Applications of the Engage Coupler

Overview

The Engage Coupler is a watertight enclosure for connecting two power cables within an Enphase installation. In many cases, the Engage Coupler acts as an alternative to an electrical junction box that provides enhanced flexibility and can save time and materials.

Application Types

The Engage Coupler can be used 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 (Figure 1)
  4. Create wiring extensions for Engage Cable (Figure 2)

NOTE: 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.

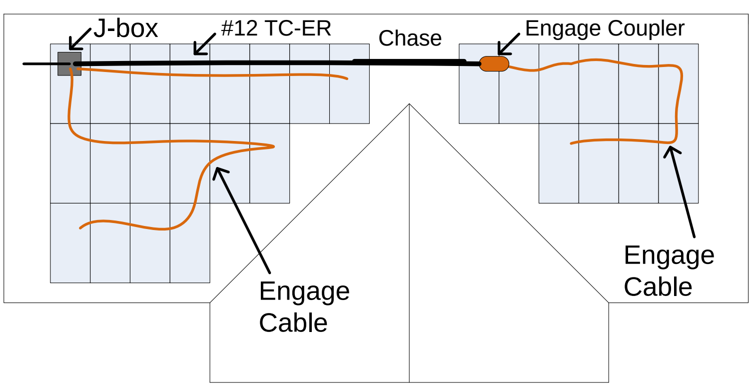


Figure 1: Engage Coupler is connecting Engage Cable to TC-ER field cable, enabling a cable extension that runs through an open conduit chase to the main junction box.

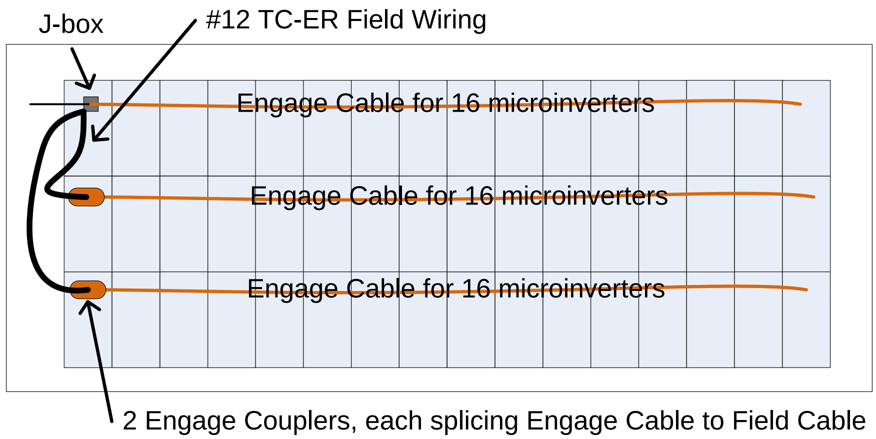


Figure 2: Engage Couplers are connecting Engage Cables to TC-ER field cables, providing an extension so that multiple circuits can be fed from a single junction box.

Wiring and Assembling the Engage Coupler

The Engage Coupler can be spliced with single-phase or three-phase Engage Cable or #12 TC-ER cable. Follow the directions from the Engage Coupler Installation Note, paying particular attention to the following:

- Do not strip more than 2.36 inches (± 0.2 inches) of the outer jacket from the cable.
- Be sure to carry a small screwdriver for tightening the wire terminals.
- Ensure that the rubber gaskets are fully seated in the strain reliefs before tightening.
- Tighten the hex nuts to 6 N m (53.1 in-lbs). This is beyond hand tight and requires pliers.

Supporting the Engage Coupler and #12 TC-ER

Mount the Engage Coupler with 1.5-inch rigid (HW- heavy wall) conduit straps or with Heyco SunBundler cable ties. The Coupler has an outside diameter of approximately 1.875 inches. The images below show the Engage Coupler supported with Heyco SunBundler cable ties and a conduit strap.

For an additional buffer against moisture, it is recommended to provide a drip loop when cabling is running into the Engage Coupler from above.

Support the Engage Cable and TC-ER field cable with Enphase ET-Clips, Heyco SunBundler cable ties, or other electrical fasteners. The #12 TC-ER field cable must be supported off the roof and supported at intervals not to exceed six feet.


Specifying #12 TC-ER Cable

Typically, #12 TC-ER cable is available through most electrical and cable distributors, but it may require special orders or some lead-time. The cable should be specified with the following ratings:

Conductor Size	#12 AWG, Stranded
UL Category	TC-ER approved; Flame Rating FR-03
Nominal Voltage	600V
UL AWM Rating	Wet/Dry 90C
Temperature Range	-40 C to +90 C
Sunlight Resistance	“Sunlight Resistant”
Oil Resistance	“Oil Resistant”
Outer Diameter	10.5mm – 12.5mm; Circular

The single-phase Engage Cable contains the standard color coatings of black, red, white, and green. The three-phase Engage Cable contains standard color coatings of black, red, blue, white, and green. It may not always be possible to source TC-ER with this color combination. As an alternative, some authorities having jurisdictions (AHJs) allow for the marking of conductors using wire marking tape, heat shrink, or labels.

Calculating Voltage Drop with Engage Couplers and #12 TC-ER Cable

Adding an Engage Coupler on its own does not require any additional calculations for voltage drop. This is because the resistance of the mechanical connections at the wire terminals is negligible. However, adding a section of #12 TC-ER cable will contribute to the total wire losses of the system, and it should be accounted for in the design.

This document provides supplemental information on calculating voltage drop when using the Engage Coupler and #12 TC-ER field cable. A comprehensive explanation of how to calculate voltage drop with M215 Microinverters can be viewed in the document, ***Enphase Tech Brief - Voltage Drop for M215***, which can be found at:

http://enphase.com/wp-uploads/enphase.com/2011/12/EnphaseTechBrief_Vdrop_M215.pdf

Enphase recommends that the total voltage drop across all wire sections in the system be maintained to less than 2%. These wire sections include the Engage Cable, TC-ER field cable, wiring from the roof-mounted junction box to the microinverter load center, and wiring from the microinverter load center to the utility service entrance.

All of the calculations from the Voltage Drop Tech Brief still apply, but some additional considerations will apply when adding TC-ER field cable. The first thing to consider is where the section of TC-ER field cable will be added to the system. This will determine how many microinverters are considered in the calculation, and therefore, it will impact the current being carried by the TC-ER field cable.

Voltage Drop within #12-4 TC-ER Cable (240V, Single Phase)

In a single-phase 240V application that is using #12-4 TC-ER field cable between the Engage Cable and the junction box, use the following formula. The resistance of #12 copper conductors has been included in this formula, as well as the current of a single M215 at 240V.

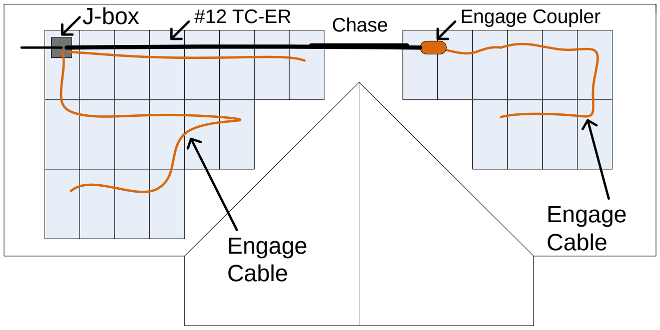
$$\text{Vrise} = (0.9\text{A} * \text{\# of inverters}) * (0.00205\ \Omega/\text{ft}) * (2\ \text{way wire length})$$

240V Scenario 1: Suppose we are running 30 feet of #12 TC-ER field cable between the Engage Cable and the roof mounted junction box, and the Engage Cable is fully populated with 17 M215 Microinverters.

Vrise = (0.9A * 17) * (0.00205 Ω/ft) * (60 ft) = 1.89V
% of Vdrop = 1.89V / 240V = **0.79%**

240V Scenario 2: Suppose we are running 30 feet of #12 TC-ER field cable between the Engage Cable and the roof mounted junction box, as displayed in the image to the right.

The #12 TC-ER field cable will carry the current of ten M215 Microinverters.



Vrise = (0.9A * 10) * (0.00205 Ω/ft) * (60 ft) = 1.1V
% of Vdrop = 1.1 V / 240V = **0.46%**

240V Scenario 3: Suppose we are running 30 feet of #12 TC-ER field cable between two sections of Engage Cable in a fully populated branch circuit of 17 M215 Microinverters. The first section of cable nearest to the junction box contains seven M215 Microinverters and the second section of cable contains ten M215 Microinverters. In this scenario, the #12 TC-ER field cable will carry the current of the ten M215 Microinverters, and the calculation would be the same as in Scenario 2.

Vrise = (0.9A * 10) * (0.00205 Ω/ft) * (60 ft) = 1.11V
% of Vdrop = 1.11V / 240V = **0.46%**

Voltage Drop Calculations within #12-5 TC-ER Cable (208V, Three Phase)

In a three-phase 208/120V application that is using the #12-5 TC-ER field, use the following formula. The resistance of #12 copper conductors has been included in this formula.

In a three-phase system, the circuits are only balanced when the number of microinverters on a cable is divisible by three. For this reason, it is recommended to round the number of microinverters per branch circuit up to the next number divisible by three.

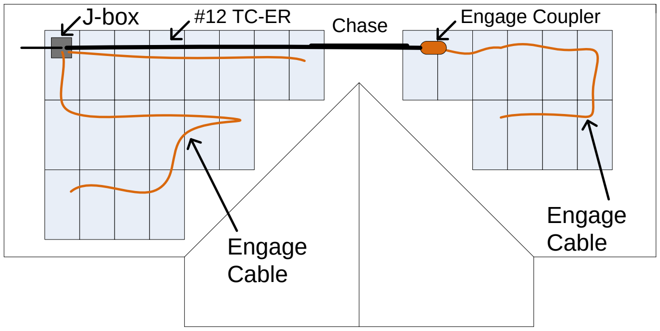
VRise = (215W/inverter) * (# of inverters/branch circuit) * (0.00205Ω/ft) * (1 way wire length) / 208V

208V Scenario 1: Suppose we are running 30 feet of #12-5 TC-ER field cable between the Engage Cable and the roof mounted junction box, and the Engage Cable is populated with 24 M215 Microinverters.

Vrise = (215W * 24 M215) * (0.00205 Ω/ft) * (30 ft) / 208V = 1.53V
% of Vdrop = 1.53V / 208V = **0.74%**

208V Scenario 2: Suppose we are running 30 feet of #12-5 TC-ER field cable between the Engage Cable and the roof mounted junction box as displayed in the image to the right.

The #12-5 TC-ER field cable will carry the current of ten M215 Microinverters. As recommended, we will round the number up from ten to 12.



Vrise = (215W * 12 M215) * (0.00205 Ω/ft) * (30 ft) / 208V = 0.76V
% of Vdrop = 0.76V / 208V = **0.37%**

208V Scenario 3: Suppose we are running 30 feet of #12-5 TC-ER field cable between two sections of Engage Cable in a branch circuit of 24 M215 Microinverters. The first section of cable nearest to the junction box contains 12 M215 Microinverters and the second section of cable also contains 12 M215 Microinverters. In this scenario, the #12-5 TC-ER field cable will carry the current of the 12 M215 Microinverters.

Vrise = (215W * 12 M215) * (0.00205 Ω/ft) * (30 ft) / 208V = 0.76V
% of Vdrop = 0.76V / 208V = **0.37%**

Additional documents for Enphase products are available at:
http://www.enphase.com/support/downloads/.