

# Installer's Guide to Troubleshooting an Enphase System



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## FCC Compliance

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, you are 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 the 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.

Changes or modifications not expressly approved by the party responsible for compliance may void the user's authority to operate the equipment.

## Other Information

Product information is subject to change without notice. All trademarks are recognized as the property of their respective owners.

User documentation is updated frequently; Check the Enphase website (<http://www.enphase.com/support>) for the latest information.

For warranty text, refer to <http://www.enphase.com/warranty>.

For Enphase patent information, refer to <http://enphase.com/company/patents/>.

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# Important Safety Information

## Read this First

This manual contains important instructions for installers to use during installation and maintenance of the Enphase® Microinverter System™.

## Product Labels

The following symbols appear on the **product label** and are described here:



**WARNING:** Hot surface.



**DANGER:** Risk of electrical shock.



Refer to product instructions.

## Safety and Advisory Symbols

To reduce the risk of electric shock, and to ensure the safe installation and operation of the Enphase® Microinverter, the following safety symbols appear throughout this document to indicate dangerous conditions and important safety instructions.



**DANGER!** This indicates a hazardous situation, which if not avoided, will result in death or serious injury.



**WARNING!** This indicates a situation where failure to follow instructions may be a safety hazard or cause equipment malfunction. Use extreme caution and follow instructions carefully.



**WARNING!** This indicates a situation where failure to follow instructions may result in burn injury.



**NOTE:** This indicates information particularly important for optimal system operation. Follow instructions closely.

## Safety Instructions

### General Safety



**CAUTION:** Before installing or using the Enphase Microinverter, read all instructions and cautionary markings in the technical description, on the Enphase Microinverter System, and on the photovoltaic (PV) equipment.



**DANGER:** Risk of electric shock. Do not use Enphase equipment in a manner not specified by the manufacturer. Doing so may cause death or injury to persons, or damage to equipment.



**DANGER:** Risk of electric shock. Be aware that installation of this equipment includes risk of electric shock. Do not install the AC junction box without first removing AC power from the Enphase System.



**DANGER:** Risk of electric shock. The DC conductors of this photovoltaic system are ungrounded and may be energized.



**WARNING:** Risk of electric shock. Always de-energize the AC branch circuit before servicing. Never disconnect the DC connectors under load.



**WARNING:** Risk of electric shock. Risk of fire. Only use electrical system components approved for wet locations.



**WARNING:** Risk of electric shock. Risk of fire. Only qualified personnel should troubleshoot, install, or replace Enphase Microinverters or the Engage Cable and Accessories.



**WARNING:** Risk of electric shock. Risk of fire. Ensure that all AC and DC wiring is correct and that none of the AC or DC wires are pinched or damaged. Ensure that all AC junction boxes are properly closed.



**WARNING:** Risk of electric shock. Risk of fire. Do not exceed the maximum number of microinverters in an AC branch circuit as listed in the manual. You must protect each microinverter AC branch circuit with a 20A maximum breaker.



**WARNING:** Do not connect Enphase Microinverters to the grid or energize the AC circuit(s) until you have completed all of the installation procedures and have received prior approval from the electrical utility company.



**NOTE:** To ensure optimal reliability and to meet warranty requirements, the Enphase Microinverter System must be installed according to the instructions in this manual.



**NOTE:** The AC and DC connectors on the cabling are rated as a disconnect only when used with an Enphase Microinverter.



**NOTE:** Protection against lightning and resulting voltage surge must be in accordance with local standards.



**NOTE:** Many PV modules have a central stiffening brace. In these cases, do not position the connector and microinverter at the exact centre of the PV module. Instead, position the drop connectors so that the connectors do not conflict with the braces.



**NOTE:** Completely install all microinverters and all system AC connections prior to installing the PV modules.

## Microinverter Safety



**WARNING:** Risk of Skin Burn. The body of the Enphase Microinverter is the heat sink. Under normal operating conditions, the temperature is 15°C above ambient, but under extreme conditions the microinverter can reach a temperature of 80°C. To reduce risk of burns, use caution when working with microinverters.



**WARNING:** Risk of electric shock. Risk of fire. If the AC cable on the microinverter is damaged, do not install the unit.



**WARNING:** Risk of electric shock. Risk of fire. Do not attempt to repair the Enphase Microinverter; it contains no user-serviceable parts. If it fails, contact Enphase customer service to obtain an RMA (return merchandise authorization) number and start the replacement process. Tampering with or opening the Enphase Microinverter will void the warranty.



**WARNING:** Risk of Equipment Damage. The M215 and M250 may be paired only with 60-cell PV modules.



**WARNING:** When pairing with M250 (M250-60-2LL-S22, S23, or S24) or M215 (M215-60-2LL-S22-IG, S23-IG, or S24-IG), the PV module DC conductors must be labeled “PV Wire” or “PV Cable”.



**WARNING:** Risk of Equipment Damage. You must match the DC operating voltage range of the PV module with the allowable input voltage range of the Enphase Microinverter.



**WARNING:** Risk of Equipment Damage. The maximum open circuit voltage of the PV module must not exceed the specified maximum input DC voltage of the Enphase Microinverter.



**WARNING:** Risk of Equipment Damage. The microinverter must be installed under the module, out of rain and sun. Do not mount the microinverter in a position that allows long-term exposure to direct sunlight or in a vertical orientation that allows water to collect in the DC connector recess. Do not install the microinverter black side up or vertically, with the DC connectors facing up.



**WARNING:** Be aware that only qualified personnel may connect the Enphase Microinverter to the utility grid.



**NOTE:** The Enphase Microinverters has field-adjustable voltage and frequency trip points that may need to be set, depending upon local requirements. Only an authorized installer with permission and following the requirements of the local electrical authorities should make adjustments.



**NOTE:** The Enphase Microinverter works with single-phase or three-phase electrical service.

## Engage Cable and Accessory Safety



**DANGER:** Risk of electric shock. The Engage Cable terminator cap must not be installed while power is connected.



**WARNING:** Risk of electric shock. Risk of fire. When stripping the sheath from the Engage Cable, make sure the conductors are not damaged. If the exposed wires are damaged, the system may not function properly.



**WARNING:** Risk of electric shock. Risk of fire. Do not leave AC connectors on the Engage Cable uncovered for an extended period. If you do not replace the microinverter immediately, you must cover any unused connector with a sealing cap. Sealing caps may not be reused.



**WARNING:** Risk of electric shock. Risk of fire. Make sure protective sealing caps have been installed on all unused AC connectors. Unused AC connectors are live when the system is energized by the grid. Sealing caps may not be reused.



**WARNING:** Use the terminator only once. If you open the terminator following installation, the latching mechanism is destroyed. Do not reuse the terminator. Do not circumvent or manipulate the latching mechanism.



**CAUTION:** When installing the Engage Cable, secure any loose cable to minimize tripping hazard.



**NOTE:** Check the labeling on the Engage Cable drop connectors to be sure that the cable matches the electrical utility service at the site. Use 208 VAC Engage Cable at sites with three-phase service, or use 240 VAC Engage Cable at sites with single-phase service.



**NOTE:** There are two release-holes in the drop connector on the cable. These are not for mounting but are used to disconnect the connector. Keep these release holes clear and accessible.



**NOTE:** When looping the Engage Cable, do not form loops smaller than 4.75 in. (12 cm) in diameter.



**NOTE:** If you need to remove a sealing cap, you must use the Enphase disconnect tool or a screwdriver. Sealing caps may not be reused.



**NOTE:** When installing the Engage Cable and accessories, adhere to the following:

- Do not expose the terminator cap or cable connections to directed, pressurized liquid (water jets, etc.).
- Do not expose the terminator cap or cable connections to continuous immersion.
- Do not expose the terminator cap or cable connections to continuous tension (e.g., tension due to pulling or bending the cable near the connection).
- Use only the connectors and cables provided.
- Do not allow contamination or debris in the connectors.
- Use the terminator cap and cable connections only when all parts are present and intact.
- Do not install or use in potentially explosive environments.
- Do not allow the terminator to come into contact with open flame.
- Make sure that all terminator cap seals are seated correctly in the wire organizer.
- Fit the terminator cap using only the prescribed tools and in the prescribed manner.
- Use the terminator to seal the conductor end of the Engage Cable; no other method is allowed.



**NOTE:** Do not use the shipping cap to cover unused connectors. The shipping cap does not provide an adequate environmental seal. Enphase sealing caps are required to protect against moisture ingress.



## Overview

This document describes troubleshooting flows and procedures only. For product and installation information, refer to <http://www.enphase.com/support>.

Troubleshooting areas covered in this document include:

- Envoy and Communications Issues
- Microinverter / PV Module Issues
- Messages and Alerts
- Best Practices

Use the troubleshooting table on page 9 to find information on a problem according to category:

- Production issues
- Envoy not reporting
- Microinverter not reporting
- General troubleshooting



- 1 Enphase Microinverters**
  - are installed beneath each solar module
  - maximize energy harvest
  - send AC power over AC wiring to the load center
  - also send performance data via the AC wiring
- 2 Envoy Communications Gateway**
  - plugs into an AC outlet
  - collects information via the AC wiring
  - transmits data through a standard broadband router to the Internet
  - collects information and transmits it to Enlighten
- 3 Enphase Enlighten Monitoring**
  - provides monitoring and analysis
  - allows performance data to be viewed from any web browser



# Troubleshooting Topics

Use the following table to find information on a problem by category.

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<b>Production issues</b>	
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<b>Topic</b>	<b>Page</b>
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LCD displays "Reset Clock"	12
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## Envoy and Communications Issues

The following sections describe possible problems and solutions. Areas include:

- Envoy Issues
- Networking and Internet Issues
- Power Line Communication Issues between the Envoy & Microinverters



**WARNING:** Do not attempt to repair the Enphase Envoy; it contains no user-serviceable parts. Tampering with or opening the Envoy will void the warranty. If the Envoy fails, contact Enphase customer service to obtain an RMA (return merchandise authorization) number and start the replacement process.



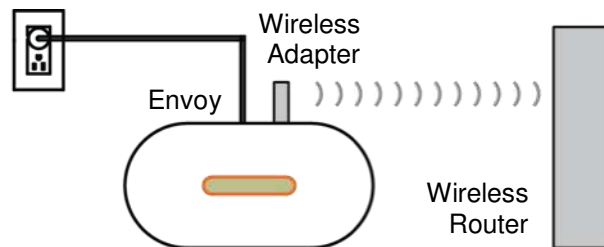
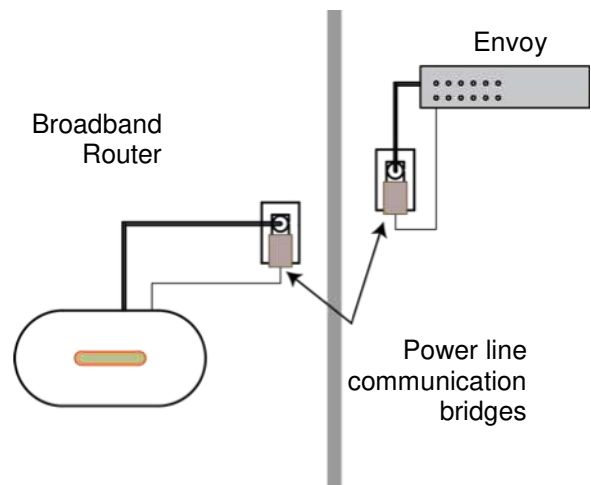
### Envoy Issues

#### A physical Ethernet connection is not practical at the site

The location for the Envoy yields a good signal-strength between the Envoy and the Microinverters (over the power lines), but it is remote from the router. An Ethernet cable from the broadband router to this spot is not practical.

Try these solutions:

- Use an Enphase Wireless Adapter (order WF-01) as shown.
- Use Enphase power line communication bridges (order ELPC-01) with the Envoy as shown.
- Or, you can use a third-party wireless Ethernet bridge (available at computer stores).



### **LCD is completely blank**

1. Try another outlet (just in case).
2. If this fails, the Envoy unit must be replaced. There are no field replaceable parts for the Envoy. Contact Enphase Customer Support [support@enphaseenergy.com](mailto:support@enphaseenergy.com).

### **LCD displays “Reset Clock”**

If the Envoy has a current Internet connection, let it use this connection to retrieve an upgrade from Enlighten. This may take up to 20 minutes, depending upon the speed of the connection. You may need to contact Enphase Customer Support to initiate the upgrade.

### **LCD displays “Envoy Failure”**

This message displays after the Envoy has tried unsuccessfully three times to initialize. This may happen when the Envoy has been moved, and its initialization process interrupted.

1. Unplug the Envoy from the electrical outlet, and then plug it in again. Leave the Envoy in place for at least 15 minutes.
2. If it continues to display **Envoy Failure** or if it never moves beyond the Initialization stage, contact Enphase Customer Support.

### **LCD displays "Scanning Inhibited"**

This message displays after an installer has used the Installer's Toolkit to provision the Envoy. Leave the Envoy in this condition for normal operation. If you need to re-enable scanning, contact Enphase Customer Support ([support@enphaseenergy.com](mailto:support@enphaseenergy.com)).

## Networking and Internet Issues

The Enphase Envoy Communications Gateway operates much as another computer does. As such, many of the troubleshooting steps for the Envoy are the same as those for other computers at the site.

### Issue: Wireless Adapter Wi-Fi Problems

- If the wireless installation fails, try these solutions:
  - ✓ Verify that the Envoy is at version "R3.8" or later. If needed, upgrade the Envoy as directed.
  - ✓ Verify that the wireless adapter is fully seated in the Envoy USB port.
  - ✓ Verify that the Envoy has two USB ports and that the USB adapter is in the left port (looking at Envoy from the front). Envoys with only one USB port do not support Wi-Fi.
  - ✓ Remove power from all units in the chain, then apply power in this order: 1) modem, 2) router, and 3) Envoy.
- If the Envoy is installed in an enclosure and you are using the wireless adapter, that enclosure must be plastic or fiberglass to allow wireless communication. Metal enclosures impede wireless communication.
- Stucco and plaster wall construction may contain metal mesh, which can affect wireless range. If you cannot see your router or access point in the list on the Envoy, or cannot maintain a connection, relocate the Envoy to be closer to your router or access point.
- If you remove the wireless adapter, wait about 15 seconds before re-inserting it.

### Issue: How Set Up Wi-Fi without Wi-Fi WPS

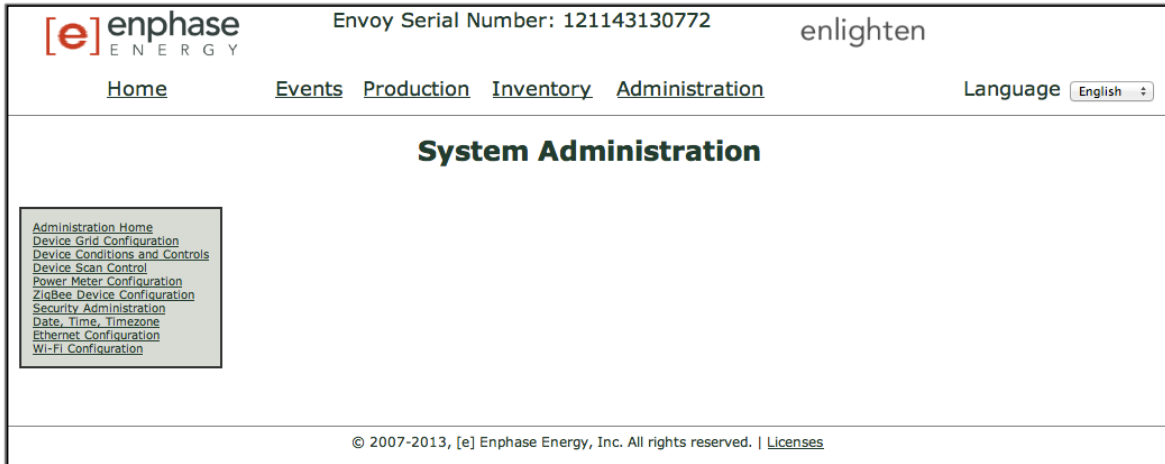
The Envoy with wireless adapter supports several wireless security protocols:

- Wi-Fi WPS
- WEP Open System
- WEP Shared Key
- WPA-PSK
- WPA2-PSK
- WPA-EAP
- WPA2-EAP

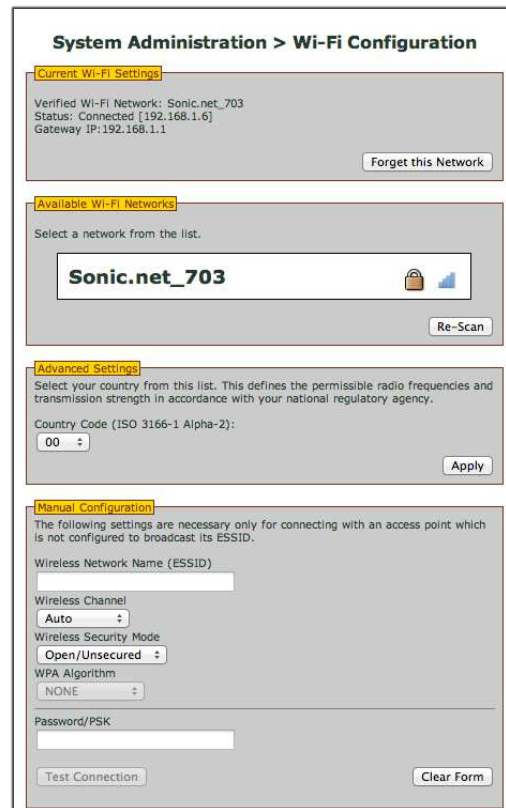
If the router does not support Wi-Fi WPS or you do not wish to use Wi-Fi WPS, follow these steps to establish a wireless connection using one of the listed protocols.

- a. Verify that the wireless adapter is fully seated in the left USB port (looking at Envoy from the front). Envoys with only one USB port do not support Wi-Fi.
- b. Plug the included Ethernet cable either to a laptop directly or to a PC on the same broadband router network.
- c. Access the Envoy Administration page. Enter the IP address of the Envoy LCD in the Internet browser.
- d. Enter the default login credentials for the Administration menu:
  - Username: **admin**

- Password: **admin**



- From the Administration menu, select **Wi-Fi Configuration**. This menu option is available only when the wireless adapter is installed in a USB port on the Envoy.
- The interface displays a list of available networks.
- Click a network to select it and enter the password.
  - If you don't see your network listed, the router SSID broadcast may be blocked. If so, enter the SSID (name) and password.
  - If your network is not blocked and not listed, click **Re-Scan** to refresh the list of networks.
  - Status messages appear during the connection process, including "Connection Test" and Confirmation".
- Click **Join Network** when displayed. After joining, the network displays in bold in the list of available networks.
- Disconnect the Ethernet cable. Within two minutes, an updated IP address displays on the Envoy LCD screen, indicating that a wireless connection is established. Within a minute, the Envoy LCD screen displays **+Web**, indicating a successful connection to Enphase.



## LCD shows a non-routable/self-assigned IP address AND shows “-Web”

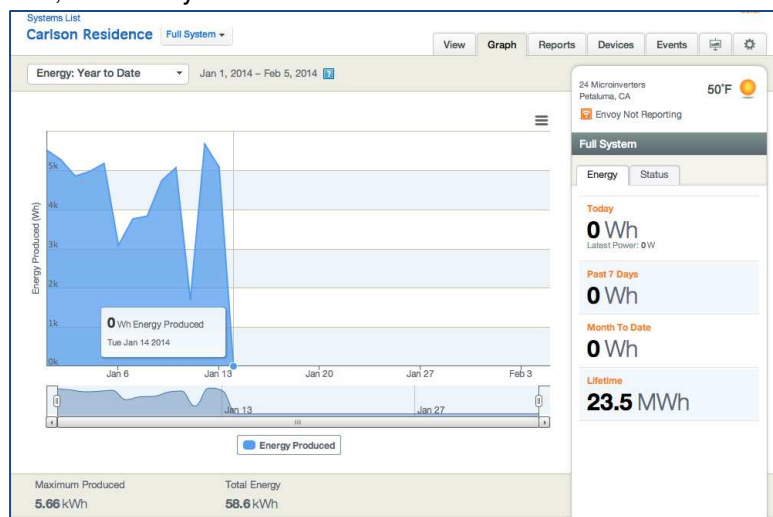
The Envoy has no connection to the Enlighten software platform. If the Envoy shows a self-assigned IP (169.254.120.1) and “-Web”, either a physical Ethernet connectivity issue is preventing it from obtaining a DHCP-issued IP address, or there is a setup problem.

### What is DHCP?

During the power-up sequence, the Envoy requests a DHCP-issued IP address from the broadband router. The router obtains an address from a pool of available IP addresses from a Dynamic Host Configuration Protocol (DHCP) server. The DHCP server ‘leases’ an IP address to each device in the Local Area Network (LAN). The Envoy, like other computers in the LAN, uses the DHCP IP address as the path to the Internet.

Troubleshoot as follows.

1. Verify the Envoy connection to the router.
  - a. Verify connection. The Envoy requires connection to a router, with the CAT5 cable that came with the Envoy or by installing an Enphase Wireless Adapter (order WF-01 separately).
  - b. Verify that the Envoy is connected to a broadband router. A switch or hub cannot be substituted for the router.
    - i. Determine the make and model of the router. This will help you discover if it is a true router, rather than a hub or switch.
    - ii. A switch or hub placed between the modem and the ISP connection may also cause this problem.
  - c. Check that the Local Area Network (LAN) port LED is lit. The LED is on the rear of Envoy next to the LAN port., is the Envoy network port light lit? If so, the Envoy is waiting for a response from Enlighten, and will show “+Web” soon. If not, reseat connections or try another CAT5 cable.
  
2. Did the Envoy previously have an Internet connection at this site?
  - a. If so, what has changed? Is it a new router or ISP? Was there a power outage?
  - b. If yes to any of these, remove power from all units in the chain, then apply power again in this order: Cable/DSL Modem, Router, and Envoy.
  - c. If the router was replaced, make sure the new device is actually a router, not a hub or a switch.
  - d. Look up the site in Enlighten. According to the graph, when did this Envoy last report (last date/time shown in the energy production graph)? What changed at that point in time?
  - e. Try using the Envoy menu button to “Get New IP address.” Press and hold





the Envoy Menu button; after two seconds you will see the Envoy menu. Continue holding the Menu button; when the LCD window displays “Get New IP Address”, release the Menu button.

- f. If using an Ethernet CAT5 cable between the Envoy and router, try replacing this cable.
  - g. Is there an “Envoy not Reporting” event in Enlighten? If so, see page 40.
3. If Enphase power line communication bridges are in use, check that all LEDs are either on or flashing as described in “Are my power line communication bridges working?” Try the following:
- a. Relocate one of the bridges to a different power outlet, and make sure that neither one is in a power-strip or UPS battery-backup device.
  - b. Bypass the bridges and plug the Envoy directly into the Router to eliminate the bridges as the source of trouble. They may be faulty or they may be too far apart.
  - c. Replace the Ethernet cables, one at a time, to eliminate these as the cause.
4. Is the router set up with MAC (media access control) filtering? If enabled, MAC filtering prevents the Envoy from obtaining a DHCP address because the router refuses the DHCP request.
- Temporarily disable MAC filtering, add the MAC address of the Envoy to the broadband filter MAC address list, and then enable MAC filtering.

**What is a MAC address?**

A MAC address is a unique identifier permanently assigned to a network interface and MAC filtering uses those addresses as a common security technique. In the router, enter a list of MAC addresses from the other computers at your site that share the router. Only those MAC addresses can participate in the router’s network.

5. Is there a firewall set up on the LAN? Most routers either have the firewall disabled or they come with a basic firewall rule of *Allow all outbound traffic but disallow all inbound traffic*. This allows you to view any website, but prevents unsolicited Internet traffic from coming into the premises via the router.

**What is a Firewall?**

A network firewall is a set of router rules that allow or disallow certain types of inbound or outbound traffic to your LAN. Firewall rules are specific rules that you can set up to allow or disallow different types of network traffic.

The Envoy initiates **outbound** connections to Internet servers. Such connections may be restricted by firewall rules set up on the site’s broadband router. Broadband routers typically allow all outbound connections and restrict any or all inbound connections.

- If outbound firewall rules are applied at the site, you must configure a static IP address for the Envoy and add new rules that allow outbound access as follows:

Direction	Source	Protocol	Port	Destination
OUT	<Envoy IP address>	TCP	443	reports.enphaseenergy.com
OUT	<Envoy IP address>	TCP	443	securereports.enphaseenergy.com
OUT	<Envoy IP address>	TCP	443	home.enphaseenergy.com
OUT	<Envoy IP address>	TCP	2020	home.enphaseenergy.com †
OUT	<Envoy IP address>	UDP	123	us.pool.ntp.org

† Port 2020 is an optional support port used when there are issues with the standard HTTPS port (443).

The Envoy connects to these servers using their DNS names. If you add firewall rules for Envoy reporting, Enphase recommends using the DNS names rather than the underlying IP addresses as the IP addresses are subject to change without notice.



**WARNING:** Do not change the Envoy DHCP setting to use a static IP address unless you also reserve the same IP address on the broadband router. See the section on DHCP Reservations in your router's setup manual. Failure to reserve the static IP address on the router results in duplicate IP addresses and intermittent Internet connection problems with the Envoy.

### The Envoy is using a static IP and cannot get a web connection

If the site owner prefers not to use DHCP, set up the Envoy to use a static IP address.

- Use the Envoy's web interface to navigate to the Administration page. The Username is "admin", and password is "admin". Click the "Network Connectivity" menu item. This allows you to see if the Envoy is using DHCP or static IP, and allows you to change this setting if needed.
- Click "Check Network Connectivity" to view the Envoy connections.



**WARNING:** Do not change the Envoy DHCP setting to use a static IP address unless you also reserve the same IP address on the broadband router. See the section on DHCP reservations in the router instructions. Failure to reserve the static IP address on the router will result in duplicate IP addresses and intermittent Internet connection problems with the Envoy.

For more information on how to use the Envoy Interface, refer to the *Envoy Installation and Operation Manual* at <http://www.enphase.com/support>.

### LCD periodically shows "-Web" for minutes or hours at a time.

If the Envoy LCD intermittently shows a good IP and "+Web", but periodically shows "-Web" for minutes or hours at a time.

- The Internet service may be dropping out periodically. Does this happen with other Internet-connected devices at the premises? If so, contact the ISP.
- Does the Envoy connection drop when another device at the premises obtains an Internet connection? If so, a switching device at the premises is likely allowing only one Internet connection at a time. Check the router for this limitation.
- If using an Ethernet CAT5 cable between the Envoy and router, try replacing this cable.

### LCD shows a valid IP, but also shows "-Web"

The Envoy has no connection to the Enlighten software platform. The LCD shows a valid IP (something other than 169.254.120.1), but also shows "-Web".

- The Envoy is waiting for a response from Enlighten, and will likely show "+Web" soon. Wait a few minutes longer.
- Check that the Envoy is connected to a broadband router and not a hub or switch.

### The router or DSL modem at the site has only one Ethernet port

If the site has only a single-port DSL modem and the system owner's computer is already using that port, choose from the following solutions:

- Install a broadband router to allow multiple private LAN connections to the single WAN connection. See **Setup 1** below.

**What are LAN and WAN?**

WAN = The Wide Area Network is the network beyond your local premises.

LAN = The Local Area Network is the network within your local premises.

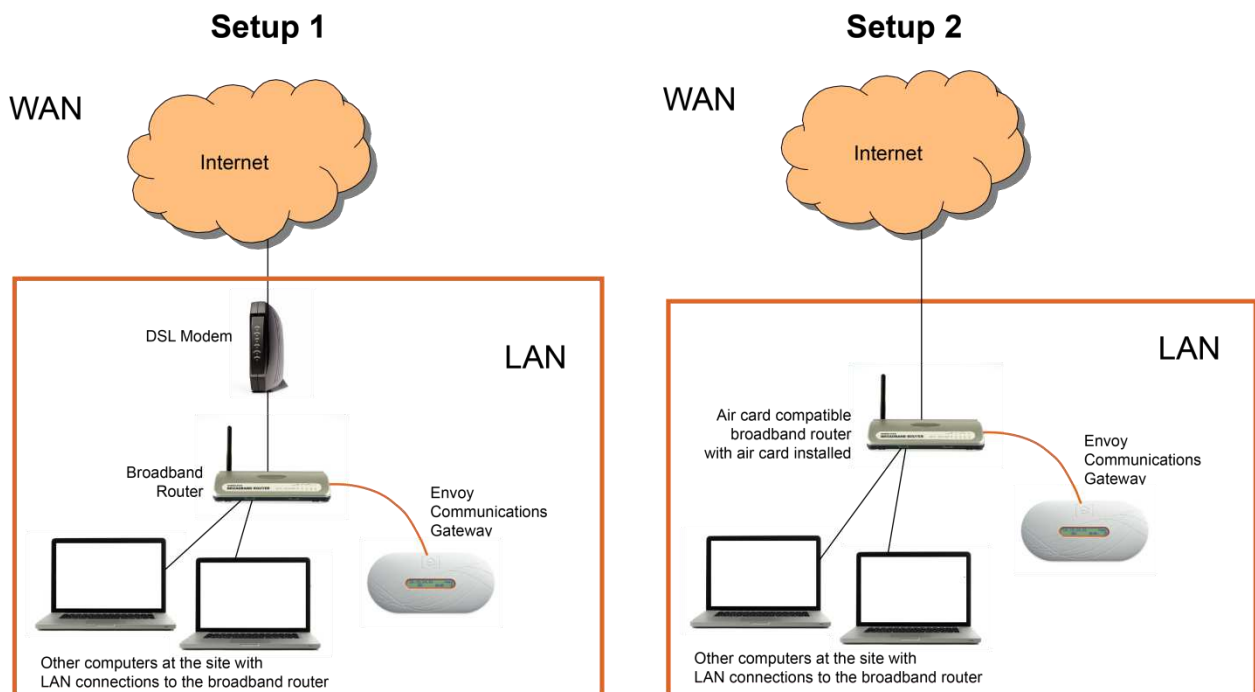
Also, if the broadband connection is setup to only allow one Internet-connected host at a time, contact the ISP to change the account to allow multiple hosts to connect at one time. The ISP may recommend a router, or you may opt to buy one at a retailer.

- If the site has a wireless broadband router, purchase an ENV-120-02, the kit that includes an Envoy and a Wi-Fi stick. Install it as described in *Envoy Installation and Operation Manual* at <http://www.enphase.com/support>.

**Internet service is not available on site**

Consider buying an air card or hot spot. There are some cases where this is the only Internet connectivity option for the site. Air cards are also called EVDO or CDMA cards and typically provided by Sprint, Verizon or AT&T. Purchase an air card compatible router (e.g., Cradlepoint MBR 95). Plug the air card into the indicated port on the router to create a LAN at the site. See **Setup 2** below.

After installing the air card, you can then install the Envoy as described in the *Envoy Installation and Operation Manual* at <http://www.enphase.com/support>.



## Are my power line communication bridges working?

Use the status lights to verify connections.

Indicator	LED	Status
Power	On	Device is powered on
	Off	No power
PLC Activity	Flashing	Activity on power line
	Off	No activity on power line (should flash intermittently)
Ethernet Link	On	There is Ethernet connectivity
	Flashing	There is Ethernet traffic
	Off	No Ethernet activity



### Issue: Internet Traffic is Slower After Installing a Bridge

Cross talk occurs when a power line communication bridge establishes communication with a bridge in a neighboring home or business. Crosstalk impacts the volume of Internet traffic. To determine if an Internet traffic slowdown problem originates from crosstalk, disconnect the bridge from the router. If the Envoy stays online and the bridge continues to indicate connectivity, you may be gaining connectivity from another bridge. Reconnect the bridge to the router and disconnect the other bridge from the Envoy. If the volume of Internet traffic increases, other devices may be gaining access to the Internet through your bridge. Reconnect the bridge. To prevent crosstalk, use the solution below according to the type of bridge you have.

#### Asoka PL9650

1. Verify that both adapters are plugged in to an outlet and that one adapter is connected via Ethernet cable to the router while the other is connected via Ethernet cable to the Envoy.
2. Change the password for your pair of bridges so that neighboring devices can no longer gain access to the Internet through your bridge. Use Asoka's free, Windows-only configuration software to change the password. Go to the "Advanced" screen of the configuration utility and change the password. Follow any additional instructions. The configuration software is available at <http://www.asokatech.com/downloads-page>.



#### Asoka PL9660-Q1

1. Verify that both adapters are plugged in to an outlet and that one adapter is connected via Ethernet cable to the router while the other is connected via Ethernet cable to the Envoy.
2. On one adapter, press and hold the **Sync/Reset** button for one second, then release. The Power LED starts flashing.
3. Within two minutes of releasing the **Sync/Reset** button on the first adapter, press and hold the **Sync/Reset** button on the second adapter for one second. The Power LED starts flashing.
4. Allow 15 seconds for pairing to occur. When pairing is successful, the power LED lights up solid.



#### ReadyNet EN200

1. Verify that both adapters are plugged in to an outlet and that one adapter is connected via Ethernet cable to the router while the other is connected via Ethernet cable to the Envoy.



2. Press and hold the **Sync / Reset** button for two seconds on each unit. After this, the Ethernet light flashes. The units then reset and attempt to link using default factory settings.

#### *Tenda P200*

1. Verify that both adapters are plugged in to an outlet and that one adapter is connected via Ethernet cable to the router while the other is connected via Ethernet cable to the Envoy.
2. On adapter one, press and hold the **Reset/Pair** button for two to three seconds, then release. The Power LED starts flashing.
3. Within two minutes of releasing the **Reset/Pair** button on adapter one, press and hold the Reset/Pair button on adapter two for two to three seconds, then release it. The power LED starts flashing.
4. The Power and PLC LEDs on both adapters display a solid light to indicate that an encrypted private network is successfully created.



### **The Envoy cannot get a “+Web” even though all premises networking is intact**

If you have gone through all appropriate troubleshooting exercises and cannot get the Envoy to show a “+Web” condition and other computers in the LAN are able to get to the Internet, then it may be that the Envoy has a hardware or networking problem. Contact Enphase Customer Support.

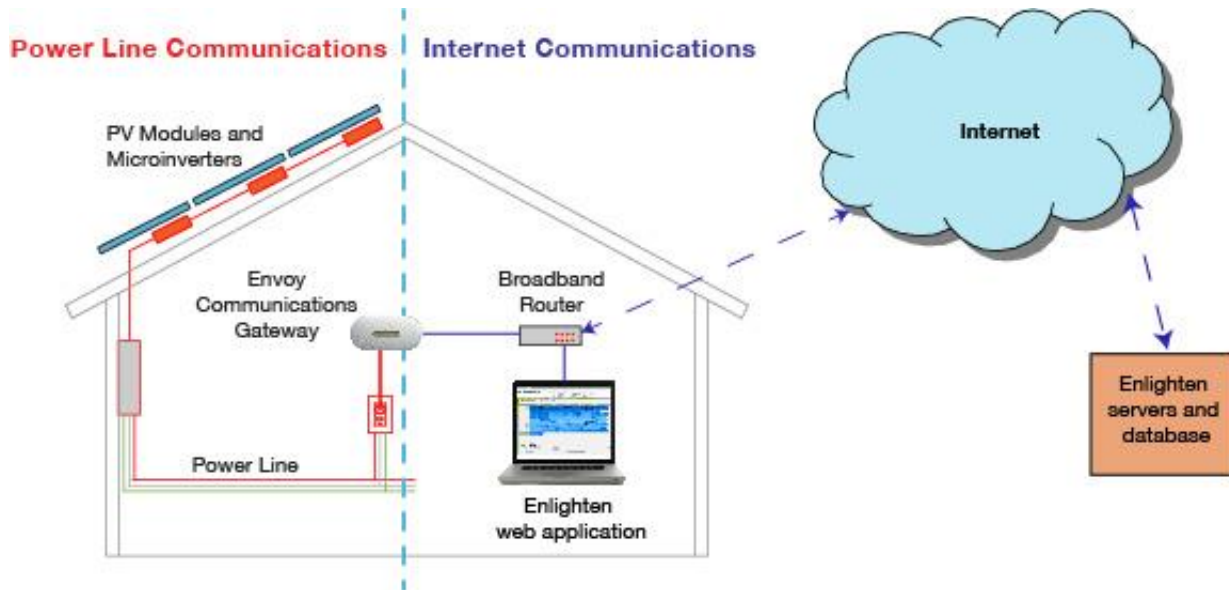
### **Can I use a dial-up Internet connection with the Envoy?**

No. Dial-up Internet connections do not allow consistent communication between the Envoy and Enphase. As such, Enphase Energy does not support dial-up connections.

## Power Line Communication Issues between the Envoy & Microinverters

Enphase Microinverters use a power line transmission protocol at the site for communication with the Envoy. All electrical loads at the premises share this common collection of power lines and circuits, and terminate at the load center, the location of the circuit breakers. The load center is typically found on the side of the house or building or in the garage. Since the power lines are shared with other loads, interference can occur, particularly as new devices are plugged in.

Power line communication between the Envoy and the microinverters is completely separate from the Envoy Internet communication. That is what makes the Envoy a “gateway device”. One side of the Envoy communicates with the microinverters via the power lines. The other side of the Envoy communicates with the Internet using a standard Ethernet/network cable plugged into your broadband router.



At power-up, the Envoy performs a **power line** communication check to determine the strength of the signal between the microinverters and the Envoy. This check does not assess Internet communications. During power up, the Envoy performs a communication check. A few minutes after power-up, the Envoy displays a number of bars from 0 to 5 (figure shows four bars) that indicate the signal strength of power line communications between the Envoy and the microinverters.

- A signal strength from 3 to 5 bars is usually sufficient.
- A signal strength of 1 or 2 bars is workable, but not ideal. In these cases, relocate the Envoy to a dedicated outlet closer to the load center.
- Zero bars means that either that you need to relocate the Envoy, or that there are one or more devices causing interference between the Envoy and the microinverters in the array
- Zero bars may also mean that the Envoy has never detected any devices, so you should initiate a device scan.

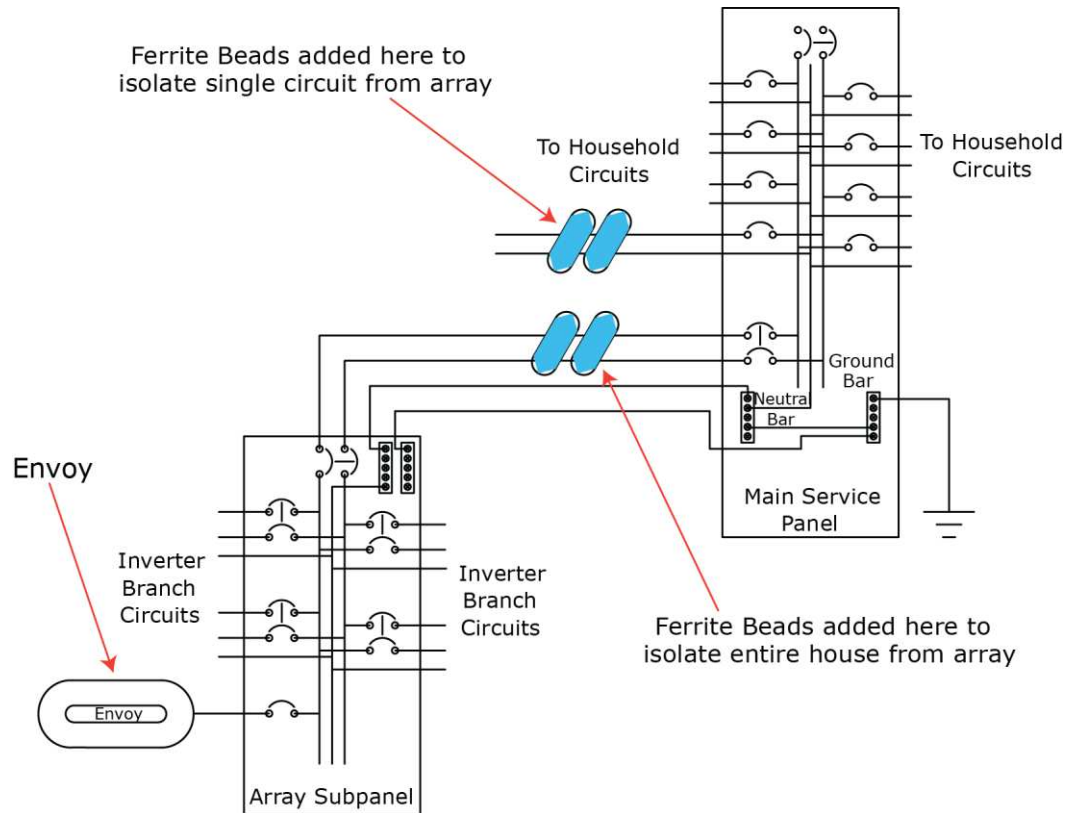


## Microinverters are not detected, or, power line communication level is low or poor

If the Envoy LCD level indicator displays 2 or fewer bars,, or you may be seeing “Microinverter Failed to Report” events.


1. The Envoy may be plugged into an AC outlet that is too far from the electrical load center. Relocate it to an outlet physically closer to the load center.
2. Is there an unbroken Neutral line from the load center to the solar array branch circuit? This is required for system communications.
3. Is another device causing interference?
  - If the Envoy is not detecting the Microinverters in the array(s), or if the event log frequently lists **Microinverter Failed to Report** events, then either the power line communication signal strength is weaker than required, or there is interference on the line from a device at the site.
  - Unplug any other device that may be sharing the outlet with the Envoy. Use another outlet for the unplugged device.
  - The following devices **may** interfere with power line communications:
    - ✓ power strips and surge protectors on the same circuit
    - ✓ UPS (Uninterruptible Power Supply) / battery backup units on the same circuit
    - ✓ dimmer switches
    - ✓ home automation/security devices that use power line communication
    - ✓ touch lamps
    - ✓ battery chargers (cell phone and laptop chargers)
    - ✓ AC adapters (laptop power cord)
    - ✓ heavy rotating motors (e.g., fans, refrigerators, freezers, water pumps)
    - ✓ workshop equipment (e.g., drill press, table saw, wood routers, planers)
    - ✓ CFLs (Compact fluorescent lights) with failed ballasts anywhere in the home
    - ✓ electronic pest deterrents
    - ✓ GFI outlets
    - ✓ some brands of arc-fault protected outlets (arc-fault breaker)
  - Determine the source of the interfering load by isolating the Enphase signal from other systems. The Enphase system transmits at 144kHz, and adequately filters X10 and other signals. but not all other systems adequately filter the Enphase signal. To best isolate the signal:
    - ✓ Install a PV subpanel to land all the solar branch circuits.
    - ✓ Install a dedicated outlet for the Envoy (and power line communication bridges, if needed) off the subpanel.
    - ✓ Filter the phase conductors running from the subpanel back to the load center. Ferrite toroids are an effective, simple filtering mechanism. Refer to [http://en.wikipedia.org/wiki/Toroidal\\_inductors\\_and\\_transformers](http://en.wikipedia.org/wiki/Toroidal_inductors_and_transformers) for more information. Here is the link to specific model required: <http://search.digikey.com/scripts/DkSearch/dksus.dll?vendor=0&keywords=Epcos+B64290L0082X087>
    - ✓ If this subpanel is remote from the router, you may need power line communication bridges to span the gap from the Envoy back to the site’s router. However, remember that these bridges do not help or hinder the power line communication signal between the Envoy and the microinverters.  
If the signal path for the bridges is impeded by the use of the subpanel, you can use a wireless Ethernet bridge instead.





Adding Ferrites to Reduce Noise

4. There may be a Phase imbalance. Have an electrician evaluate the circuit breakers in the load center to see how many breakers, and of what size, are on each of the two phases of the split-phase 240 VAC service to ensure that the phases are balanced. As a troubleshooting technique, you may want to try plugging the Envoy into an outlet of a circuit on the other phase or moving the breaker of the circuit in which the Envoy is plugged onto the other phase.
5. The system may not be energized The PV module powers the microinverter only during daylight hours, and microinverters communicate only when powered. Perform a device scan or communication check only during daylight hours. Check for the following conditions:
  - Are the solar circuit breakers in the “ON” position? For the Envoy to communicate with the microinverters, the circuit breakers for the solar wiring must be in the “ON” position at the load-center.
  - Are the PV modules installed and connected? PV modules power the microinverters, and microinverters cannot communicate unless powered.
6. Not all the microinverters are detected.
  - It may be that all of the expected devices have not been detected because not enough time has passed. After you first energize the system, allow at least 30 minutes for all devices to report.
  - If the initial 8-hour scan has expired, start a new scan. You can start a new scan from Enlighten or from the Envoy. To initiate a communication from the Envoy, follow these steps:
    - ✓ Press and hold the Envoy Menu button; after two seconds the Envoy menu displays.
    - ✓ Continue to hold the Menu button; until the LCD window displays “Enable New Device Scan”, then release.

- ✓ The LCD displays **Device Scan Active**, and the Envoy begins a 30-minute scan (if a longer scan is not already in progress) to identify all of the microinverters deployed at the site.
- Alternatively, if you have an installer account, you can use Enlighten to start a new device scan:
  - ✓ Log into Enlighten, select the site, and click the **Settings** (  ) icon.
  - ✓ Click the **Status** tab in the information pane on the right.
  - ✓ Click the Envoy serial number.
  - ✓ Click the Rescan **for Devices** button.

### How to identify an interfering load

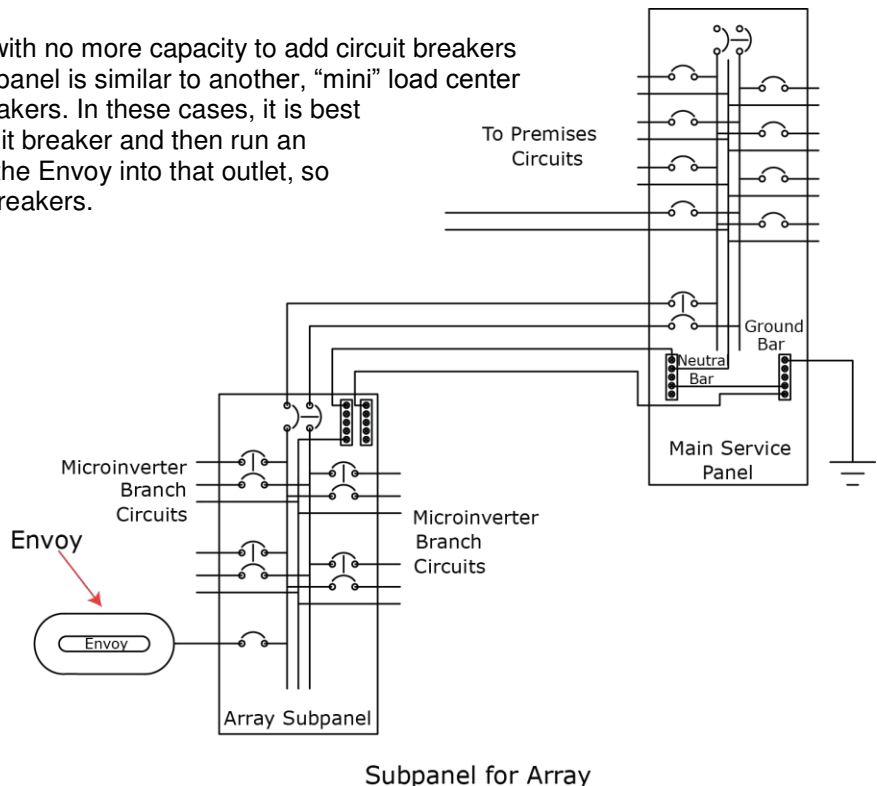
If you are unable to resolve the power line communication issue after completing the previous troubleshooting steps, inspect the load center one circuit breaker at a time. Identify the source of interference. If there is no subpanel, follow these steps to identify which circuit has the interfering load or loads.

1. Turn off all circuit breakers except those for the PV array and for the Envoy.
2. Verify that the Envoy and microinverters are communicating.
3. Turn on one additional circuit breaker and wait 10 minutes to see if there is any interference.
4. If not, turn on another circuit breaker and check again.

After completing these steps to find out which circuit has the interfering load, look at the individual loads on that circuit to determine which device is causing the interference.

### The Envoy is in a circuit on the primary load center, the solar circuits are on a downstream subpanel

If the primary load center is full with no more capacity to add circuit breakers for solar, add a subpanel. A subpanel is similar to another, “mini” load center with a small subset of circuit breakers. In these cases, it is best to add an additional 5-Amp circuit breaker and then run an outlet off of that subpanel. Plug the Envoy into that outlet, so that it is close to the PV circuit breakers.



## Power line communications with a Line-side Tap (or Supply-Side, or PLC) Installation

Note that line-side taps are called “parallel installations” in Canada.

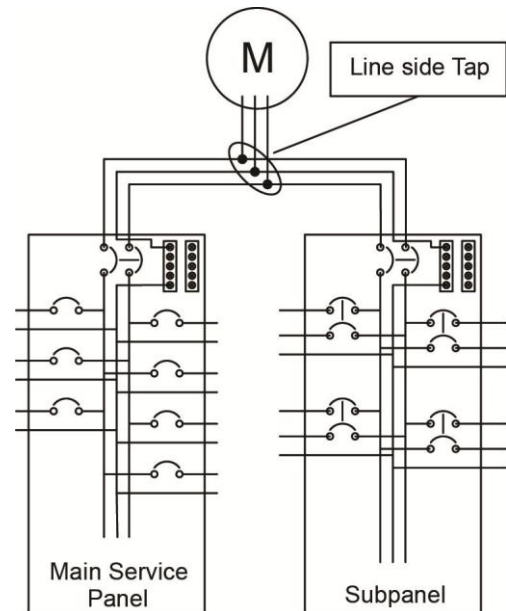
For information on line-side versus load-side connections, refer to an informative series by John Wiles,

***Making the Utility Connection: Perspectives on PV*** at <http://www.nmsu.edu/~tdi/pdf-resources/IAEI-9-10-05.pdf>.

To facilitate power line communications with a line-side tap, install the Envoy on an outlet off the PV subpanel where you land the circuit breakers and prior to the utility tie-in. Plug in the Envoy in near the electrical service center as this may suffice.

In the case where the Envoy is on the premises wiring system, try installing a pair of wireless Ethernet bridges to span the gap between the Envoy and the router. A pair of power line communication bridges comes with Envoy model ENV-120-01.

If this does resolve the issue, you may need to use a wireless bridge. As the Envoy powered at the PV subpanel is not on the premises' wiring system, add a wireless front end to the Envoy using the wireless Ethernet bridge. This assumes the site is set up for wireless access. The Linksys WRT610N is an example of a wireless bridge.



## Multiple Envoys and Filtering

When installing multiple Envoys off of a single utility transformer also install filters to isolate each Envoy into a separate communication domain, especially for large-scale projects. Use transformers or aftermarket filters to isolate communication domains.

In a large-scale project, each sub-system (or communication domain) consists of modules, microinverters, cables, branch circuit breakers, a microinverter subpanel, and a filter. A filter prevents power line communication signals from one Envoy communication domain from interfering with Envoy communication in another domain. The filter also offers the added benefit of eliminating electrical noise from site loads.

With multiple communications domains, the total number of filters can be one less than the total number of communication domains. If all other communications domains have filters, you can build one communications domain without a filter ( $n - 1$ ).

If your system contains fewer than 600 microinverters with a single Envoy on-site (a single communications domain), you do not need a filter to isolate communications domains. A system of 600 microinverters has an AC inverter output rating of 129kW. For systems with fewer than 600 microinverters, the content in this section does not usually apply.

## Using a Transformer to Isolate Communication Domains

Transformers provide excellent filtering between Enphase communication domains. A 480 V, 600 V, or medium voltage interconnection requires a transformer to step the voltage down to 208/120 Wye. If the project does not require transformers, or if a single, central transformer is selected, then you can filter Envoy communication domains with commercially available power line filters.

### **Using an Aftermarket Filter to Isolate Communication Domains**

For some larger systems, it is convenient to install commercially available power line filter products. Power line filters are available in a variety of ampacities and voltage configurations. This variety of ratings available allows maximum flexibility in your design choices.

Refer to the commercial planning tools at <http://www.enphase.com/support> for more information. For assistance with large-system/commercial design, requiring multiple Envoy devices, contact [Enphase](#) Field Applications Engineering for a design review.

### **How to Get Training on Enphase Power Line Communication**

For training on Enphase power line communication, attend a free, one-hour training webinar on the Envoy. Find out more at <http://enphase.com/support-north-america/webinars/>.

# Microinverter and PV Module Issues

This section describes ways to isolate failures within microinverters or PV modules using:

- Microinverter LEDs
- Power Production



## Microinverter LEDs

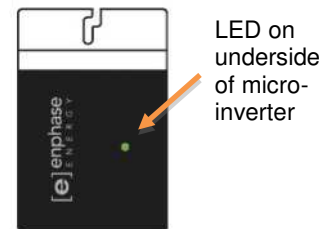
### Startup LED Operation

The status LED on the underside of each microinverter lights green about six seconds after DC power is applied. It remains lit solid for two minutes, followed by six green blinks. After that, red blinks indicate that no grid is present if the system is not yet energized.

Six short red blinks when DC power is first applied to the microinverter indicate a failure during microinverter startup.

(On older models, including M190, M210, and D380, the LED is on the **edge** of the microinverter.)

LED color	State	Meaning
Green	Solid	Normal startup
	Flashing	Transition to post start up state
Red	Flashing	No grid present (AC breaker is not turned on)
	Solid	Failed microinverter start up



### Post-Startup LED Indications

Use a handheld mirror to view indicator lights on the undersides of the microinverters. LED states are:

LED color	State	Meaning
Green	Flashing	Normal operation. The microinverter is receiving messages from the Envoy and senses that the utility grid is within voltage/frequency specifications.
Orange	Flashing	Not receiving messages from the Envoy, but is otherwise operating normally. The microinverter senses that the utility grid is within voltage/frequency specifications. Troubleshoot as described in the following sections.
Red	Flashing	Failed to produce power and <b>not operating normally</b> . The microinverter does not sense that the utility grid is within voltage/frequency specifications. The microinverter cannot produce power until this is resolved. . Troubleshoot as described in the following sections.
	Solid	Fault requiring intervention. <ul style="list-style-type: none"> <li>• For M215-60-2LL-S22-IG, S23-IG, or S24-IG this indicates a “DC Resistance Low – Power Off” fault. (continued on next page)</li> </ul>

	<ul style="list-style-type: none"> <li>• For M190, <b>M210</b>, <b>D380</b> and for <b>M215-60-2LL-S22</b>, <b>S23</b>, or <b>S24</b>, this indicates a GFDI fault.</li> <li>• Troubleshoot as described in "GFI Tripped on page 41 or "DC Resistance Low" on page 37.</li> </ul>
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### The Microinverter LEDs are flashing red

To determine the problem, perform the following checks.

1. Check DC voltages. Use a voltmeter to measure the PV modules VOC (Open Circuit Voltage) and inspect the positive and negative markings on the PV module and microinverter.
2. Check AC voltages. Are all of the phase conductors running to the microinverter branch circuits showing the appropriate nominal AC voltage? Measure line-to-line and line-to-neutral for all phase-conductors. An electrician must measure hot legs and neutral to ensure that the phases are balanced.
3. Is the system energized? Are the solar circuit breakers in the "ON" position? For the microinverters to produce, the circuit breakers for the solar have to be in the "ON" position in the electrical load center.

### The Microinverter LEDs are flashing orange

Orange flashing lights indicate that the microinverters are producing power, but not communicating with the Envoy.

1. Is there an Envoy plugged in and operating at the site? If so, what does the Communication Check show? This is likely a communications issue. See "Power Line Communication Issues between the Envoy & Microinverters" on page 21. If not, the microinverters will continue to flash orange until an Envoy is installed.

### The Microinverter LEDs are not lit

No lights indicate that the microinverter is not receiving power from the PV module.

1. Are the PV modules connected to the microinverters? PV modules power the microinverters, and microinverters cannot operate unless powered.
2. Does the site use adaptors (or jumpers) between the PV module and the microinverter? It may be that polarity is reversed. Does the site use Tyco connectors? If so, be warned that some Tyco connectors will mate but reverse polarity. Refer to the microinverter product manual to make sure that the appropriate lead from the PV module is connected to the appropriate DC lead on the microinverter.

## Power Production

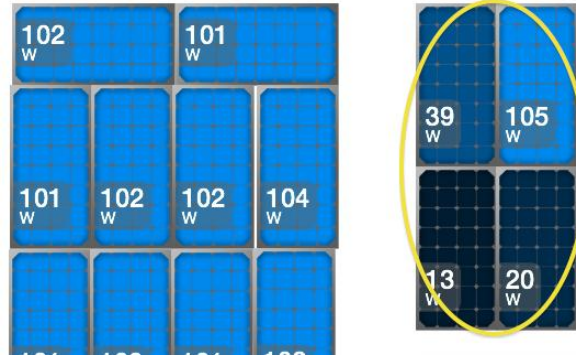
This section describes how to troubleshoot power production issues by using Enlighten Manager

### The unit under review shows low production.

1. Eliminate shading as a possible cause.

The seven-day time-lapse animation of a non-productive, or under producing PV/microinverter pair repeats can show production patterns that indicate shading. The following Enlighten snapshot shows an example of a system with shading impacts. To view a time-lapse animation of a system:

- In the **View** tab, click the Energy/Power drop-down menu. Under Power, select Past 7 Days.
- Click the playback icon. Use the controls at the base of the screen to pause, replay and change the speed of the animation playback..

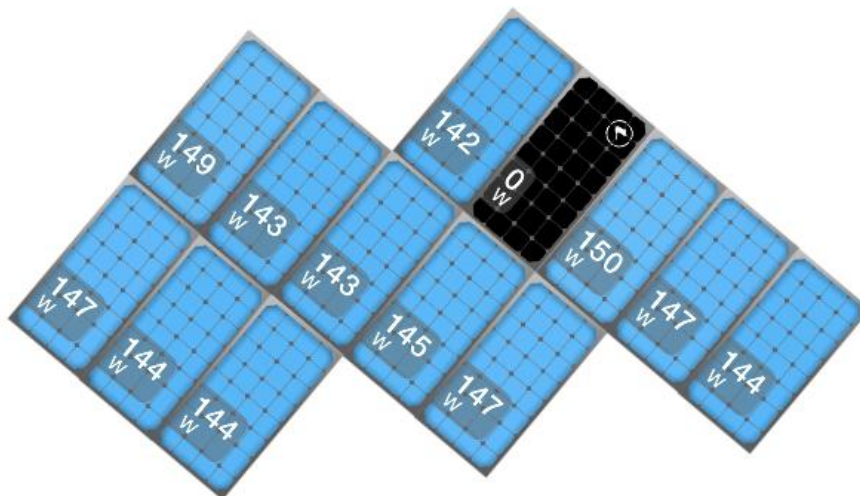


If the periods of low production are consistent and happen at the same time of day, then shading is likely the cause.


2. Refer to "Messages and Alerts" on page 33 for other possible causes of low production.

### One unit shows 0W of production but adjacent units are productive

The microinverter is communicating, but not producing. Communication with no production may indicate a DC-side failure.



Use Enlighten to view AC measurements for analysis. To view the AC measurements:

1. In the **View** tab, click the module. A status message displays.
2. Click the graph icon. 



3. When the graph displays, select **Power: Past 7 days** from the drop-down menu. The default view of the 7-day graph shows a production with a blue line.
4. At the base of the graph, click **DC Voltage** to add DC Voltage measurements.
5. Move the cursor along the green line to view the voltage reading or along the blue line to view the power production at a point in time.
6. Verify that the PV module meets the required voltage to start the microinverter. A module that is failing or is undersized, and not **compatible** with the microinverter may not generate enough power to feed power to the microinverter, even if it had previously done so.

Enphase Microinverter Model	Minimum Required Start Voltage (VDC)
M250	22 V
M215	22 V
M190	28 V
D380	28 V
M210	38 V

If your analysis suggests that the PV module no longer meets specifications and that it cannot start up the microinverter, swap the PV module with a known productive module in the array.

Call Enphase Energy Customer Support (877-797-4743) when you arrive on site for assistance with real-time readings as you make changes in your array configuration.

If the problem moves with the PV module, then you can conclude that the PV module is faulty.

### About Open-Circuit Voltage

Measuring open-circuit voltage on the PV module does not conclusively confirm a PV module fault. For example, excessive resistance limits current flow, and is not be apparent until the PV module is connected, since there is no current flow at open circuit. In this case open circuit voltage might be within specifications and masking another problem.

Sometimes a microinverter reports zero DC voltage. In this case, measuring the open circuit voltage of the PV module will help identify a PV module that has failed.

If the problem does not appear to be with the PV module, Enphase Energy Customer Support will assist you in further diagnosing the issue.

### Other Checks

- Use Enlighten or the Envoy interface to check for an event on the affected microinverter:
  - ✓ ACVOOR: see “ACVOOR (AC Voltage Out of Range)” on page 34.
  - ✓ ACFOOR: see “ACFOOR (AC Frequency Out of Range)” on page 33.
  - ✓ GFI Tripped: see “GFI Tripped on page 41.
  - ✓ Grid Gone: see “Grid Gone” on page 42.
  - ✓ DC Too Low: see “DC Too Low” on page 39.
  - ✓ DC Too High: see “DC Too High” on page 40.
- Determine how long the affected microinverter has been reporting zero production. View the graph for this microinverter or run a report in Enlighten. Did this cessation of production coincide

with any other events at the site, such as a power-outage, lightning activity, or other change in the electrical environment?

### The PV modules are dark and no production displays in Enlighten

Modules that are shaded gray, with no indication of production level, have temporarily lost connectivity with the Envoy. This is different than a unit that is reporting, but reporting 0W AC power.

Communication outages may be caused by poor power line communications, or by DC voltage that has slipped below the level required to turn on the microinverter. Microinverters that are not powered on do not communicate with the Envoy.

1. Use Enlighten or the Envoy interface to check for an event on the affected microinverter.
2. Is there a corresponding **Microinverter Failed to Report** event for this unit? Refer to “Microinverters are not detected, or, power line communication level is low or poor” on page 22.
3. In Enlighten, select the module and view the production history. When did the microinverter last report to Enlighten? See “Run a report to view production history” on page 31 or “View module production history” on page 32.

### Enlighten does not allow me to select the PV module

This position in the array has no serial number associated with it. Use **Array Builder** to assign the serial number to that spot in the array. If the serial number has not yet been detected, see “Microinverters are not detected, or, power line communication level is low or poor” on page 22.

### View the PV module production history

To view production history for a PV module, refer to “Run a report to view production history” on page 31 or “View module production history” on page 32.

### Run a report to view production history

The following system-wide reports are available in Enlighten from the Reports tab.

- Site Energy Production – Lists the energy produced by day and the total production for the selected time period.
- Monthly Energy Production Report – Lists system energy production by week for the selected month. This report also lists peak power for each week and energy production for the previous month and year-to-date.
- Site Recent Power Production – Lists system power production measurements for the past seven days in five-minute increments. The report shows zero production during intervals when sunlight is unavailable or when the system is powered down.
- Power Meter Report – This report is only available for systems that have a Revenue Grade Meter (RGM) installed. It lists the Energy and Power delivered by the system, as well as the Cumulative Energy in 15-minute increments for the selected date range.
- Per Module One Day Energy Production – Lists daily energy production by module (microinverter serial number) as well as the total system production for the selected day.


Per Module One Month Energy Production – Lists the monthly energy production by module (microinverter serial number) as well as total system production for the selected month.

You can also generate reports for specific modules. From the **View** tab, click the module you want to report on, then click on the module serial number. Click the 'Reports' tab and then select from report options drop-down menu.

- Microinverter Energy Production
- Microinverter Recent Power Production – Lists the power production of a module in 5-minute increments.

### **View module production history**

1. In the **View** tab, click the module. A status message displays.

2. Click the graph icon. 

1. Click an Energy or Power range from the drop-down menu..

It is useful to select the history of DC Voltage and DC Current for the module in-question because this can show a date when one or the other varied from historical patterns.

### **There is an event or alert message on the system**

There may be an event or alert associated with one, several or all of the devices in your system. If so, see “Messages and Alerts” on page 33.

## Messages and Alerts

You can view event messages in Enlighten or in the Envoy interface. Event messages show a summary of the detected issue and a recommended action.



### ACFOOR (AC Frequency Out of Range)

The microinverter reports that the frequency coming from the utility is either too low or too high as specified by UL standards (UL1741). The typical frequency is 60.0 Hz.

Microinverter Model	Nominal Frequency Range (Hz)
M250	57 to 62.5 Hz
M215	57 to 61 Hz
M190	59.3 to 60.5 Hz
D380	59.3 to 60.5 Hz
M210	59.3 to 60.5 Hz

**AC Frequency Out of Range** events are usually transient, indicating an anomaly from the utility, and usually self-correcting by the utility. If Frequency Out of Range events persist, troubleshoot as follows.

Although **ACFOOR** events can happen because of an actual frequency out-of-spec condition, these events more likely to occur because of either a poorly shaped AC waveform or excessive THD (Total Harmonic Distortion) emanating from the utility service. This type of error rarely affects just one unit, and usually indicates an AC service issue.

Along with **ACFOOR** events, “Grid Gone” might be occurring. This indicates **Anti-Islanding**, which also sometimes occurs during **ACVOOR (AC Voltage Out of Range)** and **ACFOOR** events.

#### What is “Anti-Islanding”?

“Anti-islanding” is protection against the continuous operation of the inverter and part of the utility load while isolated from the remainder of the electric utility system.

If power from the utility is disconnected, the utility-interactive inverter ceases to export power within two seconds. Anti-Islanding protects utility line workers and loads.

## ACVOOR (AC Voltage Out of Range)

The microinverter reports that the AC voltage coming from the utility is either too low or too high as specified by UL standards (UL1741). Acceptable ranges for AC service are shown in the table below:

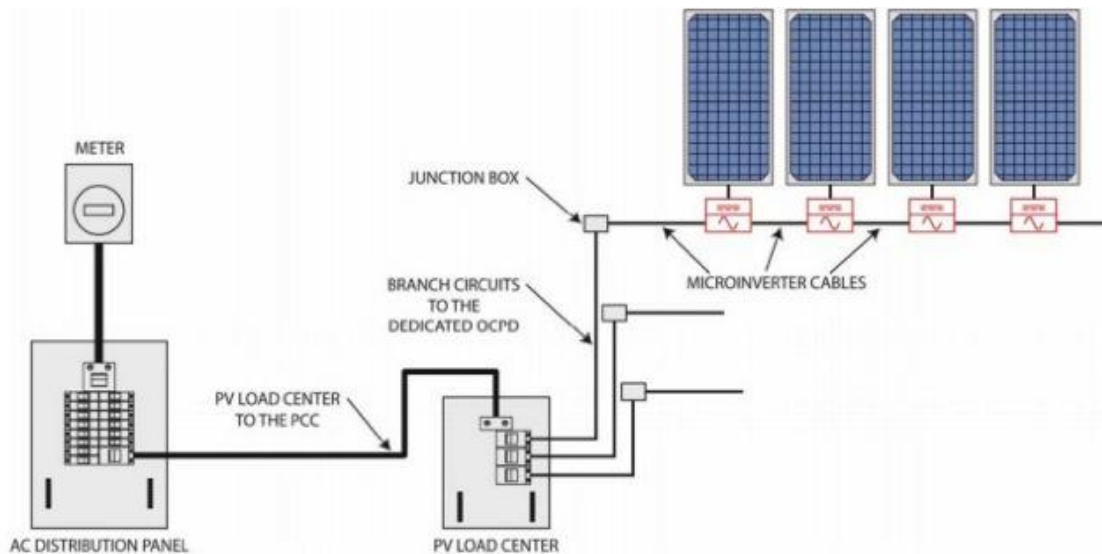
240 Volt AC Split Phase		208 Volt AC Three Phase	
L1 to L2	211 to 264 VAC	L1 to L2 to L3	183 to 229 VAC
L1, L2 to neutral	106 to 132 VAC	L1, L2, L3 to neutral	106 to 132 VAC

An **ACVOOR** condition should correct itself, as there are often periodic variations in Utility voltage. **If the condition persists**, troubleshoot as follows.


### ACVOOR in an **entire branch or multiple branches**

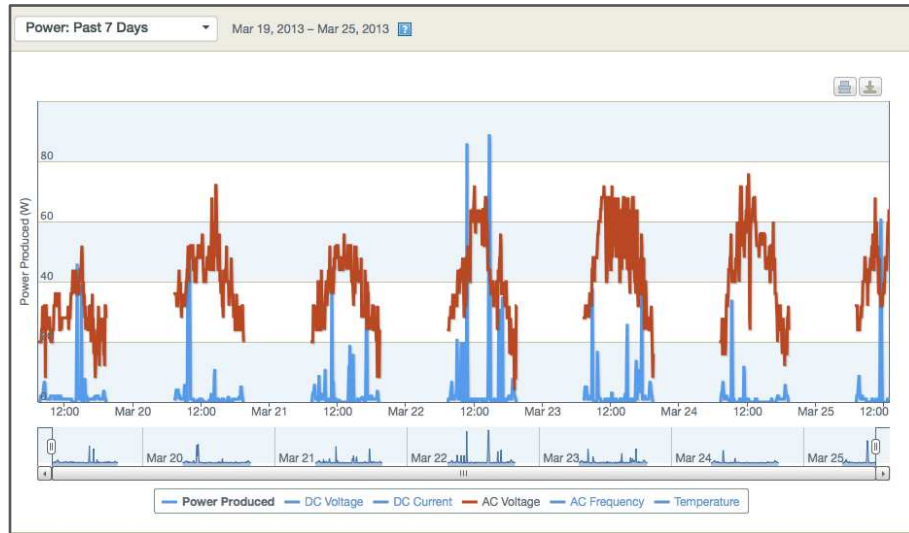
Checks:

1. Measure voltages for L-L and L-N for all phase conductors at the service entrance (PCC), at each Enphase branch circuit breaker, at each Enphase branch circuit junction box, at each Enphase branch circuit AC pigtail (if used in this installation), and at the last microinverter of each Enphase branch circuit.



2. As an alternative, you can check AC voltage in Enlighten. To view the AC measurements:

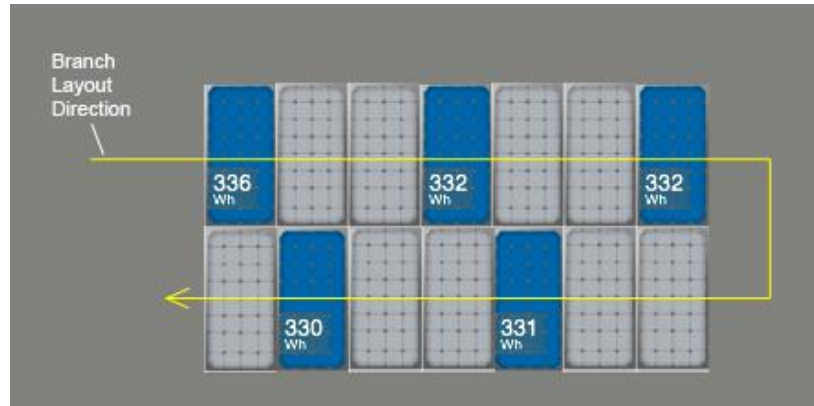
- Click on the module under review in the **View** tab.
- In the pop-up, click the graph icon. 
- Click **Power: Past 7 Days**. The 7-day graph displays production in blue.



- At the bottom of the graph, select **AC voltage** to display AC voltage in brown. Move the cursor over the AC voltage and verify that AC voltage has been consistent and within range.
3. You can also select **AC Frequency** to view AC frequency readings.
  4. Verify that the AC pigtail or cabling to the junction box is correctly terminated per wire color as described in the Microinverter Installation and Operations Manual.
  5. Verify that a circuit breaker with the correct amperage rating is installed and that the number of termination poles is correct.
    - If the breaker is undersized, the branch may experience nuisance tripping at peak production times.
    - If the breaker is oversized, the branch may have been damaged with too much current flow through the microinverters.
  6. Verify that the service entrance power is **not** coming from a 240 VAC “DELTA” or 240 VAC “STINGER” secondary transformer.
  7. Make sure that the site does not have undersized conductors, either to the Enphase branch circuit or between the primary load center and the subpanel if a subpanel is installed.
    - If the array branch circuits land on a PV subpanel and there is additional wire run back to the main service tie-in, you must perform additional voltage rise calculations. Enphase Energy recommends that the total voltage rise on all wiring sections be 2% or less. This includes the Enphase Engage Cabling, the homerun wiring from the junction box to the microinverter subpanel, and the section from the microinverter subpanel to the main service panel or Point of Common Coupling (PCC). Refer to the Calculating Voltage Rise Technical Brief at [enphase.com/support](http://enphase.com/support).

## ACVOOR in only a few microinverters

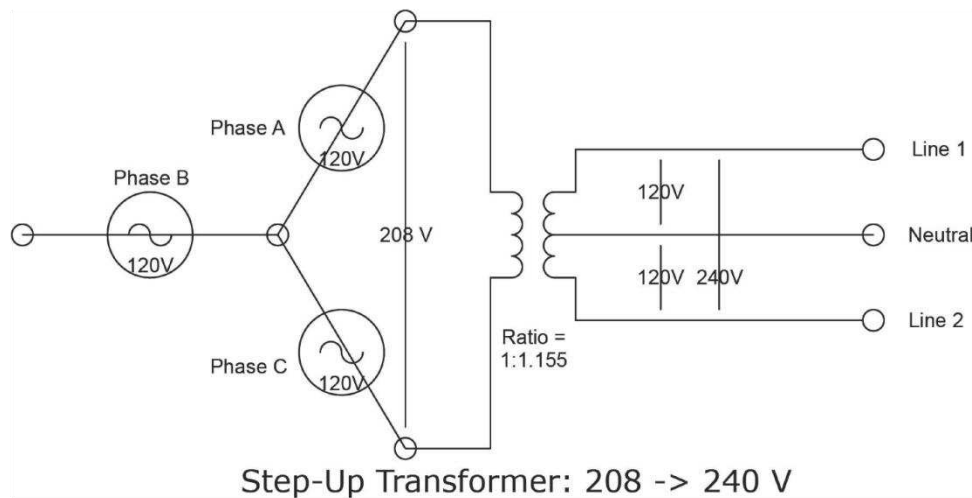
1. If the condition alternates among microinverters, incorrect cabling may be in use. The following array in Enlighten shows the result of using 208 Volt cabling at a site with 240 Volt service. Only every third unit is productive.



2. If only one unit experiences an **ACVOOR**, and the condition persists with consistent, out of spec readings, the problem is likely with the microinverter. The microinverter may need to be replaced.
3. If multiple units consistently experience **ACVOOR** events, there was probably an installation or wiring error during installation.
  - If the affected units are contiguous or if an entire branch is affected, there might be:
    - An On/Off switch
    - A homemade AC combiner
    - An incompatible AC disconnect between the circuit breaker and the AC pigtail of the PCU branch circuit.
    - Faulty wiring, terminations, or circuit breakers only for those affected Enphase branch circuits. Something as simple as a wire terminated on a circuit breaker that is not screwed down tightly can cause **ACVOOR** on a given branch circuit.
  - An AC pigtail is defective, or its AC connector (or one of the microinverters on the branch's AC connector) is damaged or defective. If, for example, on a branch circuit the first three units are fine, but the remaining 8 or 9 units on the branch are in a state of ACVOOR, there is something wrong either at location #3 or #4 in the branch circuit affecting the AC Voltage from that point and downstream on the branch circuit.
  - If the **ACVOOR** is not an installation or wiring defect, and there are multiple units impacted on an intermittent basis, utility service on site may be too high. One of the following may be causing this on the utility side:
    - The utility transformer bringing service to the site is damaged or defective.
    - The utility is purposely pushing the higher AC voltage into some areas during times of peak demand.
    - The homerun conductors from the Enphase branch circuits to their respective circuit breakers are undersized. Refer to the Calculating Voltage Rise Technical Brief at [enphase.com/support](http://enphase.com/support).



- A step-up transformer installed on site between the primary load center and the Enphase branch circuits can create ACVOOR conditions.



- If you checked and verified all of the previous conditions and **ACVOOR** nuisance tripping is still occurring, and neither the installer nor the utility can mitigate, Enphase can modify all of the microinverter grid profiles to allow for slightly expanded trip-points, while still remaining within spec.

## Critical Temperature

A Critical Temperature condition is rare and occurs if the microinverter reports an internal temperature that exceeds the rated range. The microinverter reacts by producing less power to reduce internal temperature. Once the internal temperature of the microinverter diminishes, the microinverter resumes full power production and the error message clears. No action is required unless the condition persists. If it persists, contact Enphase Energy customer support.

This reflects internal temperature coming from a sensor inside the microinverter, not the ambient temperature. For more information, see the Enphase Technical Brief on temperature at <http://www.enphase.com/support>.

## DC Resistance Low – Power Off

A DC Resistance Low – Power Off event occurs only with the M250 Microinverter and some models of the M215 Microinverter and is indicated with a solid red status LED on the microinverter. The LED remains red and the Envoy continues to report the fault until the error clears.

An insulation resistance (IR) sensor in the microinverter measures the resistance between positive and negative PV inputs to ground. If either resistance drops below a threshold, the microinverter stops power production and raises this event. This may indicate defective module insulation, defective wiring or connectors, moisture ingress, etc. Although the cause may be temporary, this microinverter condition persists until the sensor is manually reset.

If a microinverter registers a DC Resistance Low condition, clear this condition through the Envoy Interface. An Envoy is required to send the **clear-dc-resistance-low** message to clear the condition. If the condition does not clear after you perform the following procedure, contact Enphase Energy customer support at [support@enphaseenergy.com](mailto:support@enphaseenergy.com).

To send the **clear-dc-resistance-low** message to a microinverter:

1. From the Envoy Administration menu, choose **Device Conditions and Controls**.

The screenshot shows the Enphase Envoy Administration web interface. At the top, the Enphase logo and 'enlighten' branding are visible, along with the Envoy Serial Number: 110938093522. The navigation menu includes Home, Events, Production, Inventory, Administration, and Language (English). A sidebar menu on the left lists various administration options, with 'Device Conditions and Controls' highlighted. The main content area displays 'System Administration > Device Conditions and Controls'. Below this, there is a table titled 'Active Devices' with columns for Select, Serial Num, Part Num, Control Flags, Condition Flags, and Last Report. The table contains one entry with the serial number 121245017436, part number 800-00299-r02, and condition flag 'DC Resistance Low - Power Off'. An orange callout box with the text 'Click here' points to the 'Serial Num' column of the table.



**NOTE:** Do not check the box in the **Select** column.

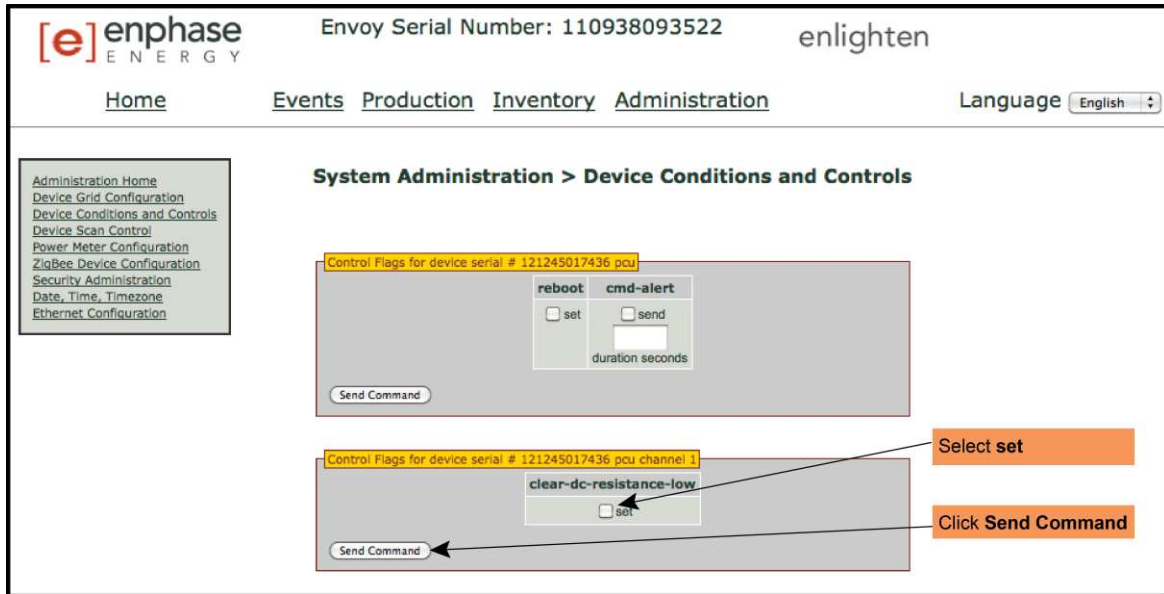
2. Click the **serial number** of the unit displaying **DC Resistance Low - Power Off**.  
The Control Flags screen displays.



**CAUTION:** Do not select the **reboot** and **cmd-alert** control flags unless recommended by Enphase. The functions are:

- **reboot** - reboots the inverter
- **cmd-alert** - clears a condition flag for a command sent

3. In the **clear-dc-resistance-low** menu, click the **set** box.



4. Click **Send Command**.

## DC Too Low

A **DC Too Low** condition occurs when the microinverter detects that DC input voltage from the PV module is too low. This is normal in the morning and in the evening. If this condition triggers during daylight hours, any of the following conditions may trigger this event:

- There is an extended period of low solar irradiance (for example, a period that includes the night hours plus a few hours of low sunlight after sunrise).
- There is a bad or missing DC connection to the microinverter. Enphase recommends that a qualified electrician inspect the DC connection between the module and the microinverter. The connection may need to be tightened or may require replacement.
- The microinverter may have been paired with an incompatible PV module. Is the PV module on the Enphase Compatibility list? An incompatible PV module may work sometimes, but will not work consistently or effectively. Some incompatible PV modules do not produce enough DC to start up the microinverter. To check DC input measurements to a microinverter, see “Check DC measurements” under “One unit shows 0W of production but adjacent units are productive” on page 29.
- The polarity is reversed. If the unit shows zero production, does the site use adaptors (or jumpers) between the PV module and the microinverter? Verify by measuring the PV modules VOC (Open Circuit Voltage) and inspect the positive and negative markings on the PV module and microinverter.
- To determine if the problem is with the microinverter or with the PV module, swap the DC leads from the suspect unit and an adjacent unit. Check Enlighten periodically (this may take up to 30 minutes), and if the problem moves to the adjacent module, then the PV module is not functioning correctly. If the problem stays in place, then the problem is with the microinverter. Contact Enphase Customer Support for help in reading the microinverter data and for help in obtaining a replacement microinverter if needed.
- The PV module may be damaged or defective. Although PV modules have a very long service-life expectation, they are somewhat fragile and directly exposed to the elements. The glass on the surface of the PV module can become cracked, lowering the PV module output or causing a **Ground Fault (GFI)** to trip.

## DC Too High

The microinverter reports that DC input voltage from the PV module is too high.

- If one microinverter reports **DC Too High** events, then the PV module may be incompatible. The PV module may generate a higher voltage than is recommended for the microinverter. Refer to the Module Compatibility Calculator at <http://enphase.com/module-compatibility-calculator-m250-update/> to check PV module compatibility
- If multiple units report **DC Too High**, and you have ruled out incompatible PV modules, contact Enphase Customer Support to verify the firmware version of the microinverters.

## Device Produced No Power

**Device Produced No Power** triggers when the microinverter produced 0 watts of power for more than 24 hours.

- Verify that the site has service from the electrical utility and that none of the solar circuit-breakers are tripped.
- Check the system event history for **AC Voltage Out Of Range** and **AC Frequency Out Of Range**. These events indicate possible problems with your utility service.
- Check the system event history for **GFI Tripped** or **DC Resistance Low**. If the solar installer verifies that the connected PV module is working, this event can indicate that the microinverter needs to be replaced.

## Envoy not Reporting

An Envoy not Reporting event is raised when the Internet connection is experiencing a problem.

If the Envoy LCD displays **-Web**, then the Envoy is not currently communicating with the Enlighten servers. The Internet service may be down or the router may be unplugged or turned off.

Internet connections often have temporary outages. If the situation persists, contact your ISP (Internet Service Provider). When the connection is restored, the Enphase Envoy communication gateway will transmit all the energy data that it stored.

- If the Internet service is dropping out periodically, and you notice that other devices at the site are also losing Internet connectivity, contact the ISP.
- Do you have dial-up Internet service? Dial-up Internet service is not supported on the Envoy.
- The Envoy may have an internal error; see “Envoy Issues” on page 11.
- See “Did the Envoy previously have an Internet connection at this site?” on page 15.

## Gateway Failure

The Envoy has detected a software problem. To clear this message, unplug the Envoy from the electrical outlet and then plug it back in. Do this only once. If it returns to failure mode, contact Enphase Customer Support.

## GFI Tripped

This condition occurs only with the M215, M190, D380, M210, M200, and M175 microinverters. A solid red status LED on the microinverter indicates a ground fault (GFDI) error. The LED remains red and the Envoy continues to report the fault until the error has cleared.

If a microinverter registers a GFI Tripped condition, you can attempt to clear this condition through the Envoy Interface. An Envoy is required to send the **clear-gfi message** to clear the condition. If the condition does not clear after you perform the following procedure, contact Enphase Energy customer support at [support@enphaseenergy.com](mailto:support@enphaseenergy.com).

To send the **clear-gfi** message to a microinverter:

1. From the Administration menu, choose **Device Conditions and Controls**.

The screenshot shows the Enphase Enlighten web interface. At the top, the logo 'enphase ENERGY' and 'enlighten' are visible, along with the 'Envoy Serial Number: 110938093522'. Navigation tabs include 'Home', 'Events', 'Production', 'Inventory', and 'Administration'. A language dropdown is set to 'English'. On the left, a sidebar menu lists various administration options, with 'Device Conditions and Controls' highlighted. The main content area shows the breadcrumb 'System Administration > Device Conditions and Controls'. Below this is a table titled 'Active Devices' with columns: 'Select', 'Serial Num', 'Part Num', 'Control Flags', 'Condition Flags', and 'Last Report'. The table contains one row with the following data: '110934070347', '800-00037-r08', 'None', 'GFI Tripped Alert Active', and 'Mon May 13, 2013 03:40 PM PDT'. An orange callout box with the text 'Click here' points to the 'Serial Num' column header.



**NOTE:** Do not check the box in the **Select** column.

2. Click on the **serial number** of the unit showing the GFI condition.

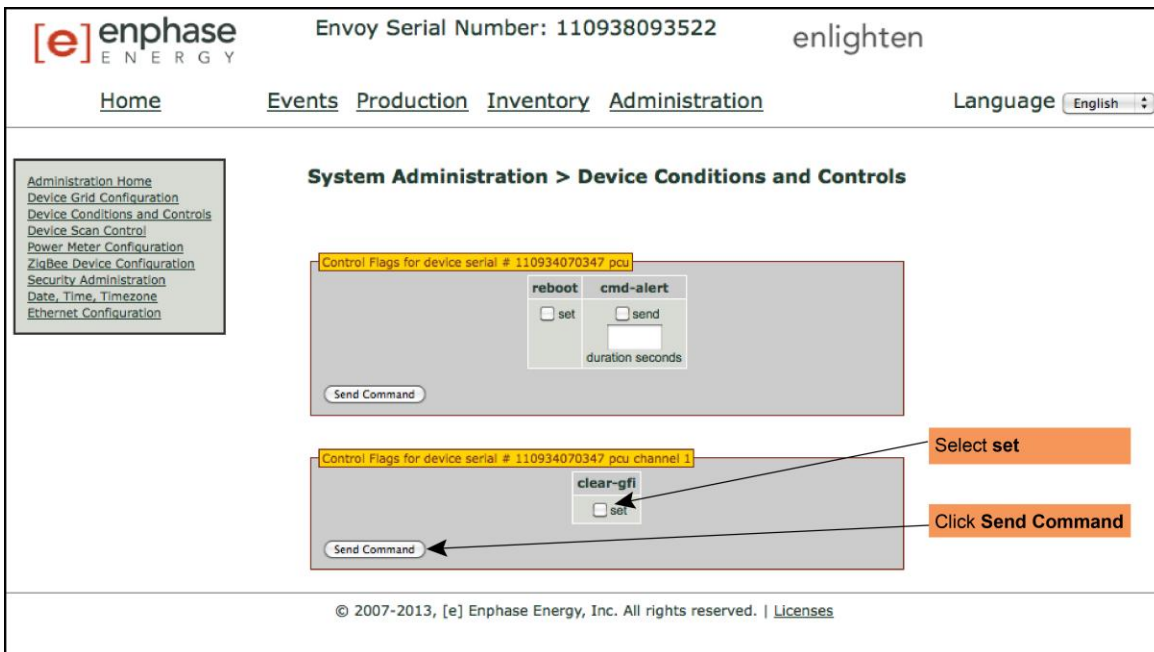
The Control Flags screen appears.



**CAUTION:** Do not select the **reboot** and **cmd-alert** control flags unless recommended by Enphase. The functions are:

- **reboot** - reboots the inverter
- **cmd-alert** - clears a condition flag for a command sent

- In the **clear-gfi** menu, select **set**.



- Click **Send Command**.

## Grid Gone

The microinverter reports that power from the utility is no longer present or is out of voltage or frequency specification. In most cases, no action is required. Solar production resumes when conditions normalize.

Enphase microinverters are **utility interactive** and require a connection to the utility.

### What is a “Utility Interactive” inverter?

The NEC (National Electric Code) defines this as, “An inverter intended for use in parallel with an electric utility to supply common loads that may deliver power to the utility.” A utility-interactive inverter lets PV system owners export excess power back to the utility.

- Verify that the solar circuit breakers are on at the load center. If all breakers are on, the condition should clear itself.
- If **Grid Gone** events repeatedly occur on one microinverter or only on portions of a branch, call Enphase Customer Support for assistance.

## Microinverter Failed to Report

A microinverter that reports a **Microinverter Failed to Report** condition is unable to communicate with the Envoy over the AC power lines. Occasional instances of this error may be ignored as microinverter communications will likely recover on the next reporting cycle.

- Verify that the site has service from the electrical utility and that no solar circuit-breaker has tripped.
- If communications do not recover right away (the Envoy polls the microinverters every five minutes), make sure that the Envoy is plugged in very near to the circuit breaker panel. Also, if other devices are sharing the electrical outlet with the Envoy, remove those devices to improve communication signal strength.
- If the Envoy was recently relocated, or if new devices or appliances were added to the circuit, the new location may not be suitable for power line communications. You may need to relocate the Envoy to improve signal strength and reduce interfering noise on the power lines.
- If several microinverters are reporting this condition, you may need to relocate the Envoy to another electrical outlet to improve communication signal strength.

For further troubleshooting steps, see “Microinverters are not detected, or, power line communication level is low or poor” on page 22.

## Over Temperature

See “Critical Temperature” on page 37.

## Zigbee Device Failed to Report

If the Envoy is connected to an Environ thermostat, this condition may occur if there is an interruption in communication between the Environ thermostat and the Envoy.

Make sure the Envoy ZigBee USB stick is plugged into the Envoy. Occasional instances of this error may be ignored, as a temporary interference to the radio signal may cause this condition and will recover on its own. If this condition persists, it may be necessary to add a ZigBee repeater to boost signal strength between ZigBee devices.

See the *Environ Smart Thermostat Installation and Operation Manual* at <http://www.enphase.com/support> for more information.

## Zigbee USB Stick Removed

The Envoy Communication Gateway no longer detects the presence of the ZigBee USB stick. Make sure that the ZigBee USB stick is fully seated in the Envoy USB port.



# Best Practices

## Installation sequence

Enphase considers following sequence of steps to be a best practice that reduces installation delays.

1. Register the System
2. Connect the Envoy Communications Gateway
3. Position the Enphase Engage Cable
4. Attach the Microinverters to the PV Racking
5. Dress the Cable
6. Connect the Microinverters
7. Terminate the Unused End of the Cable
8. Connect the Cable to the AC Junction Box
9. Complete the Installation Map
10. Connect the PV Modules
11. Energize the System
12. Use the Envoy to Complete System Setup
13. Build Array in Enlighten

## Care of the solar array

### How do I clean the solar array?

Visually inspect the array to check for dust, debris, leaves, and other soiling. If cleaning is needed, follow the module manufacturer's instructions for cleaning or contact a local professional to schedule a cleaning.

### How do I maintain the solar array?

Installers may want to conduct an annual check of the integrity of mechanical and electrical connections. An electrician can verify that the electrical connections are intact and working efficiently.

Many installers suggest that homeowners visually inspect the modules (panels), especially after storms and in areas prone to hail and high winds. An inspection from the ground (use binoculars, if needed) is usually sufficient.

At the array, get voltage readings from individual modules to confirm maximum performance and check for problems not visible from the ground. For example, inspect the seals around the individual module frames.

Installers can also check mechanical connections, perform a re-torque of all electrical connections, confirm proper voltage and performance, and log cumulative data from the microinverters to keep and compare performance records for the system.

### Will a grid-tied solar array provide power during a power outage?

Grid-tied arrays cannot provide electrical power during electrical power outages. Safety requirements dictate that grid-tied microinverters stop exporting power in the event of grid power loss.

### **Will the array provide power during when it is snowing or hailing?**

Full sun is not required for the array to produce, but in poor weather, the panel production won't be 100%.

On a cloudy day, the modules will produce at a much lower rate.

If snow accumulates on the modules, production may be zero. Snow tends to slide off modules more quickly than other roof surfaces, and the modules are usually installed in a south-facing direction. If snow days are likely, then factor snow days into the system's projected production.

Solar modules can tolerate rough weather. Most are designed to withstand ¾-inch hail at 120 miles per hour, and they are also built to stand up to direct lightning strikes.

### **Can I add solar panels to the solar power system later?**

Yes. Unlike arrays built with traditional string inverters, adding to the array is a simple procedure without a lot of design constraints.

### **Other Questions?**

Contact Enphase Customer Support at [support@enphaseenergy.com](mailto:support@enphaseenergy.com).