Circuit Calculations for the M215 Microinverter

Overview

This document serves as a reference guide for properly sizing conductors for M215 microinverter branch circuit home runs. This supplements the more comprehensive Enphase Energy technical brief, *Calculating AC Line Voltage Drop for M215 Microinverters with Engage™ Cables*. Enphase Energy recommends maintaining the total voltage drop on all wiring sections to 2% or less. This includes the Enphase Engage Cabling, the homerun wiring from the junction box to the microinverter subpanel, and the section from the microinverter subpanel to the main service panel or Point of Common Coupling (PCC).

This document lists the maximum conductor lengths from the array located junction box back to the main service panel, assuming that a 1% voltage drop is maintained.

240 VAC Single-Phase

External Branch (Home Run) Wiring Maximum Distance to Maintain 1% V_{Drop} for 240 VAC Single-phase

	Microinverters per Branch for 240 VAC Single-Phase																
AWG	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
	Maximum One-Way Wire Length (in Feet) to Maintain 1% V_{DROP}																
#12	653	327	218	163	131	109	93	82	73	65	59	54	50	47	44	41	38
#10	1038	519	346	260	208	173	148	130	115	104	94	87	80	74	69	65	61
#8	1656	828	552	414	331	276	237	207	184	166	151	138	127	118	110	103	97
#6	2627	1313	876	657	525	438	375	328	292	263	239	219	202	188	175	164	155
#4	4173	2087	1391	1043	835	696	596	522	464	417	379	348	321	298	278	261	245

V_{Drop} Calculation

The typical formula to calculate the percent of voltage drop for 240 VAC single-phase is:

$$\%\,VDrop = \frac{(Amps/Inverter \times \#\ of\ Inverters) \times (Resistance\ \Omega/ft) \times (2\ way\ wire\ length\ feet)}{240\ Volts}$$

Circuit Current Calculation

The formula to calculate the circuit current of a branch is:

$$Amps/Branch = Maximum\ Output\ Power \div 240\ V \times \#\ of\ Microinverters$$

For example, if the maximum output power is 215 Watts AC and there are 17 microinverters, then:

$$215\ W \div 240\ V \times 17 = 15.3\ \ Amps/Branch$$

Overcurrent Protection Calculation

Use the value of 1.25 and the Circuit Current Calculation on page 1 to determine the overcurrent protection value. For example, if the circuit calculation is 15.3 Amps, then:

$$15.3 \times 1.25 = 19.1\ Amps$$

Conclusions for 240 VAC Single-Phase

For less than 1% voltage drop in a fully populated branch circuit home run for 240 VAC single-phase:

- Install 1 to 17 M215 microinverters per branch circuit, up to 3655 Watts AC
- Install a maximum 2 Pole 20 Amp circuit breaker
- Use a minimum 12AWG wire size
- Engage Cable required

208 VAC Three-Phase

External Branch (Home Run) Wiring Maximum Distance to Maintain 1% V_{Drop} for 208 VAC Three-Phase

Microinverters per Branch for 208 VAC Three-Phase									
	3	6	9	12	15	18	21	24	25
AWG	Maximum One-Way Wire Length (in Feet) to Maintain 1% V_{DROP}								
#12	335	168	112	83.8	67	56	48	42	39
#10	559	279	186	140	112	93	80	70	64
#8	860	430	287	215	172	143	123	107	99
#6	1369	684	456	342	274	228	196	171	158
#4	2164	1082	721	541	433	361	309	270	250

V_{Drop} Calculation

The typical formula to calculate the percent of voltage rise for 208 VAC three-phase is:

$$\%\ VDrop = \frac{(Watts/Inverter) \times (\#of\ Inverters) \times (Resistance\ \Omega/ft) \times 1\ way\ wire\ length\ feet) / 208\ Volts}{208\ Volts}$$

Circuit Current Calculation

The formula to calculate the circuit current of a 208 VAC three-phase branch is:

$$Amps/Branch = \frac{Maximum\ Output\ Power/208\ Volts}{1.732\ (value\ of\ \sqrt[2]{3}\ for\ three\ phase)}$$

For example, if the maximum output power is 215 Watts AC and there are 25 microinverters, then:

$$215\ W \div 208\ V \times 25 \div 1.732 = 14.92\ Amps/Branch$$

Overcurrent Protection Calculation

Use the value of 1.25 and the Circuit Current Calculation value on page 2 to determine the overcurrent protection value. For example, if the circuit calculation is 14.92 Amps, then:

$$14.92 \times 1.25 = 18.65\ Amps$$

Conclusions for 208 VAC Three-Phase

For less than 1% voltage drop in a fully populated branch circuit home run for 208 VAC three-phase:

- Install 3 to 25 M215 Microinverters per branch circuit, up to 5160 Watts AC
- Install a maximum 3 Pole 20 Amp circuit breaker
- Use a minimum 12 AWG wire size
- Engage Cable Required

Summary

To minimize any installation difficulties, please adhere to the tables in this document and the information in the Enphase technical brief, *Calculating AC Line Voltage Drop for M215 Microinverters with Engage™ Cables* (refer to www.enphase.com/support/downloads).