Mounting and Grounding of Module-Level Power Electronics (MLPE) on Solar Mounts, LLC Ground Structures & Solar Carports

Background:

PV module level power electronics (MLPE) have become a very popular feature in many residential and commercial rooftop installations over the past 15 years. What are they? They are small, rugged, NEMA 4X / IP65 electronics enclosures, typically 15-25 cm (7-9") in length and width, with a depth rarely exceeding 5 cm (2 inches). They are designed to fit underneath a PV module, within the frame dimensions. In almost every case, the device will have a mounting plate or tabs where the device can be hung/attached/clipped to the PV module frame itself, or onto the PV module support rails or carport purlins. NOTE: many of these MLPE devices can handle 2 or 4 PV modules simultaneously.

Microinverters convert the PV module DC power to 240V AC power right at the PV module. On the other hand, PV module optimizers will manipulate the PV module voltage and current output (in concert with other optimizers on the same PV string) to optimize PV string output. Finally, in any rooftop system in North America, PV module rapid shutdown devices must be deployed to ensure rooftop system safety (NEC Article 690.12). NOTE: since microinverters and optimizers are located at each PV module, shutting down power to the PV system will shut down each microinverter and optimizer, essentially providing module-level rapid shutdown.

Although rapid shutdown devices (i.e., "RSD") are required on every rooftop installation in North America, microinverters and PV module optimizers are not required by the National Electrical Code. These devices are an option for system owners who are striving to maximize their PV system output but have trees or obstructions that throw shadows on the PV array during peak sun hours. And these devices are simultaneously meeting Code for module-level rapid shutdown of your rooftop PV array. Microinverters and optimizers can maximize the PV module output, or PV module string output, even though the module or a group of modules are being shadowed, variably heated, variably tilted, etc.. And there are other advantages to installing MLPE devices, e.g., granular monitoring, more options for layouts, reducing the distance from rooftop obstructions to open up more space on a commercial roof, etc..

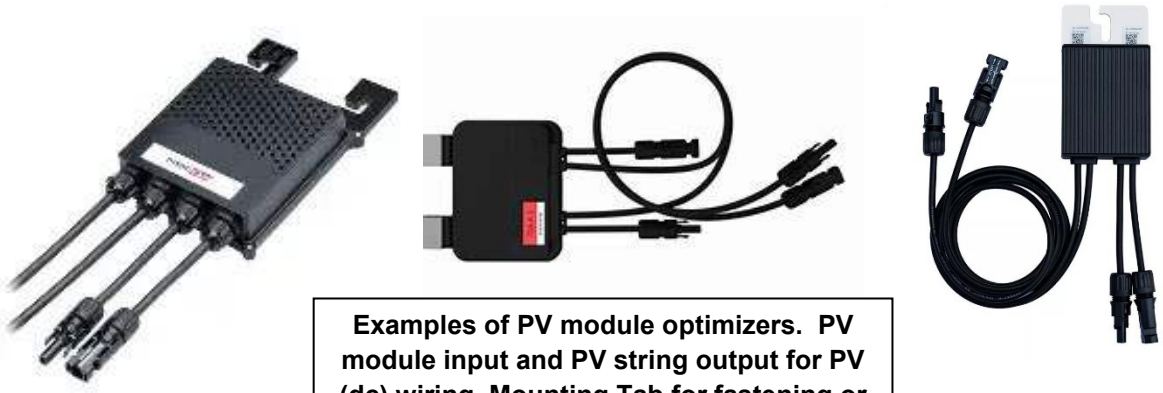
Deploying MLPE on Solar Mounts, LLC Solar Carports:

First, please recognize that solar carports are not classified as a building, and therefore, rapid shutdown (Article 690.12) is not required. Solar Carports are defined in the International Building / Fire Code as **detached, non-habitable Group U structures** (please see Solar Mounts Application Note on Solar / Shade Structures as Defined by the IBC / IFC).

However, there are advantages to installing module-level microinverters or optimizers. Solar Carport system owner/operators can expect 5-20% increase in PV system output, especially in partially shaded locations, and as the system ages. Owning a system with MLPE allows system operators and owners to watch every PV module. This can pay benefits if the abundant data helps guide preventative maintenance. So, there may be carport owners who want to optimize the performance of their PV system. There may be carport owners who have PV arrays near trees or that get shaded by nearby buildings. Microinverters or optimizers at every PV module on carports at partly shaded sites can noticeably improve the performance of these systems.

Below are examples of microinverters You can see they measure ~8” x 7” x 1.5” (Enphase M250 = 212 mm (8.3 in) × 175 mm (6.9 in) × 30.2 mm (1.2 in)). This is typical for single or double-module devices. On both examples, you see a metallic mounting tab/plate at the top of each device. Installers can use this metallic tab to ground the device and attach it to the PV module support system.

Examples of Microinverters. Input for PV (dc) wire, output for AC trunk (string) cable. Mounting Tab for fastening to the support rails or purlins.



Examples of PV module optimizers. PV module input and PV string output for PV (dc) wiring. Mounting Tab for fastening or clipping to the support rails or purlins

Images above show PV module optimizers with different types of mounting tabs at the top of the devices. Optimizers (and RSDs) are smaller and lighter weight than microinverters and are sometimes attached to the PV module support rack with only one fastener. It is not uncommon to see the entire optimizer supported by only the tab(s)/plate at the top, while the rest of the device hangs in free air, kind of a “diving board’ situation(!), but also keeping the heat sink and device cool.

Installation Method

If the optimizer or microinverter cannot be clipped onto the inside of the PV module frame (this is the best option for the Solar Mounts, LLC Ballasted Roof System), Solar Mounts, LLC recommends installers use a 1”-1.5” stainless or galvanized (e.g., GR5) self-drilling screw with a flat washer at the mounting tab to secure the microinverter or optimizer to the purlin. Attach the device so that the heat sink is not blocked and the dc / ac wires can be routed along the purlins so that the dc/ac wires are free to expand and contract but are bundled and protected for a professional look.

If you have any questions about the grounding and mounting of module-level power electronics (MLPE) like microinverters and optimizers, please contact us and let’s talk about it!

Contact Us

For technical support, specification questions, or sales inquiries:

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