
**Network Settings Screen**

Different methods of access to the Gateway are available.

**Communications Gateway**

Array Mini Inverters Gateway

**Network Settings**

Name: HIQGTY-1040 HTTP Port: 80  
 DHCP: ENABLED FTP Cmd Port: 21  
 IP Address: 107.142.42.1 FTP Data Port: 8000  
 Net Mask: 255.255.255.248 Diag Port: 1000  
 Gateway: 107.142.42.6  
 Primary DNS: 107.142.42.6  
 Secondary DNS: 0.0.0.0  
 MAC Address: 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

**HiQ Gateway LOCAL WEB**

Power line

Local Ethernet network

Local device

External device

Database

**Communications Gateway**

Array > Summary

Composition Production

Panel 4	Power	412 Watts
Balance 0		75000.252 kWh
Minimum 1		15000.000 kWh

Historical data

3 Days

**Figure 38** Gateway Page and Methods of Accessing Data

# Gateway Access Inside a Local Network

**To access locally from a Windows device:**

1. Select the **Gateway** tab. Use the **Network** button to open the **Network Settings** screen as shown in Figure 39.
2. Open a web browser. Type the **NET NAME** into the address bar. In Figure 39, this is **HIQGTY-1120**. The listed IP address can also be used. In Figure 39 the address is **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**

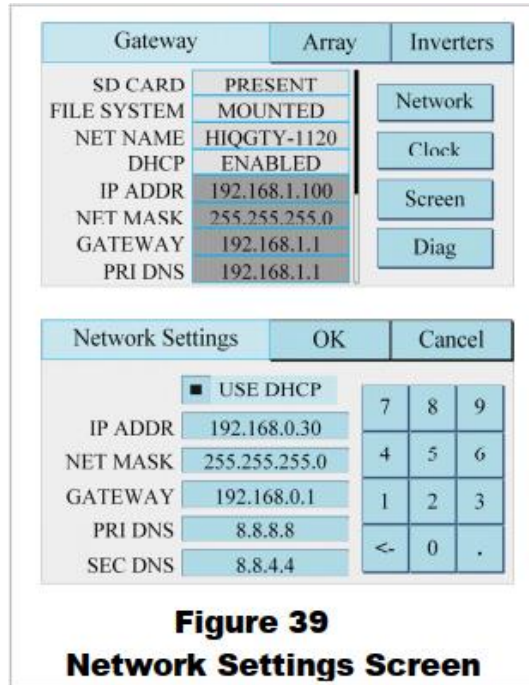
**Password: HiQSolar**

The home screen for that particular Gateway will appear as shown in Figure 40.

**To access locally from Mac OS computer device (including iPads & iPhones):**

Follow the steps above, with the following exception:

- o **NET NAME** is not supported. The IP address (the contents of **IP ADDR**) must be entered into the browser address line.



**Figure 39  
Network Settings Screen**



**Figure 40 Web Interface**

<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**. In Figure 39 this is 192.168.1.1.



# Webpage Menu Map

**Communications Gateway**  
 HiQ Solar Array Mini Inverters Gateway

**Array > Summary** Hide Controls

(Event Log)

Power On Off+Unlock Off+Lock  
 Clear Fault Clear Fire/Arc

**Composition Production**

Panels 4	Power 412 Watts
Balancers 0	75960.262 KWH
MiniInverters 1	
Healthy	

The interface screen has three tabs: **Array**, **Mini Inverters**, and **Gateway**.

**Array (A)** is similar to the **Array Summary** screen on page 26. (It shows the full system, not just the PV array.) This screen shows the same controls **(B)** as on page 26.

**NOTE:** A smartphone can control this system when local network settings allow. Because phone screens are small, the wrong controls could accidentally activate or disable important functions. To avoid this, some screens have a button **(C)** to **Show** or **Hide Controls**.

**Mini Inverters (D)** shows items similar to the **Inverters** screen on page 27, including DC and AC data. These controls can also be hidden **(E)**.

**Gateway (F)** shows items similar to the **Gateway** screen on page 30.

**Communications Gateway**  
 HiQ Solar Array Mini Inverters Gateway

**Mini Inverters > Serial# 1001** Show Controls

(Info)(AC Side)(DC Side)(String Power)

Power On Off+Unlock Off+Lock  
 Clear Faults Beep Test Arc Detection

Mode Generating

String 1	String 2
317.360 V	348.510 V
419.990 W	478.940 W
0	0
798.020 V	

Status Healthy

Phase 1	Phase 2	Phase 3
795.560 Vpp	783.850 Vpp	785.000 Vpp
278.390 Vrms	276.500 Vrms	275.880 Vrms
290.420 W	295.580 W	303.770 W
889.780 W	6641.311 KWH	59.975 Hz

Status Healthy

PLC

Status 6650 Signal  
 1110 Noise

**Communications Gateway**  
 HiQ Solar Array Mini Inverters Gateway

**Network Settings**

Name: HIQGTY-1040 HTTP Port: 80  
 DHCP: ENABLED FTP Cmd Port: 21  
 IP Address: 107.142.42.1 FTP Data Port: 8000  
 Net Mask: 255.255.255.248 Diag Port: 1000  
 Gateway: 107.142.42.6  
 Primary DNS: 107.142.42.6  
 Secondary DNS: 0.0.0.0  
 MAC Address: 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 41

Gateway Webpage Menu Structure

# Gateway Access Outside a Local Network

## LAN-side Configuration

DHCP has a lease time after which it requests renewal, causing problems if a different IP address is assigned. To keep the same IP address continuously, several methods may be used.

- o Keep the Gateway in DHCP but force the router to allocate the same IP address each time. This is generally the most desirable way if supported by the router.  
If this functionality is supported by the router it might look like Figure 42, here called **DHCP Reservation**.
- o Change to a fixed IP address.

Router capabilities and user interfaces vary. This example uses a particular Cisco router. In Figure 42, the router has a defined range of 50 IP addresses it has reserved for DHCP allocation (from 100 to 149 for the last field in the address).

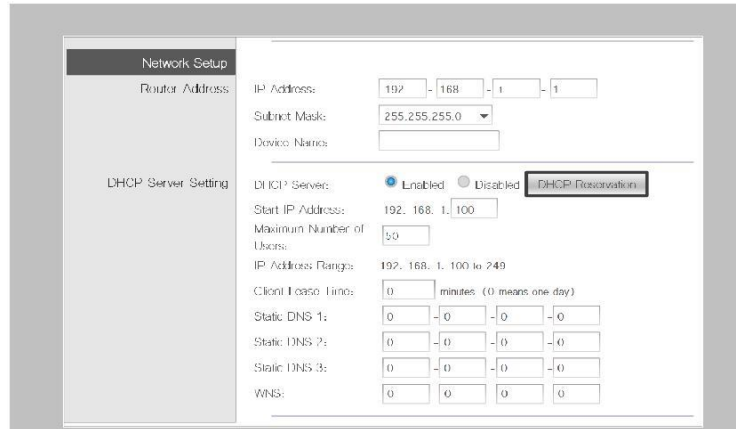
The **DHCP Reservation** screen for this router is depicted in Figure 43. It allows examination of the devices currently logged on, and the option of assigning an address in the Gateway's allowed range.

Alternatively, a fixed IP address can be assigned outside the DHCP range. (Figure 43 shows the example address **192.168.1.37** being assigned.)

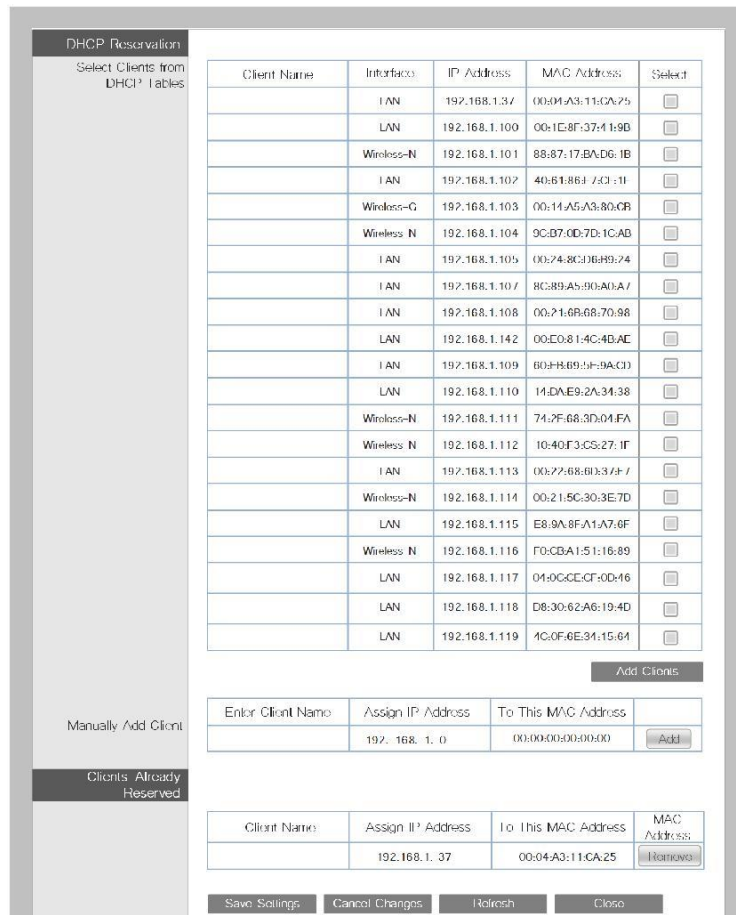
If this is done, the Gateway must also be configured. On the **Network Settings** screen, unselect the **USE DHCP** box. (See Figure 34 on page 30.)

For the other settings:

- o **IP ADDR:** Assign the IP address as noted.
- o **NET MASK:** Usually remains at **255.255.255.0**.
- o **GATEWAY:** Usually entered from the router screen.
- o **PRI DNS:** Usually entered from the router screen.
- o **SEC DNS:** Usually remains at **0.0.0.0**.



**Figure 42 DHCP Reservation on Cisco Router**



**Figure 43 Assigning IP Address on DHCP Reservation Screen**

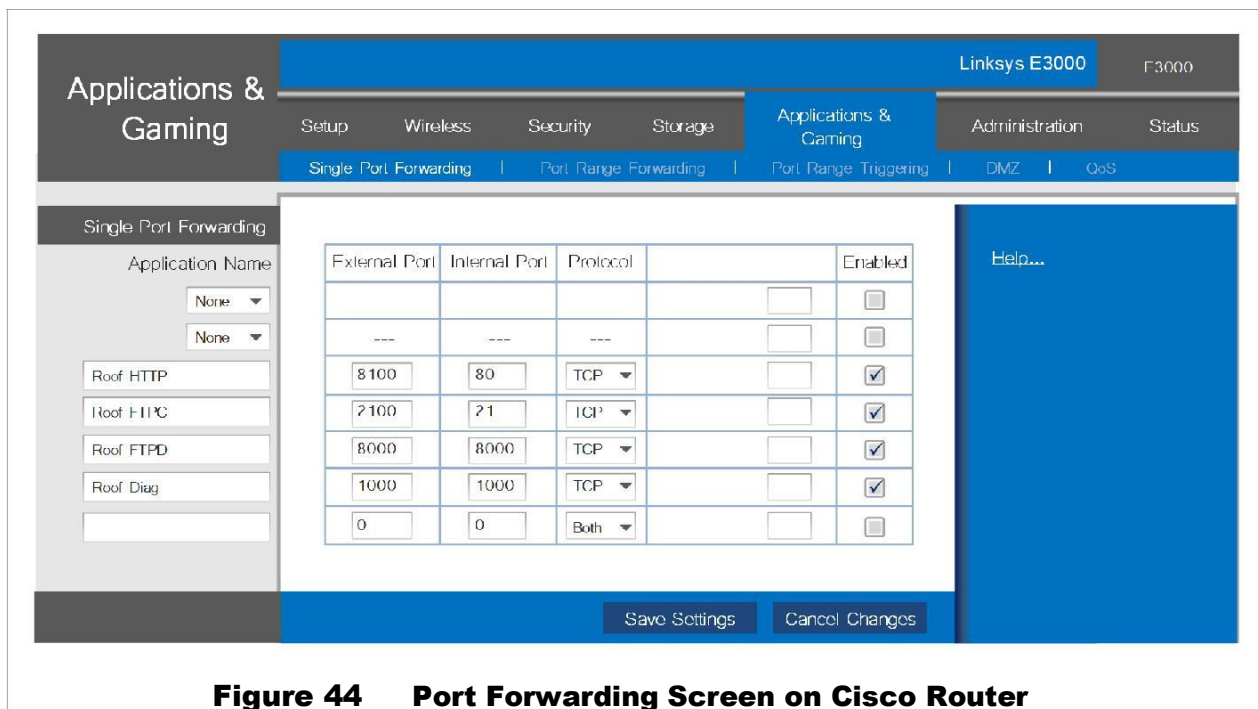
## WAN-side Configuration

In the Cisco router used as an example here, the **Applications and Gaming** screen is used to open a port for outside communication. (See Figure 44.) The aim 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 four possible ports required to fully access the Gateway and TrueString inverters remotely. Access to the control web page alone requires only the setup of the first of those listed in Table 4.

**Table 4 Port Numbering Assignments**

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 for operations such as firmware updates	1000 (Use this setting only)	1000



**Figure 44 Port Forwarding Screen on Cisco Router**

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.

## Utility Protective Functions (Webpage only)

The TrueString 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 values specified by the utility company may be set.**

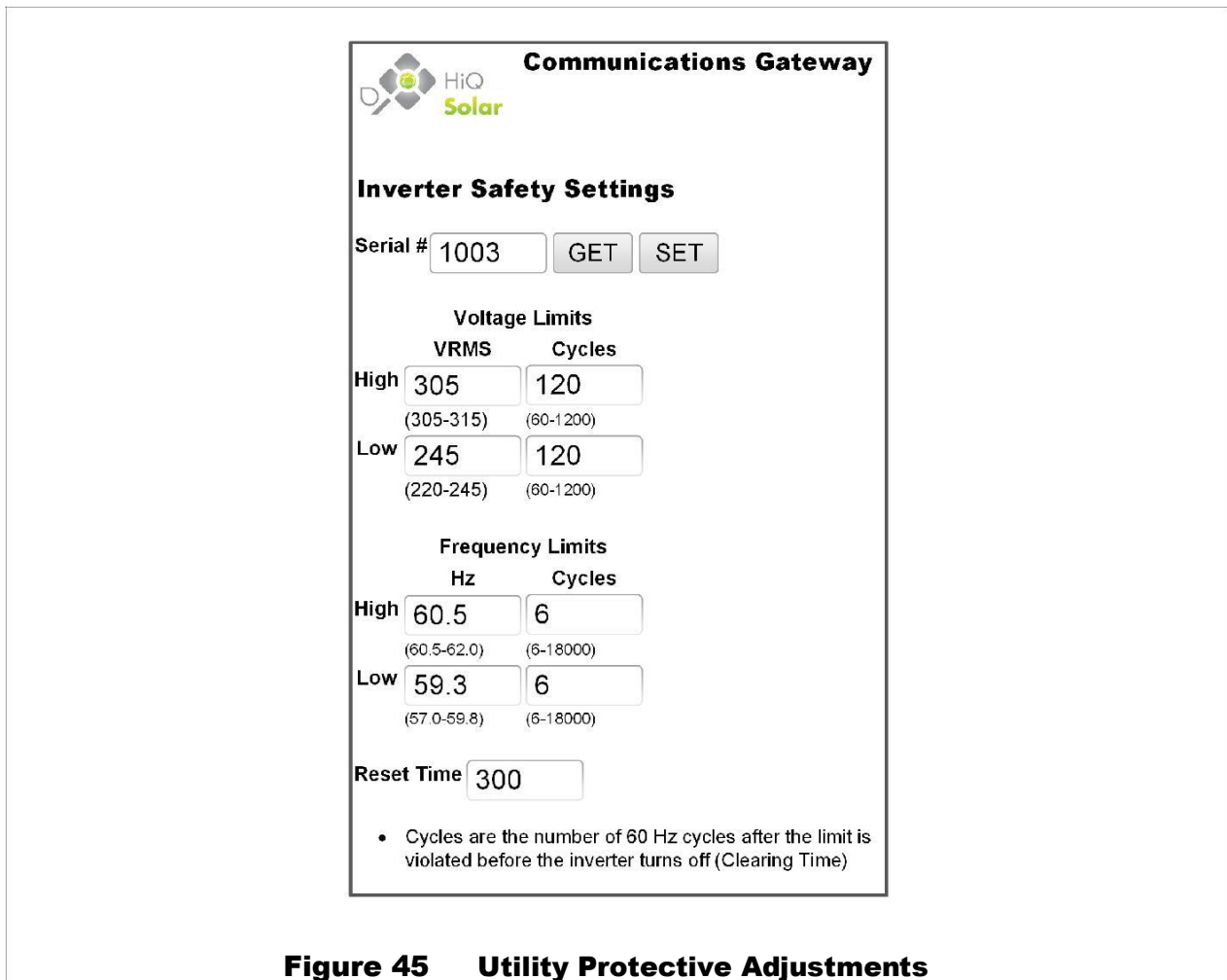
Changes are made through the web pages and cannot be accessed from the Gateway touch screen. When logged into a particular Gateway through the web portal, type the following into the browser URL address bar after the serial number: **/SAFETYLIMITS.htm** (capitalization is important here). This will bring up the screen shown in Figure 45.

An example is **http://hiqgy-1020/SAFETYLIMITS.htm**.

To communicate with a particular inverter on that Gateway, enter the individual serial number into the **Serial #** field. Press the **Get** button to begin communication with that particular inverter. This will populate its present values in the web page.

When desired changes have been completed, press the **Set** button to write the new values back to that same inverter.

Available ranges are given in the **Specifications** section near the end of this document.

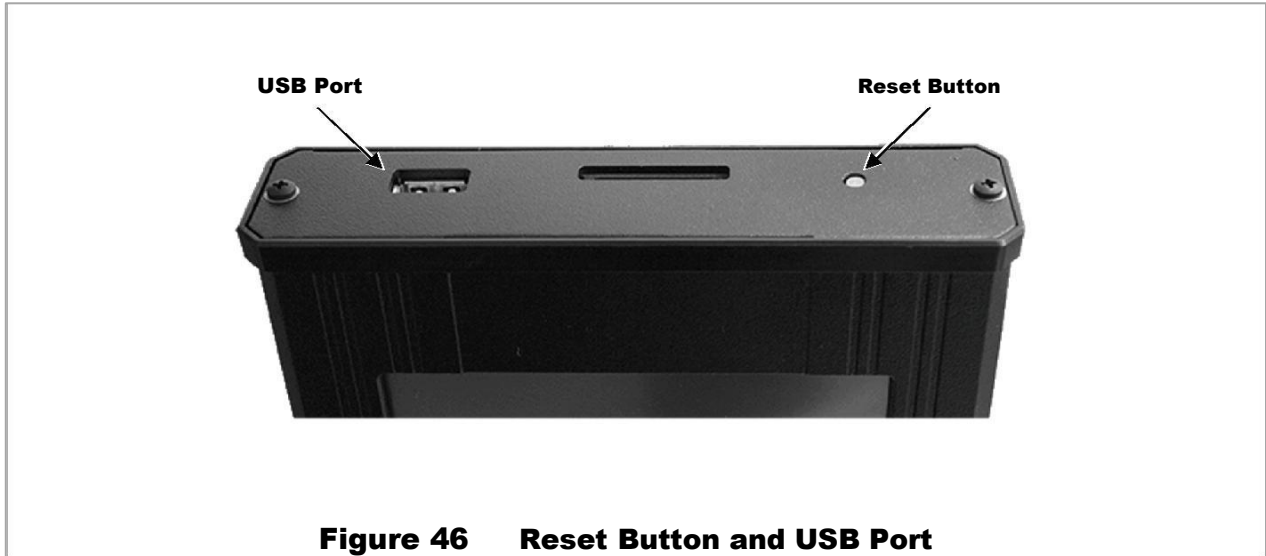


**Figure 45 Utility Protective Adjustments**

## Other Gateway Features

The Gateway has several features that are not usually accessible after installation. These include a USB port and a button marked **RESET**.

- The **RESET** button performs a full system reboot, the same as if both AC and DC power had been removed.
- The USB port is not functional at this time.



# Accessing Historic Data Online

Once the internet communication has been established with the gateway and the HiQ box on the Array screen is green the data is being uploaded to the HiQ monitoring server. To view the historic data, the site(s) must be registered on the monitoring server and an account must be registered to log in to the site(s).

To register the site, you will need the communication gateway serial number which can be found on the back of the gateway and on the networking screen Net Name.

To register an account, a valid email address will be needed to activate the account.

To register the site, please visit: <http://www.higsolar.com/siterequest>

To register for a monitoring account, please visit: <http://www.higsolar.com/user-request>

After registering for an account, an activation email will be sent. The activation link must be clicked for the account to be activated. If an email doesn't arrive, please check your SPAM or junk mail folder.

# Troubleshooting

## General Troubleshooting

The primary way of troubleshooting a system is to investigate using the Gateway. The Gateway can be viewed on its touch screen interface, or by accessing it using a web browser. Assuming the issue is not with communications, browser access allows the use of a mobile device such as a phone while physically at the installation location.

As detailed later, the inverter has a set of LED indicators that can also provide status. These messages are summarized below.




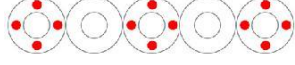


## Troubleshooting Topics

The troubleshooting section is divided up as follows:

- o LED indicators
- o Overview of possible issues
- o Symptoms and causes
- o More details on selected issues

## LED Indicators

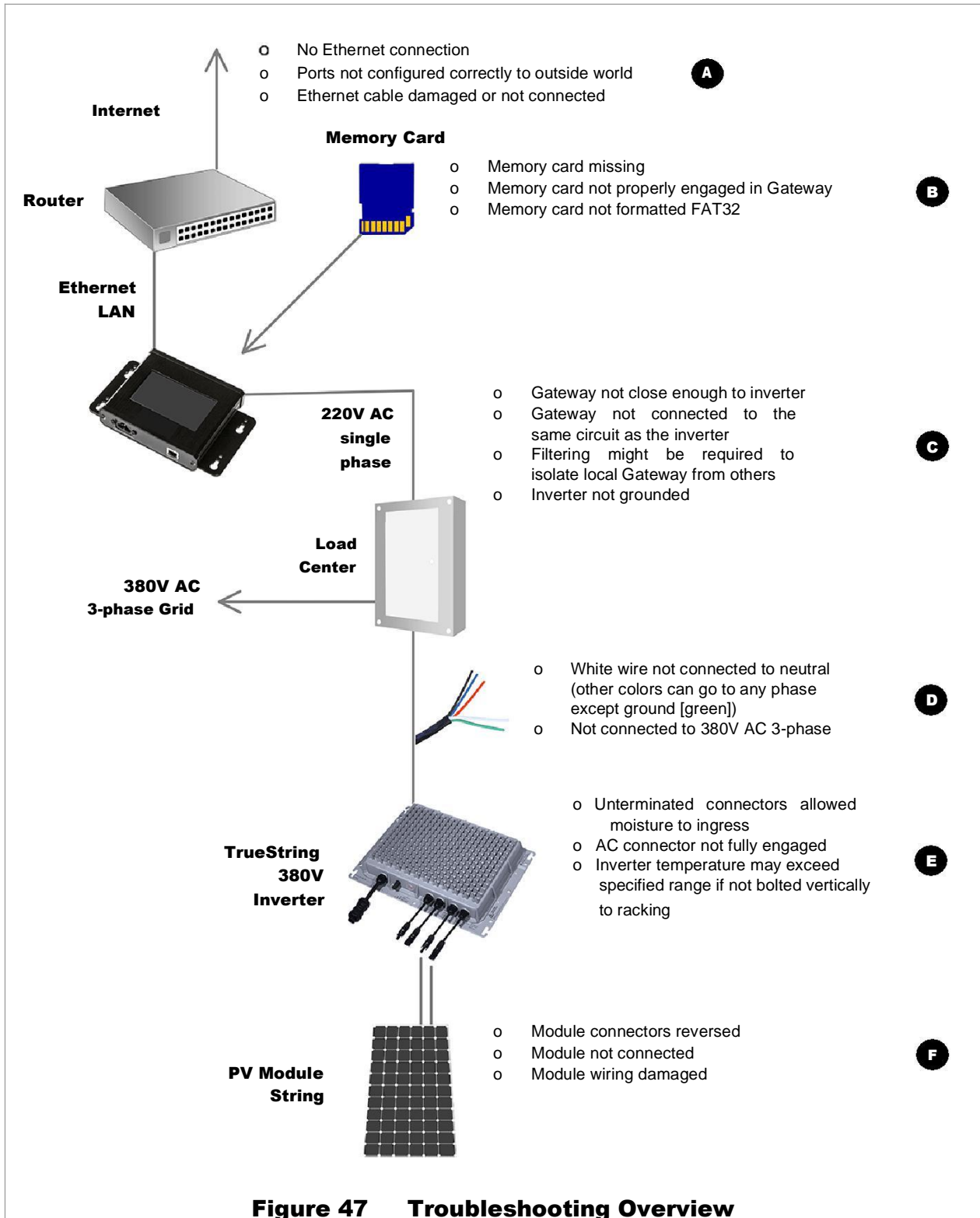
**Table 5 Inverter States (Button)**

Inverter Indicator State	Button Indication
Green solid 	<ul style="list-style-type: none"> <li>o Powered up</li> <li>o Not generating (5-minute timer may be running)</li> <li>o No faults</li> </ul>
Green, left-right alternating flash 	<ul style="list-style-type: none"> <li>o Power-on self-test (will take &lt;1 minute)</li> </ul>
Green, clockwise circular flash 	<ul style="list-style-type: none"> <li>o Powered up</li> <li>o Generating</li> <li>o No faults</li> </ul>
Red rapid flash 	<ul style="list-style-type: none"> <li>o Fault condition</li> </ul> <p>Examples:</p> <ul style="list-style-type: none"> <li>• Ground fault (RCD) or Arc has been detected</li> <li>• No grid</li> </ul>
Green flash, mostly on 	<ul style="list-style-type: none"> <li>o <b>Off &amp; Locked</b></li> <li>o Disabled</li> </ul>
Green flash, mostly off 	<ul style="list-style-type: none"> <li>o Sleeping</li> <li>o Not generating</li> </ul>



## Overview of Possible Issues

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



**Figure 47 Troubleshooting Overview**



## Symptoms and Causes

Letters next to individual problems (such as **D**) correspond with general locations pointed out in the **Overview** on page 40.

**Table 6 Symptoms and Corresponding Issues**

<b>Symptom</b>		<b>Possible Causes</b>
<b>Button</b>	<b>Touch Screen (also web interface in most cases)</b>	
Red flash (fast)	AC Section of display Has no heading	<ul style="list-style-type: none"> <li>o AC breaker or fuse open (<b>D</b>)</li> <li>o AC Output of inverter not connected (<b>D</b>)</li> <li>o AC connector not fully engaged and locked (<b>D</b>)</li> </ul>
	Moisture	<ul style="list-style-type: none"> <li>o One phase of AC not connected (<b>D</b>)</li> <li>o Connected to wrong grid type (Example: 208V or Delta) (<b>D</b>)</li> </ul>
	RCD or Arc Fault	<ul style="list-style-type: none"> <li>o RCD (ground) Fault                             <ul style="list-style-type: none"> <li>o <b>Note:</b> RCD will auto reset up to 4 times within 24 hours then will wait remainder of 24 hours to auto reset. Can also be manually reset with the button or gateway.</li> </ul> </li> <li>o Arc Fault                             <ul style="list-style-type: none"> <li>o <b>Note:</b> Will auto reset after 5 minutes</li> </ul> </li> </ul>
Solid Green	No Production	<ul style="list-style-type: none"> <li>o Insufficient PV energy; no malfunction</li> </ul>
N/A	Panel figures missing statistics	<ul style="list-style-type: none"> <li>o Missing PV Module (<b>F</b>)</li> <li>o Faulty wiring or connectors not fully engaged (<b>F</b>)</li> </ul>
	Less power output than expected	<ul style="list-style-type: none"> <li>o Shaded or dirty modules</li> <li>o Inverter in direct sun or not enough air flow causing over-temperature and reduced output (<b>E</b>)</li> </ul>
	<b>SD</b> indicator on <b>Array Summary</b> screen shows red	<ul style="list-style-type: none"> <li>o Memory card not fully engaged (<b>B</b>)</li> <li>o Memory card not properly formatted as FAT32 (<b>B</b>)</li> <li>o Memory card missing (<b>B</b>)</li> </ul>
	<b>AC</b> indicator on <b>Array Summary</b> Screen shows red	<ul style="list-style-type: none"> <li>o Gateway neutral wire connected to a phase (<b>D</b>)</li> <li>o Gateway ground not connected (<b>C</b>)</li> </ul>
	<b>Net</b> indicator on <b>Array Summary</b> screen shows red	<ul style="list-style-type: none"> <li>o Ethernet cable not connected (<b>A</b>)</li> <li>o Bad or improperly wired Ethernet cable</li> <li>o Cable not plugged into router or switch</li> <li>o Port on router or switch is not enabled</li> </ul>

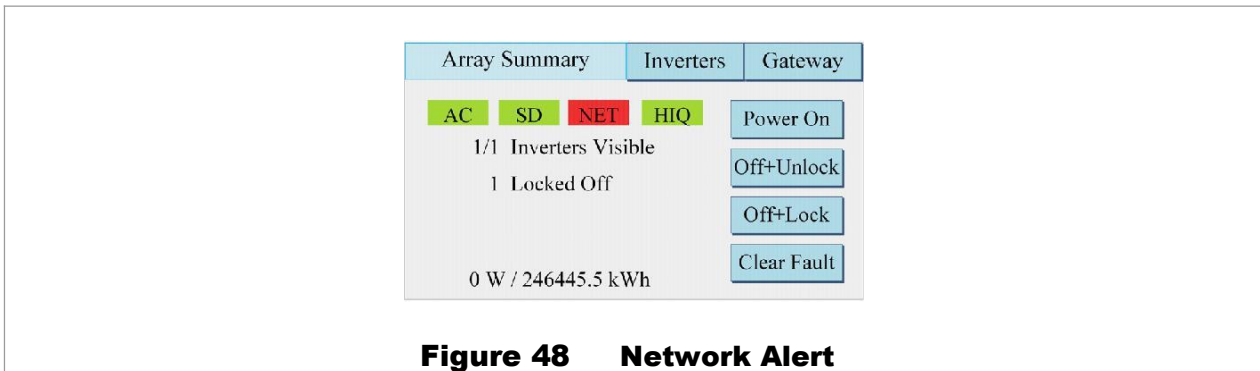
## More details by topic

This section provides more details on the lettered topics depicted on page 40. See page 26 for more information on the **Array Summary** screen shown here.

### A. Network Issues

- o No Ethernet connection
- o Bad or improperly wired Ethernet cable
- o Router or switch port not enabled

Any of the above issues can cause the Gateway's **NET** indicator to turn red.



**Figure 48 Network Alert**

### B. Memory Card Issues

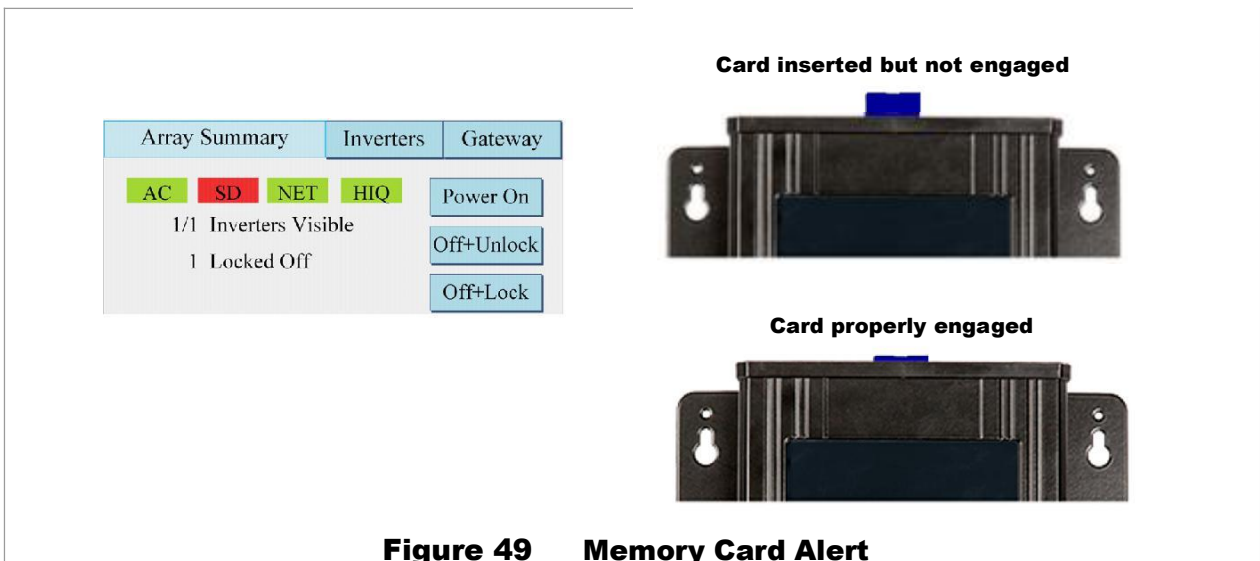
Logging of long-term performance data is saved to the memory card that was supplied with the Gateway. Note that the card is not required for the system to operate, only to retain historical information and upload to the server. If the card is in place but not fully engaged, the **SD** indicator will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

The card is formatted with the FAT32 file system. If a memory card is needed that is different than the one supplied, it will need to be formatted similarly.



#### **IMPORTANT:**

Gateway communications require the memory card to be in place. The Gateway will not communicate with the server if the card is not present.



**Figure 49 Memory Card Alert**

## C. Gateway-to-Inverter Connectivity Issues

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

The 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 local side of an isolation transformer. 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, 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.

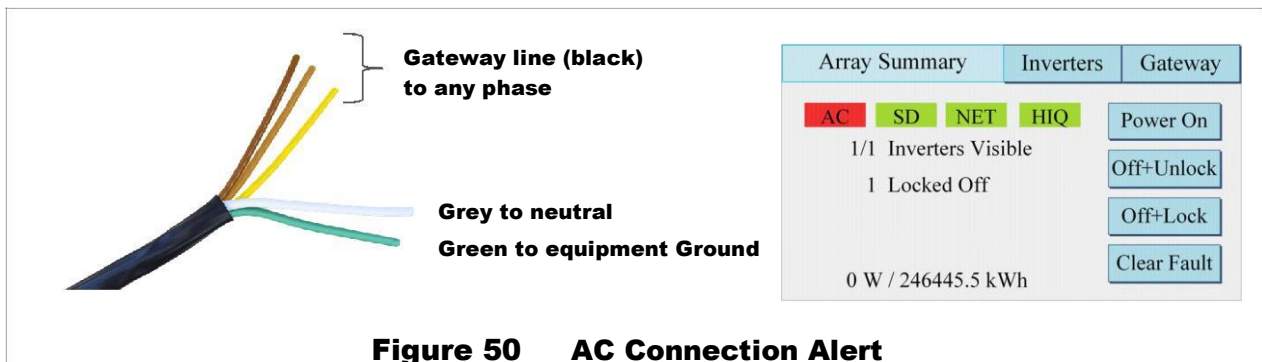
Note that a failure to establish communications can also occur if the neutral (white) wire is connected incorrectly to one of the phases or the ground wire is not connected as discussed in the next section.

## D. AC Wiring Issues

- Gateway connected through a filter, UPS, or transformer.
- AC connector not fully engaged
- Ground wire not connected
- Neutral (white) wire connected to a phase instead of neutral
- Connected to wrong voltage system (208V AC 3-phase)

When wiring the gateway to the utility grid, it does not matter which of the three phases the line (black) wire is connected to. However, the AC indicator will turn red if the neutral (white) wire of the gateway is connected to one of the phases or if the ground is not connected.

If the neutral is connected to one phase or the ground is unconnected, the Gateway PLC will not work.



### CAUTION: Equipment Damage

If the gateway neutral is connected to any phase voltage, damage is likely to result. Incorrect wiring is not covered by the warranty terms.

### E. Inverter Installation Issues

- o Underminated connectors allowed moisture to ingress
- o AC or DC connector not fully engaged
- o Temperature range exceeded (possibly from direct sun exposure, reduced spacing, or lack of airflow), 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 within the operating temperature range.

As with all such devices, NEMA6 waterproof operation requires that all connectors, whether used or unused, be properly terminated. Any connector left open may allow moisture to enter, causing the unit to eventually fail.

### F. PV Module Wiring Issues

- o PV module not connected
- o PV module wiring fault
- o Faulty wiring or connectors not fully engaged
- o Unconnected PV module(s)
- o Incorrectly constructed jumper cables such as M-M or F-F. Jumpers should normally be M-F.
- o Strings of modules wired across both inputs. Example String 1 + to input 1 + and String 1 - to input 2 -.

These are generally self-explanatory issues of improper installation.

# Specifications

## Specification Tables

**Table 8 Inverter Specifications**

<b>DC Input (two MPPT inputs)</b>	
Maximum open circuit voltage per String, VOC	1,000 VDC
Full power MPPT range, per string	450-850 VDC
PV start voltage	200 VDC
DC maximum input current, per DC input	12 A
DC maximum input short circuit current	30 A
DC maximum input source back feed current to input source	0 A
<b>AC Output</b>	
AC maximum continuous total output power to +40 °C Ambient	7.9 kW
AC de-rate with temperature, +40 to +65 °C Ambient	-175 W/ °C
AC nominal output current, per phase	12 A
AC maximum continuous output current, per phase	12 A
AC maximum output over current protection	80 A
AC minimum wire gauge for grid connection	14 AWG
AC 3-phase system compatibility	380V WYE, 3 phases, neutral and ground
AC voltage range <sup>3</sup> , phase to phase (min / nominal / max)	323V / 380V / 418V
AC voltage range <sup>3</sup> , phase to neutral (min / nominal / max)	187V / 220V / 242V
AC output frequency range <sup>3</sup> (min / nominal / max)	49Hz / 50Hz / 51Hz Hz
DC Injection in AC grid	<0.5% of DC input
Harmonic Distortion (THD/Single Frequency)	<5%/<3%
Voltage/Frequency Ride through (minimum)	2 seconds
AC reconnect time delay <sup>3</sup> (min/default/max)	1 / 300 / 1000 s
Power Factor	≥0.99 (settable from 0.8 leading to 0.8 lagging)
<b>Other Specifications</b>	
Peak efficiency	97.8%
AC Voltage Trip Limit Accuracy	±2.7 V
Frequency Trip Limit Accuracy	0.05 Hz
Trip Time Accuracy	±40 ms or 1%
Dimensions	515 x 378 x 86 mm (20.25" x 14.9" x 3.4")
Weight	13.6 kg (30.6 lb.)
Operating temperature range	-40 to +65 °C (-40 to 150 °F)
Power consumption standby/ night	<8.3 W
Cooling	Natural convection, no fan
Communication	Powerline or Modbus/RS485
Environmental rating	Outdoor / rooftop, NEMA type 6
Certification	Pending Vietnam Utility Certification EMI/EMCC FCC Part 15 Part A.

## Specifications

**Table 9 Gateway Specifications**

Specification	Value
AC input voltage, min/nom/max	244/277/305V AC
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	10 years, optionally extendable
Compliance, certifications	UL 60950-1, CSA C22.2 No. 60950-1, FCC Part 15 <sup>b</sup>
Weight	1.3 lb

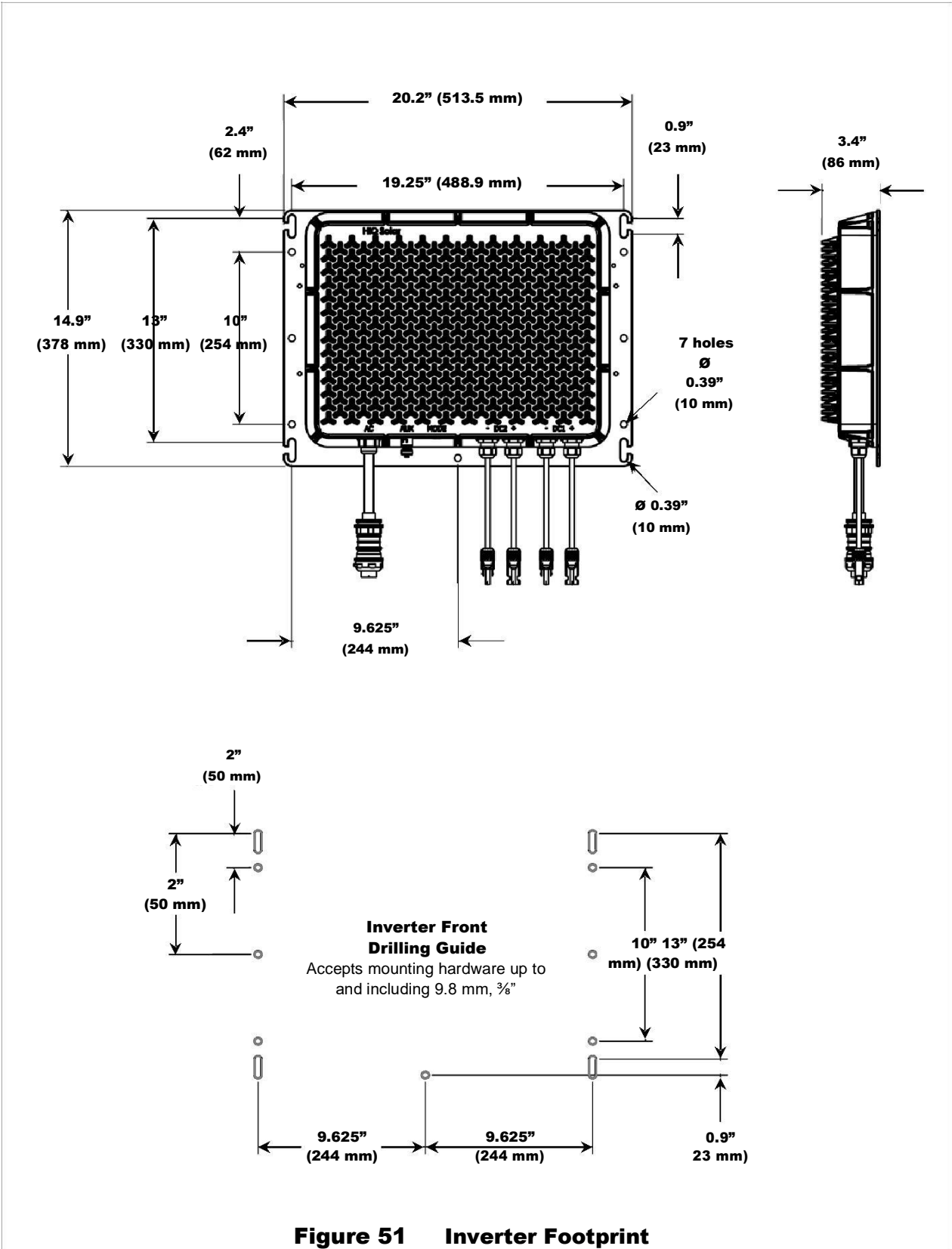


# **Regulatory Specifications**

## **Certifications**

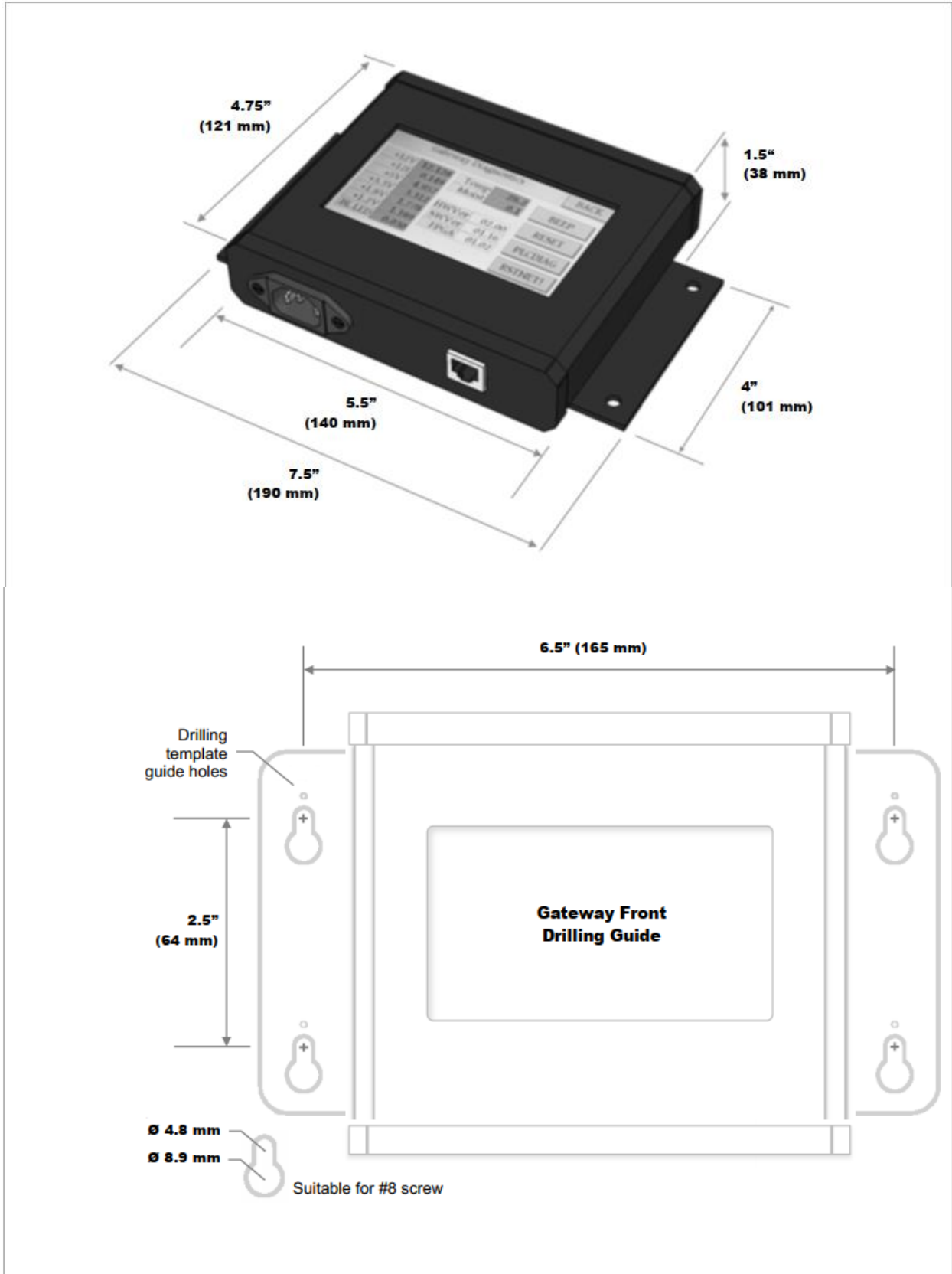
- Pending Vietnam Utility Certification  
EMI/EMCC FCC Part 15 Part A.

# Footprints



**Figure 51 Inverter Footprint**

# Specifications



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