AUSTRALIA / NEW ZEALAND

Equipment Earthing Techniques for M-series, S-Series and IQ Series Enphase Microinverters

Summary

This Technical Brief describes correct microinverter earthing methods for compliance to PV array earthing requirements.

Earthing of PV arrays is a requirement for all domestic and commercial grid-connected systems and has been mandatory since the release of *AS/NZS 5033-2012: Installation and safety requirements for photovoltaic (PV) arrays.*

On November 6th, 2014 an updated standard was released. The update, *AS/NZS 5033-2014: Installation and safety requirements for photovoltaic (PV) arrays,* alters PV array earthing requirements for microinverters.

Earth Functions

Earthing of PV arrays is a safety requirement for four main reasons:

- To provide a path for fault current to flow
- To prevent uneven potentials of exposed metal parts on a PV array.
- To specify functional earthing
- To describe lightning protection

The fault current requirements of an earth conductor relate to the current carrying capacity of the active conductors. With Enphase, the active conductors in the Enphase cable limit the earth bonding requirement to 4mm^2 within the array. From the AC isolator or PV load centre back to the switchboard, the earth conductor is sized according to the active conductor size. Refer to AS/NZS 3000:2007, table 5.1, for earth conductor size tables.

Functional earthing is a requirement of some PV equipment to remove surface charge on a PV module or to operate safety systems. Enphase Microinverters do not have any functional earthing requirements.

If lighting protection is required as per AS/NZ 1768, then the earthing conductor is required to be 16mm^2 or larger, so a separate earth cable is required from the earth electrode directly to the array frame. For lightning protection, the Enphase cable cannot be used, so the following options do not apply.

Earthing Enphase Systems

IQ-Series Microinverters (Double Insulated)

Enphase IQ-Series Microinverters are certified as non-conductive double insulated. As the IQ-Series Microinverters are double insulated, the earth conductor is not required within the AC Q Cable system that connects each microinverter.

PV array earthing requirements state that an earth must be installed from the PV array to the MEN location.

IQ-Series Earthing Methods

OPTION 1:
If the AC solar cable installed to the rooftop AC isolator includes an appropriately sized earth conductor (refer to AS/NZS 3000:2007 Table 5.1), a minimum 4mm^2 earth conductor must then be installed from the AC isolator and bonded onto the solar rail.

You must bond/earth all PV modules to the array frame. Ensure that an earth conductor is bonded from the array frame continuously to the earth bar on a switchboard.

All solar PV arrays must be earthed as per AS/NZS 5033-2014.

OPTION 2:
You can run a minimum 4mm^2 earth conductor from the earth bar on a switchboard to the PV module frame. ***You must bond/earth All PV modules to the array frame.***

M-Series and S-Series Microinverters (Earth Bonded)

Enphase M-Series, and S-Series Microinverters are earthed through the connection to the Enphase Engage (trunk) Cable. Once the Engage connector is plugged into the trunk cable, the microinverter has a connection to the AC source as well as an earth source from the earth bar. The aluminium plate on the top of the microinverter is then internally mechanically bonded to earth.

M-Series and S-Series Earthing Methods

OPTION 1:
You can place a WEEB-style earthing washer between the microinverter mounting plate and the array frame. The washer must provide the equivalent to a 4mm^2 bonding connection. Each microinverter must have one or more washers connecting it to the solar module mounting frame.
You must bond/earth All PV modules to the array frame.

OPTION 2:
You can run a minimum 4mm^2 earth conductor from the AC isolator on the roof to the array frame.
You must bond/earth All PV modules to the array frame.

OPTION 3:
You can run a minimum 4mm^2 earth conductor from the earth bar on a switchboard to the PV module frame. ***You must bond/earth All PV modules to the array frame.***

Earthing Methods Reference

Enphase Microinverter Series	**Compatible Enphase Cable System**	**Suggested Earthing Method**	**Requirements**
M-Series	Engage Cable *Contains earth conductor*	Earth washer installed under each microinverter	You must install an earth conductor between the AC isolator and earth bar on a switchboard. The earth conductor can be integral to solar AC cabling (e.g., 4mm^2 2C+E TPS, etc.).
S-Series	Engage Cable *Contains earth conductor*	Earth washer installed under each microinverter	
IQ-Series	Q-Cable *No earth Conductor*	4mm^2 minimum earth conductor installed between solar AC isolator and solar array frame	

Commissioning the Enphase PV System

To commission a system successfully, consider two electrical tests: An insulation test and a bonding conductor continuity test.

Insulation testing

An insulation test ensures that electrical separation between the cable conductors is maintained. As per the insulation resistance procedure in section D4 of AS/NZS 5033:2014, the **INSULATION TESTING MUST NOT BE COMPLETED WITH INVERTERS CONNECTED** or you will damage the inverters.

Test Voltage	**Insulation Resistance**
250 V	>0.5MΩ

Bonding conductor continuity

Check that the resistance between exposed metal parts of a PV array to the earth electrode is **<0.5Ω**. Refer to AS/NZS 3000:2007 section 7.4.7.4.