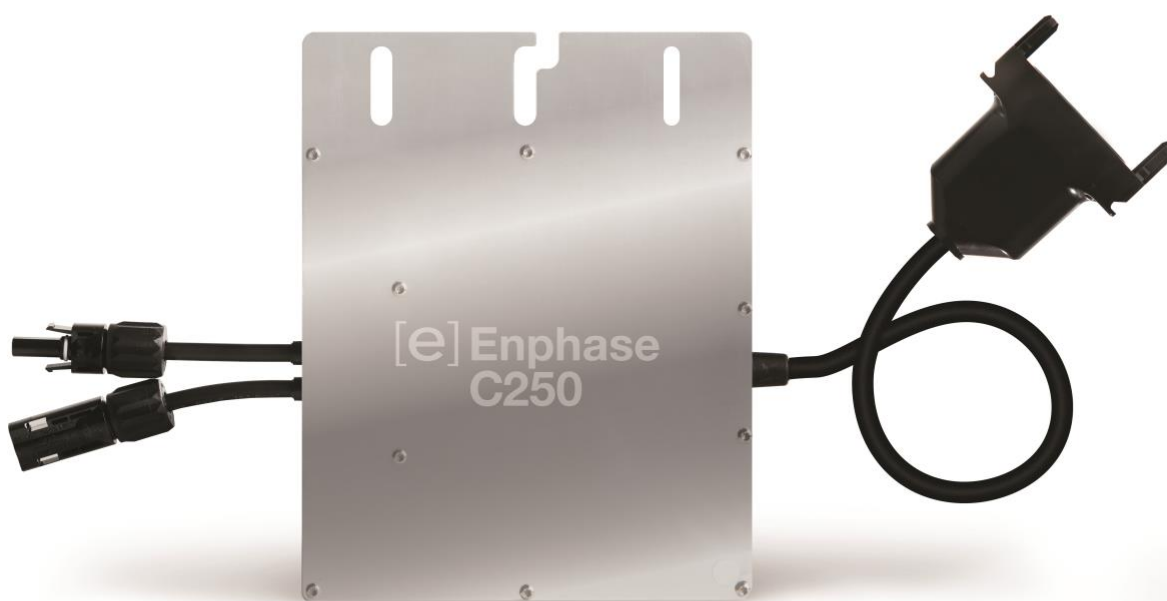


Enphase C250 Microinverter System



Corporate Headquarters Contact Information

Enphase Energy Inc.
1420 N. McDowell Blvd.
Petaluma, CA 94954
USA

Company website: <http://www.enphase.com>

Enphase Energy customer support: enphase.com/en-us/support/contact

FCC Compliance

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with this manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

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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Audience

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

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Important Safety Information

Read this First

This manual describes how to safely install and operate the Enphase® C250 Microinverter™, the Enphase® Envoy-C Communications Gateway™, and the Enphase® C250 Engage Cable™ for utility interactive applications. Read and comply with the following safety instructions.

Product Labels

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



WARNING: Hot surface.



DANGER: Refer to safety instructions.



DANGER: Risk of electrical shock.

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 center 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 Fire. When pairing with C250, 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: Enphase Microinverters have field-adjustable voltage and frequency trip points that may need to be set, depending upon local requirements. Only an authorized installer with the permission and following requirements of the local electrical authorities should make adjustments.

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. Treat all connector contacts as though they are live. Pin one in the splice box (drop connector) is live, though not used.



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.



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.

Envoy Safety



WARNING: Risk of electric shock. Do not attempt to repair the Enphase Envoy Communications Gateway; 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 Envoy will void the warranty.



WARNING: Risk of equipment damage. Do not remove power from the Envoy if the LCD screen displays: "Upgrading. . . Do Not Unplug."



NOTE: DO NOT route the power cable or the Ethernet cable through the cable tray.



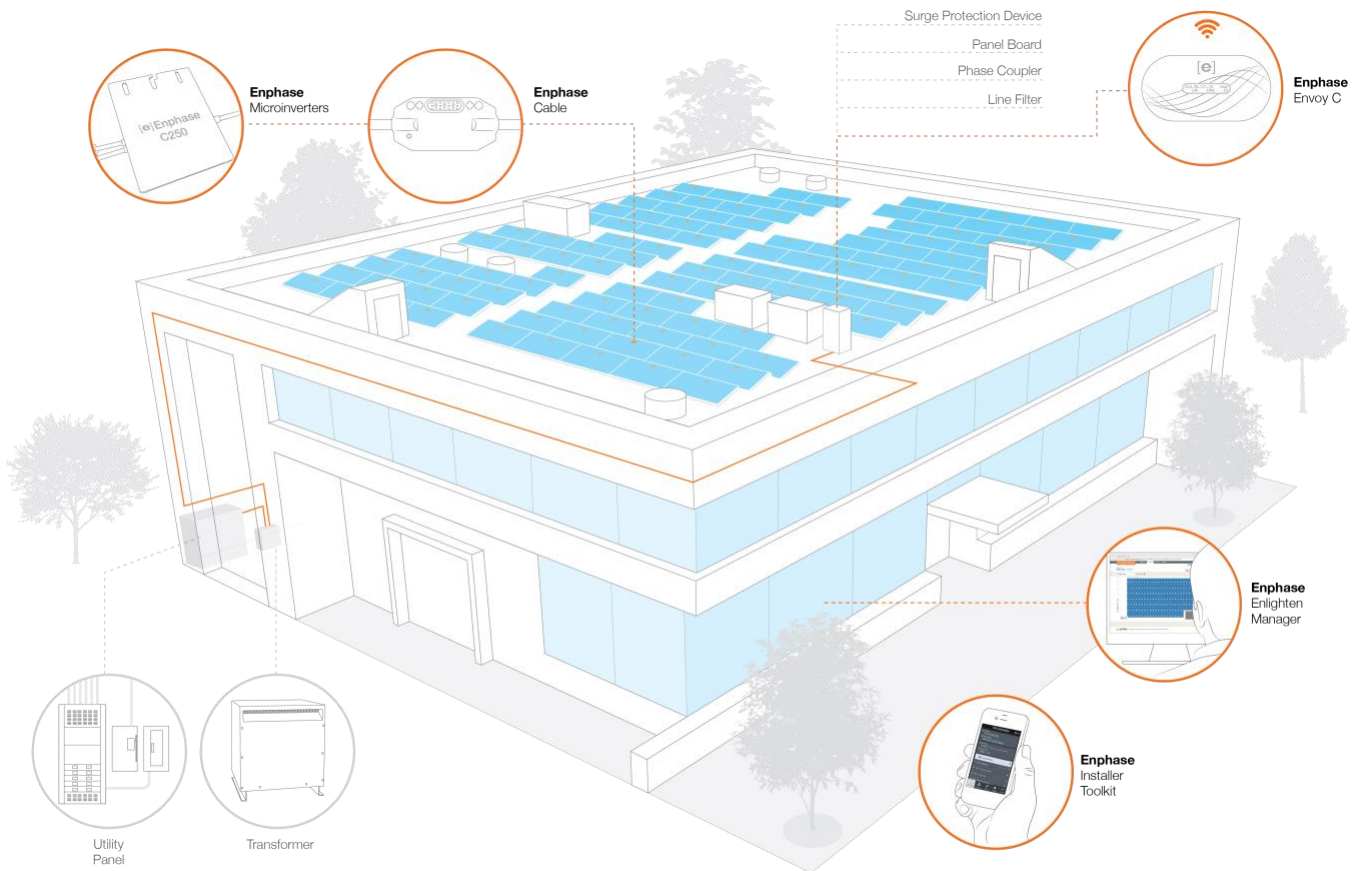
NOTE: Do not plug the Envoy into a power strip, surge protector, or uninterruptable power supply (UPS). These devices impede power line communications.

The Enphase C250 Microinverter System

Used with a transformer, the C250 Microinverter System meets the needs of large commercial installations where power distribution is 480Y/277V or medium voltage (MV).

With the fourth generation Enphase Microinverters, the DC circuit within the microinverter is isolated and insulated from ground. Ground fault protection (GFP) is integrated into the microinverter. Because of this, the microinverters do not require a GEC. As a result, it takes less time to install than other microinverters, saves money, and increases safety. Fourth generation microinverters include the C250.

This integrated system maximizes energy harvest, increases system reliability, and simplifies design, installation and management.



How the Microinverter Works

The Enphase Microinverter maximizes energy production from your photovoltaic (PV) array. Each Enphase Microinverter is individually connected to one PV module in your array. This unique configuration means that an individual Maximum Peak Power Point Tracker (MPPT) controls each PV module. This ensures that the maximum power available from each PV module is exported to the utility grid regardless of the performance of the other PV modules in the array. That is, although individual PV modules in the array may be affected by shading, soiling, orientation, or PV module mismatch, the Enphase Microinverter ensures top performance for its associated PV module. The result is maximum energy production from your PV system.

System Monitoring

Once you install the Envoy Communications Gateway and provide an Ethernet connection to your broadband router or modem, the Enphase Microinverters automatically begin reporting to the Enphase Enlighten web server. The Enlighten software presents current and historical system performance trends, and it informs you of PV system status.

Optimal Reliability

Microinverter systems are inherently more reliable than traditional inverters. The distributed nature of a microinverter system ensures that there is no single point of system failure in the PV system. Enphase Microinverters are designed to operate at full power at ambient temperatures as high as 65° C (150° F). The microinverter housing is designed for outdoor installation and complies with the NEMA 6 environmental enclosure rating standard:

NEMA 6 rating definition: Indoor or outdoor use primarily to provide a degree of protection against hose-directed water, the entry of water during occasional temporary submersion at a limited depth, and damage from external ice formation.



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

Ease of Design

PV systems using Enphase Microinverters are very simple to design and install. You will not need string calculations, and you can install individual PV modules in any combination of PV module quantity, type, age and orientation. You won't need to install cumbersome traditional inverters. Each microinverter quickly mounts on the PV racking, directly beneath each PV module. Low voltage DC wires connect from the PV module directly to the co-located microinverter, eliminating the risk of personnel exposure to dangerously high DC voltage.

Planning for System Installation

The Enphase Microinverter is compatible with most 60- and 72-cell PV modules and installs quickly and easily. It ships with integrated DC and AC cables and connectors. The DC connectors attach to the PV module, while the AC connector attaches directly to the Engage Cable. No additional cabling is needed.

The Engage Cable for C250 is available in three connector spacing options to meet varying site requirements. For Engage Cable ordering information, see “Engage Cable Planning and Ordering” on page 32.

Compatibility and Capacity

Refer to the Enphase Compatibility Calculator at: <http://enphase.com/module-compatibility-calculator-m250-update/> to ensure PV module electrical compatibility. To ensure **mechanical compatibility**, be sure to order the correct connector type for both microinverter and PV module from your distributor.



WARNING: Risk of fire. When connecting to a C250 Microinverter, the PV module DC conductors must be labeled “PV Wire” or “PV Cable” to be compliant with NEC 690.35(D) for Ungrounded PV Power Systems.

Compatibility

Model Number	Works with PV Module Type	PV Module Connector Type
C250-72-2LN-S2	60-cell or 72-cell, to 350 W	MC-4 locking connector
C250-72-2LN-S5	60-cell or 72-cell, to 350 W	Amphenol connector

Branch Circuit Capacity

Plan your AC branch circuits to meet the following limits for maximum number of Enphase Microinverters per branch when protected with a 20-amp over-current protection device (OCPD).

Maximum C250s per phase	Maximum C250s per AC branch circuit
16	48

Utility Service Requirements

When used with a transformer, the Enphase C250 Microinverter works with three-phase 480Y/277V service. Install an auto-transformer or isolation transformer so that the voltage presented to the microinverter is limited to no more than 248V, line to neutral.

Lightning and Surge Suppression

Enphase Microinverters have integral surge protection, greater than most traditional inverters. However, if the surge has sufficient energy, the protection built into the microinverter can be exceeded, and the equipment can be damaged. For this reason, Enphase recommends that you protect your system with lightning and/or surge suppression devices. In addition to having some level of surge suppression, it is also important to have insurance that protects against lightning and electrical surges.



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

Pre-installation Tasks

Install supporting structures, home-run wiring, load centers, revenue grade meter, and any other equipment required for your installation. Install this equipment per manufacturer instructions.

- Verify DC polarity between the PV module and the microinverter by temporarily connecting a PV module to a microinverter with no grid connection. The microinverter LED lights solid green for a few seconds to indicate compatibility. After two minutes the LED will flash red to indicate that no grid is present. This is normal.
- Install an auto-transformer or isolation transformer so that the voltage presented to the microinverter is limited to no more than 248V, line to neutral.
 - **Auto-transformer:** An auto-transformer is more affordable, smaller, lighter and more efficient than an isolation transformer. You can use one to generate the operating voltage for C250 from a 480Y/277V grid. The primary disadvantages of auto-transformers are that they do not provide isolation and do not derive a neutral from a delta configured system. Used in boost mode (as viewed from the PV side), these transformers usually have taps for adjustments to the PV side voltage.
 - **Isolation Transformer:** Isolation transformers with a WYE configured winding on the PV side can derive a neutral conductor when the grid side is delta configured, filter electrical noise and communication signals, and provide isolation of communication domains. These transformers usually have taps for adjustments to the PV side voltage.
- Install a phase coupler to couple the Enphase power line communication signal between the three phases. You need a phase coupler with each Envoy-C in a C250 system to allow communication with the microinverters on all three phases.
- Install Enphase Line Filters (model LCF-250-PC), if needed. If you have more than one communication domain and multiple Envoy-Cs that are tied to a common service panel or off of a single transformer, you need filters to prevent cross-talk between the communication domains. You can accomplish this with power line filters or with a single isolation transformer feeding a single communication domain, such as when a medium voltage transformer is provided for each sub-array. You must also physically separate the racking, conduits and wires of one communication domain from another communication domain by at least 12 inches.
- Install surge protection. An inline surge protective device provides the greatest level of protection, but is usually more expensive than a surge protective device that sits in parallel to the microinverter panel board. If using an inline surge protective device, locate the Envoy-C and C250s together on the load side of this device.

Refer to the C250 Commercial Design Guide at <http://www.enphase.com/support> for details on tested transformers and other devices.

Required System Components

You need the following components to install the C250 system:

- Enphase C250 Microinverter: (model C250-72-2LN-S2 or C250-72-2LN-S5)
- Enphase Envoy-C Communications Gateway: (model ENV-C250). The Envoy has a 250V-rated, NEMA 6-15P plug. The receptacle must be NEMA 6-15R.



NOTE: The C250 Microinverter works only with the Envoy-C (model ENV-C250).

- Enphase Engage Cable:

Model number	PV module orientation
ET10-277-BULK	Portrait, 60- and 72-cell modules
ET17-277-BULK	Landscape, 60-cell modules
ET21-277-192-12AWG	Landscape, 72-cell modules

For more information, see “Engage Cable Planning and Ordering” on page 32.

- Transformer: The transformer must adapt the utility voltage (usually 480Y/277V) to no more than 248V line-to-neutral for connection to the Envoy-C and C250 Microinverters.
- Surge protection device(s).
- Phase Coupler
- Enphase Line Filters (model LCF-250-PC), for additional Envoys, if needed.

Other Items

- Cable clips (model ET-CLIP-100)
- Sealing caps, as needed (model ET-SEAL-10). One needed for each unused drop on the Engage Cable.
- Terminators, as needed (model ET-TERM-10). One needed at the end of each AC branch circuit.
- Enphase disconnect tool (model ET-DISC-05). You can substitute numbers 2 and 3 Phillips screwdrivers.
- Engage Couplers (splice kits), as needed. (ET-SPLK-05)
- Commercial grade NEMA 6-15R receptacle required for each Envoy
- Outdoor-rated, weather-proof AC junction box(es)
- Gland or strain relief fitting (one per AC junction box)
- Number 2 and 3 Phillips screwdrivers
- Torque wrench, sockets, wrenches for mounting hardware
- Adjustable wrench or open-ended wrench (for terminators)
- Handheld mirror (to view LEDs on the undersides of the microinverters)
- Laptop or mobile device for Envoy set up (recommended)
- Bluetooth scanner for use with Enphase Installer Toolkit

Enphase System Installation and Commissioning

Installing the Enphase Microinverter System involves several key steps. Each step listed here is detailed in the following pages. Follow the instructions in this section to install Enphase Microinverters.

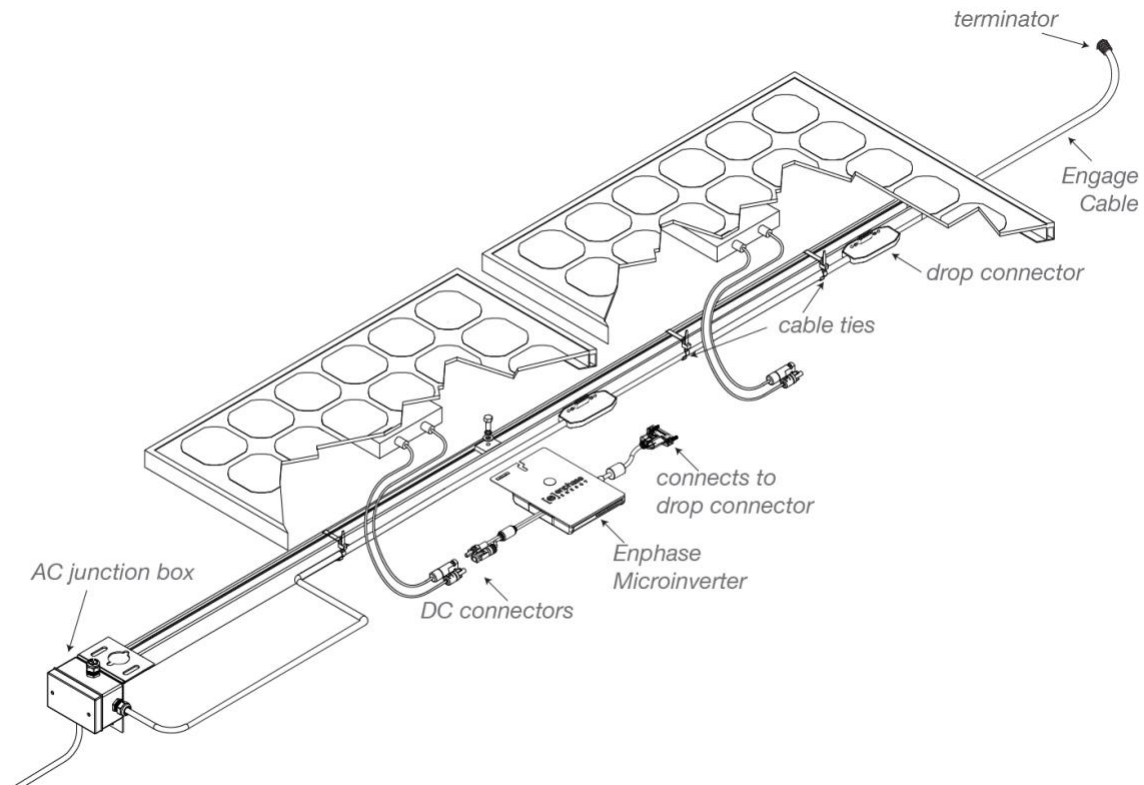
- Step 1:** Register the System
- Step 2:** Place the Envoy® Communications Gateway™
- Step 3:** Position the Enphase Engage™ Cable
- Step 4:** Terminate the Unused End of the Engage Cable
- Step 5:** Attach the Microinverters to the PV Racking
- Step 6:** Dress the Enphase Engage Cable
- Step 7:** Connect the Microinverters
- Step 8:** Connect to an AC Branch Circuit Junction Box
- Step 9:** Complete the Installation Map
- Step 10:** Connect the PV Modules
- Step 11:** Energize the System
- Step 12:** Connect the Envoy to the Internet
- Step 13:** Use the Envoy to Complete System Setup
- Step 14:** Build the Virtual Array



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



WARNING: DO NOT connect Enphase Microinverters to the utility grid or energize the AC circuit(s) until you have completed all of the installation procedures as described in the following sections.



Step 1: Register the System

Register the Envoy at the beginning of the PV installation.

- a. Use your previously issued username and password to log in to in Enlighten.
If you haven't registered, go to www.enphase.com and click **Enlighten Login**.
- b. At the installer dashboard, click **Add a New System**.
If you have already registered the site, find the system under **Installations in Progress**.
- c. Under **System**, enter the system Name, Type and Installer Reference (optional).
- d. Enter **Installer** information.
- e. Under **Owner**, enter the Name, Email, and Phone.
- f. Under **Location**, enter the Country and address information.



NOTE: If you select a country other than the US, or if you select Hawaii as the state under **Location**, the **Grid Profile** menu appears. For most regions, you do not need to select a grid profile when installing the C250 because it is preset with the appropriate profile.

However, when inter-connecting to grids managed by Hawaii Electric Industries (HEI), including HECO, you must refer to the [C250 Commercial Design Guide, Appendix A: Hawaiian Electric Industries Requirements for C250 Projects](#) for specific instructions on setting this profile and for other requirements specific to your installation.

The screenshot shows the 'Add a New System' form in the Enlighten dashboard. The form is divided into several sections: **System** (with fields for Name, Type, and Installer Reference), **Installer** (with a dropdown for Enphase Energy), **Owner** (with fields for First Name, Last Name, Email, and Phone), **Location** (with fields for Country, Street Address, Street Address 2, City, State/Province, and Zip/Postal Code), **Envoy** (with a dropdown for Internet Connection and a field for Envoy Serial Number), **Modules** (with a field for Total Number of PV Modules), and **Installation** (with a dropdown for Microinverter Attachment Type). There is also a checkbox for 'Third Party Owned' and a link to 'Change Enlighten Version'.

- g. Under **Envoy**, select the Internet Connection type and enter the Envoy Serial Number.
- h. Under **Modules**, enter total number of modules, type, etc.
- i. Click **Save** to submit the form. You will receive a confirmation message: "Activation Created Successfully."

Step 2: Place the Envoy

The Envoy's power line communication signal must be "coupled" between the three phases to allow the Envoy to communicate with all of the microinverters in the system.

- a. Install a phase coupler, or wire a capacitor into the system. With either solution, install the device on the load side of the over-current protection device.

- b. Plug the AC cord into a dedicated NEMA 6-15R receptacle. This receptacle must be indoors or in an environmentally protected location. Locate the Envoy with the phase coupler and line filter as shown in the System Diagram on page 39.

Step 3: Position the Enphase Engage Cable

The Engage Cable is a continuous length of outdoor-rated cable with integrated connectors for microinverters. These connectors are preinstalled along the Engage Cable at intervals to accommodate horizontal or vertical PV module widths. The microinverters plug directly into the connectors, and the Engage Cable is terminated into the junction box that feeds electricity back to the system AC disconnect. For more information, see “Engage Cable Planning and Ordering” on page 32.

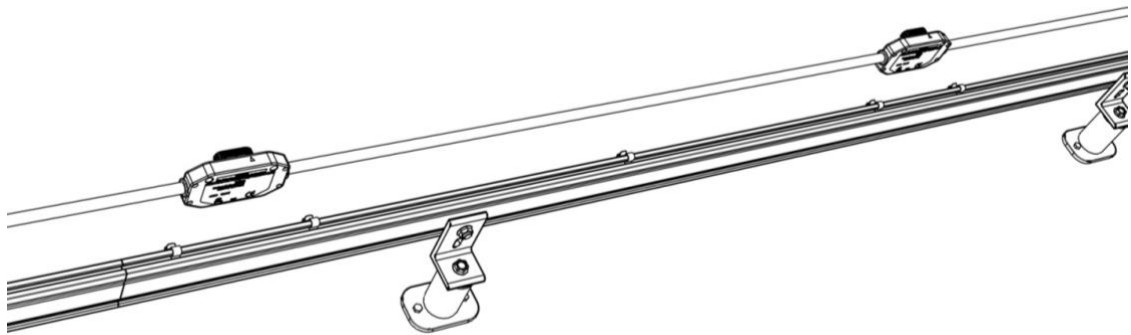


NOTE: Make sure you are using the correct cable type. Use three-phase cable (model numbers ET10-277-BULK, ET17-277-BULK, or ET21-277-192-12AWG). See “Engage Cable Planning and Ordering” on page 32. Check the labeling on the drop connectors to verify the voltage type (277).

- a. Plan the cable route so that the drop connectors on the Engage Cable align with each PV module. Allow extra length for slack, cable turns and any obstructions.
- b. Measure the path of the AC branch circuit and cut a length of Engage Cable to meet your needs.
- c. Lay the Engage Cable along the installed racking for the AC branch circuit. Position the connectors so that they align with the PV modules. Allow extra length for slack, cable turns and any obstructions.



WARNING: Risk of fire. Plan the AC branches so that they do not exceed the maximum number of microinverters in an AC branch circuit as listed on page 11 of this manual. You must protect each microinverter AC branch circuit with a 20 A maximum breaker.



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

- d. PV module widths vary by manufacturer. On the Engage Cable, connectors are spaced at intervals to allow for the widest PV modules compatible with Enphase Microinverters. If narrower PV modules are used, it may be necessary to account for excess cable by looping the cable at suitable intervals.



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

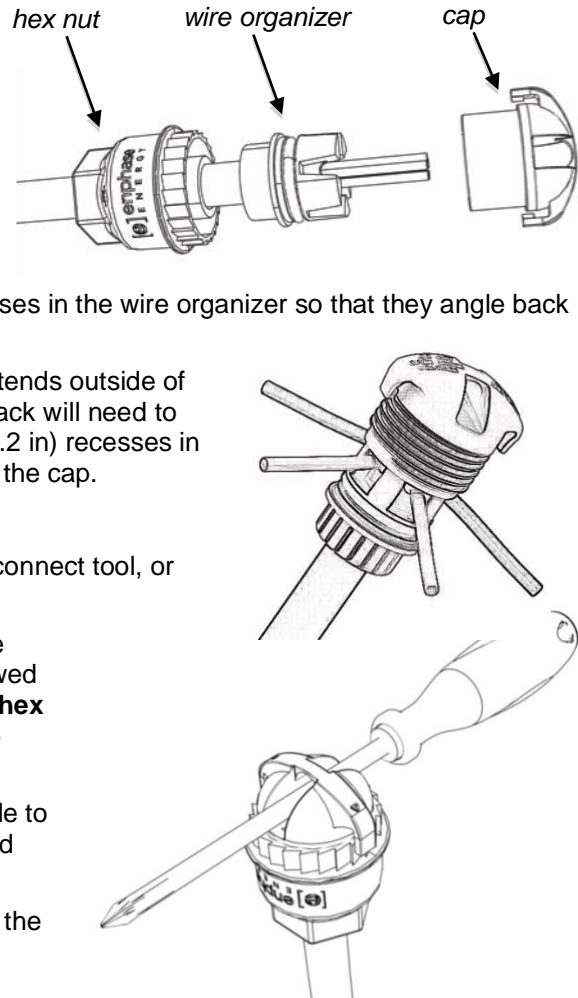
Step 4: Terminate the Unused End of the Engage Cable



WARNING: Risk of Electrical Shock. Do not install the terminator cap while power is connected.

Terminate the far end of the Engage Cable as follows.

- a. Remove 60 mm (2.5 inches) of the cable sheath from the conductors.
- b. Check that all terminator parts are present.
- c. Slide the hex nut onto the Engage Cable.
- d. Insert the Engage Cable all the way into the wire organizer (up to the stop).
- e. Bend the individual wires back into the recesses in the wire organizer so that they angle back toward the cable.
- f. Cut the individual wires so that no excess extends outside of the wire organizer. The portions that angle back will need to extend enough to fit neatly into the 0.5 cm (0.2 in) recesses in the wire organizer and flush with the edge of the cap.
- g. Place cap over the wire organizer.
- h. Hold the cap stationary with an Enphase disconnect tool, or insert a #2 Phillips screwdriver.
- i. Use a 22 mm (7/8 inch) wrench to tighten the hex nut until the latching mechanism is screwed all the way to the base. **Never unscrew the hex nut. This action can twist and damage the cable.**
- j. Use a tie wrap or cable clip to attach the cable to the PV racking, so that the Engage Cable and terminator do not touch the roof.
- k. Ensure that all cabling is located underneath the PV module.



Step 5: Attach the Microinverters to the PV Racking

- a. Mark the approximate centers of each PV module on the PV racking.
- b. Evaluate the location of the microinverter with respect to the PV module DC junction box or any other obstructions.
- c. Ensure that the microinverter does not interfere with the PV module frame or stiffening braces.
- d. Ensure that the connector from the microinverter can easily reach the connector on the Engage Cable.
- e. Allow a minimum of 1.9 cm (0.75 inches) between the roof and the bottom of the microinverter. Also allow 1.3 cm (0.50 inches) between the back of the PV module and the top of the microinverter.

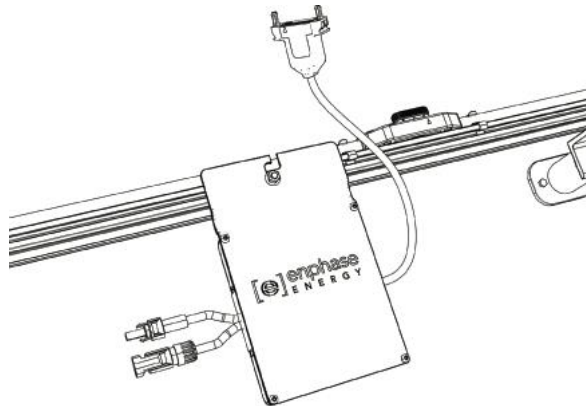


WARNING: Risk of equipment damage. You must install the microinverter under the module, out of rain and sun. Do not mount the microinverter in a position that allows long-term exposure to direct sunlight or in a vertical orientation that allows water to collect in the DC connector recess. Do not install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

- f. Mount one microinverter at each location using suitable hardware. The indicator light on the underside of the microinverter will be facing the roof.



NOTE: Do not install the microinverter black side up or vertically, with the DC connectors facing up.



- g. Torque the microinverter fasteners to the values shown. Do not over torque.

- 6 mm (1/4") mounting hardware: 5 N m (45 to 50 in-lbs)
- 8 mm (5/16") mounting hardware: 9 N m (80 to 85 in-lbs)



NOTE: Using a power screwdriver to tighten the mounting hardware is not recommended due to the risk of thread galling.

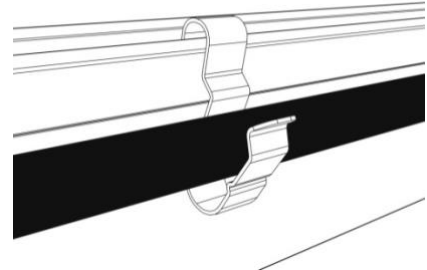
Step 6: Dress the Engage Cable



NOTE: Adhere to the following requirements:

- Do not expose the cable connections to directed, pressurized liquid (water jets, etc.).
- Do not expose the cable connections to continuous immersion.
- Do not expose the AC connector 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 cable and connectors only when all parts are present and intact.

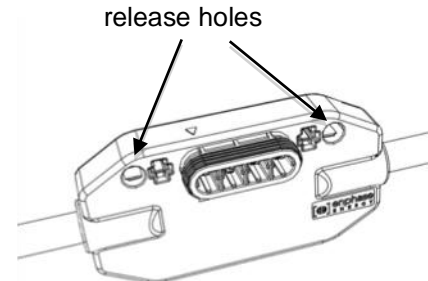
- a. Attach the Engage Cable to the PV racking using the cable clips, or you may use tie wraps. The cable clips are designed so that the cable from the microinverter can also be dressed into the clip underneath the Engage Cable.



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.**

- b. Dress the Engage Cable so that it does **not** contact the roof.

There are several ways to support the cable. One method is to place tie wraps or clips on either side of the connector. Use one or two additional clips, tie wraps, or other support scheme to secure the cable between connectors.



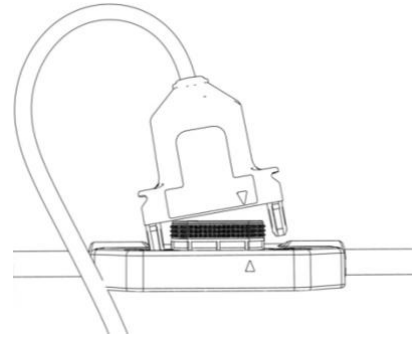
NOTE: When looping the Engage Cable, do not form loops smaller than 4.75 inches (12 cm) in diameter.



WARNING: Tripping Hazard. Loose cables can become a tripping hazard. Dress the Engage Cable to minimize tripping potential.

Step 7: Connect the Microinverters

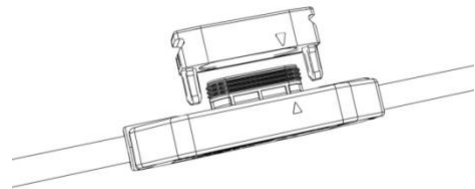
- a. Remove and discard the temporary shipping caps from the Engage Cable and connect the microinverter. There are two latching mechanisms within the connectors. Listen for **two** clicks as the connectors engage. Ensure that **both** latching mechanisms have engaged.
- b. Repeat for all microinverters in the AC branch circuit.
- c. Cover any unused connector with a sealing cap. Listen for two clicks as the connectors engage. Ensure that **both** latching mechanisms have engaged.



NOTES: Do not use the temporary 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.

Enphase sealing caps are IP67 rated. Within the term “IP67”, “IP” indicates an Ingress Protection (IP) rating against dust and liquids.

This specific rating of IP67 indicates that this connector protects against all dust particles and immersion in liquid.



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 utility system. **Sealing caps may not be reused.**



NOTE: If you need to remove a sealing cap, you must use the Enphase disconnect tool or a #3 Phillips screwdriver. See “Disconnect a Microinverter” on page 30. Sealing caps may not be reused.

- d. Avoid skipping Engage Cable connectors by using an Engage Coupler to connect two Engage Cables or to connect Engage Cable to field cable.



NOTE: When cable connectors are left unused on a three-phase system, it creates a phase imbalance on the branch circuit. If multiple cable connectors are skipped over multiple branch circuits, the imbalance can multiply.

Step 8: Connect to an AC Branch Circuit Junction Box



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.



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



WARNING: Risk of fire. Do NOT exceed the maximum number of microinverters in an AC branch circuit as listed on page 11 of this manual.

- a. Install an appropriate junction box at a suitable location on the PV racking system. You can center feed the branch, or you can install the junction box at the end of a row of PV modules.



Best Practice: Center-feed the branch circuit to minimize voltage rise in a fully-populated branch. This practice greatly reduces the voltage rise as compared with an end-fed branch. To center-feed a branch, divide the circuit into two sub-branch circuits protected by a single overcurrent protection device (OCPD).

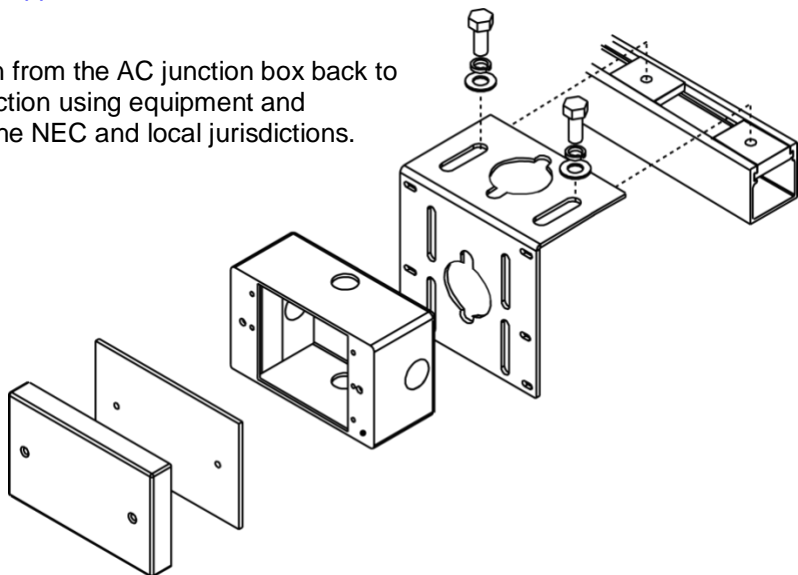
- b. Size the AC wire gauge to account for voltage rise. Select the correct wire size based on the distance from the beginning of the microinverter AC branch circuit to the breaker in the load center.

All components of system wiring must be considered, including internal voltage rise within the length of Engage Cable. Typically, three wire sections and several wire terminations must be quantified. There is also some resistance associated with each circuit breaker. As all of these resistances are in series, they add together. Since the same current is flowing through each resistance, the total voltage rise is total current times the total resistance. For a three-phase system, each of the three line currents and resistances must be calculated.

Standard guidelines for voltage rise on feeder and AC branch circuit conductors might not be sufficient for microinverter AC branch circuits that contain the maximum allowable microinverters. This is due to high inherent voltage rise on the AC branch circuit.

For more information, refer to our Technical Briefs on Voltage Drop at <http://www.enphase.com/support>.

- c. Provide an AC connection from the AC junction box back to the electrical utility connection using equipment and practices as required by the NEC and local jurisdictions.

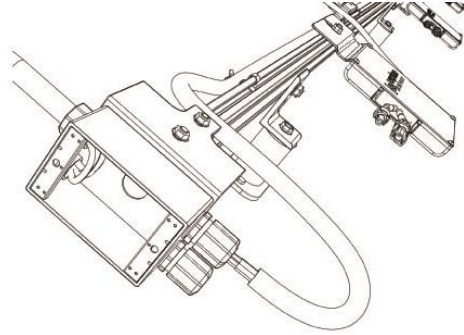


- d. Connect Engage Cable into the AC branch circuit junction box using an appropriate gland or strain relief fitting. The Engage Cable requires a strain relief connector with an opening of 1.3 cm (0.5 inches) in diameter.
- e. Connect the Engage Cable into additional AC junction boxes as needed to transition to conduit between smaller sub-arrays.

Refer to the wiring diagrams on page 39 for more information.

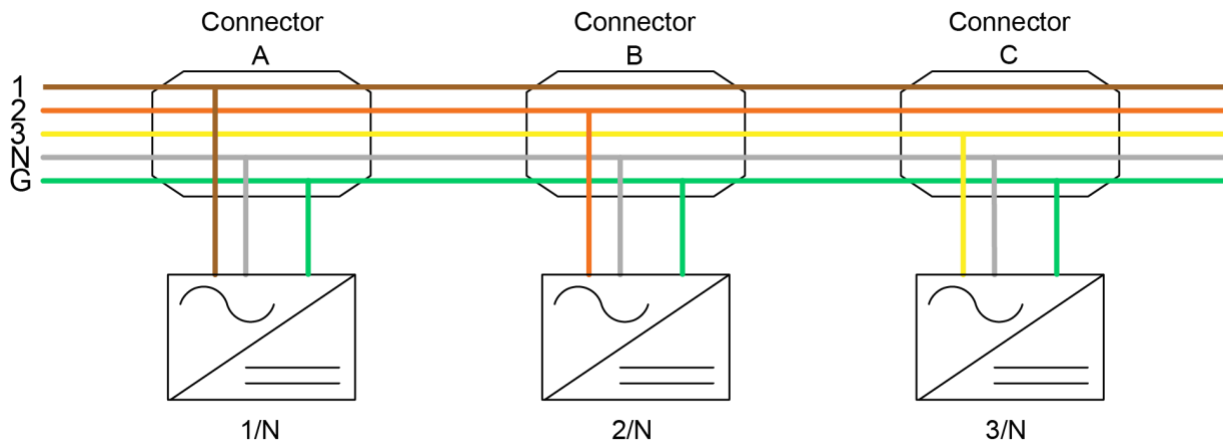
Wire colors are listed in the following table.

248 VAC three-phase
L1 – Brown
L2 – Orange
L3 – Yellow
Neutral – Grey
Ground – Green acts as equipment ground (EGC)



NOTE: Because the DC circuit is isolated and insulated from ground, the C250 does not require a GEC. Ground fault protection (GFP) is integrated into the microinverter.

Balanced 400 Vac (3-phase) is accomplished by alternating phases between microinverters as shown:



WARNING: Risk of electric shock.
Treat all connector contacts as though they are live.

Step 9: Complete the Installation Map

The Enphase Installation Map is a diagrammatic representation of the physical location of each microinverter in your PV installation. You will create the virtual array in Enlighten from this map. Use the scanning tool feature from the Enphase Installer Toolkit to easily build and configure a system. Refer to <http://enphase.com/installer-toolkit/> for more information.

If you prefer to build the table manually, use the blank map on page 38 to record microinverter placement for the system, or provide your own layout if a larger or more intricate installation map is required.

To manually build the Installation Map:

- a. Each Enphase Microinverter has a removable serial number label located on the mounting plate. Peel the removable serial number label from each Enphase Microinverter and affix it to the respective location on the Enphase installation map (see map on page 38). Remember to keep a copy of the installation map for your records.
- b. Remember to keep a copy of the installation map for your records.

Step 10: Connect the PV Modules



WARNING: Electrical shock hazard. The DC conductors of this photovoltaic system are ungrounded and may be energized.



WARNING: PV modules paired with the C250 must have DC conductors that are labeled "PV Wire" or "PV Cable" to be compliant with NEC 690.35(D) for Ungrounded PV Power Systems.

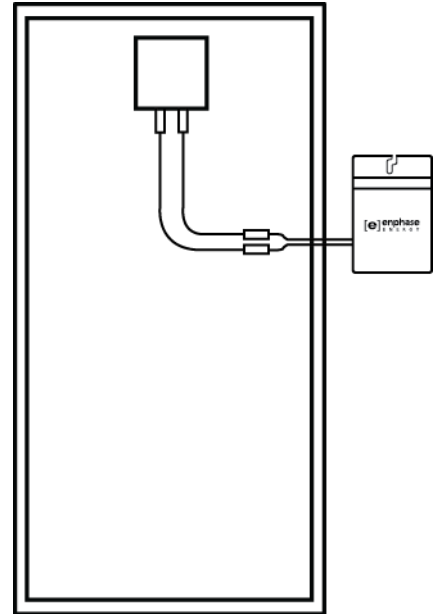


NOTE: Completely install all microinverters and all system AC connections prior to installing the PV modules.

To connect the modules:

- a. Mount compatible PV modules above the microinverters.
- b. Connect the DC leads of each PV module to the DC input connectors of the corresponding microinverter. Repeat for all remaining PV modules using one microinverter for each PV module.
- c. Check the LED on the underside of the microinverter for normal start up.

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



Step 11. Energize the System



WARNING: Risk of electric shock. Risk of fire. Qualified personnel only may connect the Enphase Microinverter to the electricity network.



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

- a. Check that the voltage presented to the microinverters is limited to 248V, line to neutral.
- b. Turn ON the AC disconnect or circuit breaker for each microinverter AC branch circuit.
- c. Turn ON the main utility-grid AC circuit breaker. Your system starts producing power **after a five-minute wait** time.

The Enphase Microinverters begin communicating over the power lines to the Envoy. The time required for the Envoy to discover all of the microinverters varies with the number of microinverters in the system and quality of the power line communications.

Step 12: Connect the Envoy to the Internet

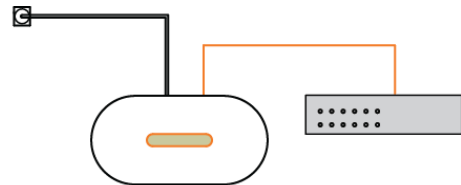


WARNING! Risk of equipment damage. Do not remove power from the Envoy if the LCD displays: “**Upgrading. . . Do Not Unplug.**”

Connect to a broadband router using method A or B, then verify the connection as follows:

Method A: Ethernet Cable

- a. Plug the included Ethernet cable into the Ethernet port on the Envoy.
- b. Plug the other end of the cable into a port on the broadband router.



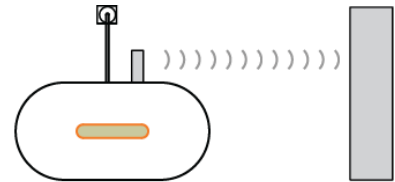
Method B: Wi-Fi (Enphase Wireless Adapter)

This method requires a wireless router and an Enphase Wireless Adapter (order WF-01).



NOTE: Only install the Enphase Wireless Adapter in locations where temperatures remain between 0° and 40° C (32° and 104° F).

- a. On the Envoy, verify that no Ethernet cable is plugged into the Envoy RJ45 port.
- b. Verify that the startup message on the LCD screen reads “R3.12” or later.
 - If not, upgrade the Envoy by connecting the Envoy Ethernet port to the broadband router with the Ethernet cable that came with the Envoy.
 - After the upgrade completes, remove the Ethernet cable from the Envoy.
- c. Plug the Enphase wireless adapter into the left USB port (looking at Envoy from the front), and wait 10 seconds.
- d. Press and hold the WPS button on the wireless router for two seconds. On many routers, the WPS button flashes at this point.
- e. Return to the Envoy. Press and hold the Envoy menu button. Release the Envoy menu button when the LCD displays **Enable Wi-Fi WPS**.
- f. Within two minutes an updated IP address appears on the Envoy LCD screen. This IP address begins with a “W” to indicate a wireless connection.
- g. If the wireless router does not support WPS, refer to the Envoy Communications Gateway Installation and Operation Manual at: <http://www.enphase.com/support> for set up.



Verification: Check the Internet Connection

Look for the **+ Web** indication. If it does not appear within five minutes after connecting to the broadband router, refer to the *Envoy Communications Gateway Installation and Operation Manual* at: <http://www.enphase.com/support> for troubleshooting information.



Step 13: Use the Envoy to Complete System Setup

Refer to the *Envoy Communications Gateway Installation and Operation Manual* at <http://www.enphase.com/support> for details on the following steps.

- a. An automatic device scan runs for eight hours after the Envoy is installed. If this scan has expired, start a new scan.
 - Press and hold the Envoy menu button (on the right side of the Envoy).
 - Release the menu button when the LCD displays **Enable Device Scan**.
- b. Check that the Envoy LCD shows a complete device count after about 30 minutes.
- c. Check power line communications as shown by the number of bars on the Envoy LCD.
 - Press and hold the Envoy menu button (on the right side of the Envoy).
 - Release the menu button when the LCD displays **Enable Communication Check**.
- d. Use the Envoy menu button to stop the scan when all devices are detected:
 - Press and hold the Envoy menu button (on the right side of the Envoy).
 - Release the menu button when the LCD displays **Disable Device Scan**.

Step 14: Build the Virtual Array

When the system is energized and the Envoy detects at least one microinverter, create the virtual array in Enlighten from the installation map you created. Once the virtual array is built, Enlighten displays a graphic representation of the PV system. It also shows detailed current and historical performance information. Go to <http://www.enphase.com> for more information on the Enphase Enlighten web-based monitoring and analysis.

To scan and upload the map and build the array:

- a. Log in to Enlighten. If you do not already have an account, go to <http://www.enphase.com> and click “Enlighten Login” to register.
- b. Scan the installation map and upload it to the Activation form online.

Use Array Builder to create the virtual array in Enlighten. Use your installation map as your reference.



NOTE: Go to <http://enphase.com/support/videos/> to view the Array Builder demo.

- c. You can now view system performance in Enlighten.

Troubleshooting

Follow all the safety measures described throughout this manual. Follow the troubleshooting procedures in this section if the PV system does not operate correctly.



WARNING: Risk of electric shock. Do not attempt to repair the Enphase Microinverter; it contains no user-serviceable parts. If it fails, contact Enphase customer support to obtain an RMA (return merchandise authorisation) number and start the replacement process.

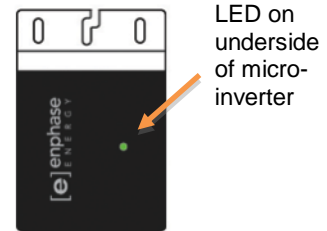
Status LED Indications and Error Reporting

Startup LED Operation

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

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 after DC power is first applied to the microinverter indicate a failure during microinverter startup.



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.
Red	Flashing	Failed to produce power and not operating normally. The microinverter does not sense that the utility grid is within voltage/frequency specifications. The microinverter cannot produce power until this is resolved. See “Troubleshoot an Inoperable Microinverter” on page 28.
	Solid	Fault requiring intervention. For C250, this indicates a “DC Resistance Low – Power Off” fault. Troubleshoot as described in the following sections.

DC Resistance Low – Power Off Fault

A solid red status LED when DC power has been cycled indicates the microinverter has detected a DC Resistance Low – Power Off event. The LED will remain red and the fault will continue to be reported by the Envoy until the error has been cleared.

An Envoy is required to clear this condition. The condition usually clears with operator intervention unless conditions causing the event have not been remedied or if the failure is permanent.

Follow the instructions in the *Envoy Communications Gateway Installation and Operation Manual* at <http://www.enphase.com/support> to clear this condition. Or, for assistance, contact Enphase customer support at enphase.com/en-us/support/contact.

Other Faults

All other faults are reported to the Envoy. Refer to the *Envoy Communications Gateway Installation and Operation Manual* at <http://www.enphase.com/support> for troubleshooting procedures.

Troubleshoot an Inoperable Microinverter

To troubleshoot an inoperable microinverter, follow the steps in the order shown.



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



WARNING: The Enphase Microinverters are powered by DC power from the PV modules. Make sure you disconnect the DC connections and reconnect DC power and then watch for the solid green about six seconds after connection to DC power.

1. Make sure AC breakers and disconnects are closed.
2. Check the connection to the utility grid and verify that the utility voltage is within allowable ranges.
3. Verify that AC line voltages at all solar power circuit breakers at the load center and subpanels are within the ranges shown in the following table.
4. Verify that AC line voltage at the junction box for each AC branch circuit is within the ranges shown in the following table:

Three Phase at Each Branch Circuit	
L1 to L2 to L3	limit to 429 VAC
L1, L2, L3 to neutral	limit to 248 VAC

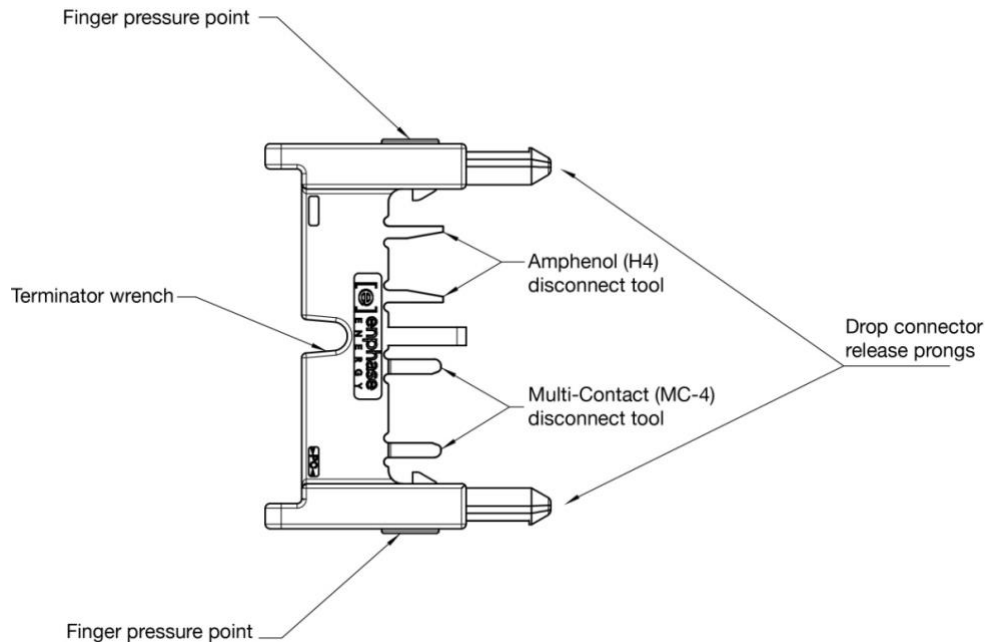
5. Using an Enphase disconnect tool, disconnect the AC cable for the microinverter in question from the Engage Cable.
6. Verify that utility power is present at the microinverter by measuring line to line and line to neutral at the Engage Cable connector.
7. Visually check that the AC branch circuit connections (Engage Cable and AC connections) are properly seated. Reseat if necessary. Check also for damage, such as rodent damage.
8. Make sure that any upstream AC disconnects, as well as the dedicated circuit breakers for each AC branch circuit, are functioning properly and are closed.

9. Disconnect and re-connect the DC PV module connectors. The Status LED of each microinverter will light solid green a few seconds after connection to DC power and then blink green six times to indicate normal start-up operation about two minutes after connecting to DC power. The LED subsequently resumes normal operation if the grid is present. See page 27 for normal LED operation.
10. Attach an ammeter clamp to one conductor of the DC cables from the PV module to measure microinverter current. This will be under one Amp if AC is disconnected.
11. Verify the PV module DC voltage is within the allowable range shown in “Specifications” on page 35 of this manual.
12. Swap DC leads with a known good, adjacent PV module. If after checking Enlighten periodically (this may take up to 30 minutes), the problem moves to the adjacent module, this indicates that the PV module isn't functioning correctly. If it stays in place, the problem is with the microinverter. Call Enphase Customer Support for help in reading the microinverter data and for help in obtaining a replacement microinverter, if needed.
13. Check the DC connections between the microinverter and the PV module. The connection may need to be tightened or reseated. If the connection is worn or damaged, it may need replacement.
14. Verify with your utility that line frequency is within range.
15. If the problem persists, contact Enphase Energy customer support at enphase.com/en-us/support/contact.

Disconnect a Microinverter

If problems remain after following the troubleshooting steps listed previously, contact Enphase Energy customer support at enphase.com/en-us/support/contact. If Enphase authorizes a replacement, follow the steps below. To ensure the microinverter is not disconnected from the PV modules under load, adhere to the following disconnection steps in the order shown:

1. De-energize the AC branch circuit breaker.
2. Disconnect the microinverter from the Engage Cable as follows:
Enphase AC connectors are tool-removable only. To disconnect a microinverter from the cable, insert the two large prongs of the disconnect tool (see illustration) into the two holes in the drop connector. Rock the connector back and forth, while pulling gently, to disengage.



If the disconnect tool is not available, insert a #3 Phillips screwdriver into one hole, and rock that side of the drop connector out. Then, insert the screwdriver into the other hole and pull the connector out entirely.

3. Cover the PV module with an opaque cover.
4. Using a clamp-on meter, verify there is no current flowing in the DC wires between the PV module and the microinverter. If current is still flowing, check that you have completed steps one and two above.



NOTE: Take care when measuring DC current as most clamp-on meters must be zeroed first and tend to drift with time.

5. Disconnect the PV module DC wire connectors from the microinverter using the Enphase disconnect tool.
6. If present, loosen the ground cleat screw and remove the grounding electrode conductor.
7. Remove the microinverter from the PV racking.



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 plan to replace the microinverter immediately, you must cover any unused connector with a sealing cap. **Sealing caps may not be reused.**

Install a Replacement Microinverter

If problems remain after troubleshooting, contact Enphase Energy customer support at enphase.com/en-us/support/contact. If Enphase authorizes a replacement (RMA), replace the microinverter as follows:

1. When the replacement microinverter is available, verify that the AC branch circuit breaker is de-energized.
2. Attach the replacement microinverter to the PV racking using hardware recommended by your PV racking vendor.



WARNING: Risk of equipment damage. You must install the Enphase Microinverter 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.

3. Torque the microinverter fasteners to the values shown. Do not over torque.
 - 6 mm (1/4") mounting hardware: 5 N m (45 to 50 in-lbs)
 - 8 mm (5/16") mounting hardware: 9 N m (80 to 85 in-lbs)



NOTE: Using a power screwdriver to tighten the fasteners is not recommended due to the risk of thread galling.

4. Connect the microinverter to the Engage Cable drop connector. There are two latching mechanisms within the connectors. Listen for two clicks as the connectors engage. Ensure that **both** latching mechanisms have engaged.
5. Mount the PV module above the microinverter.
6. Mate the microinverter and PV module as required.
7. Energize the AC branch circuit breaker, and verify operation of the replacement microinverter by checking the indicator light on the underside of the microinverter. You may need a handheld mirror to see the indicator light.
8. Initiate a device scan at the Envoy. To do this, press and hold the Menu button on the Envoy for two seconds to bring up the Envoy menu on the LCD window. When the LCD window displays "Enable Device Scan", release the Menu button. This starts a 30-minute scan at the Envoy to discover the new microinverter.
9. Use Enlighten's Array Builder to add the newly detected microinverter to the virtual array.
10. Ship the old microinverter to Enphase using the supplied return-shipping label.

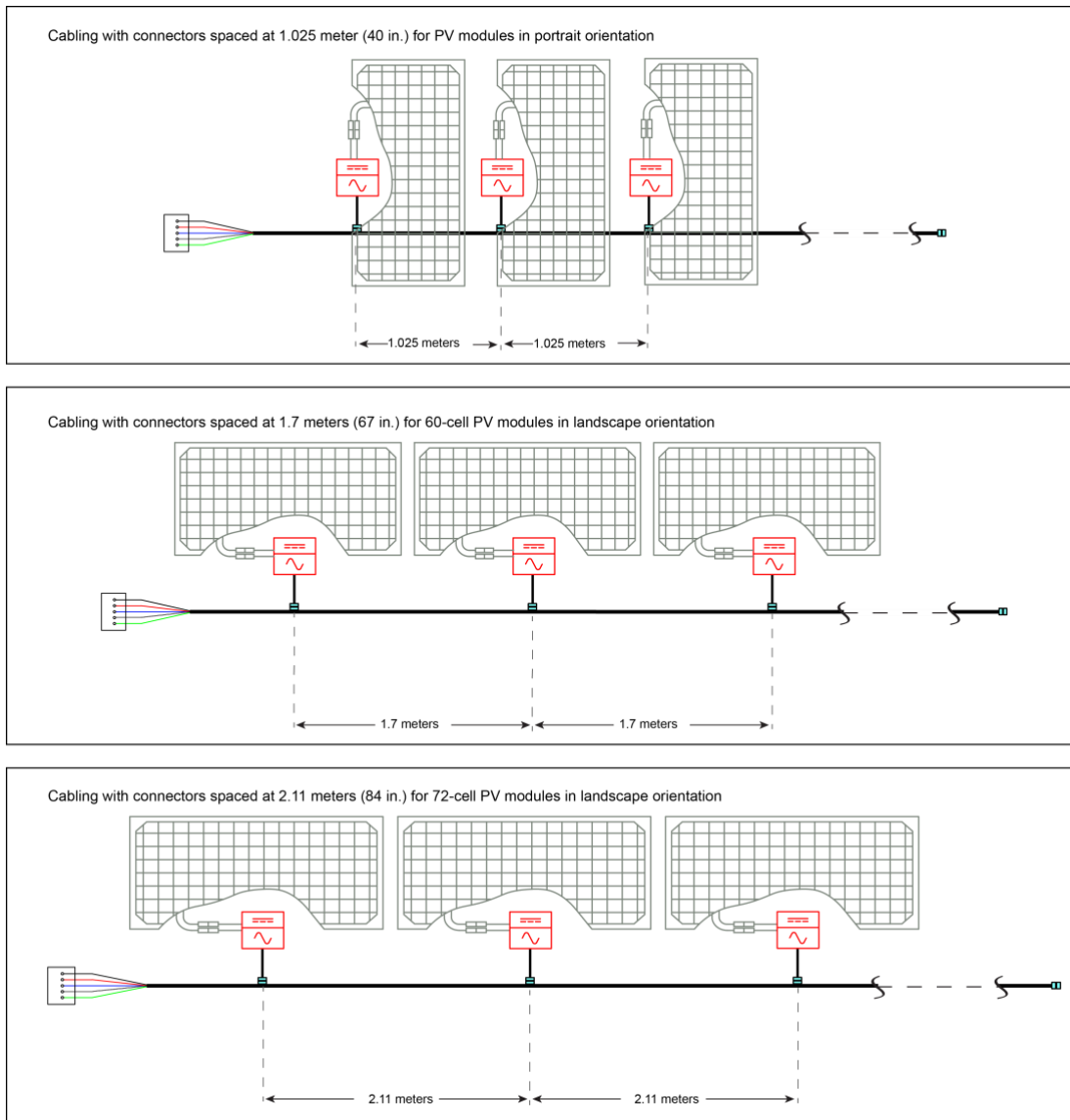
Engage Cable Planning and Ordering

The Engage Cable is a continuous length of outdoor-rated cable with integrated connectors for microinverters. These connectors are preinstalled along the Engage Cable at intervals to accommodate varying PV module widths. The microinverters plug directly into the cable connectors.

The cabling is compatible with a variety of PV racking systems. For a list of approved PV racking systems, refer to the PV Racking Compatibility document on the Enphase website (<http://www.enphase.com/support>).

Connector Spacing Options

Engage Cable for C250 is available in three connector spacing options. The gap between connectors on the cable can be either 1.025 meters (40"), 1.7 meters (67"), or 2.11 meters (84"). The 1.025 meter spacing is best suited for connecting PV modules installed in portrait orientation, while the 1.7 meter and 2.11 meter spacing allows you to install 60-cell and 72-cell PV modules in landscape orientation.



Cabling Ordering Options

Ordering options include:

Model number	Voltage type / conductor count	Connector count	Connector spacing	PV module orientation
ET10-277-BULK	277 VAC, 5 conductor	240	1.025 m (40 in.)	Portrait, 60- and 72-cell modules
ET17-277-BULK	277 VAC, 5 conductor	240	1.7 m (67 in.)	Landscape, 60-cell modules
ET21-277-192-12AWG	277 VAC, 5 conductor	192	2.11 m (84 in.)	Landscape, 72-cell modules

Planning for Cable Lengths and Type

The Cabling System is flexible enough to adapt to almost any solar design. To determine the length and cable type that you need, apply the following considerations:

- **Account for the number of Enphase Microinverters to be installed on the AC branch circuit.** Make sure to allocate the correct number of connectors, including extra connectors for gaps and turns.
- **Plan for additional cable length to reach from the AC branch circuit junction box to the first microinverter.** If greater than half a connector interval is needed, you may need to allow for one (or more) unused connectors in order to span this distance. You must cover unused connectors with Enphase watertight sealing caps.
- **Minimize the number of unused Engage Cable connectors** with three-phase systems. When cable connectors are left unused on a three-phase system, it creates a phase imbalance on the branch circuit. If multiple cable connectors are skipped over multiple branch circuits, the imbalance can multiply.

You can avoid skipping Engage Cable connectors with the use of an Engage Coupler (ET-SPLK-05). Use the Engage Coupler to connect two Engage Cables or to connect Engage Cable to field cable. There are many possible scenarios for each type of connection, but they generally fall into four categories:

- Engage Cable to Engage Cable:

1. Make use of leftover lengths of Engage Cable
2. Transition between portrait and landscape Engage Cable

- Engage Cable to Field Cable (#12 TC-ER):

3. Transition between sub-arrays on the same circuit
4. Create wiring extensions for Engage Cable



NOTE: The Engage Coupler only supports #12 TC-ER, which may not be sufficient for homerun wiring. Enphase Energy recommends maintaining less than 2% voltage drop across all wiring.

In situations where you cannot use an Engage Coupler, you can use an electrical junction box to transition between cable types.

- **Account for additional lengths of cable** when calculating total voltage rise. Refer to the Technical Brief on Voltage Drop at <http://www.enphase.com/support>.
- **Plan for additional length to reach from one row of PV modules to the next.** If the PV modules are laid out in multiple rows, the distance from one row to the next often requires additional cabling length.
- **Account for loop size.** When looping the Engage Cable, do not form loops smaller than 4.75 in. (12 cm) in diameter.
- **Consider additional cabling when installing multiple sub-arrays.** Often, an AC branch circuit may be composed of several smaller sub-arrays across more than one roof plane. In this case, cut the cable to service each smaller array, and connect the sub-arrays together using appropriately rated lengths of conduit. Accomplish the transition from cable to conduit using an outdoor rated AC junction box, as required by the NEC and local code. Cover unused connectors with Enphase sealing caps.
- **Account for any mixture of PV modules in both portrait and landscape orientation.** When PV modules are installed in mixed orientation (both portrait and landscape orientation), there are three choices for cabling:
 1. Cabling with 1.025-meter spacing between connectors results in cleanest install for the PV modules in portrait orientation. For PV modules placed in landscape orientation, plan for an unused connector between each PV module to accommodate the required additional distance. Cover unused connectors with Enphase watertight sealing caps.
 2. Cabling with 1.7-meter or 2.11-meter spacing between connectors results in cleanest install for PV modules in landscape orientation. If you use Cabling with 1.7-meter or 2.11-meter spacing between connectors for portrait installations, you must coil and dress the excess cabling so that it does not contact the roof. Cover unused connectors with Enphase watertight sealing caps.
 3. Transition between 1.025 and 1.7-meter or 2.11 meter spaced cables using an outdoor-rated junction box or an Engage Coupler. Secure this junction box or Engage Coupler to the PV racking.

Technical Data

Technical Considerations

PV modules paired with the C250 must have conductors labeled "PV Wire" or "PV Cable" to be compliant with NEC 690.35(D) for Ungrounded PV Power Systems. Be sure to verify the voltage and current specifications of your PV module match those of the microinverter.



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 voltage of the Enphase Microinverter.

The output voltage and current of the PV module depends on the quantity, size and temperature of the PV cells, as well as the insolation on each cell. The highest PV module output voltage occurs when the temperature of the cells is the lowest and the PV module is at open circuit (not operating). The maximum short circuit current rating of the PV module must be equal to or less than the maximum input DC short circuit current rating of the microinverter.

Specifications

C250 Microinverter Specifications

Enphase C250 Microinverter Parameters				
Topic	Unit	Min	Typical	Max
DC Parameters				
Recommended input power (STC)	W			350
MPPT voltage range	V	27		48
Operating range	V	16		60
Maximum DC input voltage	V			60
Minimum / Maximum start voltage	V	22		60
Maximum DC input short circuit current	A			15
AC Parameters				
Rated (continuous) AC output power (-40°C to +65°C)	W		240	
Peak AC output power	W		253	
Output power factor			>0.95	
Nominal AC output voltage range	Vrms		220 – 248	
Maximum AC output current at nominal voltage	Amps		1.0	
Nominal AC output frequency range	Hz	57	60	65
Maximum AC output over current protection device	A		20	
Maximum AC output fault current & duration	A/ms		590mA RMS for 6 cycles	
Voltage trip limit accuracy of nominal	%	±2.5		
Frequency trip limit accuracy	Hz	±0.1		
Trip time accuracy	Cycles	±2		
Miscellaneous Parameters				
Maximum microinverters per 20 amp AC branch circuit			48	

Enphase C250 Microinverter Parameters				
Topic	Unit	Min	Typical	Max
Peak inverter efficiency	%	96.5		
CEC weighted efficiency	%	96.5		
Total harmonic distortion	%		2.5	5
Ambient temperature range	°C	-40		+65
Night tare loss	mW		76	
Storage temperature range	°C	-40		+65
Features and Specifications				
Compatibility	Pairs with most 60- and 72-cell PV modules (the PV module DC conductors must be labeled "PV Wire" or "PV Cable" to be compliant with NEC 690.35(D) for Ungrounded PV Power Systems)			
Dimensions not including mounting bracket (approximate)	179 mm x 217 mm x 28 mm			
Weight	1.66 Kg			
Enclosure environmental rating	NEMA 6			
Connector type	MC4 (C250-72-2LN-S2) or Amphenol (C250-72-2LN-S5)			
Torque specifications for fasteners (Do not over torque.)	<ul style="list-style-type: none"> 6 mm (1/4") mounting hardware: 5 N m (45 to 50 in-lbs) 8 mm (5/16") mounting hardware: 9 N m (80 to 85 in-lbs) 			
Cooling	Natural convection: no fans			
Communication	Power line			
Standard warranty term	http://enphase.com/warranty			
Compliance	UL1741, IEEE1547, FCC Part 15 Class A CAN/CSA-C22.2 No. 0-M91, 0.4-04, and 107.1-01			
Integrated ground (no GEC required)	The DC circuit meets the requirements for un-grounded PV arrays in NEC 690.35. Ground fault protection (GFP) is integrated into the microinverter.			
Integrated DC disconnect	The DC connector has been evaluated and approved for use as the load-break disconnect required by NEC 690.			
Integrated AC disconnect	The AC connector has been evaluated and approved for use as the load-break disconnect required by NEC 690.			

Engage Cable Specifications

Specification	Value
System temperature range (ambient)	-40°C to +65°C (-40°F to 149°F)
Cable temperature rating	90°C Dry / 90°C Wet
Cable type	TC-ER
Cable conductor insulator rating	THWN-2
Environmental protection rating	IEC 60529 IP67
UV exposure rating: terminator, Engage Coupler, and drop connector body	UL 746 C, F1
Sunlight resistance (cable)	UL 1277
Compliance	UL486A/B, UL 514C, UL6703, UL 9703, IEC 60529 IP67, CAN/CSA 22.2 No. 21, 182.3
Conductor size	12 AWG
Cable diameter	11.75mm (0.463")
Minimum loop size	4.75 inches (12 cm)
Drop connector dimensions	11.8 cm x 6.0 cm x 3.2 cm (4.64" x 2.36" x 1.25")
Terminator cap dimensions	3.6 cm diameter x 5.1 cm tall (1.4" x 2")

Enphase Installation Map

To Sheet: _____

Panel Group:
Azimuth:
Tilt:
sheet _____ of _____

Customer information:

Installer information:

N S E W
(circle one)

2

3

4

5

6

7

A						
B						
C						
D						
E						
F						
G						
H						
J						
K						
L						
M						

To Sheet: _____

To Sheet: _____

Scan completed map and upload it to Enphase. Click "Add a New System" at <https://enlighten.enphaseenergy.com>. Use this map to build the virtual array in Enlighten's Array Builder.

Envoy Serial Label

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Sample System Diagram

