



# INSTALLATION GUIDE



## UL 3741 PV Hazard Control Installation Addendum For SolarMount Residential Roof Applications

© 2022 by Unirac, Inc. All rights reserved.



# INSTALLATION GUIDE

---

## TABLE OF CONTENTS

INTRODUCTION .....	1-2
CERTIFICATION & MARKINGS .....	3
SYSTEM COMPONENTS.....	4
APPROVED INVERTERS .....	5-6
INSTALLATION METHODS.....	7
CONFIGURATION-1.....	8
CONFIGURATION-2.....	9
CONFIGURATION-3.....	10
WIRE MANAGEMENT .....	11

## INTRODUCTION

This manual describes the procedure to install the SOLARMOUNT product, including the SOLARMOUNT Tilt Legs product, to meet the requirements of the UL3741 PV Hazard Control Standard. All installers must thoroughly read this manual and have a clear understanding of the installation procedures prior to installation. Failure to follow the methods and procedures outlined in this manual may result in injury and/or damage to property.

The SOLARMOUNT Photovoltaic Hazard Control System (PVHCS) is a UL 3741 Listed system that complies with NEC 690.12(B)(2)(1), when installed by qualified individuals as per the installation procedures described in the SOLARMOUNT System installation manual and this addendum. In the following pages of this addendum, various example configurations of system designs that comply with 690.12(B)(2) are mentioned.

### Brief Background of 2020 NEC 690.12

As per 2020 NEC 690.12 Rapid Shutdown of PV Systems on buildings, All PV arrays installed on or in buildings shall include rapid shutdown functions to reduce shock hazard for Fire Fighters (FF) in accordance with 690.12(A) through (D):

### Brief Background of UL3741

UL3741 provide a means for evaluation of PV Hazard Control components, equipment and systems that provide a reduced level of shock hazard from energized PV system equipment and circuits located within the PV array after the operation of hazard control initiation function(s) where required, such as but not limited to any PV Rapid Shutdown Equipment (PVRSE) or PV Rapid Shutdown Systems (PVRSS) that comply with UL 1741 in the United States and CSA C22.2 No 330 in Canada.

### Controlled Conductors for Rapid Shutdown

- DC circuits of PV system
- Inverter output circuits originating from inverters located within array boundary

### Controlled Parameters for Rapid Shutdown

- Outside Array Boundary:  $\leq 30V$  within 30 seconds
- Inside Array Boundary:
  - a. Listed PV Hazard Control System (UL 3741)
  - b. PV array with appropriate wire management to limit conductive parts exposure. *See page 12*

### NOTE:

- Solar Mount was tested and evaluated up to 1000 Vdc, meeting safety standards.
- Per NEC 690.7(2), PV system DC circuits for one- and two-family dwellings are limited to 600 volts.
- Compliance with UL 3741 ensures adherence to NEC (NFPA 70, 2017 and later editions) and CE Code C22.1 requirements:
  - Controls electrical shock hazards within the PV array boundary (NEC section 690.12(B)(2)).
  - Inverters and power conversion systems must comply with the 30V in 30 seconds requirement outside the PV array (NEC 690.12(B)(1)), ensuring rapid shutdown for safety.

**IMPORTANT:** Requirements for PV arrays addressed in UL 3741 are intended for compliance with the National Electrical Code (NEC), NFPA 70, 2017 and later editions and their requirements for controlling electrical shock hazards inside the array boundary as addressed in NEC section 690.12(B)(2), Rapid Shutdown of PV Systems on Buildings and with the Canadian Electrical Code (CE Code) C22.1. The Tesla equipment within this PVHCS additionally complies with the 30V in 30 seconds requirements outside the PV array as required in 690.12 (B)(1).

## DEFINITIONS

### INITIATION DEVICES

Device(s) that initiate the rapid shutdown function of the PV system

### EQUIPMENT

Equipment that performs rapid shutdown functions other than initiation devices, such as listed disconnect switches, circuit breakers, or control switches.

### ARRAY

NEC defines the array as a mechanically and electrically integrated grouping of modules with support structure, including any attached system components such as inverter(s) or dc-to-dc converter(s) and attached associated wiring. This indicates the SOLARMOUNT Racking and collocated inverters are part of the array.

### ARRAY BOUNDARY

Per NEC 690.12(B), the zone extending 1ft from array in all directions. This indicates that the array boundary can extend 1ft from the edge of the SOLARMOUNT racking, inverter or module.

## INSTALLER'S RESPONSIBILITY

- Ensure that SOLARMOUNT and other products are appropriate for the specific installation and are designed for the installation environment.
- Ensure all electrical installation and procedures should be conducted by a licensed and bonded electrician or solar contractor.
- Comply with all applicable local or national building and fire codes, including any that may supersede this manual.
- Ensure provided information is accurate and appropriate. Issues resulting from inaccurate and inappropriate information are the installer's responsibility.
- Ensure the system is grounded and bonded to meet the requirements of the National Electric Code.
- Disconnect AC power before servicing or removing modules, AC modules, microinverters and power optimizers.
- Ensure routine maintenance of a module or panel shall not involve breaking or disturbing the bonding path of the system and all work must comply with national, state and local installation procedures, and safety standards.
- If loose components or loose fasteners are found during periodic inspection, re-tighten immediately. Any components showing signs of corrosion or damage that compromise safety must be replaced immediately.
- Ensure bare copper grounding wire does not contact aluminum and zinc-plated steel components, to prevent risk of galvanic corrosion.
- Review module manufacturer's documentation for compatibility and compliance with warranty terms and conditions.
- Use only Unirac parts or parts recommended by Unirac; substituting parts may void any applicable warranty.
- Installers must refer to the SOLARMOUNT installation manual for complete installation instructions.

A yellow warning icon consisting of a black exclamation mark inside a triangle, set against a yellow background with a black border.

**IDENTIFIES CONDITIONS OR PROCEDURES,  
WHICH IF NOT FOLLOWED, COULD RESULT IN  
SERIOUS INJURY, DEATH, OR PROPERTY DAMAGE.**

A yellow caution icon consisting of a black exclamation mark inside a triangle, set against a yellow background with a black border.

**IDENTIFIES CONDITIONS OR PROCEDURES,  
WHICH IF NOT FOLLOWED, COULD RESULT IN  
SERIOUS DAMAGE OR FAILURE OF EQUIPMENT.**



**CONFORMS TO STD ANSI/UL 3741**

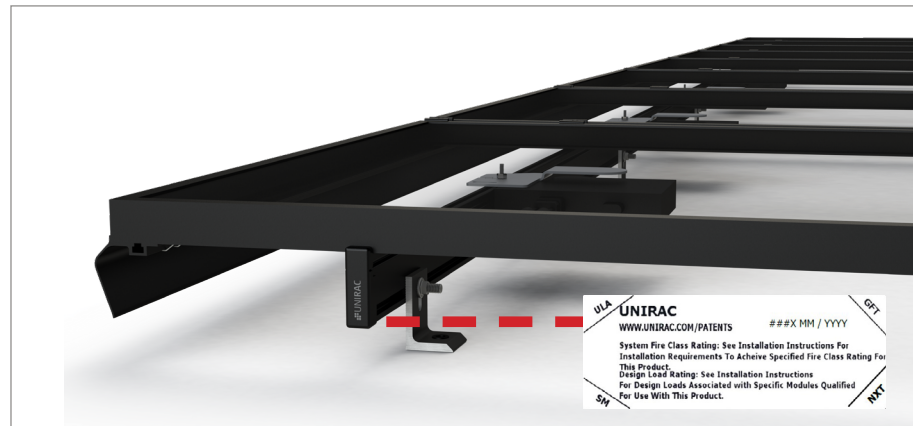
Maximum Photovoltaic Hazard Control System (PVHCS) Voltage: 600V

UL3741 LISTED



**MARKINGS**

Certification marking is embossed on module clamps. Labels should be applied to the rail at the edge of the array as shown below



**Following are the list of approved PV Hazard Control Equipment or Components evaluated at 600V Max System Voltage:**

*(Not all listed items must be implemented in a single system to achieve compliance to UL3741. Rather these are the items approved for use to meet the criteria outlined in this manual)*

## **1. MODULES**

**All modules that are fire rated as Type 1 or 2 and are listed in SOLARMOUNT Installation Guide with max module area of 29.49 ft<sup>2</sup>**

## **2. SOLARMOUNT System Components**

- SOLARMOUNT Rails
- L-Feet and Roof Attachments
- Pro Series Mid and End Clamps
- UAF Mid and End Clamps
- MLPE and Ground Accessories

*(For a complete list of SOLARMOUNT components, please refer to SOLARMOUNT installation manual.)*

## **3. Wire Clips (UL 62275 Listed)**

Hellermann Tyton Cable Ties & Edge Clips (Mnfr PNs 111-05256, 156-02224 & 156-02226)

**4. PV Connectors (UL 6703 Listed) shall be compatible and approved for the application.**

**5. PV Wire (UL 4703 Listed)**

**6. RayTray v2 Solar Wire Management System (UL 870 Listed)**

## **7. Listed Conduit (all sizes apply)**

- Electrical Metallic Tubing (EMT) (Sizes 3/4" and greater) (UL 797 Listed)
- Rigid Metal Conduit (RMC) (Sizes 3/4" and greater) (UL 6 Listed)
- Intermediate Metal Conduit (IMC) (Sizes 3/4" and greater) (UL 1242 listed)
- Flexible Nonmetallic Conduit (Sizes 3/4" and greater) (UL1660 Listed)
- PVC - Schedule 40 or 80 (Sizes 3/4" and greater) (UL 651)
- Listed Tubing, Fittings and Grounding Components

## INSTALLATION METHODS PER UL 3741 AND NEC 690.12

The following PV Design configurations are recommended by Unirac to show SOLAR MOUNT system comply with NEC 690.12(B). Compliance is not limited to these configurations.

**CONFIGURATION 1A:** Array(s) with Listed UL 3741 PV Hazard Control System and String Isolation Device(SID)– *See page 6*

**CONFIGURATION 2A:** Array(s) and Sub Array(s) with Listed UL 3741 PV Hazard Control System Within Same Array Boundary – *See page 8*

**CONFIGURATION 3A:** Arrays with Listed UL 3741 PV Hazard Control System With Distinct Array Boundaries – *See page 10*

## SOLAR MOUNT INSTALLATION WITH TESLA EQUIPMENT

The Solar Mount UL 3741 certification is applicable when used with Tesla's MCI-1 string isolation device in combination with either a Tesla PV Inverter, Powerwall+, or Powerwall 3 Power Conversion System (PCS).

### String Isolation Devices (SID)

- Tesla MCI-1 (1550379-00-F)
- Max Voltage = 600V, Max Imp = 13A, Max Isc = 19A

### PV Inverter (PVI)

- 7.6 kW (1538000)
- 3.8 kW (1534000)

### Energy Storage Systems

- Powerwall+ (1850000)
- Powerwall 3 (1707000)

**NOTE:** Refer to the applicable Tesla Inverter or Powerwall Installation Manual for specific instructions, including MCI-1 mounting, clearances, ratings, compatible connectors, and rapid shutdown initiation methods.

The following MCI-1 installation configurations are specific to the Solar Mount UL 3741 Listing and supersede MCI-1 configurations shown in the Tesla installation manuals.

**CONFIGURATION 1B:** Single Series String Array with Tesla MCI-1s – *See page 7*

**CONFIGURATION 2B:** Multiple Arrays Within Same Array Boundary Using MCI-1s – *See page 9*

**CONFIGURATION 3B:** Multiple Arrays With Distinct Array Boundaries Using MCI-1s – *See page 11*

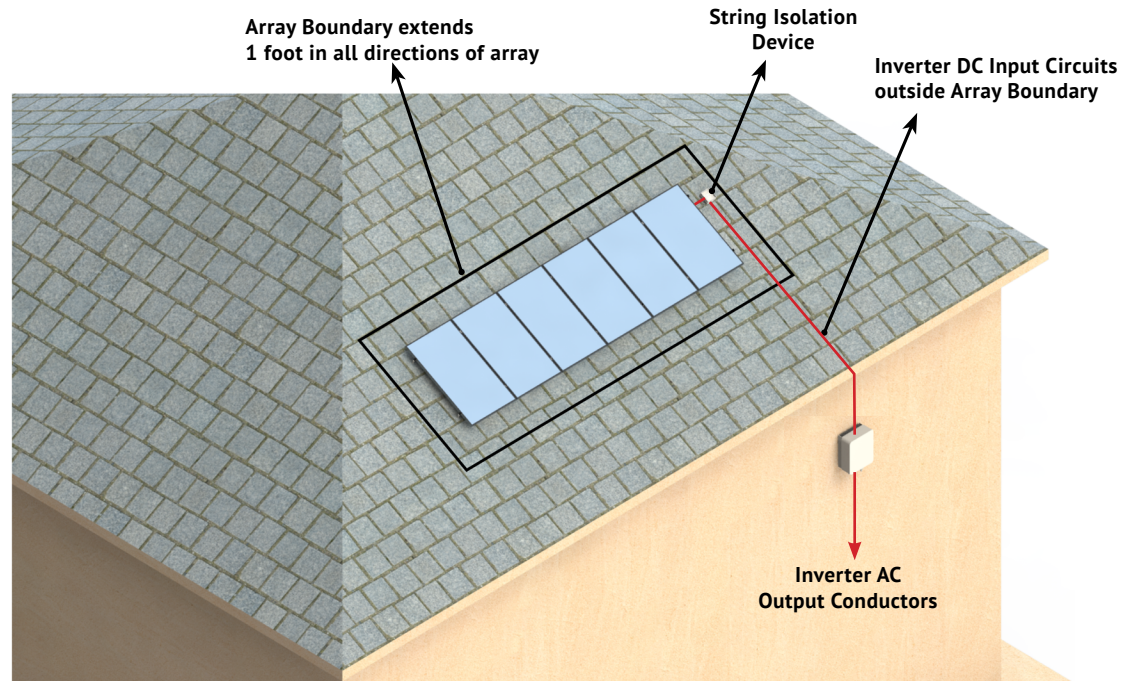
### Controlled Parameters after Rapid Shutdown Initiation for all configurations

**Outside Array Boundary:** ≤ 30V within 30 seconds

**Inside Array Boundary:** ≤ 600V

## CONFIGURATION-1A

*Array(s) with Listed UL 3741 PV Hazard Control System and String Isolation Device(SID)*



1. By using listed UL3741 PVHCS, array(s) complies with NEC 690.12(B)
2. Use String Isolation Device as shown in above figure to control inverter input circuits (DC) that are outside of the array boundary and comply with NEC 690.12(B)(1).

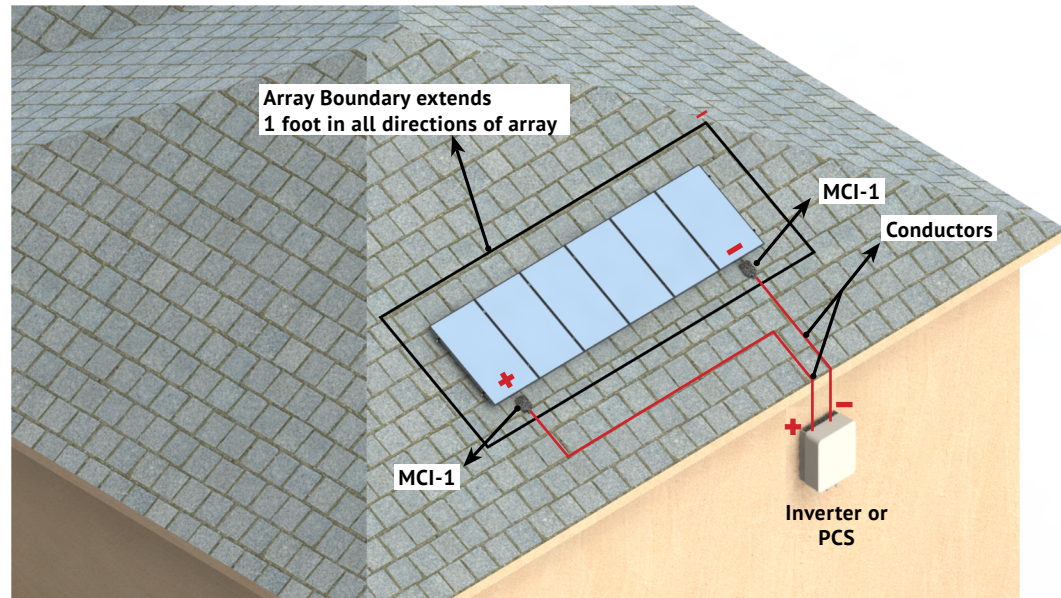
### NOTE:

- For controlled parameters information See page 5
- Refer to pages 4 and 5 for approved string isolation devices and installation methods

**Example array not specifically verified by Intertek.**

## CONFIGURATION-1B

*Single Series String Array with Tesla MCI-1s*



When a single string is connected within a single array, as illustrated above, it is essential to install Tesla MCI-1s at minimum at the positive and negative ends of the string, positioned between the end modules and the homerun leading to the PCS

**NOTE:**

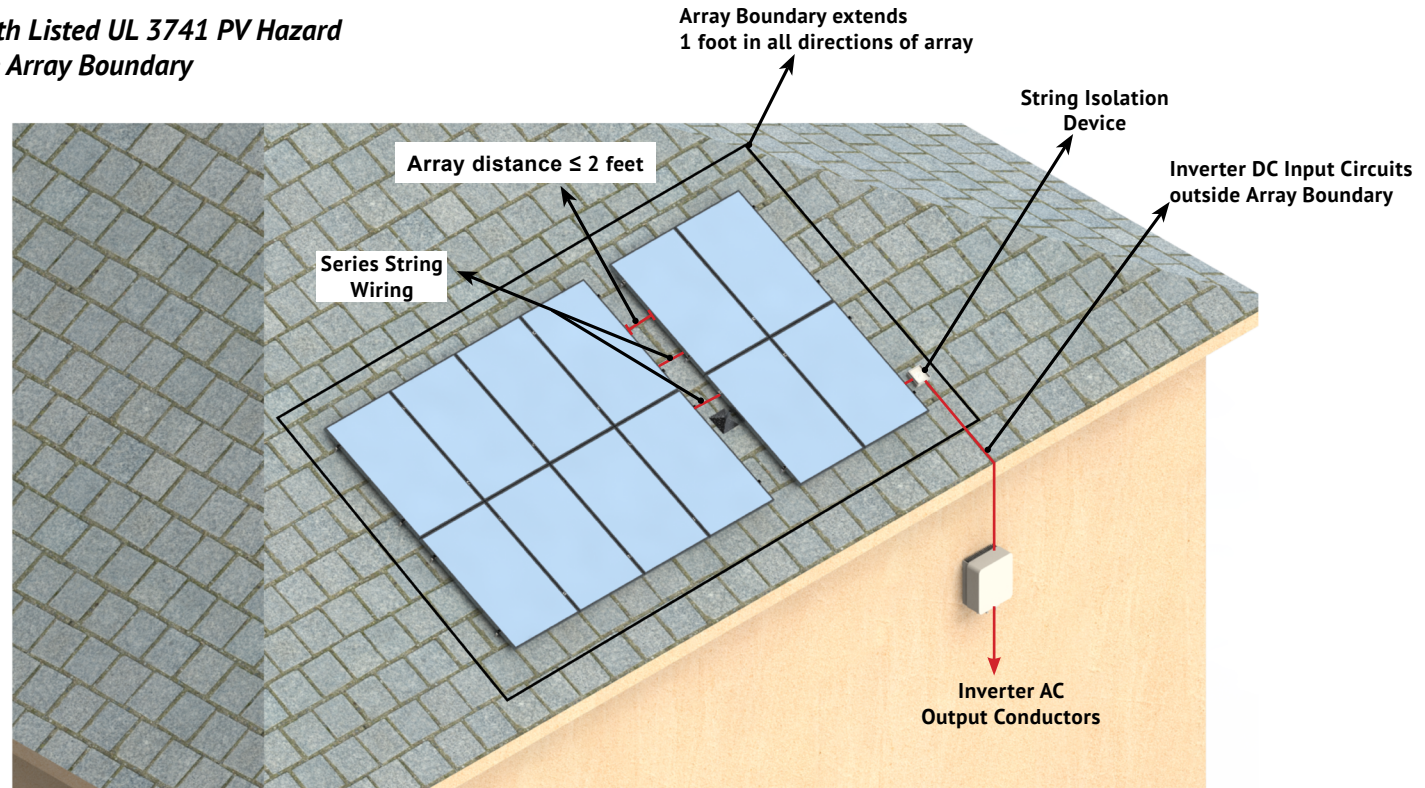
For controlled parameters information *See page 5*

Example array not specifically verified by Intertek.



## CONFIGURATION-2A

*Array(s) and Sub Array(s) with Listed UL 3741 PV Hazard Control System Within Same Array Boundary*



1. When two or more arrays are located not more than 2 feet apart, this results in a single array boundary.
2. By using listed UL3741 PVHCS, array(s) complies with NEC 690.12(B)
3. Use String Isolation Device as shown in above figure to control inverter input circuits (DC) that are outside of the array boundary and comply with NEC 690.12(B)(1).

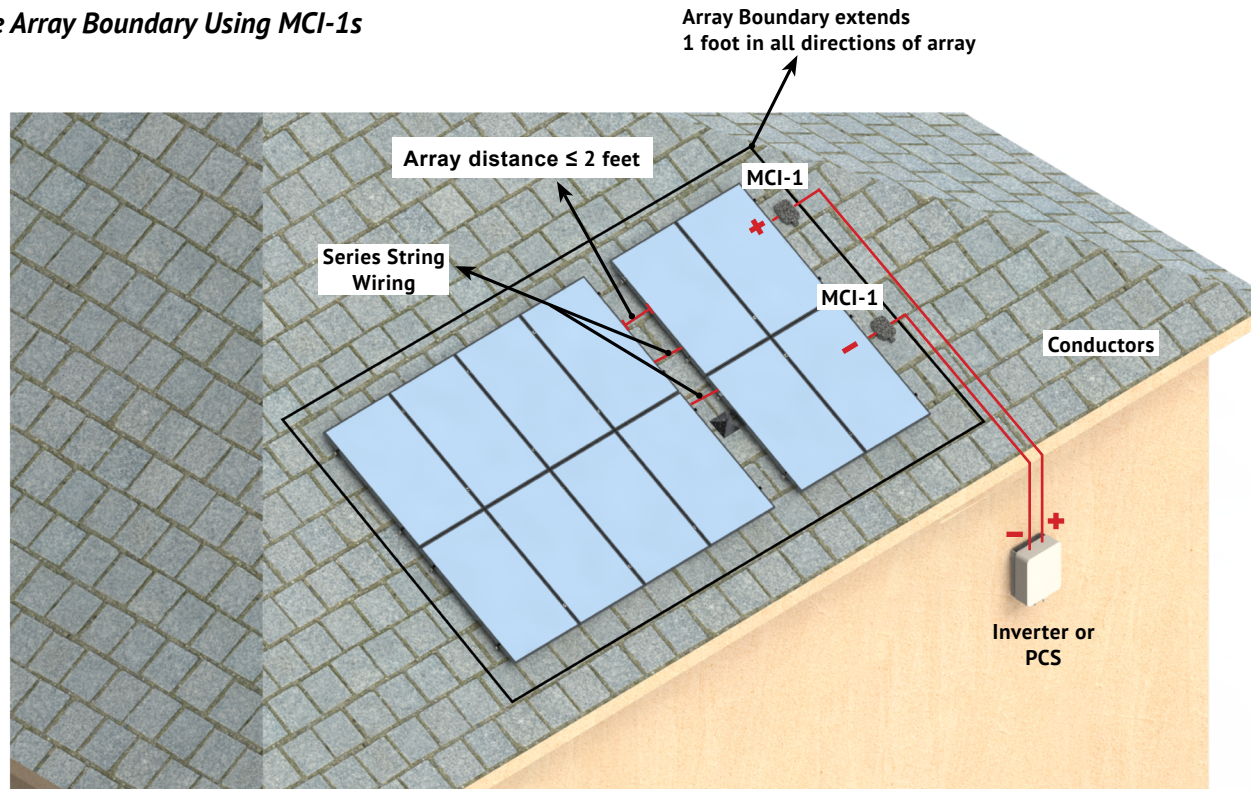
**NOTE:**

- For controlled parameters information See page 5
- Refer to pages 4 and 5 for approved string isolation devices and installation methods

**Example array not specifically verified by Intertek.**

## CONFIGURATION-2B

### Multiple Arrays Within Same Array Boundary Using MCI-1s



1. When two or more arrays are located not more than 2 feet apart, this results in a single array boundary.
2. When a two arrays are connected as illustrated above, it is essential to install Tesla MCI-1s at minimum at the positive and negative ends of the string, positioned between the end modules and the homerun leading to the PCS

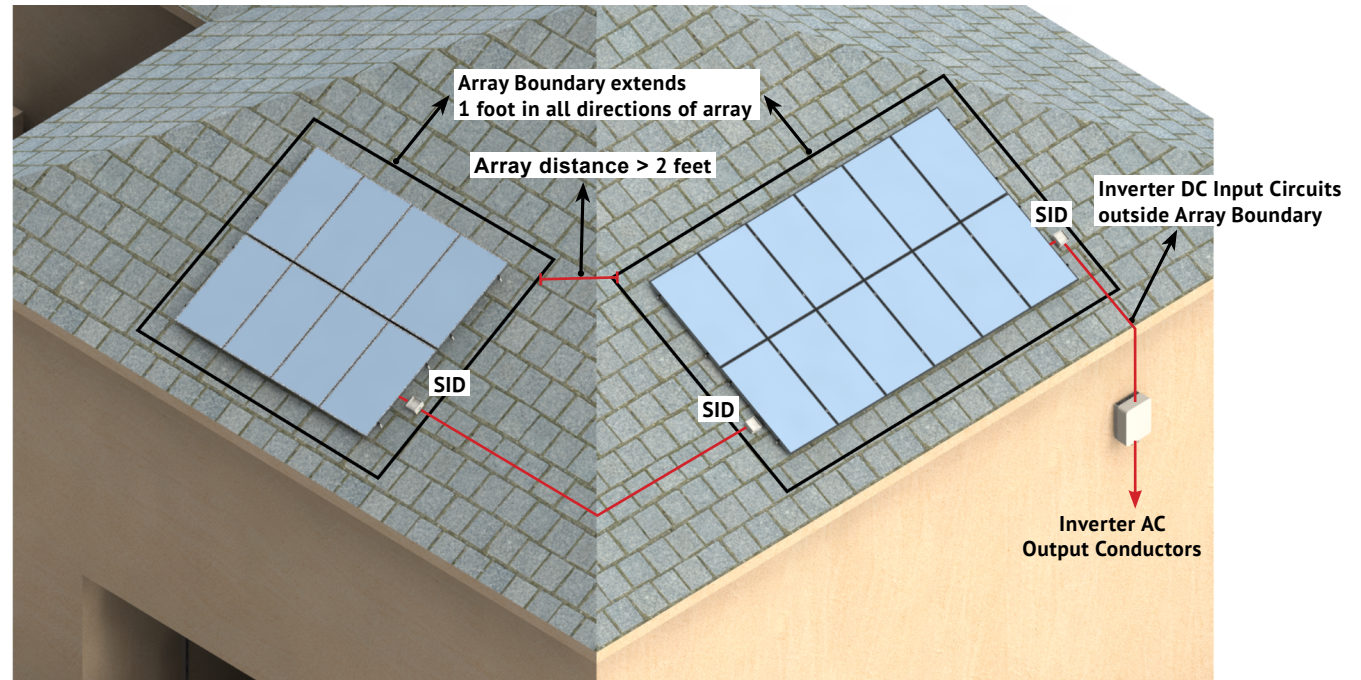
**NOTE:**

For controlled parameters information See page 5  
 Example array not specifically verified by Intertek.



## CONFIGURATION-3A

*Arrays with Listed UL 3741 PV Hazard Control System  
With Distinct Array Boundaries*



1. When two or more arrays are located more than 2 feet apart, this results in distinct array boundaries.
2. Array(s) uses UL3741 listed PVHCS and complies with 690.12(B)(2)(1)
3. Use String Isolation Devices on both ends of the connection between arrays to control series string and inverter input circuits (DC) that are outside of the array boundary and comply with NEC 690.12(B)(1).

**NOTE:**

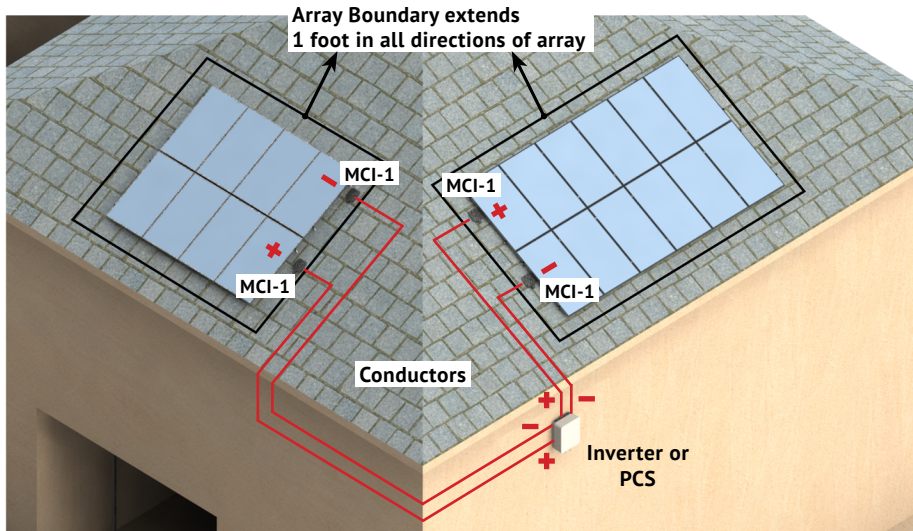
- For controlled parameters information See page 5
- Refer to pages 4 and 5 for approved string isolation devices and installation methods

**Example array not specifically verified by Intertek.**



## CONFIGURATION-3B

### Multiple Arrays With Distinct Array Boundaries Using MCI-1s



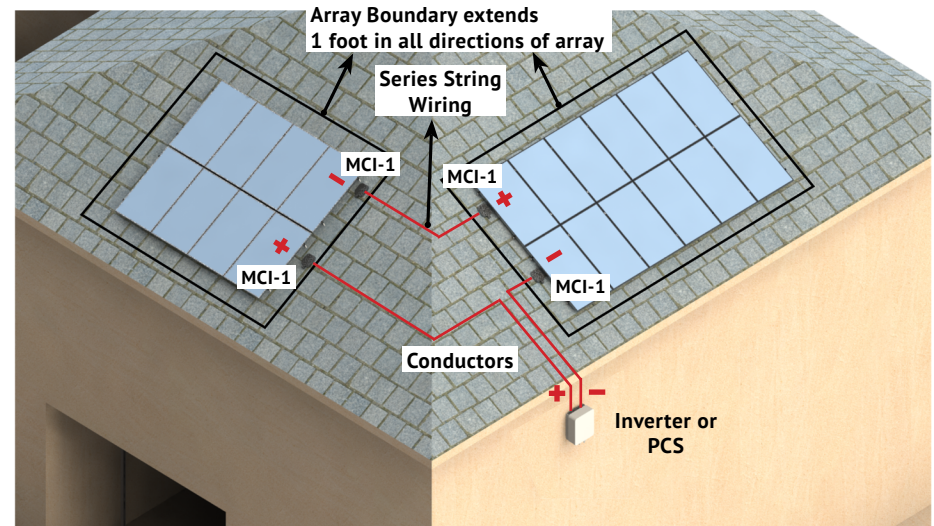
**Case-1: Distinct Arrays without String Sharing**

When a two arrays are connected as illustrated above, it is essential to install Tesla MCI-1s at minimum at the positive and negative ends of the string, positioned between the end modules and the homerun leading to the PCS

**NOTE:**

For controlled parameters information See page 5

Example arrays not specifically verified by Intertek.



**Case-2: Distinct Arrays with String Sharing**

When a two arrays are connected as illustrated above, it is essential to install Tesla MCI-1s at minimum at the positive and negative ends of the string, positioned between the end modules and the homerun leading to the PCS and connection between arrays.

## UL 3741 WIRE MANAGEMENT GUIDELINES

The SOLARMOUNT wire management components noted in the list of approved PVHCS equipment on **page 4** were evaluated and approved for providing wire protection against potential FF interactions. To achieve wire protection as required per UL 3741, all wires shall be routed such that they are not exposed to potential FF interactions. It is achieved using:

### WIRE CLIPS

- Route wires under modules using approved wire clips. *See figures 1, 2, 3&4.*
- Do not allow wires to sag between clips.
- Do not overtighten or pinch wires.
- Utilize wire clips to prevent contact between the wire and the metallic components of the module and racking system.
- Do not zip tie cables directly to the SOLARMOUNT rails, instead use approved edge clips on module frames and/or approved conduits or raceways.
- For row-to-row connections, use wire clips to fasten wires to edge of the last module in row and first module in the next row.

### WIREWAY

- Protect wires in exposed areas such as pathways and spaces between sub arrays by utilizing the listed wireway options on **page 4** (RayTray, conduit, etc.).
- Ensure that PV wire is not exposed to sharp edges when entering or exiting listed wireway.

