

Bulletin 64-6-3
PV rapid shutdown
Rules 64-200, 64-218

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Scope

- 1) Background
- 2) PV rapid shutdown initiator
- 3) Rapid shutdown requirements for split arrays
- 4) Micro-inverters and roof mounted “string” inverters

1) Background

Fire service representatives are concerned about the inherent shock hazard that most PV power systems present to first responders. To address their concerns, Rule 64-218 provides requirements for the rapid shutdown process for PV systems installed on or in buildings. For ground-mounted PV systems, where the PV Source circuits enter a building that only houses PV system equipment, the rapid-shutdown requirements do not apply.

Based on the intent of Rule 64-218, rapid shutdown process can be defined as a process that:

- de-energizes PV source or output conductors that are more than 1 m in length on or inside a building, and
- de-energized conductors to not more than 30 V within 30 s of initiation.

If a combiner is close (not more than 1 m) to a PV array/module, Rule 64-218 does not require a PV module level shutdown. PV conductors within a PV array and up to a combiner box located within 1 m are permitted to remain energized.

It is important to understand that Rule 64-218 does not provide “**how to**” design the rapid shutdown process.

The Rule specifies the objective and the end result of the rapid shutdown process includes:

- circuits required to be de-energized
- acceptable voltage; and
- time to achieve that voltage.

2) PV rapid shutdown initiator

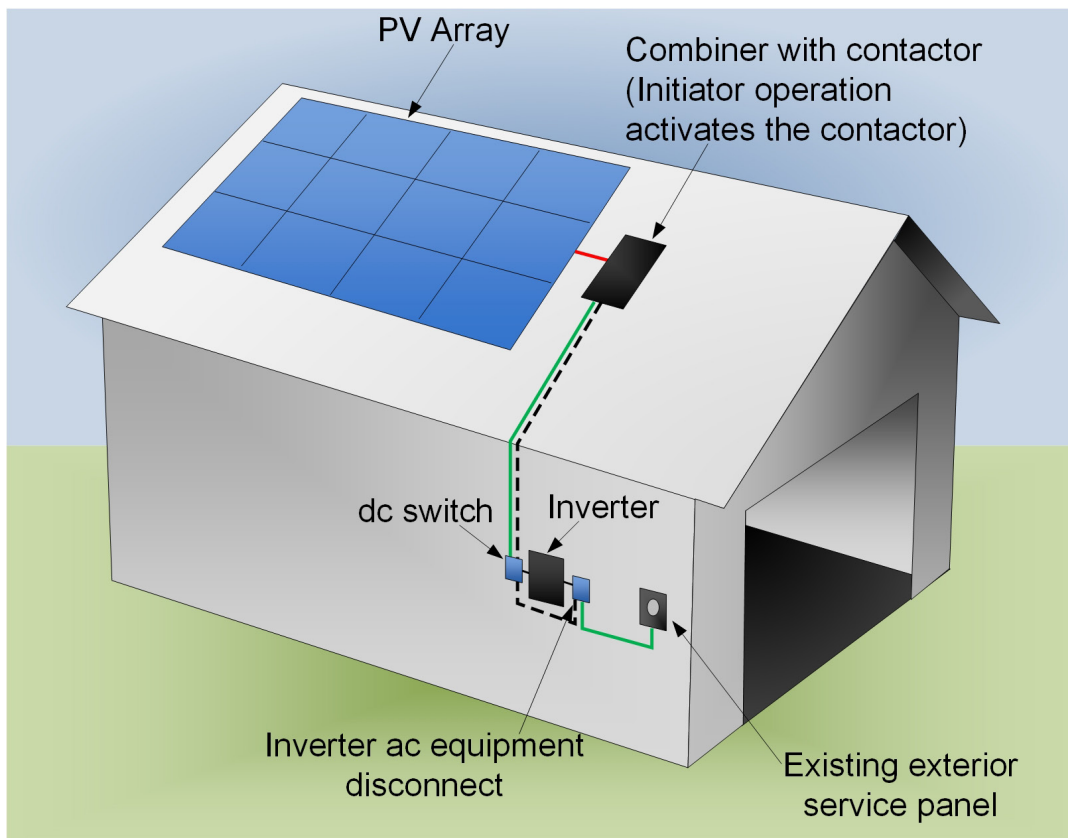
There shall be a device included in the PV rapid shutdown process that initiates the process. Considering that the intent of the Rule is that emergency responders can shut down the PV system, should an emergency situation occur, the rapid shutdown initiator is required to be a manual device. When a manually activated rapid shutdown device is

provided, there is nothing that prevents other systems, such as an ancillary device from a fire alarm system, to also be able to shut down the system. The initiator may or may not be required to be a load breaking device, based on the design. If the initiator is part of a control circuit that activates a rapid shutdown and is not interrupting any load, it is not required to be a load breaking disconnecting means. Only when the initiator activates the rapid shut down by opening a PV source or output circuit is it required to be a load breaking disconnecting means. Rule 64-218 requires a device to initiate photovoltaic rapid shutdown to be readily accessible and located at the supply authority meter location. For other than single dwelling units, the location shall be at the consumer service or meter and at a permanent access to a building roof where the array(s) is installed; or within sight and within 9 m of the array(s). For stand alone systems, the initiating device shall be located at the permanent access to the building roof where the array(s) is installed or within site and within 9 m.

Rule 64-218 does not specify that a rapid shutdown device is required to be an emergency shut-off switch used for only that purpose. Based on a rapid shutdown process design, PV ac or dc disconnecting means may also be used as a rapid shutdown initiator, as shown in Diagram B2. The examples of devices that may be used as an initiator are:

- Utility disconnect switch
- “DG” disconnect switch
- Rapid-shutdown switch

Diagram B2 – “DG” disconnect switch or Utility disconnect switch may be used as an initiator



3) Rapid shutdown requirements for conductors of a split array

Rule 64-218 1) requires a PV system to be provided with a rapid shutdown when the PV source or output circuit insulated conductors is more than 1 m from the array. Questions have been asked if the requirements still applies to split arrays where the interconnecting wiring between the segments of the array exceeds 1 m from the PV array. Since it is difficult to tell which modules are interconnected with other modules to form a power producing unit, rapid shutdown is still required since the intent is to quickly identify conductors which are still energized after the rapid shutdown has been initiated primarily by first responders.

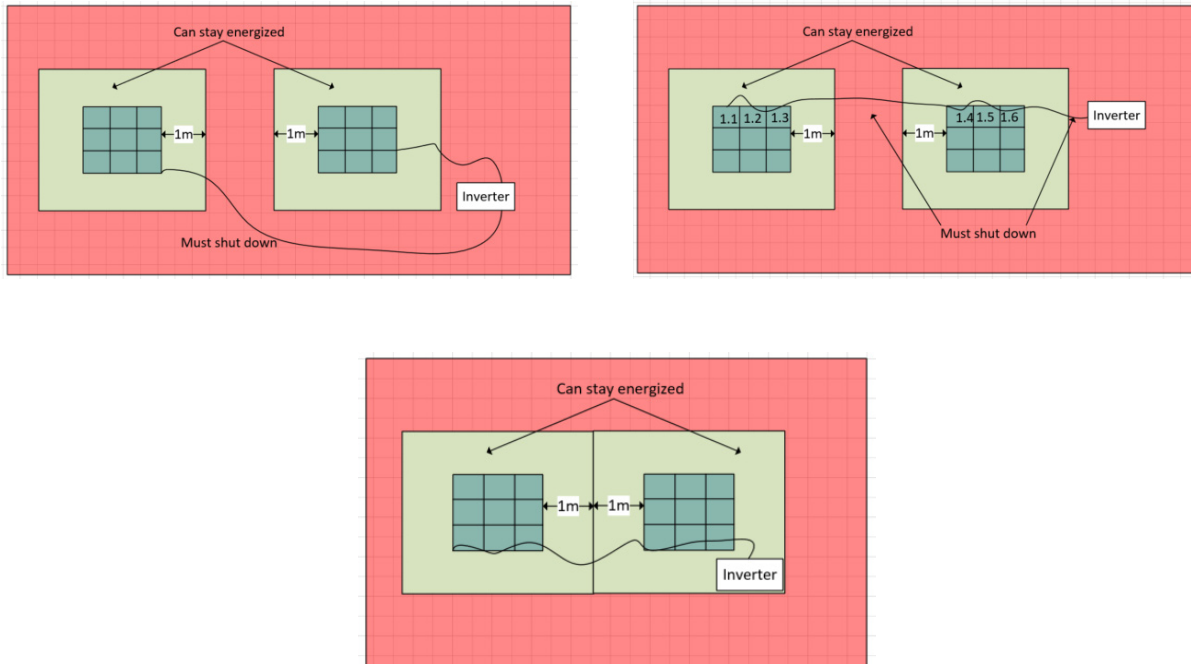
Question

Where a Photovoltaic array is comprised of PV modules that are not contiguous (split array), can the interconnecting wiring between segments of the array exceed 1 meter without meeting rapid shutdown requirements of Rule 64-218 1)? (Diagram B3 below shows examples for rapid shutdown requirements).

Answer

No

Diagram B3 - Split array rapid shutdown requirements



4) Micro-inverters and roof mounted “string” inverters

PV installations with micro-inverters and ac modules may inherently comply with rapid-shutdown requirements. Loss of ac power immediately de-energizes all PV system circuits outside the array. Only circuits internal to modules and between modules and micro-inverters or ac modules remain energized.

Another case would be where an interactive inverter (that operates only in grid-dependant mode) with an integral combiner box, sometimes referenced as a “string” inverter, is located within 1m of a PV array/module. Loss of ac power will immediately de-energize PV system conductors outside the 1 m envelope.

Marking is required, in accordance with Rule 64-200 2) and 3), to identify that the PV system is equipped with rapid shutdown and identification of the Utility disconnect switch, when used as the rapid shutdown initiator.