

M250 Microinverter System — Installation Planning

The M250 Microinverter

The Enphase M250™ Microinverter is a powerful and efficient grid-tied microinverter. It is compatible with most 60-cell PV modules (to 300 Watts or higher) and installs quickly and easily. It works with both three-phase 208 VAC and single-phase 240 VAC services. A separate model is available for 230 VAC service in other regions.

For detailed installation information, refer to the **M250 Installation and Operations Manual** or the **M250 Quick Install Guide** at <http://www.enphase.com/support>.



Microinverter Compatibility

The Enphase M250 is electrically compatible with all 60-cell modules. The PV module must also use PV (photovoltaic) Wire. To ensure **mechanical** compatibility, order PV modules with MC-4, Type 2 connectors.

Model Number	Electrical Compatibility	Module Connector Type
M250-60-2LL-S22	60 cell PV module	MC-4 Type 2 Locking



NOTE: Be sure to order the correct connector type for both microinverter and PV module from your distributor.

As a rule, the electrically positive output of the PV module always connects to the positive input of the microinverter. However, PV modules come with a variety of labels. For more information, refer to **Mating Microinverters with PV Modules for Correct Polarity** at <http://www.enphase.com/support>.

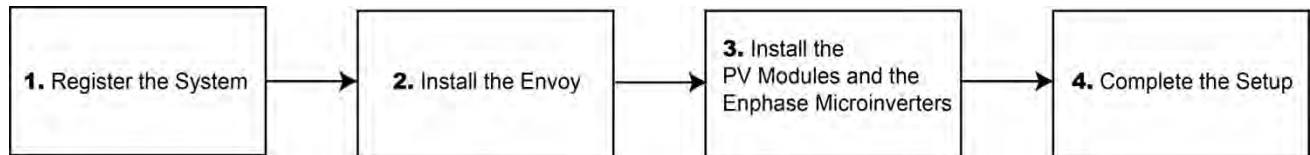
Branch Circuit Capacity

Do not exceed the maximum number of microinverters in an AC branch circuit as listed in the following table. You must protect each microinverter AC branch circuit with a 20A maximum breaker.

Maximum number of M250s per 20 amp AC Branch Circuit	
Service type	Max M250s per AC branch
240V	16
208V	24

Installation Flow

Every Enphase installation should include these basic steps. Plan to complete these steps in the order shown.



1. Register the System

- First-time installers: go to <https://enlighten.enphaseenergy.com/users/new> and complete the form. Your login credentials will be emailed to you.
- Existing installers and those with new credentials: Log into the Enphase Enlighten[®] software.
- Click “Add a New System” in the Installation Status widget.

2. Install the Envoy

- Install the Envoy[®] Communications Gateway as directed by the installation manual.
- Locate a dedicated AC outlet close to the load center. Place the Envoy so that its AC cord can reach this outlet.
- Plug the Envoy into the dedicated AC outlet and connect it to a broadband router. Wait for the Envoy to display “+Web”.
- Allow 20 minutes in case a software upgrade is required. Do not unplug the Envoy during software upgrade!
- Set up the Grid Profile for your region, if required.

3. Install the PV Modules and the Enphase Microinverters

- Install the PV modules and microinverters as directed by the installation manuals.
- Use the Installer Toolkit to scan the microinverters. For more information, go to <http://enphase.com/installer-toolkit/>.
- As an alternative, you can manually build the map: Peel the removable serial number label from each microinverter and affix it to the respective location on the map.

4. Complete the Set Up

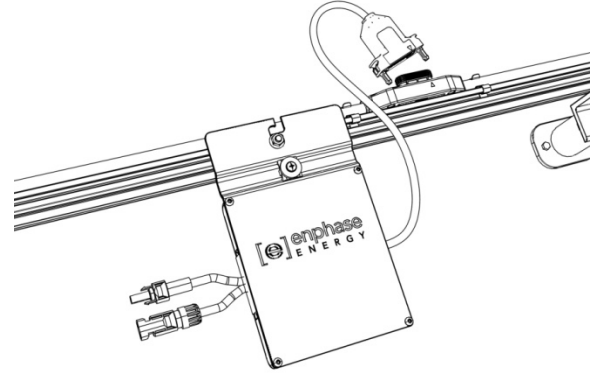
- Ensure at least 3 level bars and the correct number of microinverters are showing on the Envoy LCD screen.
- Once the Envoy has detected the microinverters, log in to Enlighten to use the Array Builder. For tips on how to use it, visit <http://enphase.com/support/videos>.

The Enphase Engage Cable

The M250 has integrated DC and AC cables and connectors. The DC connectors attach to the PV module, while the AC connector attaches directly to the Engage™ Cable. No additional cabling is needed.

The Engage Cable is a continuous length of 12 AWG, outdoor rated cable, with integrated connectors for microinverters. These connectors are preinstalled along the entire cable and spaced to accommodate either portrait and landscape PV module orientations.

To install the cable, just roll out the desired length of cable and cut it to size. One end is wired directly into the junction box at the head of the branch circuit. The other end is sealed from the environment using an Engage Terminator. The M250 AC cable connectors are then plugged into the regularly spaced connectors as shown.

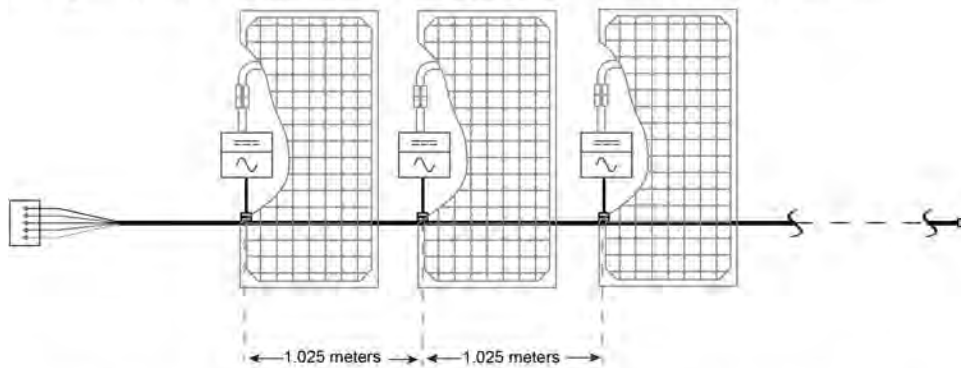


The Engage Cable is available in two connector spacing options and two voltage types: 240 VAC and 208 VAC. To fit differing needs, the cabling is available in a variety of lengths.

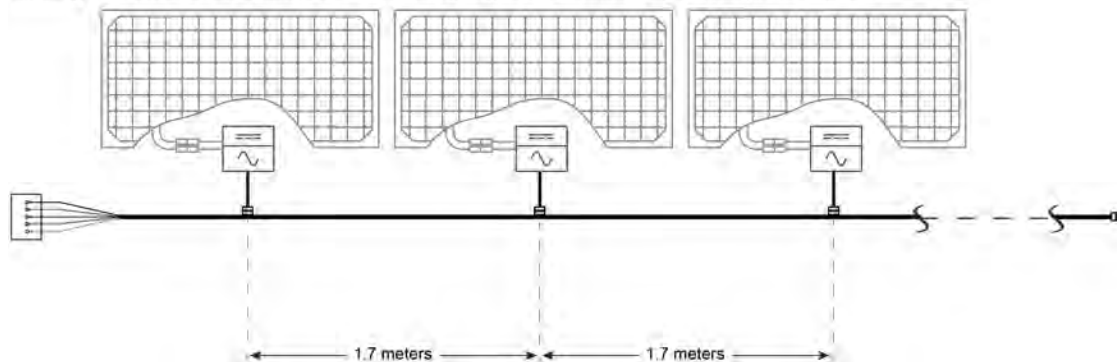
Connector Spacing Options

The gap between connectors on the cable can be either 1.025 meters (40") or 1.7 meters (67"). The 1.025 meter spacing is best suited for connecting PV modules installed in portrait mode, while the 1.7 meter gap is best suited to PV modules installed in landscape mode.

Cabling with connectors spaced at 1.025 meters (40") for PV modules in portrait orientation

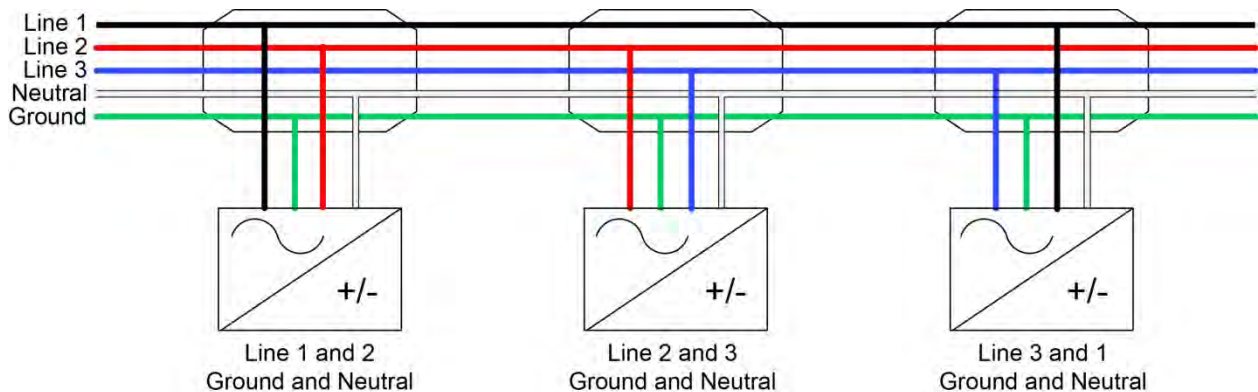


Cabling with connectors spaced at 1.7 meters (67") for PV modules in landscape orientation



Voltage Types and Conductor Count

The Engage Cable is available for either 240VAC split phase or 208VAC three phase (Separate models are available for 230 VAC service). **All cable connectors bear labels indicating their cable voltage designation.** Typically used for residential applications, 240VAC cabling includes four conductors. Three-phase 208VAC 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 the conductors from one microinverter to the next as shown in the following diagram.



Cabling Length Options

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

Model Number	Voltage type/ conductor #	Connector count	Connector spacing	PV module orientation	Approx. weight
ET10-240-40	240VAC, 4 conductor	40 connectors	1.025 m (40")	Portrait	18.1 kg (40 lbs)
ET17-240-40	240VAC, 4 conductor	40 connectors	1.7 m (67")	Landscape	20.4 kg (45 lbs)
ET10-208-30	208VAC, 5 conductor	30 connectors	1.025 m (40")	Portrait	13.6 kg (30 lbs)
ET17-208-30	208VAC, 5 conductor	30 connectors	1.7 m (67")	Landscape	15.9 kg (35 lbs)
ET10-240-BULK	240VAC, 4 conductor	240 connectors	1.025 m (40")	Portrait	over 90 kg (200 lbs)
ET17-240-BULK	240VAC, 4 conductor	240 connectors	1.7 m (67")	Landscape	over 90 kg (200 lbs)
ET10-208-BULK	208VAC, 5 conductor	240 connectors	1.025 m (40")	Portrait	over 90 kg (200 lbs)
ET17-208-BULK	208VAC, 5 conductor	240 connectors	1.7 m (67")	Landscape	over 90 kg (200 lbs)

Planning for Cable Lengths and Type

The Engage Cable is flexible enough to adapt to almost any solar design. To determine the length and cable type that you need, take into account the following considerations:

- **Calculate the number of Enphase Microinverters to be installed on the AC branch.** Be certain to allocate the correct number of connectors, including extra connectors for gaps and turns.
- **Account for any additional length required to reach from the AC branch circuit junction box to the first microinverter.** If greater than half a connector cable interval is needed, it may be necessary to include one (or more) unused connectors in order to span this distance. Unused connectors must be covered with Enphase sealing caps.
- Plan to minimize the number of unused connectors with three-phase systems. If 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 Engage Couplers. For instance, use the Engage Coupler to connect two Engage Cables or to connect Engage Cable to field cable. There are many possible scenarios for each type of connection, but they generally fall into four categories:

Engage Cable to Engage Cable:

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

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

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



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

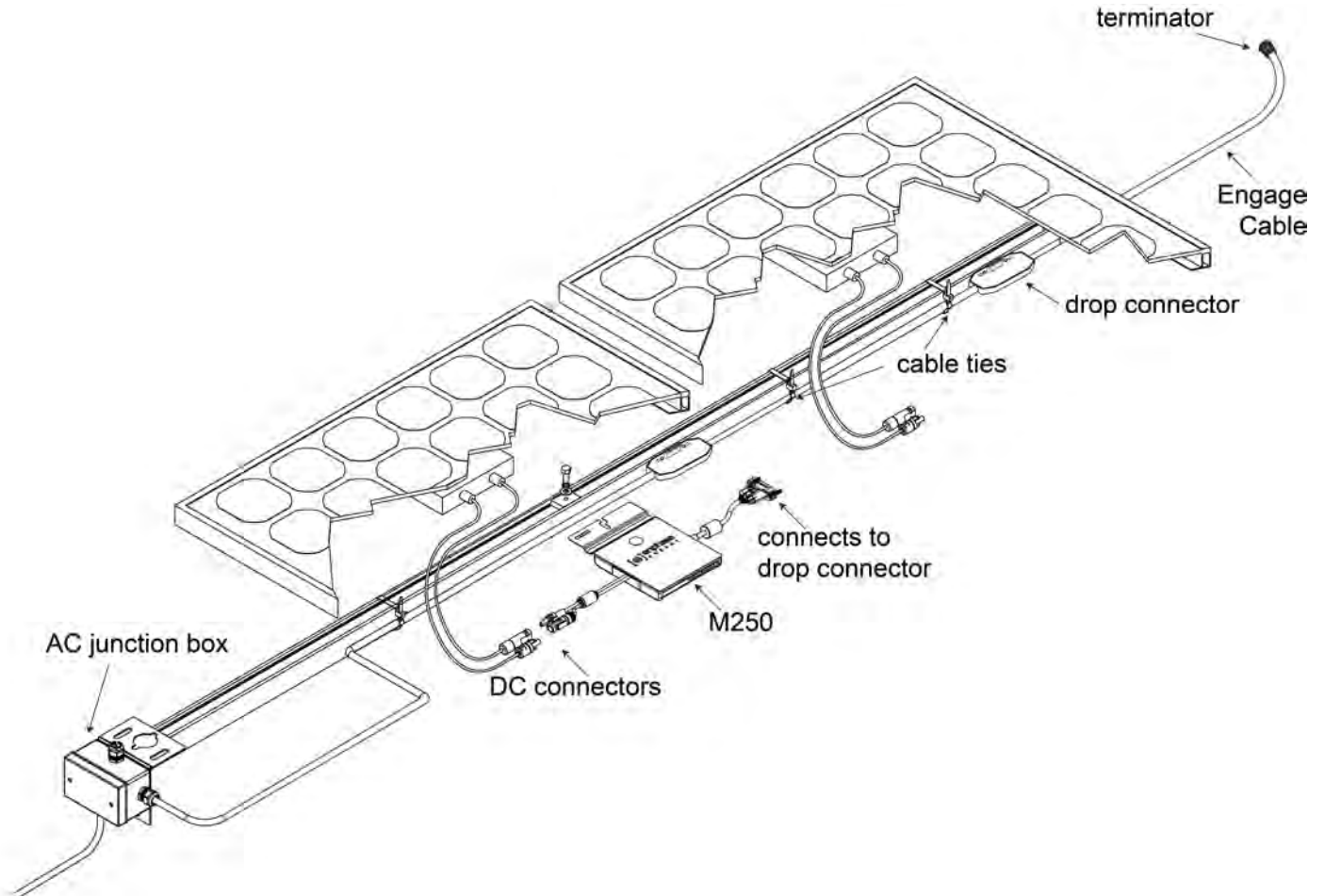
In situations where you cannot use an Engage Coupler, you can use an electrical junction box to transition between cable types.

- You must account for all lengths of cable when calculating total VRise. Refer to the following documents (at <http://www.enphase.com/support>) for more information on the Engage Coupler and to maintain AC VRise at less than 2%:
 - Applications of the Engage Coupler
 - Circuit Calculations for the M250 Microinverter
 - Calculating AC Line Voltage Drop for M250 Microinverters with Engage Cables
- **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, plan for any additional cable needed to cover the distance from one row to the next.
- When planning cabling turns or loops, **do not form loops smaller than 4.75 inches (12 cm).**
- **If needed, plan for multiple sub-arrays.** The 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 using appropriately rated runs of conduit. Accomplish the transition from cable to conduit by using an outdoor rated junction box, as required by the NEC and local code. You must cover unused connectors with Enphase sealing caps.
- **Mixture of PV modules in both portrait and landscape installation.** When PV modules are installed in mixed orientation (both portrait and landscape orientation), solutions include:
 1. Using Engage Cable with 1.025 meter spacing between connectors results in cleanest install for the modules in portrait mode. For modules placed in landscape mode, plan for an unused

- connector between each PV module to achieve the required additional distance. Unused connectors must be covered with Enphase watertight sealing caps.
- Using Engage Cable with 1.7-meter spacing between connectors results in cleanest install for the modules in landscape mode, but requires that any additional cable length between PV modules in portrait mode be coiled and dressed so that cabling does not contact the roof. Again, unused connectors must be covered with Enphase sealing caps.
 - Another solution when PV modules are installed in mixed orientation is to transition between 1.025 and 1.7 meter spacing cable options using the Engage Coupler or an outdoor-rated junction box. This junction box can be installed to the PV racking. Refer to <http://enphase.com/products/engage-coupler/> for information on the Engage Coupler.

How it Fits Together

In the following diagram, the M250 Microinverter and the Engage Cable are shown together with racking, grounding and PV modules.



Microinverter Installation Requirements

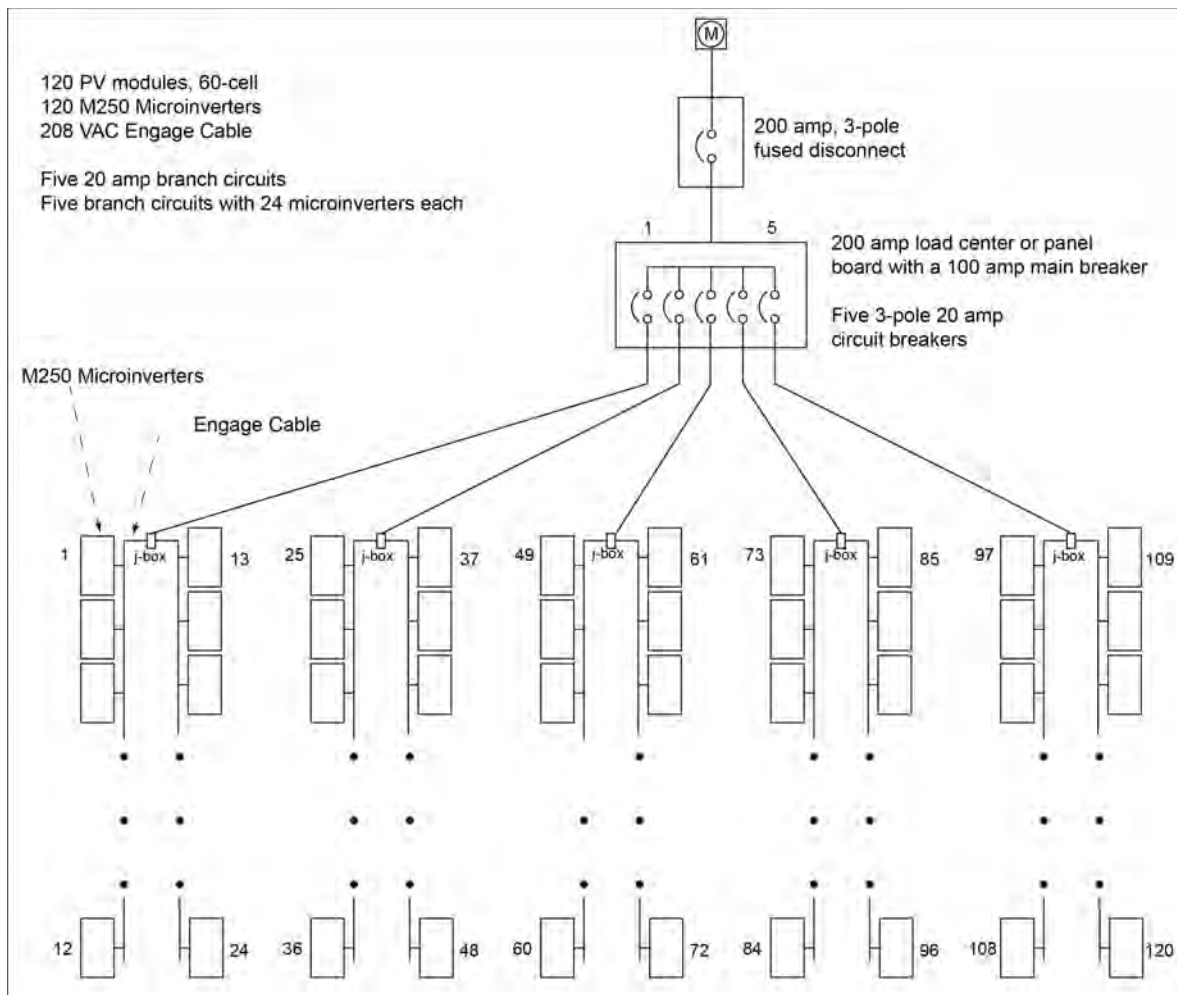
- Allow a minimum of 1.9 cm (0.75 inches) between the roof and the bottom of the microinverter.
- Allow 1.3 cm (0.50 inches) between the back of the PV module and the top of the microinverter.
- **You must install the M250 under the module, out of rain and sun.**
- **Do not mount the microinverter in 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.**
- Installing the microinverter black side up or vertically, with the DC connectors facing up, is not permitted.

Racking Compatibility

The M250 Microinverter and Engage Cabling are compatible with a variety of racking systems. For a list of approved PV racking types, refer to the Racking Compatibility document at <http://www.enphase.com/support>.

Example Installation: Layout & Parts Needed, 208 VAC Commercial

The following installation diagram shows an example with five branches. The 208V layout shows five center-fed branches with 24 microinverters each. The PV modules are in landscape orientation. Tables following the diagram list required and optional equipment.



Enphase Items Required

Quantity	Description	Order Number
120	M250 Microinverter	M250-60-2LL-S22
3 packs	Cable clip (each pack contains 100 clips)	ET-CLIP-100
1 pack	Disconnect tool (each pack contains five tools)	ET-DISC-05
1 pack	Branch terminator (each pack contains 10 terminators)	ET-TERM-10
1	Engage Cable divided into ten lengths: Each length should be about 20.4 meters (67 feet) with 12 connectors.	ET17-208-BULK
1 pack	Watertight Sealing cap (each pack contains 10). Required only if there are any unused connectors; Unused connectors must be covered with this cap.	ET-SEAL-10
1	Envoy® Communications Gateway (monitors up to 600 microinverters) ¹	ENV-120
as needed	Engage Coupler (each pack contains five Couplers). Used for splicing two AC power cables within an array.	ET-SPLK-05

Non-Enphase Items Required

Quantity	Description
120	60-cell PV module
5	Weather-proof (NEMA) junction box
5	Three-pole 20 amp circuit breaker
1	Three-pole 200 amp circuit breaker
1	200 amp load center
1	Lightning protection device (3-phase AC surge protector)
as needed	Homerun conductors
as needed	Torque wrench, sockets, wrenches for mounting hardware
as needed	Adjustable wrench or open-ended wrench (for terminator caps)
as needed	Inspection mirror (for viewing indicator lights on the undersides of the microinverters)

¹ If installing a system of more than 600 microinverters, see the Commercial Design Guide at <http://www.enphase.com/support>.