

Enphase AC Combiner Box with Enphase Envoy-S



Contact Information

Enphase Energy Inc.
1420 N. McDowell Blvd.
Petaluma, CA 94954
enphase.com
info@enphaseenergy.com
enphase.com/en-us/support/contact

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

This Class B digital apparatus complies with Industry Canada ICES-003.

For third-party license information, refer to enphase.com/licenses.

For Enphase patent information, refer to enphase.com/company/patents/.

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

For warranty text, refer to enphase.com/warranty.

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

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Audience

This manual is intended for use by professional installation and maintenance personnel.

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SAFETY

Read this First

Follow the instructions in this manual. These instructions are key to the installation and maintenance of the Enphase AC Combiner Box™.

To ensure the safe installation and operation of the AC Combiner Box, note the following safety symbols that 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.


NOTE:

This indicates information that is very important for optimal system operation. Follow instructions closely.

Safety Instructions



DANGER: Risk of electrocution!

Do not install current transformers (CTs) when current is flowing in the sensed circuit. Always install CT wires in the terminal blocks before energizing the sensed circuit.



DANGER: Risk of electric shock. Risk of fire.

Do not attempt to repair the Envoy-S; it contains no user-serviceable parts. Tampering with or opening the Envoy-S will void the warranty. If the Envoy-S fails, contact Enphase Customer Support for assistance (enphase.com/en-us/support/contact). Refer servicing to qualified personnel.

Only use electrical system components approved for wet locations.

Ensure that all wiring is correct and that none of the wires are pinched or damaged.

Do not wire unused terminals or terminal blocks on the Envoy-S.

Before making any connections verify that the circuit breakers are in the off position. Check all wiring before applying power.



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.

Be aware that installation of this equipment includes risk of electric shock. Do not install the AC Combiner Box without first removing AC power from the Enphase System. Disconnect the power coming from the photovoltaics before servicing or installing.

Only qualified personnel should troubleshoot, install, or replace the AC Combiner Box or the Envoy-S.

Improper servicing of the combiner box or its components may result in a risk of shock, fire or explosion. To reduce these risks, disconnect all wiring before attempting any maintenance or cleaning.

Always de-energize the AC branch circuit before servicing. Never disconnect the DC connectors under load.

Do not work alone. Someone should be in the range of your voice or close enough to come to your aid when you work with or near electrical equipment. Remove rings, bracelets, necklaces, watches etc. when working with this equipment.

**WARNINGS:**

Before installing or using the Enphase AC Combiner Box, read all instructions and cautionary markings in the technical description and on the AC Combiner Box.

Use the circuit breakers in the Enphase AC Combiner Box only for serving Enphase equipment. No other loads are allowed.

This unit is not provided with a GFDI device. This inverter or charge controller must be used with an external GFDI device as required by the Article 690 of the National Electrical Code for the installation location.

This product is intended for operation in an environment having a maximum temperature of 46°C.

**NOTES:**

Perform all wiring in accordance with all applicable local electrical codes, with the Canadian Electrical Code, Part I, and with the National Electrical Code (NEC), ANSI, and NFPA 70.

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

Using unapproved attachments or accessories could result in damage or injury.

Install the AC Combiner Box in the field with 75°C or 90°C copper conductors sized per local code requirements and voltage drop/rise considerations.

Use Class 1 wiring methods for field wiring connections to terminals of a Class 2 circuit. Use only 12 to 6 gauge wire. Select the wire gauge used based on the protection provided by the circuit breakers/fuses. Overcurrent protection must be installed as part of the system installation.

To ensure optimal reliability and to meet warranty requirements, the Enphase AC Combiner Box must be installed according to the instructions in this manual.

The Enphase AC Combiner Box with Enphase Envoy-S

The Enphase AC Combiner Box™ with Enphase Envoy-S Metered™ consolidates interconnection equipment into a single enclosure and streamlines PV installations by providing a consistent, pre-wired solution for residential applications. The included Envoy-S provides integrated revenue-grade PV production metering (ANSI C12.20 +/- 0.5%) and optional consumption monitoring (+/- 2.5%).

The **AC Combiner Box** is an outdoor-rated, NRTL-certified NEMA type 3R, polycarbonate enclosure containing an Enphase Envoy-S, circuit breakers, and wiring for Envoy-S connections. The AC Combiner Box combines up to three AC branch circuits of Enphase Microinverters.

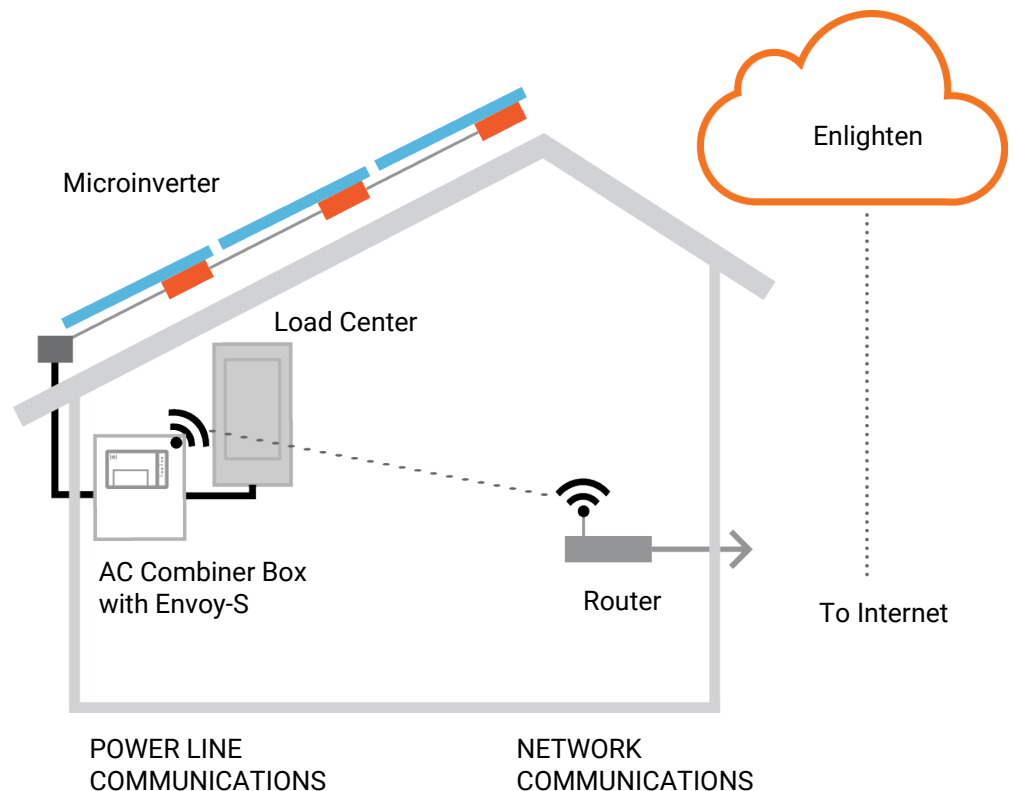
The **Envoy-S Metered** operates as a gateway between the Enphase Microinverters and the Enphase Enlighten™ web-based monitoring and analysis software. The Envoy-S monitors the microinverters that are connected to the PV modules. It collects energy and performance data from the microinverters over on-site AC power lines, and it forwards that data to Enlighten, via the Internet, for statistical reporting.

How the Enphase Microinverter System Works

The Enphase Microinverter converts the DC output of the PV module into grid-compliant AC power. In addition to performing the DC to AC conversion, it maximizes energy production by using a sophisticated Maximum Power Point Tracking (MPPT) algorithm. This integrated system maximizes energy harvest, increases system reliability, and simplifies design, installation and management.

The Enphase Enlighten web-based monitoring and analysis software analyzes the data collected by each communicating microinverter and automatically detects any shortfall in energy production, identifies possible causes, and suggests solutions. Enlighten constantly monitors every Enphase Microinverter connected to the Envoy-S and is essential for system monitoring and troubleshooting.

Enlighten provides a wide range of information on system performance. You can even access Enlighten on your mobile device and view current performance information wherever you are.



Pre-installation Checks

Review the following pre-installation checks before you install the AC Combiner Box.

Plan the Internet Connection

To use the **Enlighten** web-based monitoring and analysis software, additional requirements are:

- Internet connection for the Envoy-S through a traditional router or modem or Enphase Mobile Connect (Enphase model CELLMODEM-01). Decide whether to connect the Envoy-S to the Internet using integrated Wi-Fi, an Enphase Mobile Connect modem, or using Ethernet cable with or without a power line communication (PLC) bridge.
- One of the following Web browsers with cookies enabled: Chrome 5 or higher, Firefox 11 or higher, Internet Explorer (IE) 9 or higher, or Safari 5 or higher

Download the Installer Toolkit

The Enphase Installer Toolkit is a mobile app for iOS and Android devices that allows installers to configure the system while onsite, eliminating the need for a laptop and improving installation efficiency.

- Download the Enphase Installer Toolkit mobile app and open it to log in to your Enlighten account. With this app, you can connect to the Envoy to track system installation progress. To download, go to enphase.com/installer-toolkit or scan the QR code:
- To run the Installer Toolkit app, you need either of the following mobile devices:
 - An Android mobile device running Android version 4.2 or later, or
 - An iOS device running iOS 7.0 or later, specifically an iPhone 4 or later or an iPod Touch 5th generation



Enphase Installer Toolkit mobile app

Box Contents

Check the shipping box for the following items:

- Enphase AC Combiner Box with Envoy-S
- Ferrite bead to attach to your Ethernet Cable, if used
- The *Enphase AC Combiner Box Quick Install Guide*

Required Items

- Tools, including screw driver, pliers, torque wrench, etc.
- Overcurrent protection in accordance with NFPA 70-2014, §705.12(D)
- Suitable mounting hardware: use screws that are long enough to secure the unit to the vertical mounting surface
- 75°C or 90°C copper conductors, rated for wet locations
- UL listed rain-tight or wet location hubs for wire entry into the enclosure

Optional Items

Make sure you have the following optional items, if needed:

- Two consumption metering split-core CTs (order two CTs: Enphase CT-200-SPLIT)

- Enphase Mobile Connect modem (order Enphase CELLMODEM-01)
- Ethernet over power line communication (PLC) bridge with Ethernet cables (order Enphase EPLC-01)
- Ethernet cable: 802.3, Cat5E or Cat6, unshielded twisted pair (UTP). Do not use shielded twisted pair (STP) cable.

System Metering

The Enphase AC Combiner Box is an AC Solar combiner with Envoy-S Metered for integrated revenue grade PV production metering (ANSI C12.20 +/- 0.5%) and optional consumption monitoring (+/- 2.5%), which requires additional CTs.

Wiring Reference

The following lists tightening torque, allowable wire size, and type for field-wiring terminals:

- 20 in-lbs tightening torque for circuit breaker connections
- 14 in-lbs tightening torque for combined output connections
- 45 in-lbs tightening torque for large neutral and ground busbar screws (6-4 AWG)
- 20 in-lbs tightening torque for small neutral and ground busbar screws (12-10 AWG)
- 12 to 6 AWG for branch inputs
- 12 to 4 AWG for combined output
- Wire type: 75°C or 90°C copper conductors, rated for wet locations
- Copper conductors only

Create the Map and Install the PV Modules and Microinverters

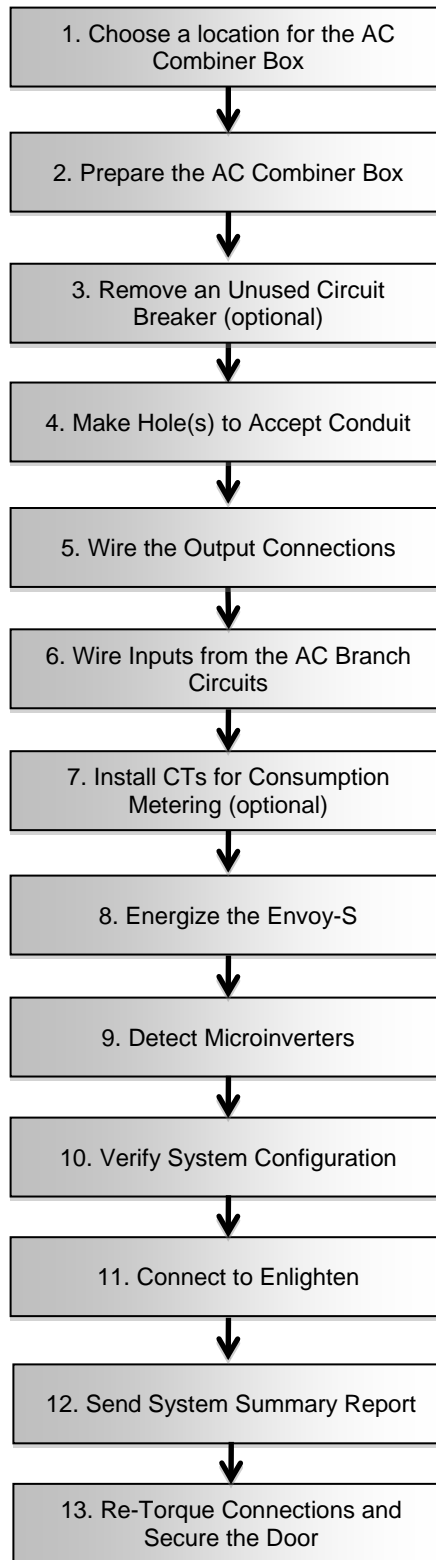


- Create the map and install the PV modules and microinverters as directed by the installation manuals. You can scan this map later using Installer Toolkit and your mobile device.

NOTE: If needed, you can find an installation map at the back of any Enphase Microinverter manual.

- Create a paper installation map to record microinverter serial numbers and positions in the array. Peel the removable serial number label from each microinverter and affix it to the respective location on the installation map. You can scan this map later using the Enphase Installer Toolkit and your mobile device.
- Peel the removable label from the bottom of the Envoy-S and affix it to the installation map.
- Always keep a copy of the installation map for your records.

Installation Sequence



Installing the AC Combiner Box

1. Choose a Location for the AC Combiner Box

- a. Install the AC Combiner Box in a readily accessible location, at least four feet (1.2 meters) off the ground. Do not block the vent on the side of the AC Combiner Box.
- b. Consider the dimensions of the combiner box, easy access, box height, and length of cable when selecting the location. The box is rainproof but not watertight.

2. Prepare the AC Combiner Box

- a. If needed, reposition the mounting feet. You can adjust each of the four mounting feet to several different positions. Adjust as desired for the mounting location.
- b. Open the enclosure door. Pinch the top of the hinge rod using needle-nosed pliers. Slide the door up and away to remove it. Set the door aside for later reattachment.
- c. Mount the box on a vertical surface, using supplied washers to protect the feet.
- d. Remove the clear plastic deadfront and keep the screws and washers in a safe place (for example, inside the removed enclosure door).
- e. Locate and remove the Spare Parts and XA-SLOT bags.



Foot mounting on back of unit



Foot mounted horizontally



Mounting foot



Foot mounting screw

Foot mounted at an angle



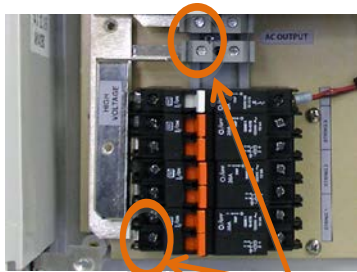
Foot mounted vertically



3. Remove an Unused Circuit Breaker (optional)

The combiner includes three 20 A, 2-pole circuit breakers for combining inputs. If required by local jurisdiction, you can remove one 2-pole breaker if there are only two branch circuits. If you do not need to remove a circuit breaker, skip this step.

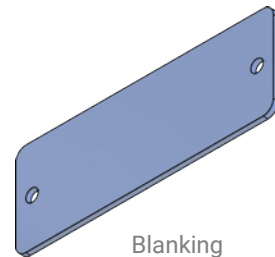
- a. Use a straight blade screwdriver to completely loosen the busbar side of the Line 1 and Line 2 terminal blocks (gray).
- b. Remove any load wire(s) on the breaker you want to remove.
- c. Loosen the busbar lug(s) of only the breaker you want to remove.
- d. Release the DIN rail locking tabs of all breakers.



Loosen these screws



Locking tabs



Blanking plate

- e. Rock the breaker/busbar assembly to the left to release it from the DIN rail, and remove the breaker.
- f. Rock the breakers back to the right so they are seated back on the DIN Rail.
- g. Lock all of the breaker locking tabs.
- h. Tighten the busbar side of the Line 1 and Line 2 terminal blocks (gray) to 14 in-lbs (1.6 Nm).
- i. Verify that all busbar connections are tight.
- j. Install the blanking plate onto the dead front over the location of the removed breaker using the screws provided. Every AC Combiner Box comes with an XA-SLOT spares kit with two screws and a blanking plate.

4. Drill Hole(s) to Accept Conduit



WARNING: Do not drill conduit holes on the top of the box or at any location that allows moisture ingress. This voids the warranty for the combiner box and the Envoy-S.



WARNING: Observe bend radius requirements when routing wires.



NOTE: The label template has three holes, but most applications require only two.

- a. A label on the outside of the combiner box indicates the best location to make a hole or holes to accept conduit fittings. Locate this label.

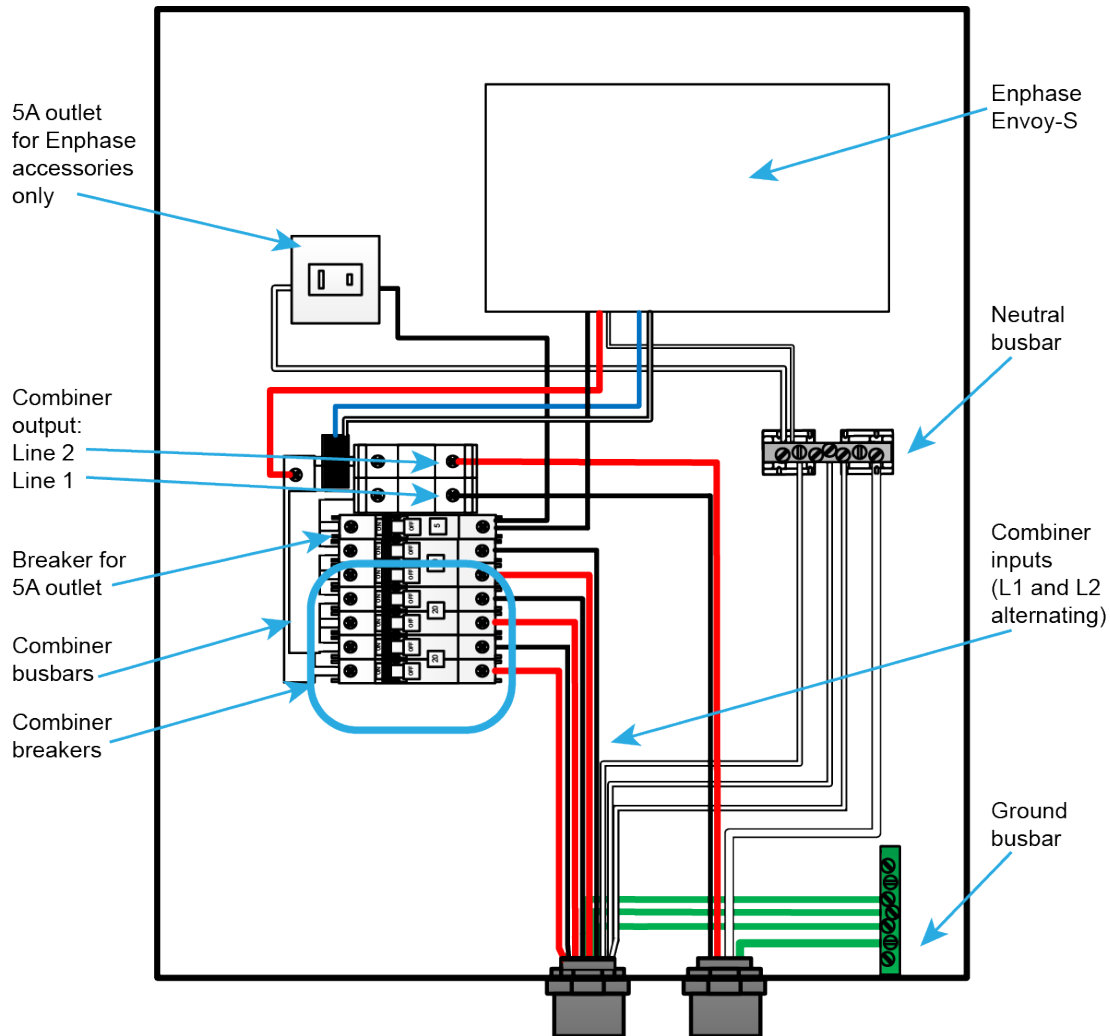


BEST PRACTICES: Use a stepped drill bit for making the conduit holes. Using a hole saw may crack the plastic housing. As an alternative, use a sharp chassis punch with caution. Drill only at the label location. Do not drill a hole in any other location on the box.

- b. Use the provided label as a template for typical conduit placement. The center of the holes on the label are marked with a “+”.
- c. Use a snap punch or other type of center punch to prevent the drill from wandering. Drill a pilot hole with a smaller drill before using a step drill bit.
- d. Remove the label after drilling.
- e. Use only UL listed rain-tight or wet location hubs for wire entry into the enclosure.

5. Wire the Output Connections

- Use conductors sized per local code requirements: 12 to 4 AWG copper conductors for combined output. Take into consideration the voltage drop/rise and upstream breaker or fuse.
- The two DIN rail terminal blocks above the circuit breakers are the output connections. Install the black wire into the lower terminal block and the red into the upper terminal block.
- Torque to 14 in-lbs (1.6 Nm).
- Connect the neutral (white) to the neutral busbar.
- Connect the ground (green or green/yellow) to the "Ground" busbar and torque to 45 in-lbs (5 Nm).



6. Wire Inputs from the AC Branch Circuits

The combiner comes with three 20A circuit breakers (16A continuous) to which you wire the microinverter AC branch circuits.

- a. Use copper conductors sized per local code requirements and voltage drop/rise considerations: 12 to 6 AWG copper conductors for branch inputs.
- b. Bring in the wires from each AC branch circuit.
- c. Connect the neutral wires (white) to the neutral bus and the ground wires (green or green/yellow) to the ground bus. Torque to 45 in-lbs (5 Nm).
- d. Connect L1 and L2 (usually one black and one red) from each AC branch circuit to the circuit breakers.
- e. Torque to 20 in-lbs (2.4 Nm).



NOTE: L1 and L2 should be wired as shown, with L1 and L2 alternating.

7. Install CTs for Consumption Metering (optional)

The Envoy-S inside the AC Combiner Box is pre-wired at the terminal blocks for power and production metering connections. One solid-core current transformer (CT) is provided for revenue grade production metering. You can install two optional split-core CTs to provide consumption metering. To do this, you must use a protected route in conduit for the CT wires from the main load center to the Envoy-S. If you need to extend the wires, refer to the *Enphase Envoy-S Installation and Operation Manual* at: enphase.com/support.



DANGER! Risk of electrocution! Do not install CTs when current is flowing in the sensed circuit. Always install CT wires in the terminal blocks before energizing the sensed circuit.



DANGER! Risk of electric shock. Always de-energize the load center before beginning wiring.



DANGER: Risk of electric shock. Risk of fire. Do not wire unused terminals or terminal blocks on the Envoy-S.



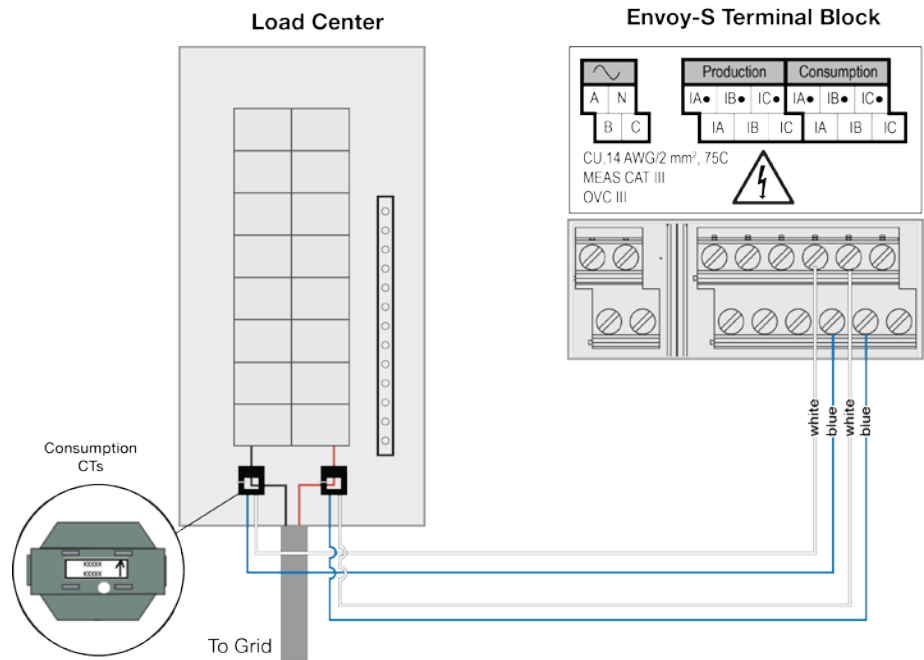
NOTE: Because of variance in load center design and main power feed, there may not always be enough space to install consumption metering CTs.




NOTE: To properly measure power and energy, CT inputs A and B must align with the respective voltage inputs A and B. For example, make sure both CT input A and voltage input A are the same line phases.

When installing CTs, it is important to match CT and sense voltage phases. Be sure to consistently identify and match the two AC lines at three points: the main load center feed, the Envoy, and the solar production circuit breaker. Wire colors (typically black and red) may not always consistently identify Lines 1 and 2. If in doubt, use a multimeter to check.

- a. Make sure that the main load center wires are de-energized until you have secured the CT wires in the terminal blocks.
- b. Locate the screw on the left side of the terminal block door, loosen it with a screwdriver to unlock, and flip open the terminal block door.
- c. Before running the CT wires through the conduit, use colored tape to mark one of the CTs and the free end of its wires.
- d. For the marked CT wires, connect the white wire to "IA•" and the blue wire to "IA".
- e. For the unmarked CT wires, connect the white wire to "IB•" and the blue wire to "IB".
- f. Tighten the terminal block screws to 5 in-lbs.
- g. Install the marked CT on the load center feed wire Line 1 (matching the Combiner output terminal Line 1, bottom terminal) with the CT arrow pointing toward the load. Latch the CT and listen for the click as it closes.
- h. Install the unmarked CT on the load center feed wire Line 2 (matching the Combiner output terminal Line 2, upper terminal) with the CT arrow pointing toward the load. Latch the CT and listen for the click as it closes.



8. Energize the Envoy-S

- a. Re-install the clear plastic deadfront. Start all of the screws, but do not completely tighten them. Once all screws are partially tightened, go back and tighten each one completely.
- b. Close the terminal block door, and secure it with the screw.
- c. Reinstall the AC Combiner Box door.
- d. Turn on the circuit feeding the combiner box.
- e. All four LEDs flash amber during boot up. This typically takes 2 to 3 minutes. When boot up is complete, the Device Communications LED  flashes amber indicating that that microinverters are not yet detected.


9. Detect the Microinverters


Use one of the following methods to detect microinverters.

Method A: Provision Microinverters with Installer Toolkit

Use the Installer Toolkit mobile app to configure the Envoy-S with the serial numbers of the installed microinverters.

- a. Launch Installer Toolkit and tap **View Systems**.
- b. Select the system you are working with, or tap **[+]** to add a system.
- c. Connect to the Envoy-S with your mobile device as described in the side note.
- d. Return to Installer Toolkit. If the serial number for the Envoy-S you are installing is not displayed on the System Overview screen, tap the **[+]** next to the word “Envoys”. When the app displays the serial number of the Envoy-S, tap it to add it to the system.
- e. Create the arrays and scan the serial numbers from the installation map as instructed by the Installer Toolkit Operation Manual at enphase.com/support.
- f. Tap the **Connect** button. This provisions the scanned microinverters on the Envoy-S.
- g. When prompted, confirm the number of microinverters that you installed.
- h. If your system is in Hawaii or in another region that does not use the **Factory-Installed Grid Profile**, select and apply a grid profile to the microinverters.


The Device Communications LED  lights solid green if all of the provisioned devices are communicating or solid amber if any devices are not communicating.

NOTE: Connecting to Envoy-S with a Mobile Device:
The Envoy’s AP (Access Point) Wi-Fi network allows you to connect your mobile device to the Envoy-S. The AP Mode LED  lights solid green when the network is available.

- On the Envoy-S, if the AP Mode LED is not lit, press the AP Mode button.
- On your mobile device, go to Settings and join the Wi-Fi network “Envoy_nnnnnn” (where “nnnnnn” represents the final six digits of the Envoy serial number).


Method B: Discover Microinverters with Installer Toolkit

- a. Use the Installer Toolkit mobile app to set the number of microinverters the Envoy-S should search for on the power line.
- b. Connect to the Envoy-S with your mobile device as described in the side note.
- c. Launch Installer Toolkit and tap **Connect to an Envoy**.
- d. When prompted, enter the number of microinverters that you installed.
- e. If your system is in Hawaii or in another region that does not use the **Factory-Installed Grid Profile**, select and apply a grid profile to the microinverters.
- f. When prompted to start a device scan, tap **OK**.


The Device Communications LED  flashes green while scanning. It lights solid green when all of the microinverters you installed are communicating or solid amber if any devices are not communicating.

Method C: Discover Microinverters with the Envoy-S

If you are not using the Installer Toolkit app, press the **Device Scan** button on the Envoy-S. The Envoy searches the power line for 15 minutes, but does not know how many microinverters it should discover.


The Device Communications LED  flashes green for 15 minutes while scanning. At the end of the scan, it lights solid green if at least one microinverter was discovered or solid amber if no microinverters were discovered (or if any discovered microinverter stops communicating).

With All Methods

If the Device Communications LED  remains solid, see “Microinverter Detection Issues” on page 25.



10. Verify System Configuration

While still connected to Envoy-S with Installer Toolkit, check the Envoy Overview screen for the following:

- a. Confirm that the expected number of devices are discovered and communicating.
- b. If you selected a grid profile, check the Envoy Overview screen to make sure the new profile is set on all the microinverters. This may take up to 5 minutes for a typical system.
- c. Set up metering:
If there is a check next to **Production Meter**, the production meter is enabled. If a gear  is shown, you must enable the meter:
 - Tap **Production Meter** and follow the on-screen instructions to enable the Production Meter.
 - If you installed consumption metering CTs, tap the > to the right of **Consumption Meter**.
 - Based on where you installed the consumption CT, indicate whether the circuit that passes through the consumption CT includes:
 - Load with solar production (also known as net) or
 - Load only (also known as total or gross), for example, in the case of a line-side tap.
 - Tap **Enable Consumption Meter**.
 - Return to the **Overview** screen and verify the meter reading(s).



WARNING! If using consumption metering, be sure to set the meter type correctly. You cannot change this setting once the meter is enabled.

If you used Installer Toolkit to detect microinverters, the Power Production LED  lights solid green when all expected microinverters are producing power. If you did not use Installer Toolkit, it lights solid green if all communicating microinverters are producing power. It flashes green when microinverters are upgrading. Check Installer Toolkit for production status details. If the Power Production LED  remains solid amber, see “Power Production ” on page 26.

11. Connect to Enlighten

The Envoy-S requires a connection to the Internet for reporting to Enlighten. You can provide this connection through an existing broadband router, other Wi-Fi access point at the installation site, or by using the Enphase Mobile Connect cellular modem.



WARNING! Risk of Equipment Damage. Do not remove power from the Envoy-S if the LEDs are flashing green. This indicates that a software upgrade is in progress.

Connect to a broadband router using one of these methods, described in the following sections:

- Method A: Integrated Wi-Fi
- Method B: Enphase Mobile Connect (order CELLMODEM-01 separately)
- Method C: Ethernet cable (not included, installer must provide). This method requires that you use the ferrite bead included with the AC Combiner Box.
- Method D: Power Line Communication Bridges (order EPLC-01 separately). This method requires that you use the ferrite bead included with the AC Combiner Box.




Method A: Integrated Wi-Fi

To use the Enphase integrated Wi-Fi, you need a wireless router. To use Wi-Fi:

- a. On the Envoy-S, verify that no Ethernet cable is plugged into the RJ45 port.
- b. If your router supports WPS, press and hold the WPS button on the wireless router for a few seconds. On most routers, a WPS LED begins flashing.
- c. If you are using the Installer Toolkit mobile app, tap the **Network** button, tap **Wi-Fi**, and then tap your network from the list of available networks. If the wireless router does not support WPS, you may be prompted to enter a password.



If you are not using the Installer Toolkit mobile app, you can only connect using WPS. Initiate a WPS connection by pressing and holding the **AP Mode** button for 5 seconds.

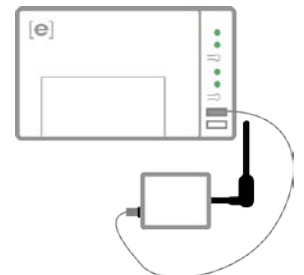
The Network Communications LED  begins flashing green. Within three minutes the Network Communications LED  lights solid green, indicating a successful connection to the Internet and to Enlighten. If the Network Communications LED  does not light solid green, see “Internet Connection Issues” on page 27.

Method B: Enphase Mobile Connect


(Order CELLMODEM-01 separately)

To install Enphase Mobile Connect:

- a. Connect the antenna to the connector (marked **CELL**) on the modem.
- b. Mount the modem as described in the *Enphase Mobile Connect Installation Guide*.
- c. Connect the USB cable:
 - First, connect the USB cable to the USB port(s) on the Envoy-S.
 - Then, connect the mini-USB connector to the Mobile Connect modem.



If receiving power from the Envoy-S, the modem power LED lights.

Within three minutes the Network Communications LED  lights solid green, indicating a successful connection to the Internet and to Enlighten.




NOTE: With Mobile Connect, the Envoy initially reports to Enlighten every five minutes for 12 hours or until the Envoy-S detects the expected number of microinverters, which is based on the number entered in **Total Number of PV Modules** in Enlighten. After that, the Envoy uses low bandwidth reporting mode. Low bandwidth mode reports 15-minute interval readings and event data to Enlighten four times a day rather than every 15 minutes as with other connection methods.

Method C: Ethernet Cable

To use this method, you need an Ethernet cable and a broadband router. In the box with the Envoy-S is a ferrite bead. You must attach this ferrite bead to your Ethernet cable to ensure there is no communication interference between the Envoy-S and other devices. To install the cable and ferrite bead:

- a. Select an Ethernet cable with unshielded twisted pairs (UTP) and suitable ratings for its environment. Do not use shielded twisted pair (STP) cable.
- b. Place the bead on the cable, near one end, and close the latch.
- c. Plug the cable end with the ferrite into the Envoy-S Ethernet port.
- d. Secure a tie wrap on the cable on each side of the ferrite bead.
- e. Tighten an additional tie wrap around the ferrite bead.
- f. Trim any tie wrap excess.
- g. Plug the other end of the Ethernet cable into a spare port on the broadband router.

Within three minutes the Network Communications LED  lights solid green, indicating a successful connection to the Internet and to Enlighten.


When you use Ethernet cable, two small LEDs on the Ethernet port indicate Ethernet link and activity. The link LED is solid green when the cable is connected correctly, and the activity LED flashes green or yellow when data is sent or received.

Method D: Power Line Communication Bridges

(Order EPLC-01 separately)

If you need to locate the Envoy-S away from the router, at a distance where an Ethernet cable is not practical or the wireless signal does not reach, use power line communication bridges with the Envoy-S. Bridges allow the Envoy-S to communicate with the broadband router over the site's power lines. To install power line communication bridges:

- a. Plug one of the bridges into the same AC outlet that the Envoy-S is using.
- b. Place the bead on the Ethernet cable, near one end, and close the latch. Do not use shielded twisted pair (STP) cable.
- c. Plug the cable end with the ferrite into the Envoy-S Ethernet port.
- d. Secure a tie wrap on the cable on each side of the ferrite bead.
- e. Tighten an additional tie wrap around the ferrite bead.
- f. Trim any tie wrap excess.
- g. Plug the other end of the Ethernet cable into the bridge.
- h. Plug the other bridge into an AC outlet near the broadband router.
- i. Connect one end of a second Ethernet cable to the second bridge, and connect the other end of the Ethernet cable into the broadband router.


Within three minutes the Network Communications LED  lights solid green, indicating a successful connection to the Internet and to Enlighten.

If the Internet Connection Fails

After using any of these connection methods, if the Envoy-S does not connect to the Internet within five to ten minutes after you attempt a connection, see “Internet Connection Issues” on page 27.

12. Send System Summary Report

When you have completed your system setup, you can generate and email a summary report.

- a. From Installer Toolkit, tap **Done** in the upper-right corner of the screen to disconnect from the Envoy. Installer Toolkit will ask if you want to view a summary report.
- b. Tap **View Report**. The report displays Envoy and system information with a list of microinverter serial numbers, their last power reports, and information about the grid profile applied to the microinverters.
- c. Tap  to email the report to your office as a record of successful system installation or to the utility for evidence of grid profile settings.



NOTE: If your mobile device is connected to the Envoy using AP mode, the email stays in the email app’s outbox to be sent when the mobile device reconnects to the Internet. To disconnect from the Envoy network, go to Settings on your mobile device and disconnect from the Envoy-S Wi-Fi network “Envoy_nnnnnn” (where “nnnnnn” represents the final six digits of the Envoy serial number).



NOTE: If you connect to an Envoy after associating it to a system, the report includes a system name and address. For more information, refer to the *Enphase Installer Toolkit Operation Manual* at: enphase.com/support.

13. Re-Torque Connections and Secure the Door



WARNING: Do not skip this step. You must re-torque all field wiring connections after one hour.

- a. Turn off power to AC combiner box at the main load center. Verify that all power is removed from the system before attempting any wiring.
- b. Open the AC Combiner Box door.
- c. Remove the clear plastic dead front, and keep the screws and washers in a safe place.
- d. Measure voltage L1 to L2, L1 to N, and L2 to N to make sure there is no voltage present.
- e. Re-torque all field wiring connections one hour after first torque. See “Wiring Reference” on page 9 for required torque values.
- f. Close and secure the door of the combiner box so that it is protected against moisture and rain.

Activate Monitoring

Register the Envoy-S for monitoring of the Enphase Microinverters in Enlighten (enlighten.enphaseenergy.com). Once you have registered the system and successfully installed the Envoy-S, Enlighten sets up an account for the site owner. When you complete the registration and installation, Enphase sends account information to the site owner so that they can log in to the Enlighten website and view system performance.

Method A: If the Envoy-S is Associated with a System in Installer Toolkit

- On your mobile device, go to your Wi-Fi settings and disconnect from the Envoy's AP network. (This should restore Internet connectivity to your device).
- Return to the Installer Toolkit app and tap the **Sync** button on the System Overview screen.
- Log in to Enlighten and click on the system activation's name from the installer dashboard.

- From the activation form, open Array Builder. To see the Array Builder demo, go to enphase.com/support/videos.

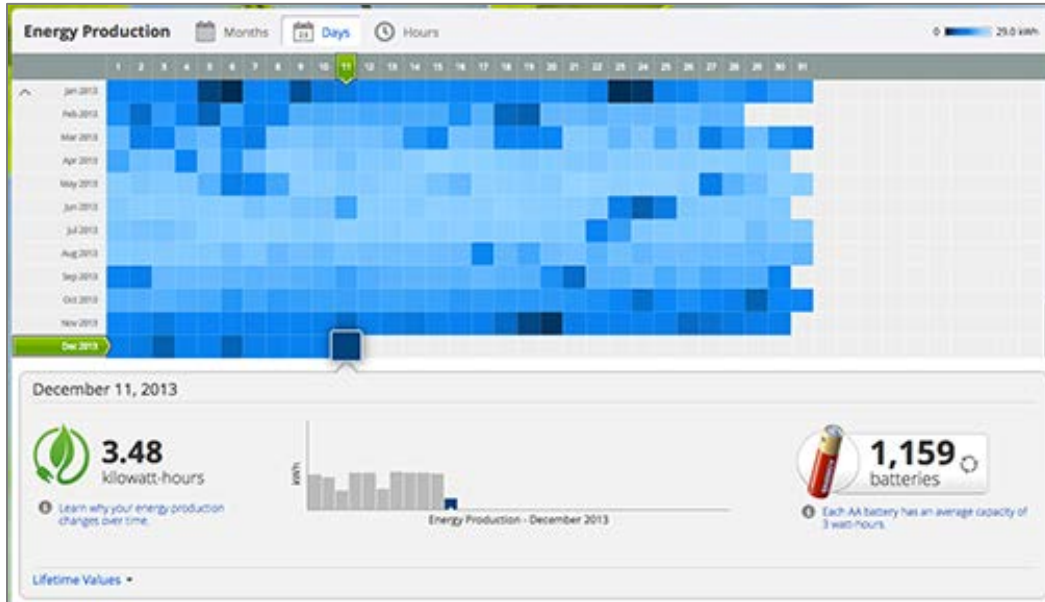
- If you used Installer Toolkit to build arrays and scan microinverter serial numbers, the array(s) are built. Make any necessary adjustments in Array Builder.
- If you did NOT use Installer Toolkit to build arrays and scan microinverter serial numbers, create the virtual array in Array Builder using the installation map as your reference. (You may need to wait if the microinverters have not yet reported to Enlighten.)

Method B: If the Envoy-S is NOT associated with a System in Installer Toolkit

- Log into Enlighten and click **Add a New System** from the installer dashboard.
- Enter the System, Installer, Owner, and Location information.
- Enter the Envoy serial number.
- Click **Save** to submit the form.
- After the microinverters have reported to Enlighten, open Array Builder from the activation form, and create the virtual array, using the installation map as your reference. To see the Array Builder demo, go to enphase.com/support/videos.

View System Performance in Enlighten

Once the array is built and the system is activated, you can log in to Enlighten to view site data. Enlighten displays a graphic representation of the PV system. It also shows detailed current and historical performance information.



Troubleshooting

The following sections describe possible problems and solutions. For Envoy-S troubleshooting information, refer to the *Enphase Envoy-S Installation and Operation Manual* at: enphase.com/support.

Loss of AC to a Single Branch of Microinverters

If a single branch of microinverters is not producing, it may indicate loss of AC to the branch. Using a multi-meter set to AC, refer to the figure and test for the following values:

- Test point A to test point B. The result should be around 240 VAC.
- Test point A to test point C. The result should be around 120 VAC.
- Test point B to test point C. The result should be around 120 VAC.
- If not, there may be a problem with the supply wiring.
- Test point C to the screws on the load-side breaker screws (D). The result should be around 120 VAC.

If not, switch the breaker off and on to reset. If this does not remedy the problem, contact Enphase Customer Support (enphase.com/en-us/support/contact).

Inoperable Envoy-S (All LEDs Off)

If the Envoy-S is not receiving power, all LEDs will be off.

Using a multi-meter set to AC, refer to the figure and test for the following values:

- Test point A to test point C. The result should be around 120 VAC.
- If not, check the supply wiring.
- Test point C to test point D. The result should be around 120 VAC.

If not, contact Enphase Customer Support (enphase.com/en-us/support/contact).

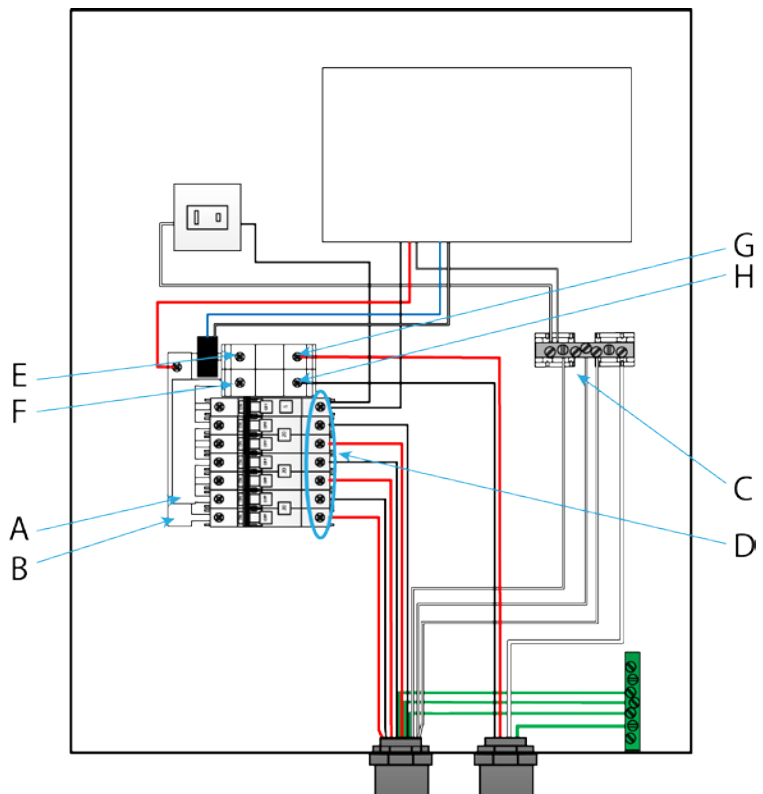
Inoperable Envoy-S and No AC to Branch

If a single branch of microinverters is not producing and the Envoy-S LEDs are off, do the following:





Using a multi-meter set to AC, refer to the figure and test for the following values:

- Test point C to test point E. The result should be around 120 VAC.
- Test point C to test point F. The result should be around 120 VAC.
- Test point C to test point G. The result should be around 120 VAC.
- Test point C to test point H. The result should be around 120 VAC.

If not, there may be a problem with the wiring from the panel.



Envoy-S LED States

| LED | State | Description |
|--|-----------------------------|--|
| All | Flashing amber in unison | The Envoy-S is booting up |
| | Flashing green sequentially | Software upgrade in progress |
| Network Communications  | Solid green | Communicating with Enlighten |
| | Flashing green | WPS connection in progress, or Envoy-S is attempting to connect to Enlighten |
| | Solid amber | Local network connection only |
| | Off | No network connection |
| AP mode  | Solid green | AP mode enabled: Envoy Wi-Fi network available |
| | Off | AP mode disabled: Envoy Wi-Fi network unavailable |
| Power production  | Solid green | All communicating microinverters are producing |
| | Flashing green | Microinverter upgrade in progress |
| | Solid Amber | At least one microinverter is not producing |
| | Off | Microinverters are not communicating (low light or night time) |
| Device Communications  | Solid Green | All microinverters are communicating |
| | Flashing Green | Device scan in progress |
| | Solid Amber | At least one microinverter is not communicating |
| | Off | Microinverters are not communicating (low light or night time) |

Microinverter Detection Issues

Troubleshoot power line communication issues as follows.

Issue: Device Communications LED is Solid Amber

If the Device Communications LED lights solid amber, it may be a result of low light levels. If there is not enough sunlight to power up the microinverters, they cannot communicate with the Envoy. If there is sufficient daylight for the microinverters to power up, the issue may be that the Envoy is having difficulty communicating over the power lines. To troubleshoot this issue:

- Check the Installer Toolkit mobile app to see which microinverters are not communicating.
- Check that the circuit breaker(s) for the PV array are in the “ON” position.
- Verify that the PV modules are connected to the microinverters.
- Verify the PV module DC voltage is within the allowable range for the microinverter.

Issue: Installer Toolkit Detects Fewer Microinverters than Expected

The **Microinverters detected** count is an indication of the number of online microinverters producing power, reporting in to the Envoy, and not having any error conditions. If this number is lower than expected, it may indicate that the Envoy is not done scanning/discovering the entire array. Alternatively, it may indicate that the Envoy is having difficulty communicating over the power lines. It could also be a result of low light levels or that the PV module voltage is too low for the microinverter to power up. To troubleshoot the issue:

- Check Enlighten or use the Installer Toolkit to connect to the Envoy to see if any microinverters are not reporting in to the Envoy or having any error conditions.
- If this problem occurs when light levels are low, try again during daylight hours.

Issue: No Microinverters are Reporting

Check for the following conditions.

Has a device scan been run while the array was active? A device scan may have been run while the array was not connected to the grid or when the array was not powered by sunlight.

- Run another scan during daylight hours.
- Check that the circuit breaker(s) for the PV array are in the “ON” position. For the Envoy to communicate with the microinverters, the PV circuit breakers must be in the “ON” position in the electrical load center.
- Verify that the PV modules are connected to the microinverters.

Is the system energized? PV modules power microinverters, PV modules provide power only during daylight hours, and microinverters communicate only when powered.

- Run another scan during daylight hours.
- Check that the circuit breaker(s) for the PV array are in the “ON” position. For the Envoy to communicate with the microinverters, the PV circuit breakers must be in the “ON” position in the electrical load center.
- Verify that the PV modules are connected to the microinverters.

Is there a phase imbalance?

- Ask the electrician to measure the conductors and neutral line to verify that the phases are balanced. If the phases are not balanced, electricians must recheck the wiring.

Power Production Issues

Issue: Power Production LED is solid amber

The Power Production LED is solid green when all microinverters are producing, flashes green when a microinverter upgrade is in progress, flashes amber when microinverters are not yet detected, or becomes solid amber when any microinverter that is expected to produce is not. Check in Installer Toolkit to see which microinverters are affected.

- If none of the microinverters are producing power, there may be a grid or wiring issue. First, verify that there is proper input voltage and frequency from the utility. Next, check the breaker and wiring.
- If all of the non-productive microinverters are on the same branch, check the breaker and wiring starting at the junction box for the affected branch.
- If only one or scattered microinverters are not producing power, first check to see that the AC connectors are fully seated in the Engage Cable connectors. Next, check that each module is meeting the required startup voltage for the microinverter (usually 22 V). A PV module that is failing or that is undersized may not generate enough power for AC conversion.
- Refer also to “Microinverter Detection Issues” on page 25 because the microinverters will not report production if they are not communicating with the Envoy-S.

Internet Connection Issues

To the Local Area Network (LAN), the Envoy is just another host on the network, much like a personal computer. Enphase offers technical support at enphase.com/en-us/support/contact for Envoy issues, but Enphase Support is not responsible for premises network or LAN.

The Envoy must obtain a DHCP (Dynamic Host Configuration Protocol) IP address and have a route to the Internet. The Envoy will request this IP address from the broadband router during the power-up sequence. Two small green LEDs on the Ethernet port indicate Internet link and activity. One LED will be solid green, and the other will blink every few seconds.

Issue: Network Communications LED is Amber or Off

When the Envoy first boots up, it is configured to perform a DHCP broadcast, requesting an IP address from a DHCP source. This source can be a server/computer, but almost all consumer-grade broadband routers also provide DHCP services as well. This is the usual source of IP addresses for network hosts (computers, laptops, and the Envoy). When the Network Communications LED is solid amber, the Envoy-S has a local network connection only and failed to connect to Enlighten after its scheduled reporting time (five minutes). When the LED is off, there is no network connection.

If you are using the Enphase Mobile Connect modem and the Network Communications LED remains off or lights solid amber, see Troubleshooting in the *Enphase Mobile Connect Installation Guide*.

For any connection method, you can troubleshoot network issues with the Installer Toolkit mobile app by tapping the **Network** button, then **Diagnostic Tools**.

- Allow 10 minutes after initial installation. If the Envoy has recently received a valid IP address, the LED will likely turn green momentarily.
- Check network connectivity to the router or other DHCP server. You may also wish to contact your Internet Service Provider or refer to your router documentation for help.
- Check that you are using a broadband router and not a switch or a hub. Many hubs and switches cannot provide a DHCP lease and may not allow the Envoy to connect to the web.
- Use the Installer Toolkit to “Get New IP Address”, and then allow 30 to 60 seconds for the Network Communications LED to show solid green.
- When using the Ethernet cable, two small LEDs on the Ethernet port indicate Internet link and activity. One LED will be solid green, and the other will blink green or yellow every few seconds. If the LEDs are not both on or blinking, try using a new Ethernet (CAT5E/CAT6) cable in place of the existing cable.
- Power down all units in the chain, applying power again in this order: 1) modem, 2) router, and 3) Envoy. Allow a few minutes for the IP address to be reassigned.
- If you replace the broadband router, configure the Envoy Wi-Fi settings for the new Wireless Network Name (SSID) and password.

Issue: Wi-Fi Problems

If the Network Communications LED remains off:

- If the Envoy is installed in an enclosure, that enclosure must be non-metallic 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.
- The WPS connection window may have timed out. Retry the connection steps.
- Make sure that the broadband router is operational by checking that other devices at the site can access the network.
- If you cannot see your router or access point in the list on the Envoy, or cannot maintain a connection, it may be necessary to add a wireless repeater to extend the network range.

If the Network Communications LED lights solid amber:

- Power down all units in the chain, applying power again in this order: 1) broadband modem, 2) router or Wi-Fi base station, and 3) Envoy.
- Make sure that the broadband router is connected to the Internet by checking that other devices at the site can access the Internet. If the other devices are not connected to the Internet, contact your ISP for assistance.

Replacing an AC Combiner Box

If problems remain after following the troubleshooting steps above, contact Enphase at enphase.com/en-us/support/contact.



DANGER! Risk of electrocution! Do not disconnect the consumption CT leads from the terminal block while the sensed circuit is energized.



DANGER! Risk of electric shock. Risk of fire. Do not attempt to repair the Enphase AC Combiner Box or the Enphase Envoy-S; they contain no user-serviceable parts. Tampering with or opening the Envoy-S will void the warranty. If the Envoy-S fails, contact Enphase Customer Support for assistance at enphase.com/en-us/support/contact.

- Warranty void if Envoy-S cover removed.
- Refer servicing to qualified personnel.



DANGER! Risk of electric shock. Always de-energize the load center before beginning wiring.

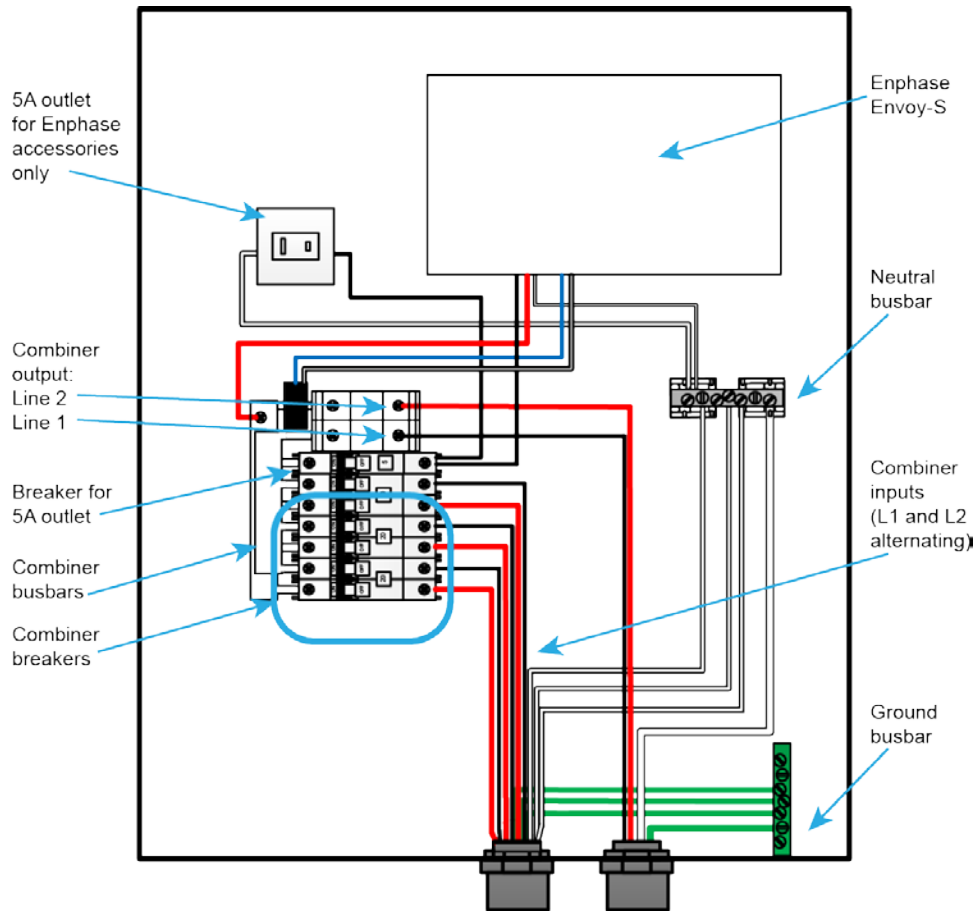


WARNING! If the Envoy-S you are replacing uses an Enphase cellular modem (Enphase Mobile Connect), do NOT move the cellular modem to another installation site. This de-activates the modem.

Remove the AC Combiner Box

If Customer Support authorizes an AC Combiner Box replacement (RMA), perform the following steps.

1. Turn off power to AC combiner box at the main load center. Verify that all power is removed from the system before attempting any wiring.
2. Open the AC Combiner Box door.
3. Remove the clear plastic dead front, and keep the screws and washers in a safe place.
4. Disconnect the combiner output connections. The two DIN rail terminal blocks above the circuit breakers are the output connections.
5. Disconnect the combiner inputs (Line 1 and Line 2 from the array) from the combiner breakers.
6. Disconnect the neutral wires (white) from the neutral bus.



7. Disconnect the ground wires (green/yellow) from the ground bus.
8. Disconnect the Ethernet cable (if used).
9. Unlatch the split-core consumption CTs (if used) and remove them from the sensed wires.
10. Disconnect the consumption CT leads from the Envoy-S terminal blocks.



NOTE: Do not remove the production CT from the AC Combiner Box. It is calibrated to work with the installed Envoy-S and cannot be reused.

11. Loosen the conduit fittings and remove the conduit fitting nuts.
12. While holding the AC Combiner Box in place, remove any mounting hardware holding the box in place, and lift the box away from the mounting surface.
13. Ship the removed AC Combiner Box to Enphase using the supplied RMA shipping label.

Replace the AC Combiner Box

Follow the steps in “Installing the AC Combiner Box” starting on page 11. After installing the new AC Combiner Box, do the following:

1. Log in to Enlighten and add the Envoy-S to the Activation for this system by clicking “**Add Another Envoy**” under the “**Envoy**” section.
2. Verify that the new Envoy-S starts discovering microinverters within 20 minutes of starting up. If necessary, use the Enlighten or Device Scan button to start a new device scan during daylight hours. (See “Method C: Discover Microinverters with the Envoy-S” on page 17.)



NOTE: If the old Envoy-S has communicated to the microinverters on the same day that the new replacement Envoy-S is installed, the new Envoy-S will be unable to discover the microinverters. Contact Enphase at enphase.com/en-us/support/contact for assistance in this situation.

3. Contact Enphase Support at enphase.com/en-us/support/contact to have the new Envoy-S added to your system and to retire the replaced Envoy-S.

Technical Data

| Model Number | |
|--|---|
| AC Combiner Box, Metered XAM1-120 | AC combiner with Enphase Envoy-S Metered™ for integrated revenue grade PV production metering (ANSI C12.20 +/- 0.5%) and optional consumption monitoring (+/- 2.5%). |
| Accessories (Order Separately) | |
| Enphase Mobile Connect™ CELLMODEM-01 | Plug and play industrial grade cellular modem with five-year data plan for residential systems up to 12 kW. (Available in the US, Puerto Rico, and the US Virgin Islands.) |
| Consumption Monitoring CT CT-200-SPLIT (order two) | Split core current transformers enable whole home consumption metering (+/- 2.5%). |
| Electrical Specifications | |
| Maximum system size | 11.5 kW at 240 VAC |
| Rating | Continuous duty |
| Maximum system voltage | 240 VAC |
| Rated output current | 48 A |
| Rated input current, each DG input | 16 A |
| Maximum fuse/circuit breaker rating (output) | 60 A |
| Solar branch circuit breakers | Three 2-pole 20A/240 VAC DIN rail-mounted breakers |
| Production Metering CT | 200A solid core pre-installed on solar busbar and wired to Envoy-S |
| Mechanical Data | |
| Dimensions (WxHxD) | 38.0 x 38.7 x 20.3 cm (15.0" x 15.3" x 8.0") |
| Weight | 5.1 kg (11.2 lbs) |
| Ambient temperature range | -40°C to +46°C (-40° to 115°F) |
| Cooling | Vented, natural convection |
| Enclosure environmental rating | Outdoor, NRTL-certified, NEMA type 3R, polycarbonate construction |
| Wire size | 12 to 6 AWG copper conductors for branch inputs. 12 to 4 AWG copper conductors for combined output. Follow local code requirements for conductor sizing. |
| Altitude | To 2000 meters (6,560 feet) |
| Internet Connection Options | |
| Integrated Wi-Fi | 802.11b/g/n |
| Ethernet | 802.3, CAT5E or CAT6 UTP @cable (not included) |
| Cellular | Optional, CELLMODEM-01 (not included) |
| Compliance | |
| Compliance, Combiner Box | UL 1741 |
| Compliance, Envoy-S | UL 916 CAN/CSA C22.2 No. 61010-1 47 CFR, Part 15, Class B, ICES 003 IEC/EN 61010-1:2010, EN50065-1, EN61000-4-5, EN61000-6-1, EN61000-6-2 Metering: ANSI C12.20 accuracy class 0.5 |