

# Installing Enphase S-Series Microinverters

To install the Enphase S230 and S280 Microinverters™, read and follow all warnings and instructions in this guide and in the *Enphase S230 and S280 Microinverter Installation and Operation Manual* at: [enphase.com/support](http://enphase.com/support). Safety warnings are listed on the back of this guide.

The Enphase Microinverter models listed in this guide do not require a grounding electrode conductor (GEC) between microinverters because ground fault protection (GFP) is integrated into the microinverter. To support GFP, use only PV modules equipped with DC cables labeled **PV Wire** or **PV Cable**.

## PREPARATION

- A) Download the Enphase Installer Toolkit™ mobile app and open it to log in to your Enlighten account. With this app, you can scan microinverter serial numbers and connect to the Envoy-S to track system installation progress. To download, go to [enphase.com/toolkit](http://enphase.com/toolkit) or scan the QR code at right.



- B) Refer to the following table and check PV module electrical compatibility calculator at: [enphase.com/en-us/support/module-compatibility](http://enphase.com/en-us/support/module-compatibility).

**NOTE:** S-Series Microinverters may only be paired with 60-cell PV modules.

- C) In addition to the Enphase Microinverters, PV modules and racking, you will need these **Enphase items**:
- Enphase Envoy-S™ communications gateway (required to monitor solar production)
  - Enphase Engage Cable™, single-phase 240 VAC or three-phase 208 VAC, as needed
  - Tie wraps or cable clips
  - Enphase Sealing Caps (for any unused drops on the Engage Cable)
  - Enphase Terminators (one needed at the end of each AC branch circuit)
  - Enphase Disconnect Tool (number 2 and 3 Phillips screwdrivers can be substituted)

- D) Check that you have these **other items**:

- 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)

- E) Protect your system with lightning and/or surge suppression devices. It is also important to have insurance that protects against lightning and electrical surges.

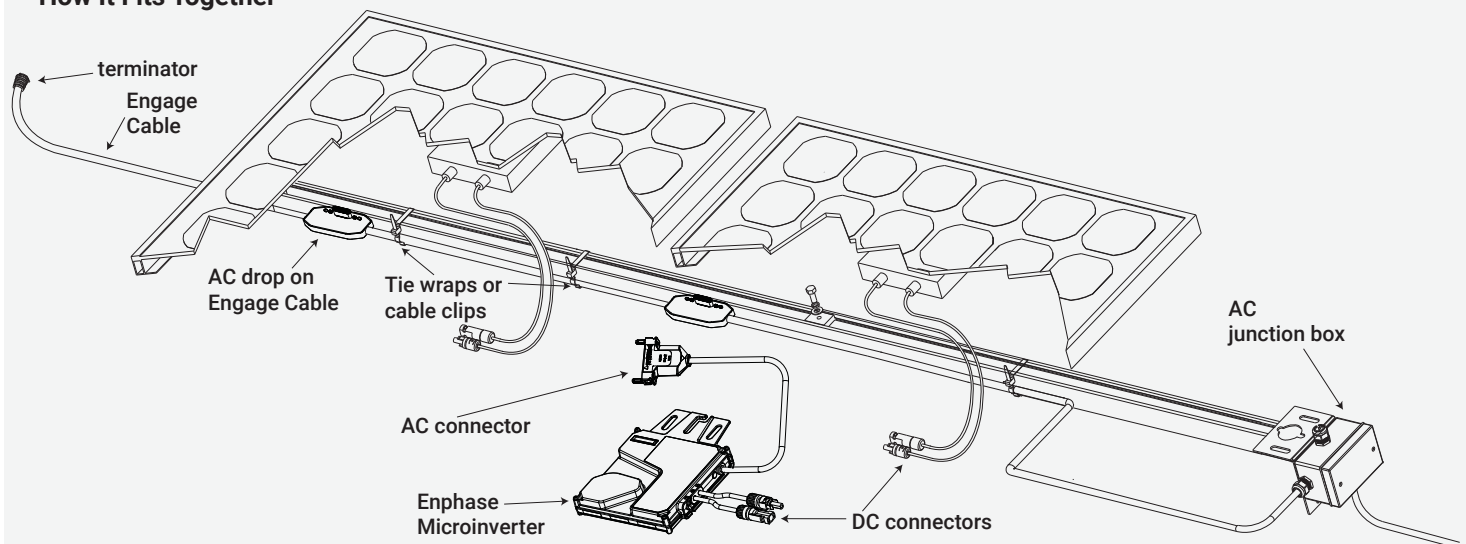
- F) Plan your AC branch circuits to meet the following limits for maximum number of microinverters per branch when protected with a 20-amp maximum over-current protection device (OCPD).

Service type	Max. S230s per branch circuit	Max. S280s per branch circuit
Single-phase 240 VAC	17	14
Three-phase 208 VAC	24	21

- G) 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. Design for a voltage rise total of less than 2% for the sections from the microinverter AC branch circuit to the breaker in the load center. Refer to the Voltage Rise Technical Brief at [enphase.com/support](http://enphase.com/support) for more information.

**Best practice:** Center-feed the branch circuit to minimize voltage rise in a fully-populated branch.

## How It Fits Together



# INSTALLATION

## 1 Position the Enphase Engage Cable

- A) Check the labeling on the Engage Cable drop connectors to be sure that the cable matches the electrical service at the site. Use 208 VAC Engage Cable at sites with three-phase 208 VAC service, or use 240 VAC Engage Cable at sites with 240 VAC single-phase service.
- B) 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.
- D) Cut a length of cable to meet your planned needs.
- E) Lay out the cabling along the installed racking for the AC branch circuit.

## 2 Install an AC Junction Box/Isolator

- A) Verify that AC voltage at the site is within range:

240 VAC Single-Phase		208 VAC Three-Phase	
L1 to L2	211 to 264 VAC	L1 to L2 to L3	183 to 229 VAC
L1, L2, to N	106 to 132 VAC	L1, L2, L3 to N	106 to 132 VAC

- B) Install an appropriately rated, off-the-shelf junction box or isolator at a suitable location on the racking.
- C) Provide an AC connection from the AC junction box back to the electricity network connection using equipment and practices as required by local jurisdictions.

## 3 Attach the Microinverters to the PV Racking

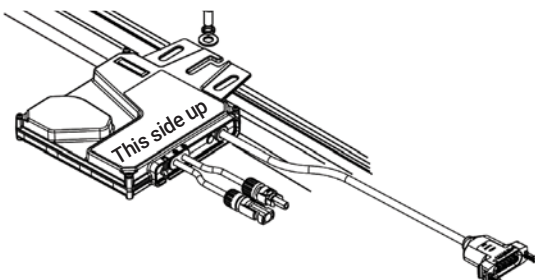
- A) Mark the approximate centers of each PV module on the PV racking.
- B) **Mount the microinverter bracket side up and under the PV module, away from rain and sun.** Allow a minimum of 1.9 cm (0.75") between the roof and the microinverter. Also allow 1.3 cm (0.50") between the back of the PV module and the top of the microinverter.



### WARNINGS:

- Install the microinverter under the PV module to avoid direct exposure to rain, UV, and other harmful weather events.
- Do not mount the microinverter in a vertical position that allows water to collect in the connector recess as it may have a harmful effect on the long term endurance of the unit.
- Do not expose the AC or DC connectors (on the Engage Cable connection, PV module, or the microinverter) to harmful weather events before the connectors are mated as it may result in weather rated damage to the connection.

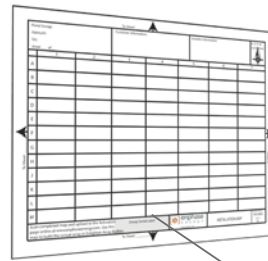
- C) Torque the microinverter fasteners as follows. Do not over torque. Using an impact driver to tighten the mounting hardware is not recommended due to the risk of thread galling.
  - 6 mm (1/4") mounting hardware: 5 N m (45 to 50 in-lbs)
  - 8 mm (5/16") mounting hardware: 9 N m (80 to 85 in-lbs)



## 4 Create an Installation Map

Create a paper installation map to record microinverter serial numbers and position in the array.

- A) Peel the removable serial number label from each microinverter and affix it to the respective location on the paper installation map.
- B) Peel the label from the Envoy-S and affix it to the installation map.
- C) Always keep a copy of the installation map for your records.



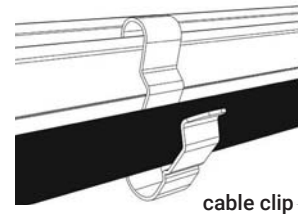
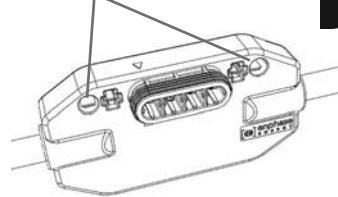
affix serial number labels

## 5 Dress the Cable

- A) Use cable clips or tie wraps to attach the cable to the racking.
- B) Dress any excess cabling in loops so that it does not contact the roof. Do not form loops smaller than 12 cm (4.75 inches) in diameter.

Keep the drop connector release holes clear and accessible.

release holes



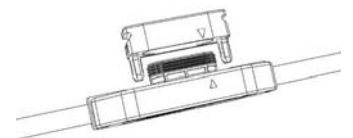
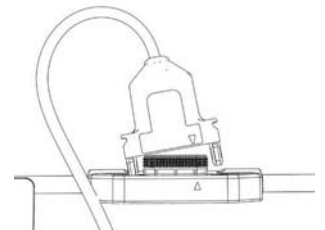
cable clip

## 6 Connect the Microinverters

- A) Remove and discard the temporary shipping cap from the cable connector and connect the microinverter. Listen for two clicks as the connectors engage.
- B) Cover any unused connectors with Enphase Sealing Caps. Listen for two clicks as the connectors engage.



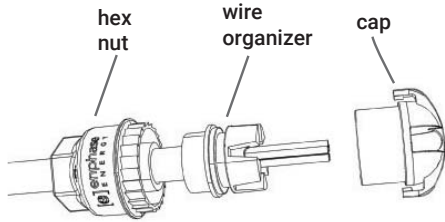
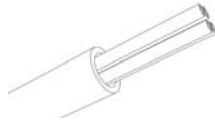
**WARNING:** Install sealing caps on all unused AC connectors as these become live when the system is energized by the utility. Sealing caps are required for protection against moisture ingress. Do not use shipping caps to cover unused connectors.



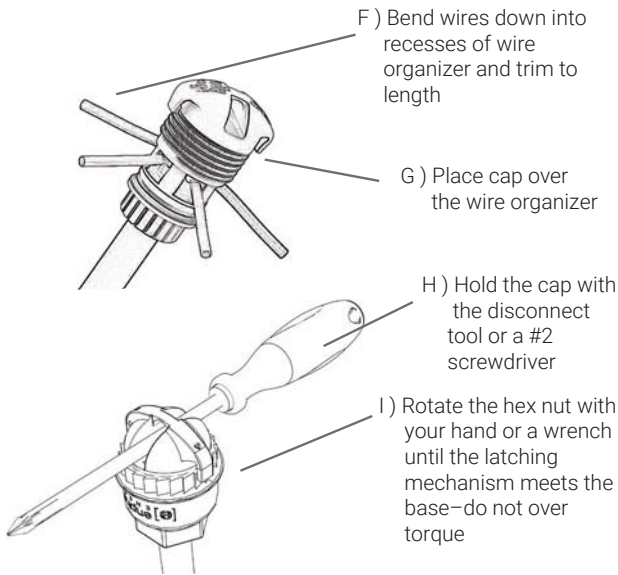
To remove a sealing cap or AC connector, you must use an Enphase disconnect tool or a #3 Phillips screwdriver.

## 7 Terminate the Unused End of the Cable

- A) Remove 60 mm (2.5") of the cable sheath from the conductors.
- B) Check that all the terminator parts are present.



- C) Slide the hex nut onto the cable.
- D) Insert the cable end all the way into the cable organizer (up to the stop).
- E) Attach the cap.



- I) Rotate the hex nut with your hand or a wrench until the latching mechanism meets the base—do not over torque
- J) Attach the terminated cable end to the PV racking with a cable clip or tie wrap so that the Engage Cable and terminator do not touch the roof.



**WARNING:** Never unscrew the hex nut. This action can twist and damage the cable.

## 8 Connect to the AC Junction Box/Isolator

Connect the Engage Cable into the AC branch circuit junction box or isolator. The Engage Cable uses the following wiring color code.

240 VAC Single-Phase Wires	208 VAC Three-Phase Wires
Black – L1	Black – L1
Red – L2	Red – L2
White – Neutral	Blue – L3
Green – Ground	White – Neutral
	Green – Ground

The green wire acts as equipment ground (EGC).

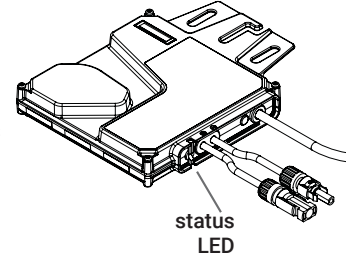
## 9 Connect the PV Modules

- A) Mount the PV modules above the microinverters.



**DANGER!** Electric shock hazard. The DC conductors of this PV system are ungrounded and may be energized.

- B) Connect the DC leads of each PV module to the DC input connectors of the corresponding microinverter.
- C) Check the status LED. The LED flashes six times when DC power is applied.



LED	Indicates
Flashing green	Normal operation. 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 either not present or not within specification.
Solid red	There is an active "DC Resistance Low, Power Off" or "GFDI" fault. To reset, refer to the <i>Enphase S230 and S280 Microinverter Installation and Operation Manual</i> at: <a href="http://www.enphase.com/support">http://www.enphase.com/support</a> .

## 10 Energize the System

- A) If applicable, turn ON the AC disconnect or circuit breaker for the branch circuit.
- B) Turn ON the main utility-grid AC circuit breaker. Your system will start producing power **after a five-minute wait time**.

## ACTIVATE MONITORING

After you have installed the microinverters, follow the procedures in the *Enphase Envoy-S Quick Install Guide* to activate system monitoring and complete the PV installation.

- Connecting the Envoy-S
- Detecting the microinverters
- Connecting to Enlighten
- Registering the system
- Building the virtual array

# PV Rapid Shutdown Equipment (PVRSE)

This product is UL Listed as PV Rapid Shut Down Equipment and conforms with NEC-2014 and NEC-2017 section 690.12 and C22.1-2015 Rule 64-218 Rapid Shutdown of PV Systems, for AC and DC conductors, when installed according to the following requirements:

- Microinverters and all DC connections must be installed inside the array boundary. **Enphase further requires that the microinverters and DC connections be installed under the PV module to avoid direct exposure to rain, UV, and other harmful weather events.**
- The array boundary is defined as 305 mm (1 ft.) from the array in all directions, or 1 m (3 ft.) from the point of entry inside a building.

This rapid shutdown system must be provided with an initiating device and (or with) status indicator which must be installed in a location accessible to first responders, or be connected to an automatic system which initiates rapid shutdown upon the activation of a system disconnect or activation of another type of emergency system.

The initiator shall be listed and identified as a disconnecting means that plainly indicates whether it is in the "off" or "on" position. Examples are:

- Service disconnecting means
- PV system disconnecting means
- Readily accessible switch or circuit breaker

The handle position of a switch or circuit breaker is suitable for use as an indicator. Refer to NEC or CSA C22.1-2015 for more information.

Additionally, in a prominent location near the initiator device, a placard or label must be provided with a permanent marking including the following wording: **'PHOTOVOLTAIC SYSTEM EQUIPPED WITH RAPID SHUTDOWN'** The term 'PHOTOVOLTAIC' may be replaced with 'PV'.

The placard, label, or directory shall be reflective, with all letters capitalized and having a minimum height of 9.5 mm (3/8 in.) in white on red background.

## SAFETY

### IMPORTANT SAFETY INSTRUCTIONS. SAVE THIS INFORMATION.

This guide contains important instructions to follow during installation of the Enphase S280 and S230 Microinverter.



**WARNING:** Hot surface.



**WARNING:** Refer to safety instructions.



**DANGER:** Risk of electric shock.



**Refer to manual**

#### Safety Symbols



**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.

#### General Safety



**DANGER:** 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.

#### General Safety, continued



**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 this guide. 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, install the Enphase Microinverters and Engage Cable according to the instructions in this guide.



**NOTE:** Perform all electrical installations in accordance with all applicable local electrical codes and the National Electrical Code (NEC), ANSI/NFPA 70.



**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 20°C above ambient, but under extreme conditions the microinverter can reach a temperature of 90°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 microinverter.



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



**WARNING:** Risk of equipment damage. The S230 and S280 may be paired only with 60-cell PV modules.



**WARNING:** Risk of fire. The DC conductors of the PV module must be labeled "PV Wire" or "PV Cable" when paired with the S230 or S280 Microinverters.



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



**WARNING:** 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 vertically with the DC connectors facing up.



**WARNING:** Risk of electric shock. Risk of fire. Be aware that only qualified personnel may connect the Enphase Microinverter to the utility grid.

#### Microinverter Safety, continued



**NOTE:** The Enphase Microinverter has 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.



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

#### Engage Cable and Accessory Safety



**DANGER:** Risk of electric shock. Do not install the Engage Cable terminator cap while power is connected.



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



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



**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. Do not reuse sealing caps.



**WARNING:** Use the terminator only once. If you open the terminator following installation, the latching mechanism is destroyed. Do not reuse the terminator. If the latching mechanism is defective, do not use 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 service at the site. Use 208 VAC (208 VAC three-phase) Engage Cable at sites with three-phase 208 VAC service, or use 240 VAC Engage Cable at sites with 240 VAC single-phase service.



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



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



**NOTE:** If you need to remove a sealing cap, you must use the Enphase disconnect tool or a #3 Phillips screwdriver. Do not reuse sealing caps.



- 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.



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To Sheet / A la hoja de: 

Panel Group/Grupo de los paneles: Azimuth/Azimet: Tilt/Inclinación: Sheet/Hoja ___ of/de ___		Customer/Cliente:			Installer/Instalador:			 N S E W N S E O	
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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 Number Label /  
Número de serie de Envoy



Escanee el mapa completo y cárguelo en Enphase. Haga clic en "Añadir nuevo sistema" en <https://enlighten.enphaseenergy.com>. Utilice este mapa para crear el conjunto de paneles virtual en el Creador de conjuntos de paneles de Enlighten.

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