



## M215 Microinverter Installation Planning

### The M215 Microinverter

The M215 Microinverter™ is a powerful and efficient grid-tied microinverter. It is compatible with PV modules (up to 270 Watts or higher) and installs quickly and easily. It works with both three-phase 208 VAC or single-phase 240 VAC services in North America. A separate model is available for 230 VAC service in other regions.



For detailed installation information, refer to the **M215 Installation and Operations Manual** and the **M215 Quick Install Guide** at <http://www.enphase.com/support>.

### Compatibility and Capacity

The M215 can be paired with most 60-cell PV modules. The M215 can also be paired with a 72-cell module if the voltage and current from of the module stays within allowable ranges for the microinverter to perform safely, notably in warm climates. Refer to the Enphase Compatibility Calculator at: <http://enphase.com/module-compatibility-calculator-m250-update/> to ensure PV module **electrical compatibility**. To ensure **mechanical compatibility**, be sure to order the correct connector type for both microinverter and PV module from your distributor.

### Mechanical Compatibility

Model Number	PV Module Connector Type
M215-60-2LL-S22-IG <sup>1</sup>	MC-4 locking connector
M215-60-2LL-S23-IG <sup>1</sup>	Tyco locking connector
M215-60-2LL-S24-IG <sup>1</sup>	SMK locking connector
M215-60-2LL-S22 <sup>2</sup> M215-60-2LL-S22-NA <sup>2</sup>	MC-4 locking connector
M215-60-2LL-S23 <sup>2</sup> M215-60-2LL-S23-NA <sup>2</sup>	Tyco locking connector
M215-60-2LL-S24 <sup>2</sup> M215-60-2LL-S24-NA <sup>2</sup>	SMK locking connector



**WARNING:** For the M215-60-2LL-(XXX)-IG, the paired PV module DC conductors must be labeled "PV Wire" or "PV Cable" to be compliant with NEC 690.35(D) for Ungrounded PV Power Systems.

<sup>1</sup> Microinverter does not require a GEC. Paired modules **must** use PV (photovoltaic) Wire.

<sup>2</sup> Requires use of a Grounding Electrode Conductor (GEC).

## Grounding Considerations

With the M215-60-2LL-IG, the DC circuit within the M215 is isolated and insulated from ground. Ground fault protection (GFP) is integrated into the microinverter. Because of this, the M215-60-2LL-IG does not require a GEC. As a result, it takes less time to install than other microinverters, saves money, and increases safety.

If you are installing the M215-60-2LL, this microinverter requires a GEC or other compliant grounding method.



**TIP:** If installing a mix of IG (Integrated Ground) and non-IG microinverters, install the non-IG microinverters closer (electrically) to the junction box to minimize GEC use.

## Utility Service Requirements

The M215 Microinverter works with split phase 240 VAC service or with three phase 208 VAC service. Measure AC line voltage at the electrical utility connection to confirm that it is within the ranges shown:

240 Volt AC, Split Phase		208 Volt AC, Three Phase	
L1 to L2	211 to 264 VAC	L1 to L2 to L3	183 to 229 VAC
L1, L2 to neutral	106 to 132 VAC	L1, L2, L3 to neutral	106 to 132 VAC

## Branch Circuit Capacity

Plan your AC branch circuits to meet the following limits for maximum number of M215s per branch when protected with a 20-amp over-current protection device (OCPD).

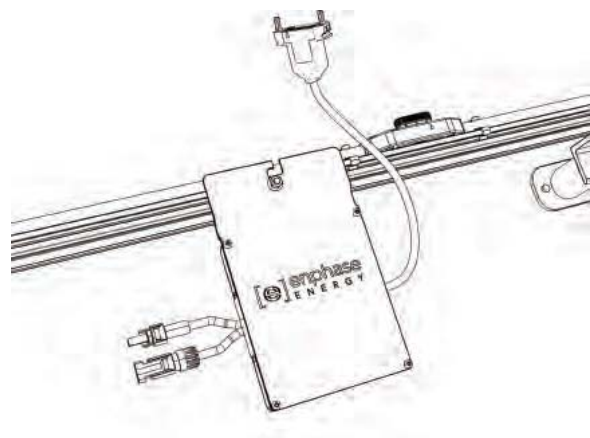
Maximum number of M215s when protected with a 20 A OCPD	
Service type	Max M215s per AC branch circuit
Split phase 240 VAC	17
Three phase 208 VAC	25

## The Enphase Engage Cable

The Engage Cable is a continuous length of 2.5 mm<sup>2</sup> (12 AWG), outdoor-rated cable with integrated connectors for microinverters. These connectors are preinstalled along the Engage Cable at intervals to accommodate PV module widths. The microinverters plug directly into the cable connectors.

## Selecting Cable Type

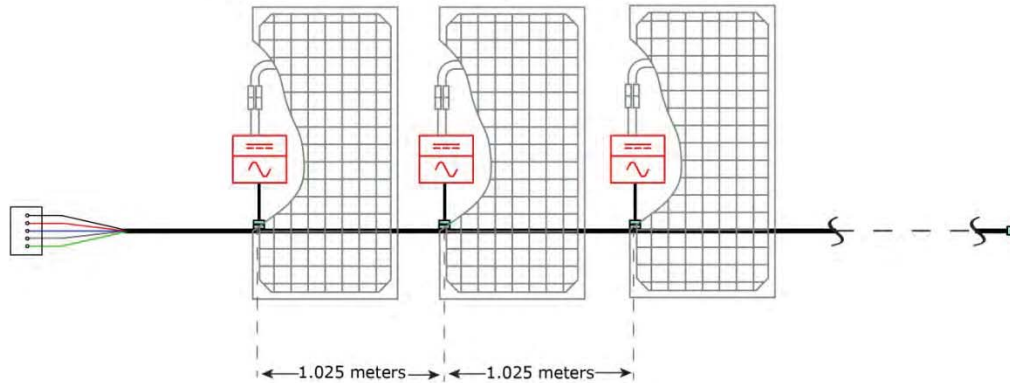
Enphase Engage Cable is available in two different voltage types and two connector spacing options. Depending upon installer needs, the cable is also available in different lengths.



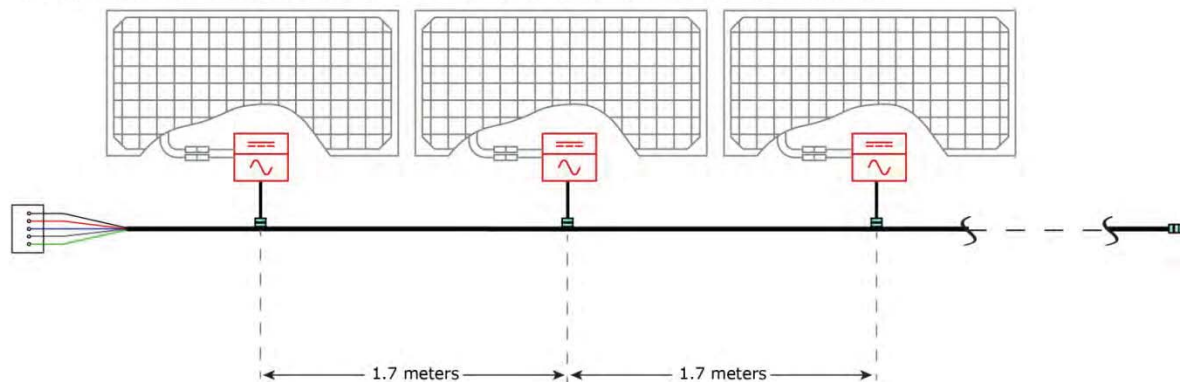
## Connector Spacing Options

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 orientation, while the 1.7-meter gap is best suited to PV modules installed in landscape orientation.

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



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



## Voltage Type and Conductor Count Options

The voltage types are either 240 VAC split phase or 208 VAC three phase. **All cable connectors bear labels indicating the cable voltage designation.** Typically used for residential applications, 240VAC includes four conductors. Three-phase 208 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.

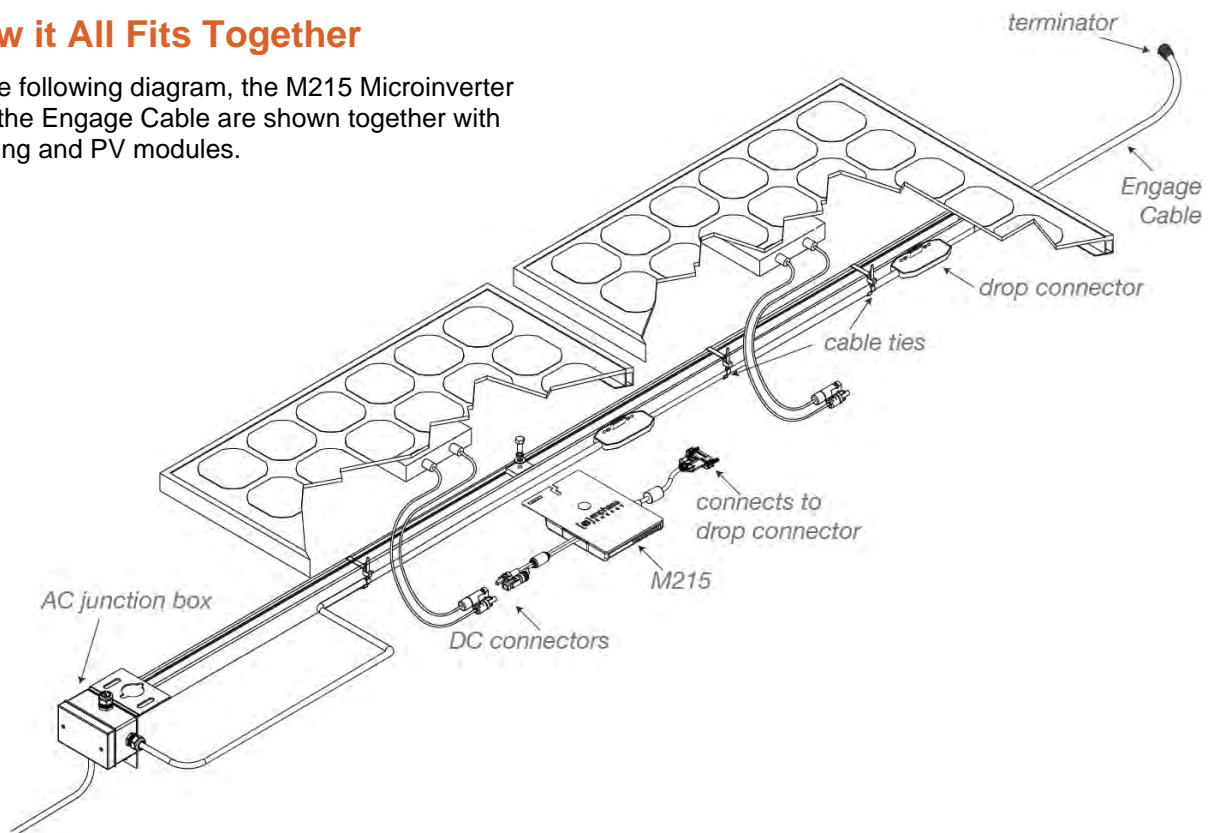
## Cabling Length Options

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. Ordering options include:

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

## How it All Fits Together

In the following diagram, the M215 Microinverter and the Engage Cable are shown together with racking 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 M215 under the module, out of rain and sun. Do not mount the microinverter in a position that allows long-term exposure to direct sunlight or in a vertical orientation that allows water to collect in the DC connector recess. Do not install the microinverter black-side up or vertically, with the DC connectors facing up.
- Do not install the microinverter black-side up or vertically, with the DC connectors facing up.

## Racking Compatibility

The M215 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>.

## Planning for Cable Lengths and Type

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

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

You can sometimes avoid skipping Engage Cable connectors with the use of Engage Couplers. 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



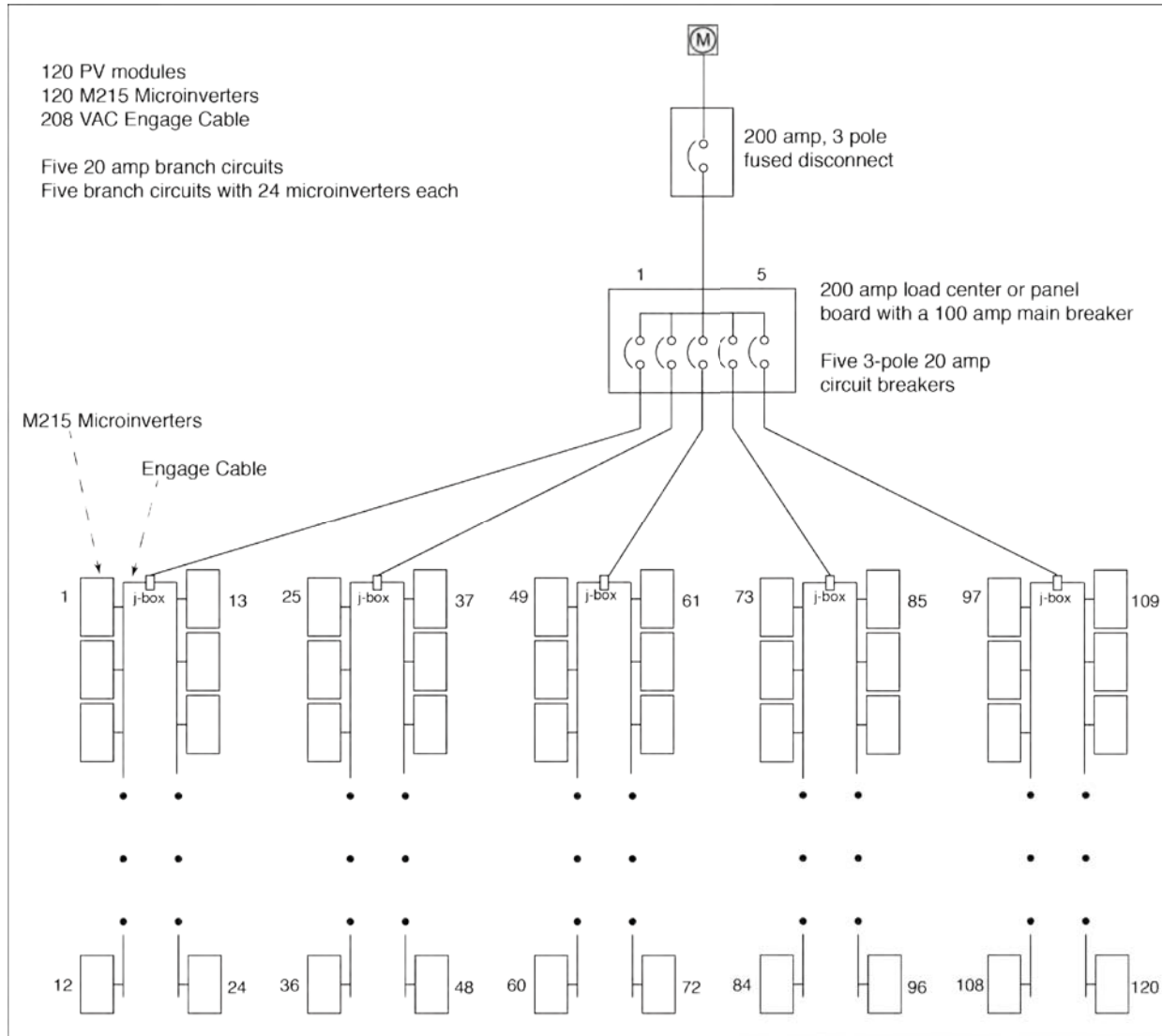
**NOTE:** The Engage Coupler supports only #12 TC-ER, which may not be sufficient for homerun wiring. Enphase Energy recommends maintaining less than 2% voltage drop across all wiring.

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

- **Account for additional lengths of cable** when calculating total voltage rise. Refer to the following documents to maintain AC voltage rise at less than 2%:
  - *Applications of the Engage Coupler*
  - *Circuit Calculations for the M215 Microinverter*
  - *Calculating AC Line Voltage Drop for M215 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, the distance from one row to the next often requires additional cabling length.
- **Account for bend radius.** When planning cabling turns or loops, you must account for a minimum bend radius of 4.75 inches (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 meter spacing between connectors results in cleanest install for the PV modules in portrait orientation. For PV modules placed in landscape orientation, plan for an unused connector between each PV module to accommodate the required additional distance. Cover unused connectors with Enphase watertight sealing caps.
  2. Cabling with 1.7 meter 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-meter spacing cable options using an outdoor-rated junction box. Install this junction box to the PV racking.

## Example Installation: Layout & Parts Needed, 208 VAC Commercial

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



## Enphase Items Required

Quantity	Description	Order Number
120	M215 Microinverter	See page 1 for order numbers
3 packs	Cable clips (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 caps (each pack contains 10). Required only if there are any unused connectors; Unused connectors <b>must</b> be covered with this cap.	ET-SEAL-10
1	Envoy Communications Gateway  For installations of more than 600 microinverters, refer to the Enphase Technical Brief: Commercial System Design with M215 at <a href="http://www.enphase.com/support">http://www.enphase.com/support</a> .	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	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	Continuous grounding conductor (if required)
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)