

AC Disconnecting Means

Overview

Authorities Having Jurisdiction (AHJs) often ask electricians to install specific AC disconnecting hardware and place it on the rooftop for microinverter-based PV systems. This document explains how Enphase Microinverter-based PV systems satisfy all “disconnecting means” National Electrical Code (NEC) requirements, without need for additional disconnect hardware. The following code editions are considered:

- NFPA 70: NEC 2011 and **NEC 2014**, Article 690, Part III Disconnecting Means
- California Electrical Code (CEC) 2016, which is based on **NEC 2014**.

Enphase Microinverter systems do not require installation of any additional rooftop AC disconnect hardware. Installers mount Enphase Microinverters within a PV array, and the microinverter and cable connectors, as part of the product listing, have been evaluated to meet the requirements of 690.33, NEC 2011 **[690.33, NEC 2014]**. The connectors also meet the disconnect requirements of 690.14, NEC 2011 **[690.15, NEC 2014]**.

The AC circuit breaker in the main panelboard serves as an additional AC disconnecting means per 690.14(D)(3), NEC 2011 **[690.15(A)(3), NEC 2014]**. When this panelboard is located near ground level, the installation meets the requirements of 690.14(C)(1), NEC 2011 **[690.13(A), NEC 2014]**.

Background

The following images show a typical microinverter system where the microinverter connects to the PV module mounting rails and where the PV module is mounted over the microinverter. The microinverter has DC power connections to the PV module, while the AC power connects through an Enphase trunk cable. An array of PV modules and microinverters interconnect through an AC cable system. All of these components, when used together, are evaluated as a listed assembly. The AC cabling connects to building wiring and terminates with a circuit breaker in an AC panelboard.



Section 690.15, NEC 2011 **[690.15, NEC 2014]** requires that inverters (including microinverters) include disconnects from all sources of power and that the disconnecting means are grouped at or within sight of the inverter. The DC and AC connectors of listed Enphase Microinverters satisfy this requirement.

Installers typically locate Microinverters in PV arrays on the roof of a building (not considered a readily-accessible location). However, Section 690.14(D), NEC 2011 **[690.15(A), NEC 2014]** permits mounting of utility-interactive inverters in locations that are not readily-accessible.

Additionally, 690.14(D)(1) and (2), NEC 2011 **[690.15(A)(1) and (2), NEC 2014]** require that AC and DC disconnects exist within sight of or within the inverter. Section 690.14(D)(3), NEC 2011 **[690.15(A)(3), NEC 2014]** requires placing an additional AC disconnect according to the location requirements of 690.14(C)(1), NEC 2011 **[690.13(A), NEC 2014]**.

This requires installers to locate an additional AC disconnect in a readily-accessible area, typically at near ground level. This additional disconnect may be either:

- A separate disconnect (such as the utility-required AC disconnect) OR
- A backfed circuit breaker in a panel board, provided that it meets the location requirements of 690.14 [C] [1], NEC 2011 **[690.13(A), NEC 2014]**

Since the additional disconnecting means must be located in a readily-accessible location, a rooftop mounted disconnect clearly does not meet these requirements.

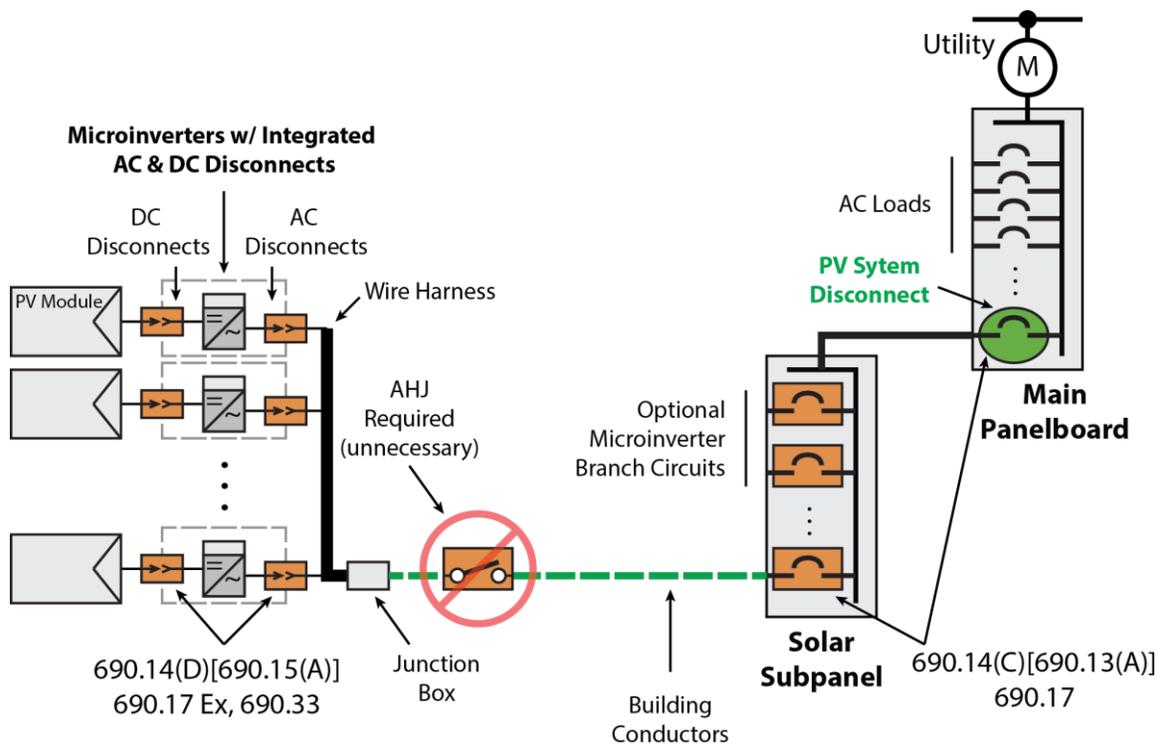
However, an exception to Section 690.17, NEC 2011 **[Exception to 690.17, 2014 NEC, TIA 14-9¹]** permits use of connectors as AC or DC disconnecting means, provided they are listed and identified for the use and meet the requirements of Section 690.33, NEC 2011 **[690.33, NEC 2014]**. Because the AC and DC connectors of the Enphase Microinverter have been evaluated as a disconnecting means, as part of a listed product, to meet these connector requirements, they can serve as a disconnecting means for the inverter².

Conclusion

Enphase Microinverter systems do not require installation of any additional rooftop AC disconnect hardware. Though Enphase Microinverters are mounted within the PV array, the connectors have been evaluated, as part of the product listing, as meeting the requirements of 690.33, NEC 2011 **[690.33, NEC 2014]**, and the connectors meet the disconnect requirements of 690.14, NEC 2011 **[690.15, NEC 2014]**.

The AC circuit breaker in the main panelboard serves as an additional AC disconnecting means per 690.14(D)(3), NEC 2011 **[690.15(A)(3), NEC 2014]**. Additionally, the system meets the location requirements of 690.14(C)(1), NEC 2011 **[690.13(A), NEC 2014]** when the panelboard is at ground level.

Any AHJs requiring yet another disconnecting means on the rooftop or near the microinverters should refer to the following single line drawing. An additional disconnect is unnecessary as the Enphase Microinverter system meets the code as described.



¹ NFPA 70® National Electrical Code® 2014 Edition – TIA 14-9

² See page 44 of [M250 Operation and Installation Manual](#).