Enphase S-Series Microinverter

141-00029, Rev 01c

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Other Information

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

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

For warranty text refer to enphase.com/warranty.

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

Audience

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

Table of Contents

SAFETY

Read this First

This manual contains important instructions for use during installation and maintenance of the Enphase S-Series Microinverter™ (S270-72-LN and S230-60-LN).

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 Instructions 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	
 **DANGER**: 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.
	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.
	Only qualified personnel should troubleshoot, install, or replace Enphase Microinverters or the Engage Cable and Accessories.
	Only use electrical system components approved for wet locations.
	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.
	If the AC cable on the microinverter is damaged, do not install the unit.

Safety Instructions

 **DANGER**: 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.
	Make sure protective sealing caps have been installed on all unused AC connectors. Unused AC connectors are live when the system is energised by the grid. Sealing caps may not be reused.
	When pairing with S-Series Microinverter, the PV module DC conductors must be labelled “PV Wire” or “PV Cable”.
	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.
 **DANGER**: Risk of electric shock.	Always de-energise the AC branch circuit before servicing. Never disconnect the DC connectors under load.
	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.
	Treat all connector contacts as though they are live. The 400 Vac Engage Cable drop connector contains two live phases.
	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.
	The DC conductors of this photovoltaic system are ungrounded and may be energised.
	The Engage Cable terminator cap must not be installed while power is connected.
 **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.
 **WARNINGS:**	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.
	Do not connect Enphase Microinverters to the grid or energise the AC circuit(s) until you have completed all of the installation procedures and have received prior approval from the electrical utility company.
	Be aware that only qualified personnel may connect the Enphase Microinverter to the utility grid.
	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.
	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 connector recess. Do not install the microinverter vertically, with the connectors facing up.
	Risk of Equipment Damage. The Enphase Microinverter is not protected from damage due to moisture trapped in cabling systems. Never mate microinverters to cables that have been left disconnected and exposed to wet conditions. This voids the Enphase warranty.
	Risk of Equipment Damage. The Enphase Microinverter functions only with a standard, compatible PV module with appropriate fill-factor, voltage, and current ratings. Unsupported devices include smart PV modules, fuel cells, wind or water turbines, DC generators, and non-Enphase batteries, etc. These devices do not behave like standard PV modules, so operation and compliance is not guaranteed. These devices may also damage the Enphase Microinverter by exceeding its electrical rating, making the system potentially unsafe.
	Risk of Equipment Damage. The S-Series Microinverter may be paired only with 60-cell PV modules.
	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.
	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.
	When installing the Engage Cable, secure any loose cable to minimise tripping hazard.

Safety Instructions

NOTES:

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

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

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

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

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

Check the labelling on the Engage Cable drop connectors to be sure that the cable matches the electrical utility service at the site. Use 400 VAC Engage Cable at sites with three-phase service, or use 230 VAC Engage Cable at sites with single-phase service.

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.

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

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

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

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.

When looping the Engage Cable, do not form loops smaller than 12 cm in diameter.

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

- Do not expose the terminator cap or cable connections to directed, pressurised 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 organiser.
- 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.

The Enphase Microinverter System

This manual details the safe installation and operation of the Enphase Microinverter.

The Enphase S-Series Microinverter System™ (S270-72-LN and S230-60-LN) is the world's most technologically advanced inverter system for use in utility-interactive (grid-connected) applications. This Enphase System maximises energy harvest, increases system reliability, and simplifies design, installation and management.

Built on the fifth-generation platform, the Enphase S-Series Microinverter achieves the highest inverter efficiency for module-level power electronics. The S-Series is compatible with storage systems, including battery management systems and is designed with advanced grid interaction features to meet utility requirements for distributed energy generation.

The productive, reliable, smart, and safe S-Series Microinverter family includes the:

- Enphase S270 Microinverter. The S270 Microinverter is rated at 260 VA continuous AC power with peak AC output power at 270 VA. The S270 is commonly paired with 72-cell and 60-cell PV Modules up to 350 watts STC.
- Enphase S230 Microinverter. The S230 Microinverter is rated at 220 VA continuous AC power with peak AC output power at 230 VA. The S230 is commonly paired with 60-cell PV Modules up to 285 watts STC.
- Enphase Envoy-S. The Envoy-S is a communications gateway that provides network access to the PV array. The Envoy-S collects production and performance data from the microinverters over on-site AC power lines and transmits the data to Enlighten through an Internet or cellular modem connection. The Envoy-S is capable of monitoring up to 600 Enphase Microinverters. Refer to the *Envoy-S Installation and Operations Manual* for details.
- Enphase Enlighten web-based monitoring and management software. Use Enlighten Manager to view detailed performance data, manage multiple PV systems, and remotely resolves issues that might impact system performance. Find out more at enphase.com/enlighten.
- Enphase Installer Toolkit mobile app for iOS and Android devices.
- 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. You can find details in the *Installer Toolkit Operation Manual*. You can use the app to:
    - Connect to the Envoy-S over a wireless network for faster system setup and verification.
    - View and email a summary report that confirms a successful installation.
    - Scan microinverter serial numbers and sync system information with Enlighten monitoring software.

How the Enphase Microinverter Works

The Enphase Microinverter converts the DC output of the PV module into grid-compliant AC power. In addition, the Enphase Microinverter maximises energy production by using a sophisticated Maximum Power Point Tracking (MPPT) algorithm. Each Enphase Microinverter individually connects to one PV module in your array. This configuration enables an individual MPPT to control each PV module, ensuring that 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. While an individual PV module in the array may be affected by shading, soiling, orientation, or PV module mismatch, each Enphase Microinverter ensures top performance for its associated PV module.

System Monitoring

Once you install the Envoy-S and provide an Ethernet connection to a broadband router or modem, the Enphase Microinverters automatically begin reporting to Enlighten. The Enlighten presents current and historical system performance trends, and informs you of PV system status.

Optimal Reliability

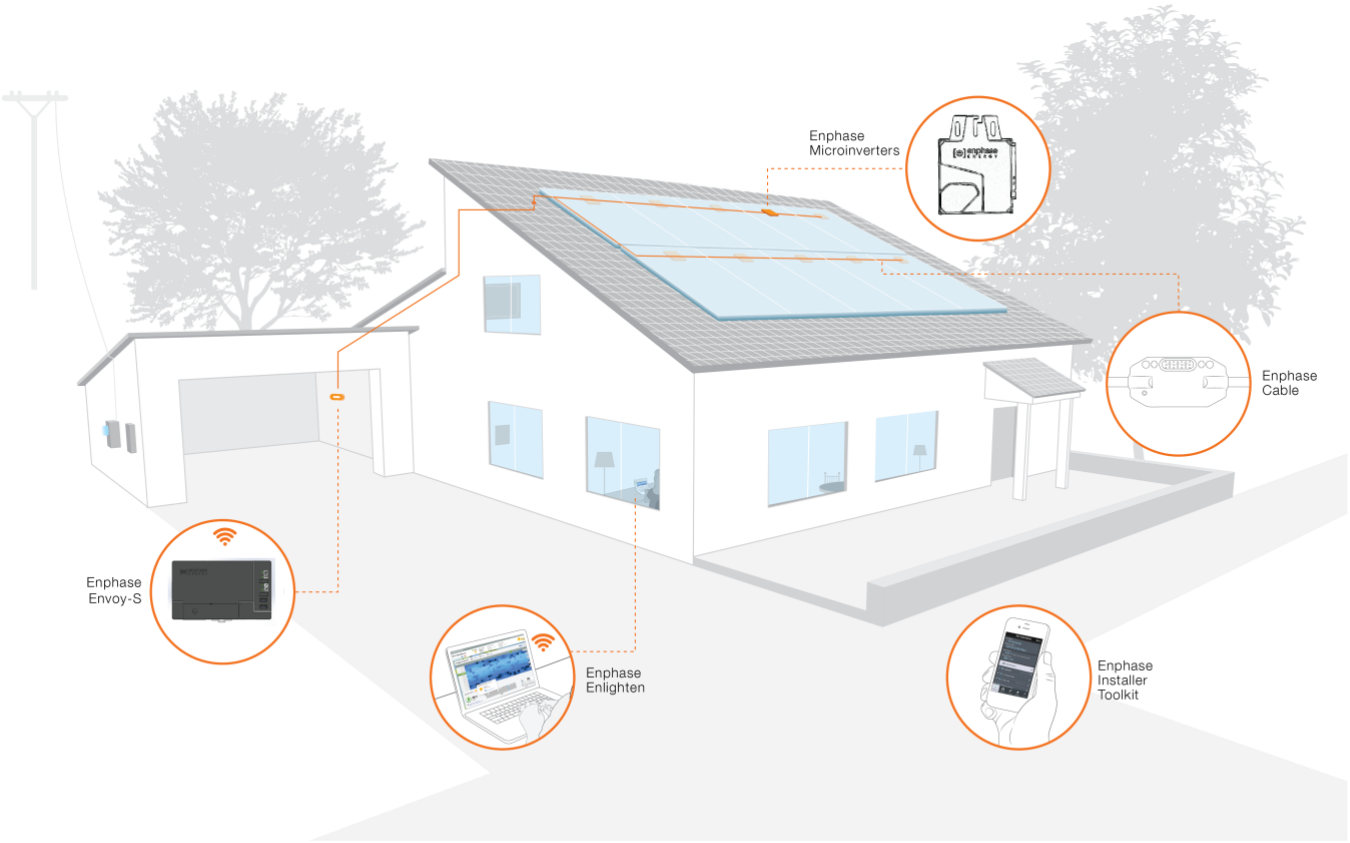
Microinverter systems are inherently more reliable than traditional inverters. The distributed nature of a microinverter system ensures that there is no single point of system failure in the PV system. Enphase Microinverters are designed to operate at full power at ambient temperatures as high as 65° C (150° F). The microinverter housing is designed for outdoor installation and complies with the IP67 environmental enclosure rating standard:

> ***IP67 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 Microinverter Installation

The Enphase Microinverter 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 Enphase Engage Cables. No additional cabling is needed.

Engage Cable is available in three connector spacing options and two voltage types to meet varying site requirements. For Engage Cable ordering information, see “Engage Cable Planning and Ordering” on page 28.

Compatibility

The Enphase S270 Microinverters are **electrically compatible** with most 60-cell and 72-cell PV modules. The Enphase S230 Microinverters are **electrically compatible** with most 60-cell PV modules. For more information, see “Technical Data” on page 31 of this manual.

Refer to the Enphase Compatibility Calculator at:

enphase.com/en-us/support/module-compatibility 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.

Compatibility Table

Model Number	Works with PV Module Type	PV Module Connector Type	Pre-set with Grid Profile
S230-60-2LN-5	60-cell, up to 285 W STC	Amphenol H4 connector	No
S230-60-2LN-5-AU	60-cell, up to 285 W STC	Amphenol H4 connector	AS/NZ 4777
S230-60-2LN-2	60-cell, up to 285 W STC	MC-4 locking connector	No
S230-60-2LN-2-AU	60-cell, up to 285 W STC	MC-4 locking connector	AS/NZ 4777
S270-72-2LN-5	60- and 72-cell, up to 350 W STC	Amphenol H4 connector	No
S270-72-2LN-5-AU	60- and 72-cell, up to 350 W STC	Amphenol H4 connector	AS/NZ 4777
S270-72-2LN-2	60- and 72-cell, up to 350 W STC	MC-4 locking connector	No
S270-72-2LN-2-AU	60- and 72-cell, up to 350 W STC	MC-4 locking connector	AS/NZ 4777

NOTE: Some Enphase Microinverters will not begin exporting power until the Envoy Communications Gateway is installed and has detected all of the microinverters at the site. In addition, the grid profile must be configured and the Envoy must have propagated these settings to the microinverters. For instructions on this procedure, refer to the *Envoy Installation and Operation Manual* at enphase.com/support.

Utility Service Requirements

The Enphase Microinverter works with single-phase 230 VAC service or with three-phase 400 VAC service. Measure AC line voltage at the electrical utility connection to confirm that it is within the ranges shown:

Single-Phase Service		Three-Phase Service	
L1 to neutral	207 to 253 VAC	L1 to L2 to L3	360 to 440 VAC
		L1, L2, L3 to neutral	207 to 253 VAC

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).

Service type	Maximum S230s per AC branch circuit
Single phase 230 VAC	17
Balanced three phase 400 VAC	48
Service type	**Maximum S270s per AC branch circuit**
Single phase 230 VAC	14
Balanced three phase 400 VAC	42

Wire Lengths and Voltage Rise

When planning the system, you must 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 centre. Enphase recommends a voltage rise total of less than 2% for the sections from the microinverter AC branch circuit to the breaker in the load centre.

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 single-phase system, the total resistance is equal to two times the one-way 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.

Enphase provides guidance about choosing wire size and maximum conductor lengths in the voltage rise Technical Brief at enphase.com/support. Refer to this brief for voltage rise values in Engage Cables and on how to calculate voltage rise in other wire sections of the system.

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

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.

Parts and Tools Required

In addition to the S-Series Microinverters, PV modules, and racking, you will need the following.

Additional Enphase Equipment and Items

- Enphase Envoy-S. For more information, refer to the *Envoy-S Installation and Operation Manual.*
- Enphase Installer Toolkit mobile app (optional, but strongly recommended)
- Engage Cable, as needed. (See “Engage Cable Planning and Ordering” on page 28)

NOTE: Order the correct Engage Cable type. Installers must order Engage Cable for either single-phase 230 VAC, typical for residential applications, or three-phase 400 VAC, typical for commercial installations. All drop connectors on the Engage Cable bear labels indicating the cable voltage designation.

- Cable clips
- Sealing caps, as needed (for any unused drops on the Engage Cable)
- Terminators, as needed (one needed at the end of each AC branch circuit)
- Enphase disconnect tool (you can substitute number 2 **and** 3 Phillips screwdrivers)

Other Items

- Outdoor-rated, weather-proof AC junction box(es)
- Gland or strain relief fitting (one per AC junction box)
- Number 2 Phillips screwdriver
- Number 3 Phillips screwdriver
- Torque wrench, sockets, wrenches for mounting hardware
- Adjustable wrench or open-ended wrench (for terminators)
- iOS (v7.0 or later) or Android (v4.2 or later) mobile device installed with Enphase Installer Toolkit

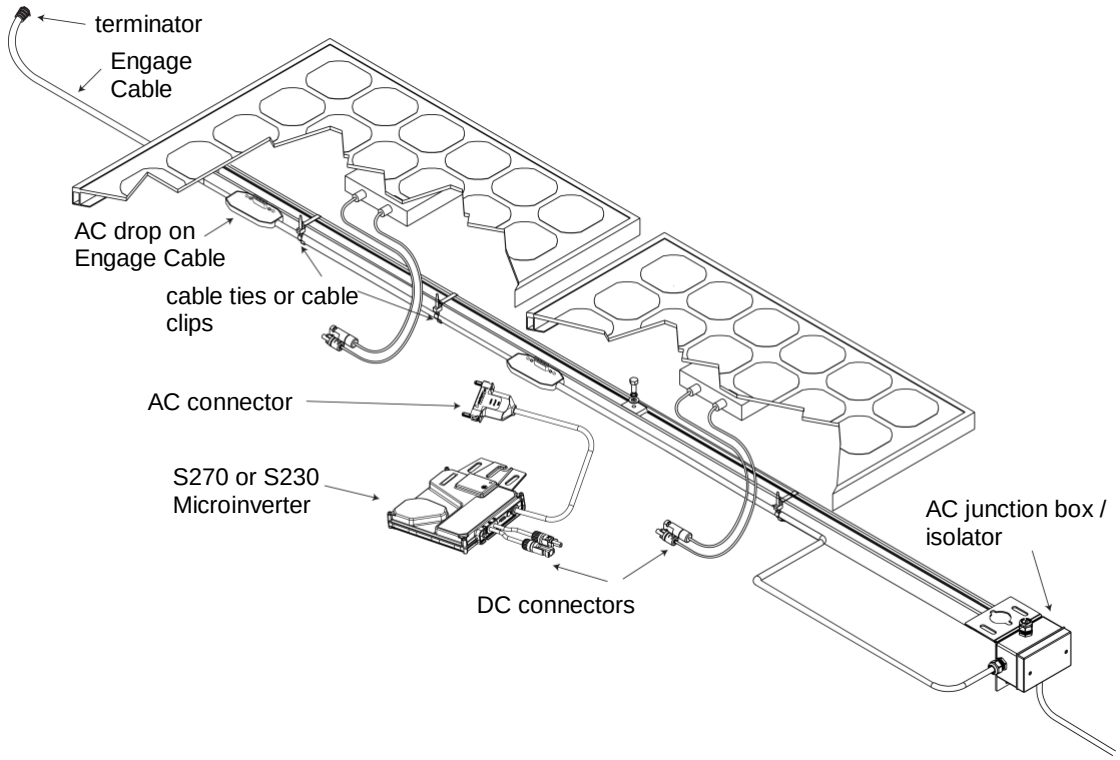
Enphase Microinverter System Installation

Enphase Microinverter System installation and activation involves these key steps. You can find detailed instructions for each step in the following pages. Follow the instructions in this section to install Enphase Microinverters.

Step 1: Position the Enphase Engage Cable
Step 2: Install an AC Junction Box
Step 3: Attach the Microinverters to the PV Rail
Step 4: Create an Installation Map
Step 5: Dress the Cable
Step 6: Connect the Microinverters
Step 7: Terminate the Unused End of the Engage Cable
Step 8: Connect to the AC Branch Circuit Junction Box
Step 9: Connect the PV Modules
Step 10: Energise the System
Step 11: Set Up and Activate System Monitoring

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

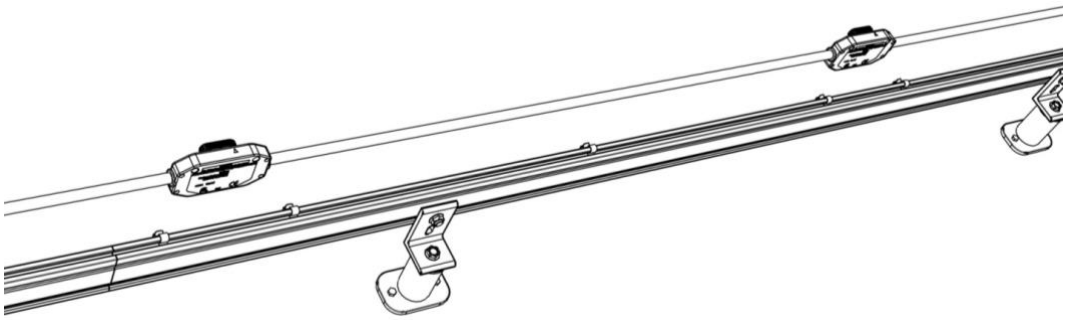
WARNING: DO NOT connect Enphase Microinverters to the utility grid or energise the AC circuit(s) until you have completed all of the installation procedures as described in the following sections.



Step 1: 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 28.

NOTE: Make sure you are using the correct cable type. Use 400 VAC Engage Cable at sites with three-phase service, or use 230 VAC Engage Cable at sites with single-phase service. Check the labelling on the drop connectors to verify the voltage type.



a. Plan the cable length to allow drop connectors on the Engage Cable to align with each PV module. Allow extra length for slack, cable turns and any obstructions.

b. Cut a length of Engage Cable to meet your planned needs.

c. Lay out the cabling along the installed racking for the AC branch circuit.

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

Service type	Maximum S230s per AC branch circuit
Single phase 230 VAC	17
Balanced three phase 400 VAC	24
Service type	**Maximum S270s per AC branch circuit**
Single phase 230 VAC	14
Balanced three phase 400 VAC	21

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

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 12 cm in diameter.

Step 2: Install the 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 10 of this manual.

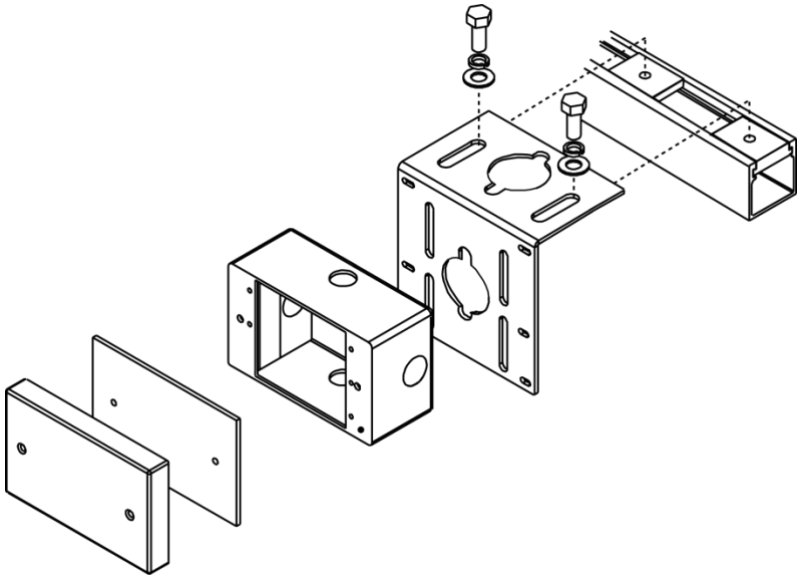
Best Practice: Make sure you have considered all components of system wiring, including internal voltage rise within the length of Engage Cable. Enphase provides guidance about choosing wire size and maximum conductor lengths in the voltage rise Technical Brief at enphase.com/support. Refer to this brief for voltage rise values in Engage Cables and on how to calculate voltage rise in other wire sections of the system.

a. Install an appropriately rated, off-the-shelf junction box at a suitable location. You can centre feed the branch, or you can install the junction box at the end of a row of PV modules.

Best Practice: Centre feed the branch circuit to minimise voltage rise in a fully-populated branch. This practice greatly reduces the voltage rise as compared with an end-fed branch. To centre-feed a branch, divide the circuit into two sub-branch circuits protected by a single overcurrent protection device (OCPD). Refer to the Voltage Rise technical briefs at enphase.com/support for more information.

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 centre.

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



Step 3: Attach the Microinverters to the PV Rail

a. Mark the approximate centres 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 between the roof and the bottom of the microinverter. Also allow 1.3 cm 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 connector recess. Do not install the microinverter vertically, with the connectors facing up.

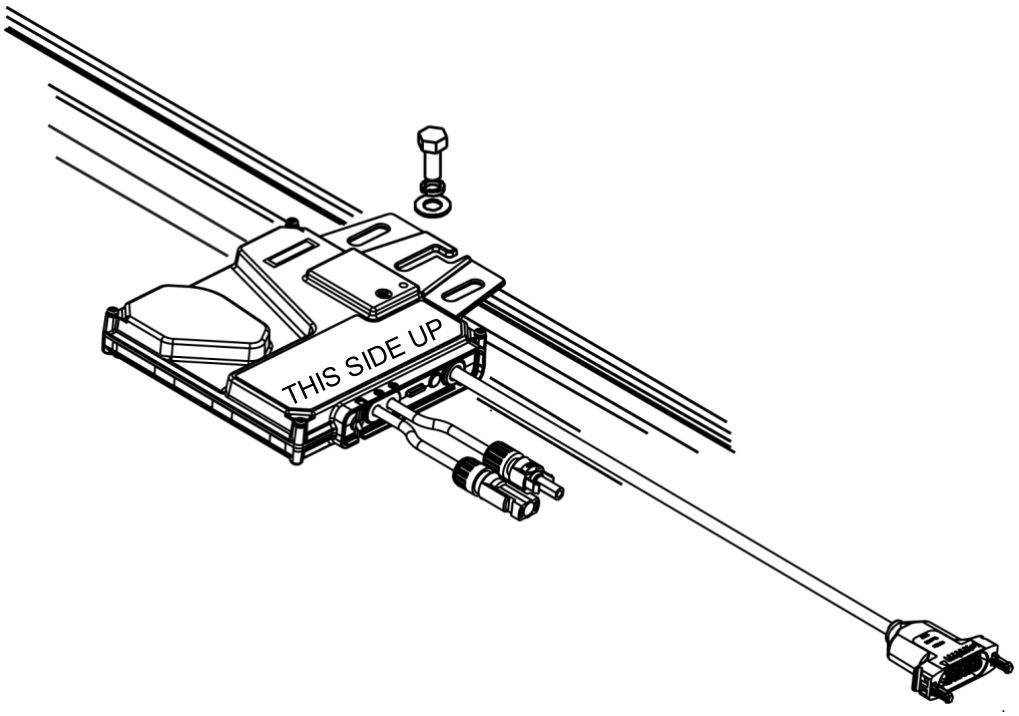
f. Mount one microinverter at each location using suitable hardware.

NOTE: Install the microinverter as shown, with the contoured side up. Failure to do so could allow the microinverter to come in contact with the PV module back sheet.

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

- 5 Nm for 6 mm hardware
- 9 Nm for 8 mm hardware

NOTE: Because of the risk of thread galling, do not use an impact driver to tighten the mounting hardware.



Step 4: Create an Installation Map

The Enphase Installation Map is a diagrammatic representation of the physical location of each microinverter in your PV installation. Copy or use the blank map on page 35 to record microinverter placement for the system, or provide your own layout if you require a larger or more intricate installation map.

Each Enphase Microinverter has a removable serial number label located on the mounting plate. Build the installation map by peeling the serial number labels from the microinverters and placing the labels on the map. You will also place the Envoy-S serial number on the map after Envoy-S installation.

After you have created the installation map, use the Enphase Installer Toolkit mobile app to record serial numbers and configure the system.

For Installer Toolkit details refer to “Detect the Microinverters” in the *Installer Toolkit Operation Manual* at enphase.com/support.

To manually build the Installation Map:

a. Copy or use the blank map on page 35 to record microinverter placement for the system, or provide your own layout if a larger or more intricate installation map is required.

b. Peel the removable serial number label from each microinverter and affix it to the respective location on the installation map.

c. Scan the serial numbers from the installation map as instructed by the *Installer Toolkit Operation Manual* at enphase.com/support.

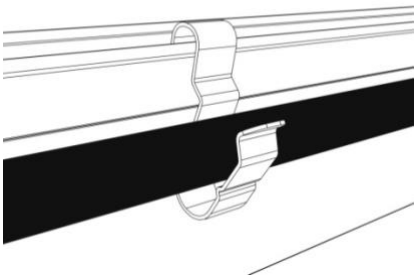
d. Always keep a copy of the installation map for your records.

Step 5: 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.

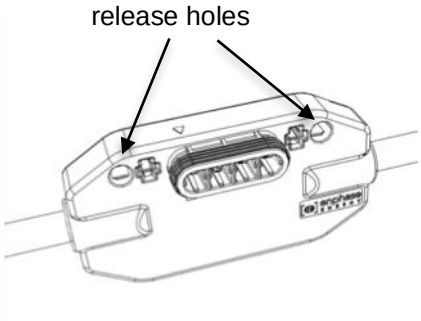
a. Attach the Engage Cable to the PV racking using cable clips, or you cable ties. Some cable clips are designed so that the cable from the microinverter can also be dressed into the clip underneath the Engage Cable.



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 cable ties or clips on either side of the connector. Use one or two additional clips, cable ties, or other support scheme to secure the cable between connectors.

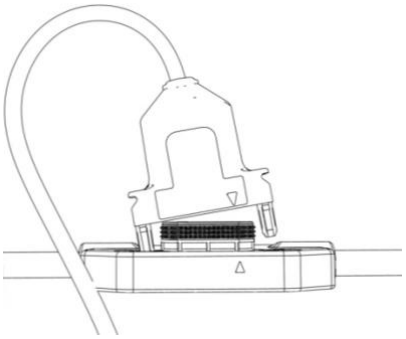


NOTE: When looping the Engage Cable, do not form loops smaller than 12 cm in diameter.

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

Step 6: 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.

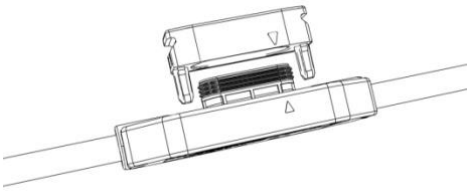


b. Repeat for all microinverters in the AC branch circuit.

c. Cover any unused connector with a sealing cap. Listen for two clicks as the sealing cap engages. Ensure that **both** latching mechanisms have engaged.

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.

NOTE: **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.



d. Avoid skipping Engage Cable connectors. Instead, use an Engage Coupler to connect two Engage Cables or to connect Engage Cable to field cable.

NOTE: On a three-phase system, unused cable connectors create a phase imbalance on the branch circuit. If you skip multiple cable connectors over multiple branch circuits, the imbalance can multiply.

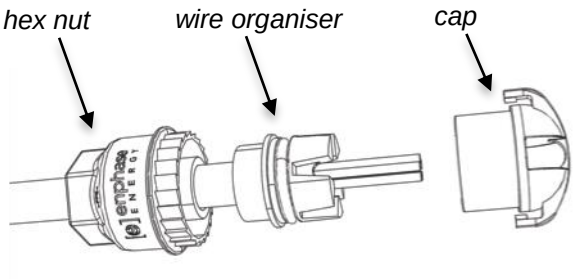
WARNING: Risk of electric shock. Risk of fire. Make sure protective sealing caps have been installed on **all** unused AC connectors. Unused AC connectors are live when the system is energised by the utility system. **Sealing caps may not be reused.**

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 25.

Step 7: 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.

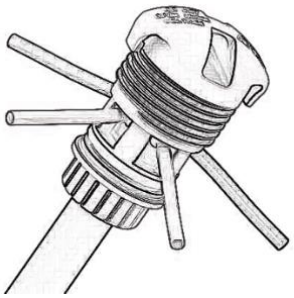


a. Remove 60 mm of the shielding from the conductors.

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 organiser (up to the stop).

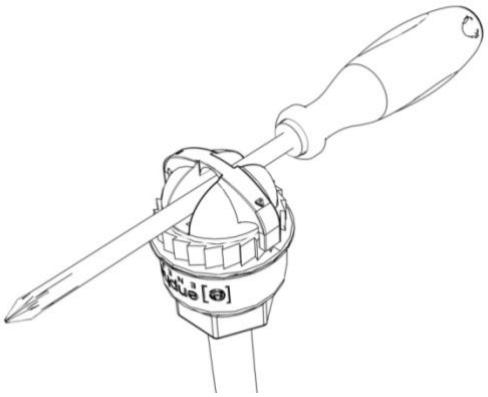


e. Bend the individual wires back into the recesses in the wire organiser so that they angle back toward the cable.

f. Cut the individual wires so that no excess extends outside of the wire organiser. 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 organiser and flush with the edge of the cap.

g. Place cap over the wire organiser.

h. Hold the cap stationary with an Enphase disconnect tool or a screwdriver.



i. Use a 22 mm 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. Attach the terminated cable end to the PV racking with a cable tie or cable clip, so that the Engage Cable and terminator do not touch the roof.

k. Ensure that all cabling is located underneath the PV module.

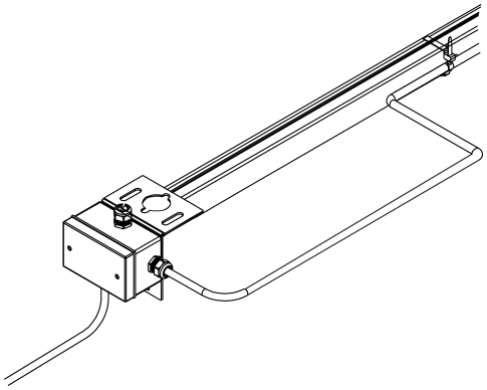
Step 8: Connect to an AC Junction Box or Isolator

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

DANGER: Risk of electric shock. Treat all connector contacts as though they are live. The 400 VAC Engage Cable drop connector contains two live phases.

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 10 of this manual.



a. Connect Engage Cable into the AC branch circuit junction box or isolator using an appropriate gland or strain relief fitting. The Engage Cable requires a strain relief connector (if used) with an opening of 1.3 cm in diameter.

b. 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 36 for more information.

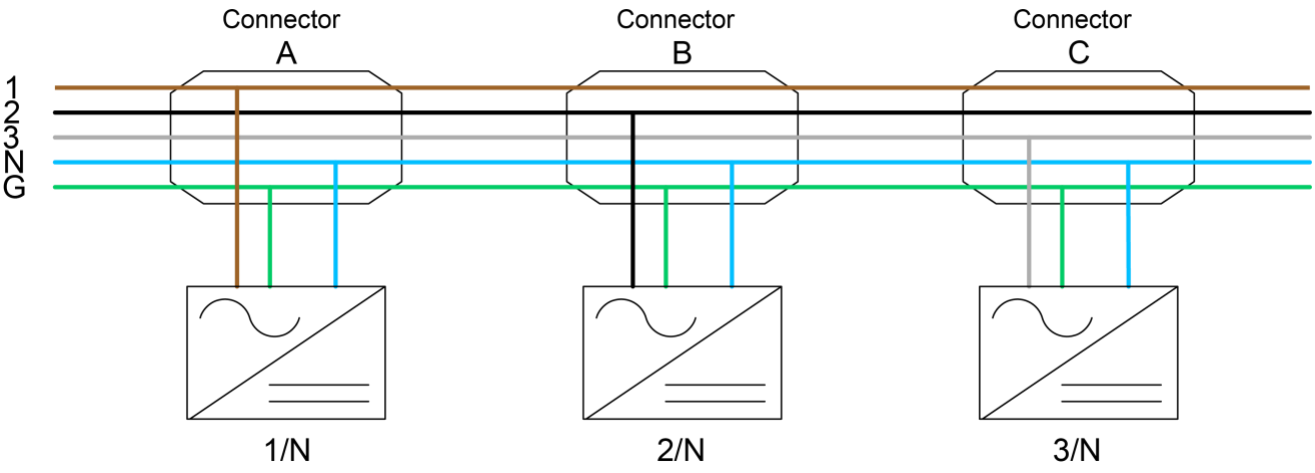
Wire colours are listed in the following table.

230 VAC single-phase	400 VAC three-phase
L1 – Brown	L1 – Brown
(not present)	L2 – Black
(not present)	L3 – Grey
Neutral – Blue	Neutral – Blue
Earth – Green/PE acts as protective earth (PE)	Earth – Green/PE acts as protective earth (PE)

Connecting Microinverters to Balanced Three-Phase

WARNING: Risk of Equipment Damage. You must connect the each wire from the Engage Cable to the proper phase. See conductor colours in the table above. Do not connect microinverters Line-to-Line in 400 VAC three-phase installations. The 400 VAC cable contains two live phases.

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



Step 9: Connect the PV Modules

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

WARNING: PV modules paired with the **S-Series Microinverter** must have DC conductors that are labelled "PV Wire" or "PV Cable" to be compliant with NEC 690.35(D) for Unearthed PV Power Systems.

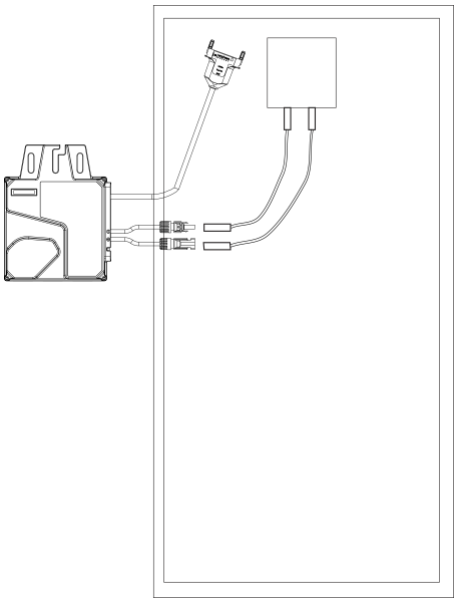
NOTE: Completely install all microinverters and all system AC connections prior to installing the PV modules.

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 side of the microinverter. The LED flashes six times. The LED flashes six time at start-up. All green flashes indicate normal start up.



Microinverter LED during Normal Operation	
LED	**Indicates**
Flashing green	Normal operation. The AC grid function is normal and there is communication with the Envoy-S.
Flashing orange	The AC grid is normal but there is NO communication with the Envoy-S.
Flashing red	The AC grid is not within specification or the grid profile is not set.
Solid red	There is a registered DC input ground (earth) resistance fault.

Step 10: Energise the System

WARNING: Risk of electric shock. Risk of fire. Only qualified personnel 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. If applicable, turn ON the AC supply to the microinverters.

b. 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-S. 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 11: Set Up and Activate Monitoring

After you have installed the microinverters, refer to *Envoy-S Quick Install Guide* or the *Envoy Installation and Operations Manual* to install the Envoy-S and set up system monitoring to complete the PV installation.

The high-level steps to complete the PV installation are:

a. Connect and energise the Envoy-S.

b. Detect the microinverters.

c. Connect to Enlighten.

d. Register the system in Enlighten.

If the microinverter you are installing is not pre-loaded with a grid profile, you must select an appropriate grid profile for your installation. You can set the grid profile through Enlighten during system registration or through the Installer Toolkit mobile app at any time. The following table lists microinverter models and grid profile status.

Model Number	Pre-set with Grid Profile / Profile type
S230-60-2LN-5	No – you must configure a profile
S230-60-2LN-5-AU	Pre-set with AS/NZ 4777
S230-60-2LN-2	No – you must configure a profile
S230-60-2LN-2-AU	Pre-set with AS/NZ 4777
S270-72-2LN-5	No – you must configure a profile
S270-72-2LN-5-AU	Pre-set with AS/NZ 4777
S270-72-2LN-2	No – you must configure a profile
S270-72-2LN-2-AU	Pre-set with AS/NZ 4777

e. Log into Enlighten and use Array Builder to build the virtual array.

Refer to the *Envoy-S Quick Install Guide* or the *Envoy Installation and Operations Manual* for instructions on how to configure a grid profile for your system.

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.

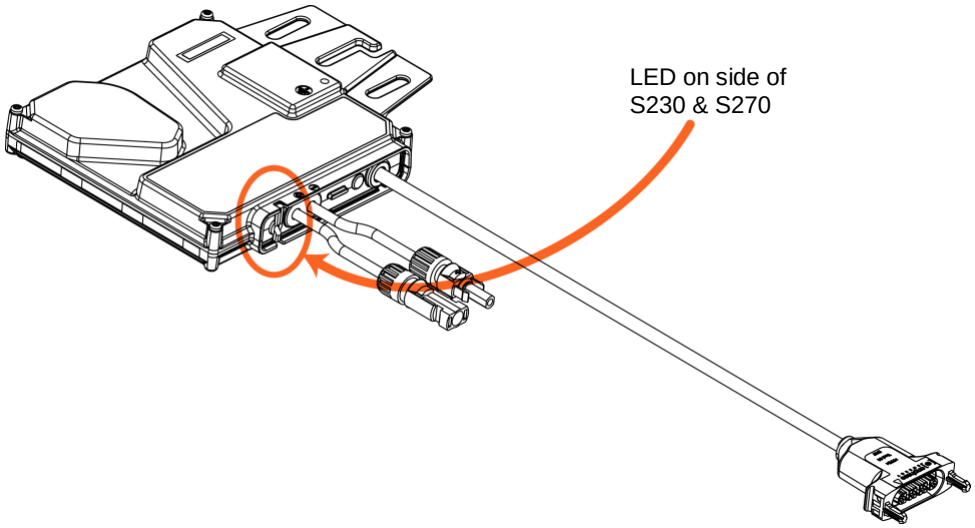
WARNING: Risk of electric shock. Do not attempt to repair the Enphase Microinverter; it contains no user-serviceable parts. If it fails, contact Enphase customer service to obtain an RMA (return merchandise authorization) number and start the replacement process.

Status LED Indications and Error Reporting

Start-up LED Operation

The status LED on the side of each microinverter lights green about six seconds after DC power is applied. The LED flashes six times, all green flashes indicate normal start-up. After that, red blinks indicate that no grid is present if the system is not yet energised.

Six short red blinks after DC power is first applied to the microinverter indicate a failure during microinverter start-up.



Post-Start-up LED Indications

View the indicator light on the side of the S230 or S270.

Microinverter LED during Normal Operation	
LED	**Indicates**
Flashing green	Normal operation. The AC grid function is active and there is communication with the Envoy-S.
Flashing orange	The AC grid is normal but there is NO communication with the Envoy-S.
Flashing red	The AC grid is not within specification.
Solid red	There is a registered DC input ground (earth) resistance fault.

Faults

All faults are reported to the Envoy. Refer to the *Envoy-S Installation and Operation Manual* at enphase.com/support for troubleshooting procedures.

Troubleshoot an Inoperable Microinverter

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

DANGER: Risk of electric shock. Always de-energise 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 centre and sub-boards 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:

Single-Phase Service		Three-Phase Service	
L1 to neutral	207 to 253 VAC	L1 to L2 to L3	360 to 440 VAC
		L1, L2, L3 to neutral	207 to 253 VAC

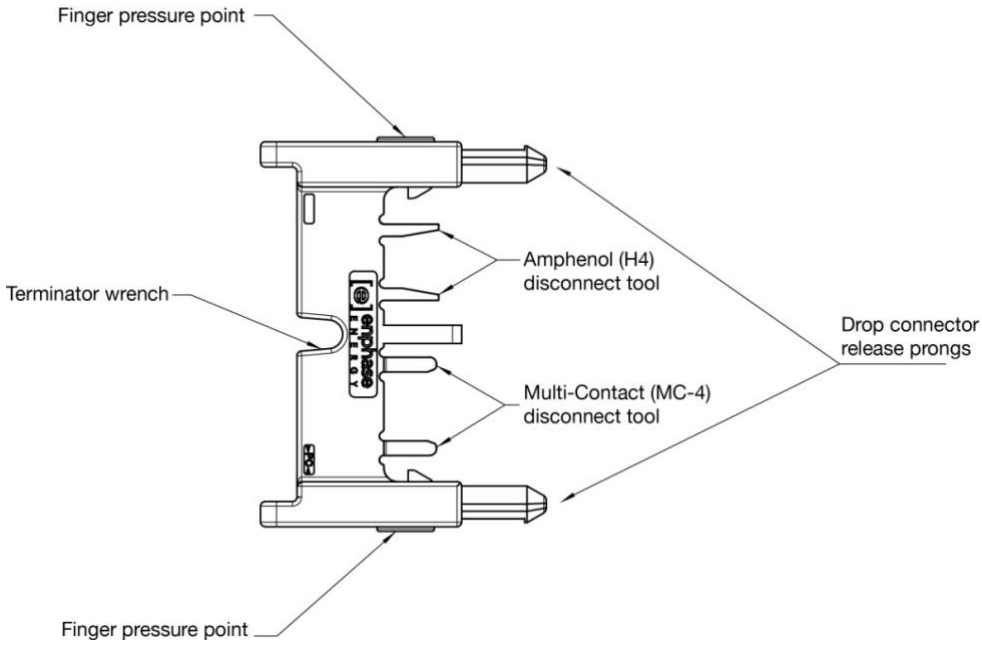
5. Using an Enphase disconnect tool, disconnect the AC cable for the microinverter in question from the Engage Cable.
6. Verify that utility power is present at the microinverter by measuring line to line and line to neutral at the Engage Cable connector.
7. Visually check that the AC branch circuit 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 23 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 31 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 Customer Support at enphase.com/global/support-request.

Disconnect a Microinverter

If problems remain after following the troubleshooting steps listed previously, contact Enphase at enphase.com/global/support-request. If Enphase authorises 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-energise 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 Engage 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. 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 at enphase.com/global/support-request. If Enphase authorises a replacement (RMA), replace the microinverter as follows:

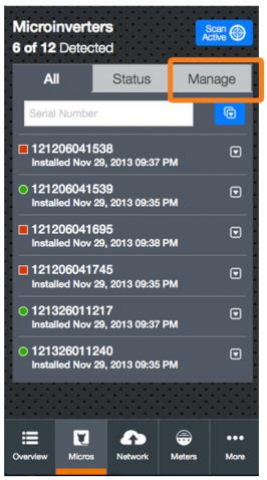
1. When the replacement microinverter is available, verify that the AC branch circuit breaker is de-energised.
2. Attach the replacement microinverter to the PV racking using hardware recommended by your PV racking vendor.

WARNING: Risk of equipment damage. You must install the Enphase Microinverter contour side up, under the module, and 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 connector recess. Do not install the microinverter vertically, with the connectors facing up.

3. Torque the microinverter fasteners to the values shown. Do not over torque.
   - 6 mm mounting hardware: 5 N m
   - 8 mm mounting hardware: 9 N m

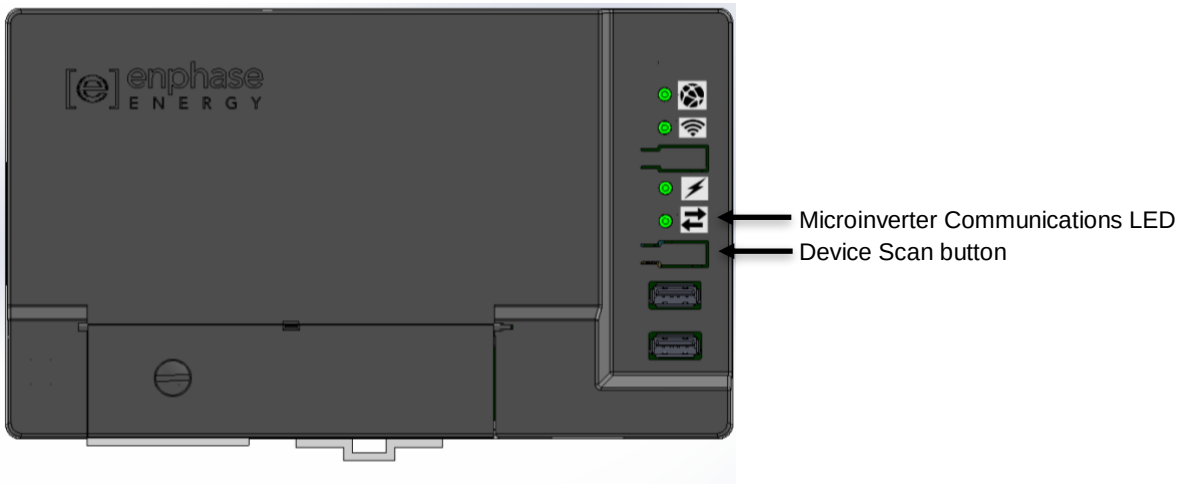
NOTE: Using an impact driver to tighten the fasteners is not recommended due to the risk of thread galling.

4. If you are using earthing washers (e.g., WEEB) to provide earth (EGC) from the microinverter to other exposed metal such as racking and modules, discard the old earthing washer and use a new earthing washer when installing the replacement microinverter.
5. 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.
6. Mount the PV module above the microinverter.
7. Mate the microinverter and PV module as required.
8. Energise the AC branch circuit breaker, and verify operation of the replacement microinverter by checking the indicator light on the side of the microinverter.
9. Use the Installer Toolkit mobile app to delete the old microinverter serial number from the Envoy-S database. In Installer Toolkit:
   a. Tap **Micros** > **Manage**.



   b. Tap the checkbox to the right of the microinverter serial number that you replaced.
   c. Tap to delete the microinverter from the Envoy-S database.

10. To add the new microinverter serial number, initiate a device scan by pressing the **Device Scan** button on the Envoy-S. The Envoy-S begins a 15-minute scan to identify all of the microinverters deployed at the site. The Microinverter Communications LED ⇆ flashes green during the scan.
11. Log into Enlighten to check for the new microinverter, and use Array Builder to add the new microinverter to the virtual array.



12. After the microinverter is detected, disable the scan. To do this, press the Envoy-S **Device Scan** button again.

    Alternatively, you can initiate a scan using the Installer Toolkit mobile app. For more information, access the Installer Toolkit help topics on your mobile device.

13. Ship the old microinverter to Enphase using the supplied return-shipping label.

Engage Cable Planning and Ordering

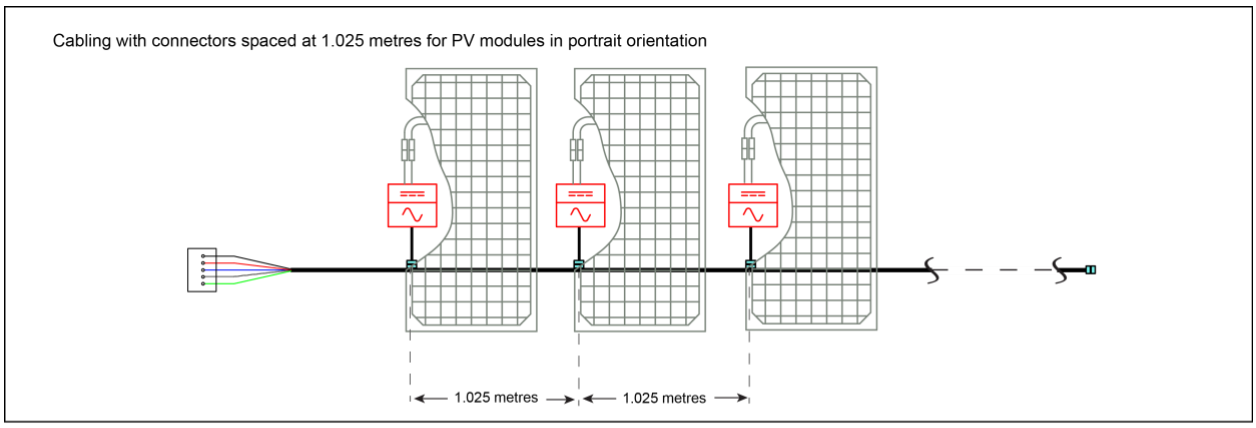
Enphase Engage Cable is a continuous length of outdoor-rated cable with integrated connectors for microinverters. These connectors are preinstalled along the Engage Cable at intervals to accommodate varying PV module widths. The microinverters plug directly into the cable connectors.

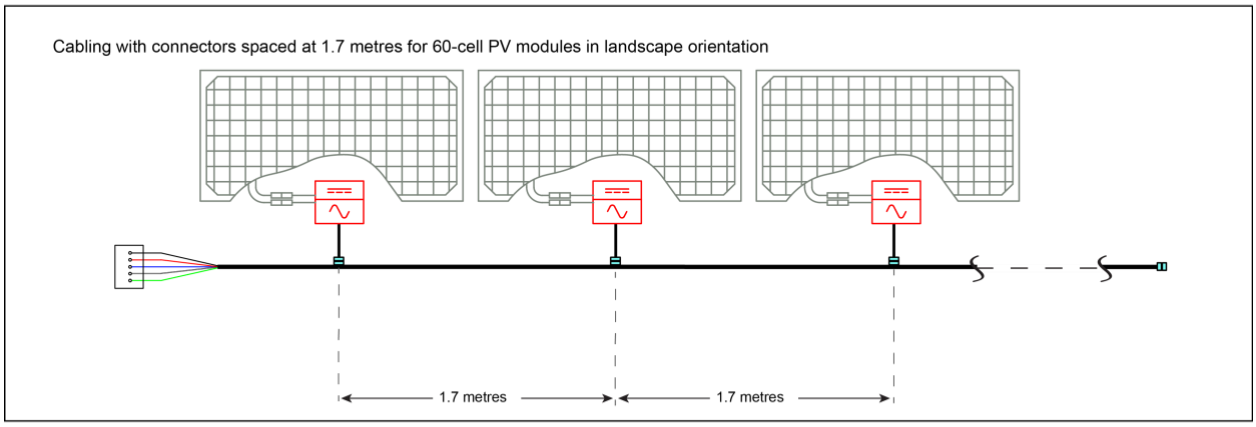
The cabling is compatible with a variety of PV racking systems. For a list of approved PV racking systems, refer to the PV Racking Compatibility document on the Enphase website (enphase.com/support).

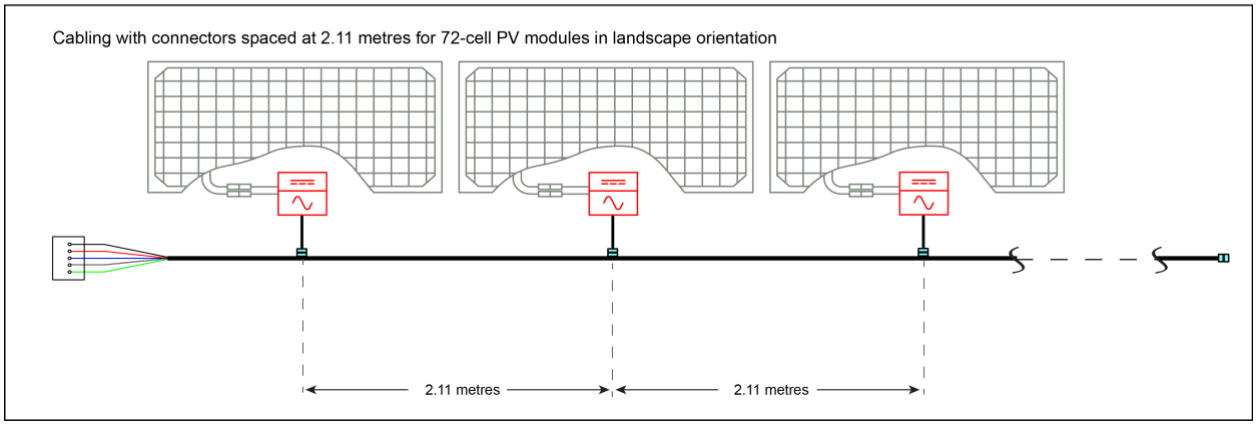
Engage Cable is available in different voltage types and connector spacing options. Depending upon installer needs, the cable is also available in different lengths.

Connector Spacing Options

Engage Cable for S230 and S270 is available in three connector spacing options. The gap between connectors on the cable is either 1.025 meters, or 1.7 meters, or 2.11 meters. The 1.025-meter spacing is best suited for connecting PV modules installed in portrait orientation. The 1.7-meter spacing allows you to install 60-cell PV modules in landscape orientation, while the 2.11-meter spacing allows you to install 72-cell PV modules in landscape orientation.







Voltage Type and Conductor Count Options

The voltage types are either 230 VAC single phase or 400 VAC three phase. **All cable connectors bear labels indicating the cable voltage designation.** Typically used for residential applications, 230 VAC includes four conductors. Three-phase 400 VAC cabling includes five conductors, and is used for most commercial installations. Because Enphase microinverters output onto two phases, three phase cabling balances the phases by rotating conductor use from one microinverter to the next as shown on page 20.

Cabling Length Options

Engage Cabling is available in shorter lengths with 30-40 connectors, depending upon voltage type. Longer lengths can be ordered and cut to suit per order. Cable is also available with C2 rating. Ordering options include:

Model Number	Voltage/ conductors	Connector count	Connector spacing	PV module orientation
ET10-230-40 ET10-230-40-C2	230 Vac, 3 conductors	40	1.025 m (40”)	Portrait
ET10-230-BULK ET10-230-BULK-C2	230 Vac, 3 conductors	240	1.025 m (40”)	Portrait
ET10-400-30 ET10-400-30-C2	400 Vac, 5 conductors	30	1.025 m (40”)	Portrait
ET10-400-BULK ET10-400-BULK-C2	400 Vac, 5 conductors	240	1.025 m (40”)	Portrait
ET17-230-40 ET17-230-40-C2	230 Vac, 3 conductors	40	1.7 m (67”)	Landscape
ET17-230-BULK ET17-230-BULK-C2	230 Vac, 3 conductors	240	1.7 m (67”)	Landscape
ET17-400-30 ET17-400-30-C2	400 Vac, 5 conductors	30	1.7 m (67”)	Landscape
ET17-400-BULK ET17-400-BULK-C2	400 Vac, 5 conductors	240	1.7 m (67”)	Landscape
ET21-230-192-2.5mm	230 Vac, 3 conductors	192	2.11 m (83”)	Landscape
ET21-400-192-2.5mm ET21-400-192-C2-2.5mm	400 Vac, 5 conductors	192	2.11 m (83”)	Landscape

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.

- **Minimise 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:
    - Make use of leftover lengths of Engage Cable
    - Transition between portrait and landscape Engage Cable

  - Engage Cable to Field Cable (such as Engage Cable, H07BQ-F, U-1000 RO2V, FG7OR, NYY-J):
    - Transition between sub-arrays on the same circuit
    - Create wiring extensions for Engage Cable

  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 rise at 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 planning cabling turns or loops, do not form loops smaller than 12 cm.

- **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-metre 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-metre or 2.11-metre spacing between connectors results in cleanest install for PV modules in landscape orientation, but requires that any additional cable length between PV modules in portrait orientation be coiled and dressed so that cabling does not contact the roof. Cover unused connectors with Enphase watertight sealing caps.
  3. Transition between 1.025 and 1.7-metre or 2.11-metre spaced cable using an outdoor-rated junction box. Install this junction box to the PV racking.

Technical Data

Technical Considerations

Be sure to apply the following considerations when installing S-Series Microinverters:

- PV modules paired with **S230** or **S270 Microinverters** must have conductors labelled "PV Wire" or "PV Cable".
- Verify that the voltage and current specifications of the 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 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.

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).

Specifications

The following tables lists specifications for:

- S230 Microinverter
- S270 Microinverter
- Engage Cable

S230 Microinverter Specifications

S230-60-LN-2-AU, S230-60-LN-2-AU, S230-60-LN-5, S230-60-LN-5-AU				
Topic	**Unit**	**Min**	**Typical**	**Max**
DC Parameters				
Peak power tracking voltage range	V	27	32	37
Operating range	V	16	32	48
Maximum input DC voltage	V			48
Minimum / Maximum start voltage	V	22		48
Maximum DC input short circuit current	A			15
Maximum input continuous current	A			10
Decisive voltage class (DC circuits)			DVC-A	
AC Parameters				
Maximum (continuous) AC output power (-40°C to +65°C)	VA		220	
Peak AC output power	VA		230	
Power factor (adjustable)	1, 0.7 leading…0.7 lagging			
Nominal AC output voltage range	V	184	230	276
Nominal AC output current	A		0.95	
Nominal AC output frequency range	Hz	45	50	55
Extended AC output frequency range	Hz	57		63
Maximum AC output over current protection device	A		20	
Maximum AC output fault current (source)	49 Apk < 10 µs, 12 Arms 3 cycles			
Current (inrush)	0 A			
AC backfeed current to module	0 mA			
High AC Voltage trip limit accuracy	%		±1.0	
Low AC Voltage trip limit accuracy	%		±1.0	
Frequency trip limit accuracy	Hz		±0.1	
Trip time accuracy	ms		±33	
Protective class / over voltage category (OVC)			I / 3	
Decisive voltage class (AC circuits)			DVC-C	
Miscellaneous Parameters				
Maximum microinverters per 20 A AC branch circuit 230 VAC (split phase) 400 VAC (three phase)				 17 48[1]
EU weighted inverter efficiency (EN50530)	%		95.8	
Static MPPT efficiency (weighted, ref EN 50530)	%		99.5	
Total harmonic distortion	%		2.0	3.0
Ambient temperature range	°C	-40		+65
Storage temperature range	°C	-40		+65
Night time power consumption	mW			50
Humidity range	%		0 – 100	
Features and Specifications				
Compatibility	60-cell PV modules only			
Dimensions not including mounting bracket	172 mm x 175 mm x 35 mm			
Weight	1.8 kg			
Enclosure environmental rating	Outdoor – IP67			
Torque specifications for fasteners (Do not over torque.)	- 6 mm mounting hardware: 5 N·m - 8 mm mounting hardware: 9 N·m			
Cooling	Natural convection: no fans			
Communication	Power line			
Standard warranty term	enphase.com/warranty			
Compliance	AS/NZS 4777.2:2005, AS/NZS 4777.3:2005, AS/NZS 4777.2:2015, RCM, IEC/EN 61000-6-3, IEC/EN 62019-1, IEC/EN 62109-2			

[1] To avoid potential phase imbalance, minimise the number of unused connectors with three-phase systems. See “Planning for Cable Lengths and Type” on page 34 for more information.

S230-60-LN-2-AU, S230-60-LN-2-AU, S230-60-LN-5, S230-60-LN-5-AU				
Topic	**Unit**	**Min**	**Typical**	**Max**
Integrated ground (earth) -- no GEC required)	Ground (earth) fault protection (GFP) is integrated into the microinverter.			
Automatic disconnect	Automatic disconnect according to VDE 0126-1-1			
Network and system protection	Meets VDE-AR-N 4105, including single-fault tolerance per Annex A.6			
Active anti-islanding method	Impedance change detection via monitoring of harmonics			

S270 Microinverter Specifications

S270-72-LN-2, S270-72-LN-2-AU, S270-72-LN-5, S270-72-LN-5-AU				
Topic	**Unit**	**Min**	**Typical**	**Max**
DC Parameters				
Peak power tracking voltage range	V	27	32	37
Operating range	V	16	32	48
Maximum DC input voltage	V			48
Minimum / Maximum start voltage	V	22		48
Maximum DC input short circuit current	A			15
Maximum input continuous current	A			12
Decisive voltage class (DC circuits)			DVC-A	
AC Parameters				
Rated (continuous) AC output power (-40°C to +65°C)	W		270	
Peak AC output power	W		280	
Power factor (adjustable)	1, 0.7 lagging…0.7 leading			
Nominal AC output voltage range	V	184	230	276
Nominal AC output current	A		1.15	
Nominal AC output frequency range	Hz	57	60	61
Extended AC output frequency range	Hz	57		63
Maximum AC output over current protection device	A		20	
Maximum AC output fault current (source)	49 Apk < 10 µs, 12 Arms 3 cycles			
Current (inrush)	0 A			
AC backfeed current to module	0 mA			
High AC Voltage trip limit accuracy	%		±1.0	
Low AC Voltage trip limit accuracy	%		±1.0	
Frequency trip limit accuracy	Hz		±0.1	
Trip time accuracy	ms		±33	
Protective class / over voltage category (OVC)			I / 3	
Decisive voltage class (AC circuits)			DVC-C	
Miscellaneous Parameters				
Maximum microinverters per 20 amp AC branch circuit 230 VAC (split phase) 400 VAC (three phase)				 14 42[2]
EU weighted inverter efficiency (EN50530)	%		95.6	
Static MPPT efficiency (weighted, ref EN 50530)	%		99.5	
Total harmonic distortion	%		2.0	3.0
Ambient temperature range	°C	-40		+65
Storage temperature range	°C	-40		+65
Night time power consumption	mW			50
Humidity range	%		0 – 100	
Features and Specifications				
Compatibility	Pairs with most 72- and 60-cell PV modules.			
Dimensions not including mounting bracket (approximate)	172 mm x 175 mm x 35 mm			
Weight	1.8 kg			

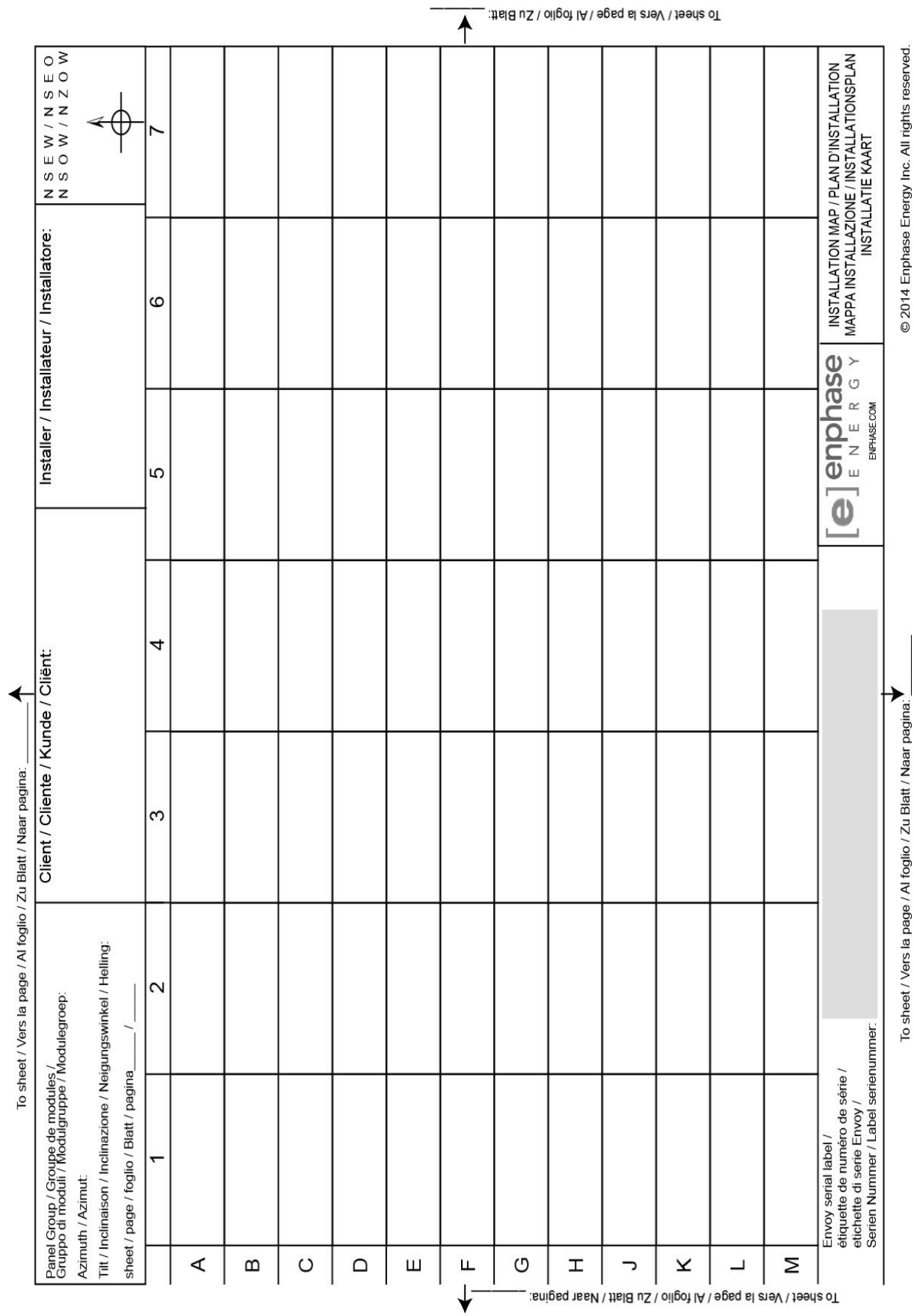
[2] To avoid potential phase imbalance, minimise the number of unused connectors with three-phase systems. See “Planning for Cable Lengths and Type” on page 34 for more information.

S270-72-LN-2, S270-72-LN-2-AU, S270-72-LN-5, S270-72-LN-5-AU				
Topic	**Unit**	**Min**	**Typical**	**Max**
Enclosure environmental rating	Outdoor – IP67			
Torque specifications for fasteners (Do not over torque.)	- 6 mm mounting hardware: 5 N·m - 8 mm mounting hardware: 9 N·m			
Cooling	Natural convection: no fans			
Communication	Power line			
Standard warranty term	enphase.com/warranty			
Compliance	AS/NZS 4777.2:2005, AS/NZS 4777.3:2005, AS/NZS 4777.2:2015, RCM, IEC/EN 61000-6-3, IEC/EN 62019-1, IEC/EN 62109-2			
Integrated ground (earth) -- no GEC required)	Ground (earth) fault protection (GFP) is integrated into the microinverter.			
Automatic disconnect	Automatic disconnect according to VDE 0126-1-1			
Network and system protection	Meets VDE-AR-N 4105, including single-fault tolerance per Annex A.6			
Active anti-islanding method	Impedance change detection via monitoring of harmonics			

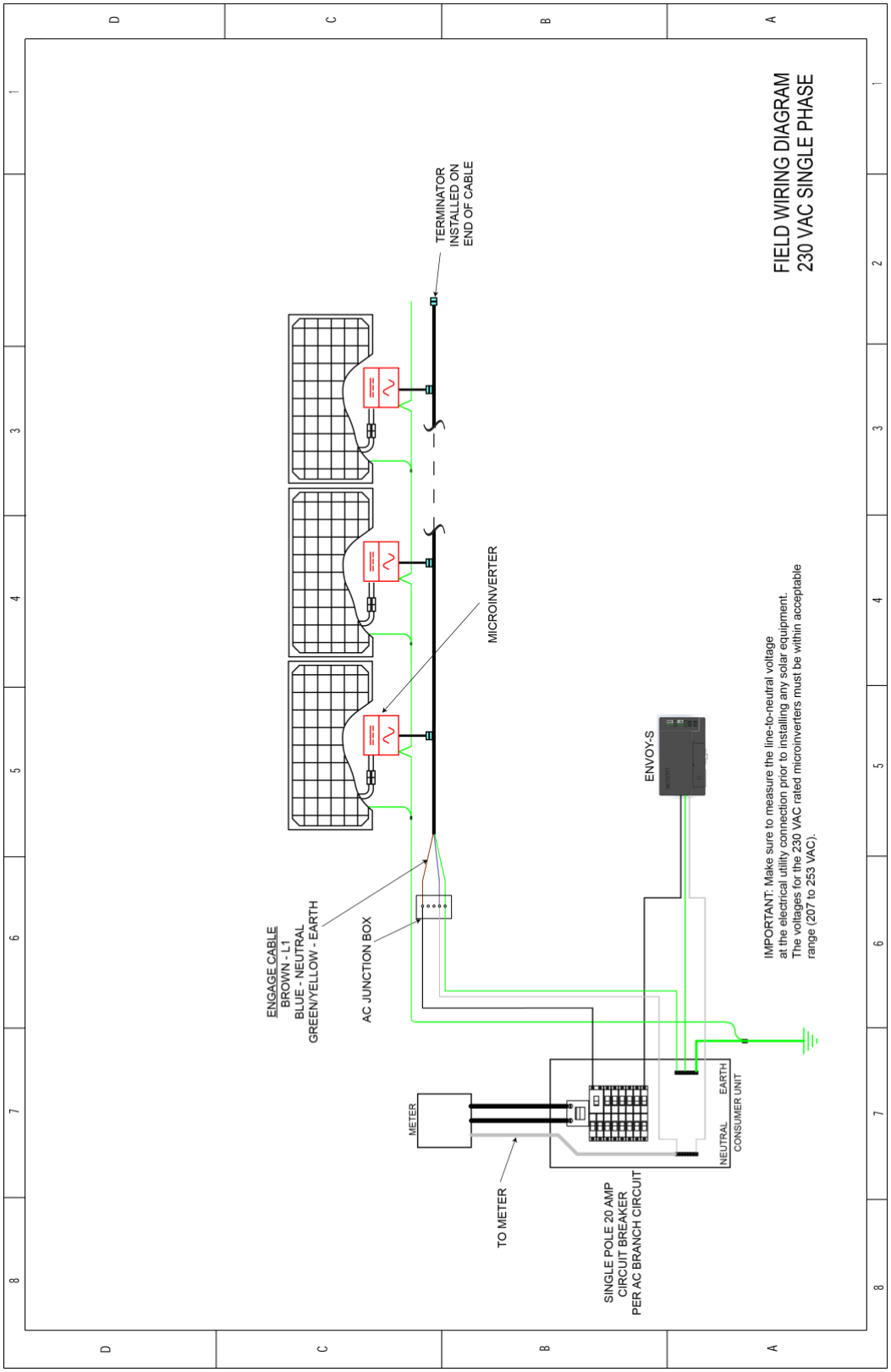
Engage Cable Specifications

Engage Cable Specifications	
Specification	**Value**
System temperature range (ambient)	-40ºC to +65ºC
Cable temperature rating	90ºC Dry / 90ºC Wet
VDE License for 230V Cable	40033278
Engage Cable	H07BQ-F for 230 Vac
Environmental protection rating	IEC 60529 IP67
UV exposure	EN ISO 4892-2
Conductor gauge	Single-phase 3G2,5 mm^2 Three-phase 5G2,5 mm^2
Maximum current carrying capacity of the Cable Single-phase 230 Vac Three-phase 400 Vac	 20 amperes 16 amperes
Engage Cable bundle diameter	1.1 cm
Drop connector dimensions	11.8 cm x 6.0 cm x 3.2 cm
Terminator dimensions	3.6 cm diameter x 5.1 cm tall

Enphase Installation Map



Sample Wiring Diagram: 230 VAC, Single-Phase



Sample Wiring Diagram: 400 VAC, Three-Phase