For Installer Company Use

For Maintenance and Inspection Use

TABUCHI ELECTRIC

Model

DG-006-F001401

String Rapid Shutdown Device(SRSD)

Installation Manual

Table of Contents

Important Safety Instructions and Warnings

Save these instructions. This manual contains important instructions for the String Rapid Shutdown Device (SRSD) that should be followed during installation, testing, inspection and maintenance of the SRSD in a photovoltaic system.

Safety symbols

The following safety symbols are used throughout the document. It is important that the installer is familiar with their meanings before installing or operating the SRSD.

Symbol	Description
⚠DANGER	Indicates a hazard that can result in serious injury or death.
⚠WARNING	Denotes an injury hazard due to hazardous voltages, currents, and temperatures. Any associated procedure must be performed as described, as not doing so could result in an injury. Do not proceed beyond this warning note until the indicated conditions are fully understood and met.
⚠CAUTION	Denotes a potential hazard to the product. Any associated procedure must perform as described, as not doing so could result in damage or destruction of the product. Do not proceed beyond this caution sign until the indicated conditions are fully understood and met.

Safety notes and warning

⚠DANGER	Prior to being connected to photovoltaic (PV) power, SRSD must be safely grounded in accordance to NEC/CEC. The method is described in this manual, in “Mount the SRSD” section.
⚠WARNING	Avoid injury! This unit is for installation and servicing by trained personal only.
⚠WARNING	This manual refers only to the mechanical mounting and connection of the SRSD. For details on the installation and commissioning of any inverter in the system, refer to the unit's installation guide.
⚠WARNING	Input and output connectors are not watertight until mated. Open connectors should be mated to each other or plugged with appropriate watertight caps.
⚠WARNING	The SRSD must be installed within 10 feet of the PV array to comply with NEC2014/ CEC2015 or within one foot to comply with NEC2017 (690.12.B.1).
⚠CAUTION	Installing a SRSD without ensuring compatibility of the module connectors with the device may be unsafe and could cause functionality problems such as ground faults, resulting in inverter shut down. In order to ensure mechanical compatibility of the SRSD and the inverter the mating connectors used for field wiring must be of the same manufacturer and connector type as those provided with the SRSD.
⚠CAUTION	This unit must be operated in accordance with the operating specifications outlined in this document.
⚠CAUTION	Opening the SRSD device box is prohibited and will void the device warranty.
⚠CAUTION	Cutting the SRSD's input or output cable connectors is prohibited and will void the device warranty.

Compatibility of SRSD with Photovoltaic Systems

For use where a DC disconnect is provided as part of inverter or where a DC disconnect is provided between the SRSD and the inverter.

⚠CAUTION There shall be no capacitors, active components or combiner boxes between the SRSD and the inverter.

This device complies with part 15 of the FCC Rules.

Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

【NOTE】 This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules.

String Rapid Shutdown Device

This String Rapid Shutdown Device (SRSD) provides a safe solution for limiting voltage to <30 V at the output of the photovoltaic (PV) array per NEC2014, NEC2017 phase 1, CEC2015. The SRSD is a chipset-based intelligent monitor with automatic rapid shutdown functionality. The device electronics continuously monitor and indicate the status of the DC disconnect switch at the string inverter and limit the voltage to <30 V when appropriate.

Purpose

This document provides installation instructions for the SRSD with an integrated mounting bracket.

Applications

The SRSD is intended for use with:

- PV panels configured in series-connected strings that terminate in a string level (central) inverter.
- Transformer-less string inverters with DC disconnect in or near the unit.

Operation

The device continuously monitors and indicates the status of the DC disconnect switch at the string inverter and limits the voltage to <30 V when appropriate, per NEC2014 (690.12), NEC2017 (690.12.B.1), CEC2015 (64-218).

When the PV string voltage is more than 90V, the SRSD goes into "detection of the inverter" mode. If the SRSD detects the inverter and that the DC disconnect switch is closed, it turns its onboard switches on and provides voltage to the inverter. The SRSD then continuously monitors the DC disconnect and as long as the DC disconnect switch stays closed, the inverter receives power from the PV array and the LED stays solid green.

If the PV string voltage drops below 60V or the DC disconnect switch is opened, the SRSD will limit the voltage to <30V from the PV array to the inverter in less than 10 seconds and the LED will blink.

Product Features

The SRSD has several key features. The device is built using solid state components and has no moving parts. Its minimal system components deliver the highest reliability to minimize the total cost of ownership.

Functions

The SRSD is an intelligent system-aware management device that detects inverter loss without extra wires. It:

- Interconnects to high voltage terminals using standard PV connectors.
- Is single fault tolerant.
- Connects serially between the array and the DC disconnect switch on the string inverter.
- Automatically senses whether the DC disconnect switch is open or closed.

Safety

The SRSD addresses the market requirements and has:

- National Electrical Manufacturers Association NEMA4X and UL 1741 standard certifications.
- Labeling to meet safety standards.
- A visual indicator light that identifies whether the device is active or dormant.
- It meets NEC2014 (690.12), NEC2017 (690.12.B.1) or CEC2015 (64-218) sections for string rapid shutdown: the output conductors of the PV array were limited to <30V , within 10 seconds, after the opening of the DC disconnect switch.

Efficiency

The SRSD device:

- Draws power from the PV array.
- Consumes less than 10 watts from PV array when the inverter draws maximum current from the string.

Mounting and installation

The SRSD's design:

- Mounts directly to module racking under a PV panel.
- Is easy to install as it does not require external cabling, power or connections.

Product Benefits

Benefits of the SRSD

The SRSD is a safe option for eliminating voltage on the cables between the PV array and the inverter, per NEC 2014 (690.12), NEC2017 (690.12.B.1) or CEC2015 (64-218).

The SRSD:

- Automatically senses the DC disconnect switch state.
- Connects serially between the array and the DC disconnect on the string inverter.
- Is easy to install and has no external cabling, power, or connection requirements.
- Is directly powered by the array with minimal consumption.
- Is designed with a low profile and mounts directly to the module racking under a panel.
- Has solid state design with no moving parts and minimal system components. Up to three SRSDs can be used in a single inverter system (one SRSD per MPPT).

Technical Specifications and Characteristics

SRSD operating range

The SRSD is designed to operate within certain parameters.

Parameter	Typical range
Voltage range when the SRSD is at full power	100V to 600V
Vs turn-on voltage	90V ± 10V
Vs turn-off voltage	Less than 60V

SRSD maximum rating

These are maximum ratings for the operation or storage of the SRSD device.

Parameter	Maximum value or range of values
Operating voltage	600V
Pass-through current	10A
DC Output overcurrent protection	13.2A
DC Input short-circuit current	16A
Maximum home run length per SRSD	150 feet
Ambient temperature range during operation	-40°C to +70°C -40°F to 158°F

System Markings

This Rapid Shutdown System is required to be provided with permanent labels and plaques for Photovoltaic Rapid Shutdown Systems.

REQUIRED INSTALLATION MARKINGS:

This PV Rapid Shutdown Equipment (PVRSE) is activated by the DC disconnect in or near the inverter, which is accessible to first responders.

To comply with the National Electric Code, Article 690.56(C), markings including the following are required to be provided by the installer.

To comply with the Canadian Electrical Code, Section 64-200, Marking including the following are required to be provided by the installer.

MARKING:

“PHOTOVOLTAIC SYSTEM EQUIPPED WITH RAPID SHUTDOWN” or “PV SYSTEM EQUIPMENT WITH RAPID SHUTDOWN”.

“Marking letters shall be capitalized and having a minimum height of 9.5 mm (3/8 in.)”

Location: Within 1 m (3 ft) from the inverter disconnect (actuating device) or service disconnect.

Type of labeling: The label or plaque type and letter size shall comply with the NEC and local jurisdiction requirements

System Configurations

System Requirements:

For use where a DC disconnect is provided as part of inverter or when a DC disconnect is provided between the SRSD and the inverter.

⚠CAUTION There shall be no capacitors, active components or combiner boxes between the SRSD and the inverter.

⚠DANGER The SRSD will not perform its intended function if the inputs of multiple MPPTs are electrically connected together, thereby bypassing the isolation between the multiple MPPTs.

System Diagram

String Level Configuration

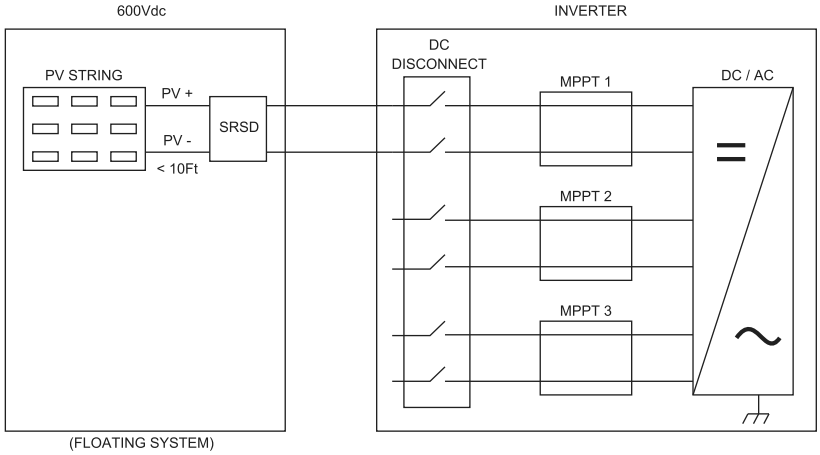
- Each individual string requires an independent SRSD unit in order to exhibit its rapid shutdown function per NEC2014 (690.12), NEC2017 (690.12.B.1) or CEC2015 (64-218). Under no circumstance should a single SRSD unit be used for multiple stings.

Inverter Level Configuration

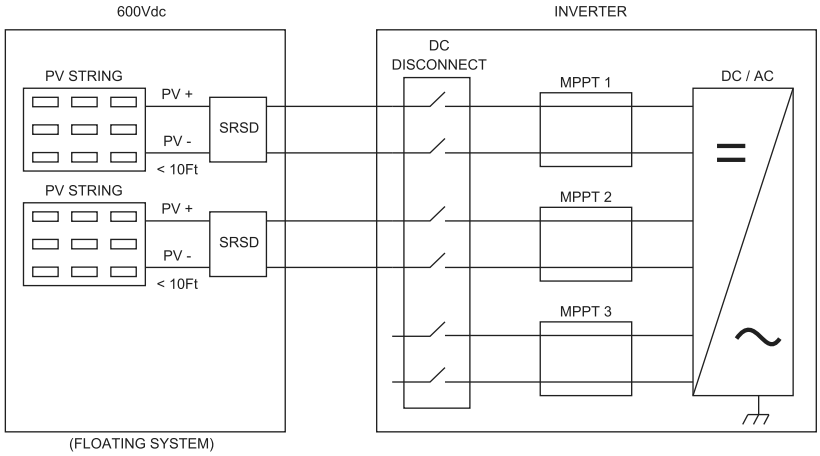
- A maximum of one SRSD unit can be used for each MPPT.
  - o If the inverter has one MPPT:
    - 1 SRSD unit can be connected
  - o If the inverter has two MPPTs:
    - MPPT 1
      - 1 SRSD unit can be connected
    - MPPT 2
      - 1 SRSD unit can be connected
  - o If the inverter has three MPPTs:
    - MPPT 1
      - 1 SRSD unit can be connected
    - MPPT 2
      - 1 SRSD unit can be connected
    - MPPT 3
      - 1 SRSD unit can be connected

Configuration Examples:

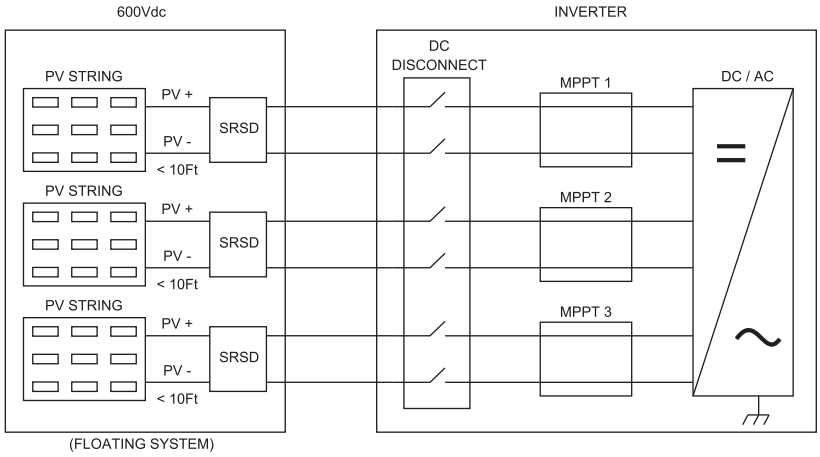
- One string in a single MPPT unit



- Two strings in two MPPT units



- Three strings in three MPPT units



⚠DANGER The SRSD will not perform its intended function if the inputs of multiple MPPTs are electrically connected together, thereby bypassing the isolation between the MPPTs. Do not install the jumpers and keep the inverter in the independent mode.

Install the SRSD

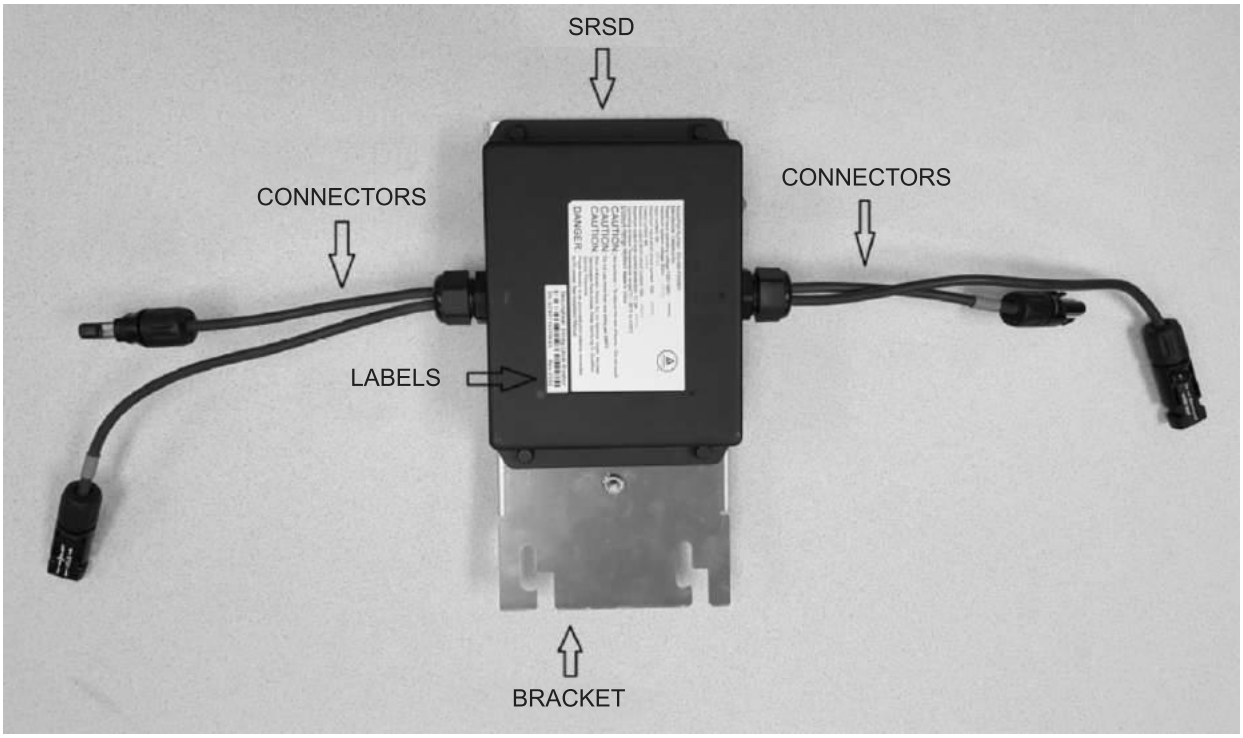
Procedure:

1. **Review the technical specifications and safety requirements.**
2. **Mount the SRSD.**
3. **Make the connections.**
4. **Test the system.**
   - Commissioning of the inverter must happen in order for the SRSD to become operational

List of Components

Parts of the SRSD

This figure illustrates the SRSD parts.



Mount the SRSD

The String Rapid Shutdown Device (SRSD) must be mounted to the module racking before attaching the module to the racking.

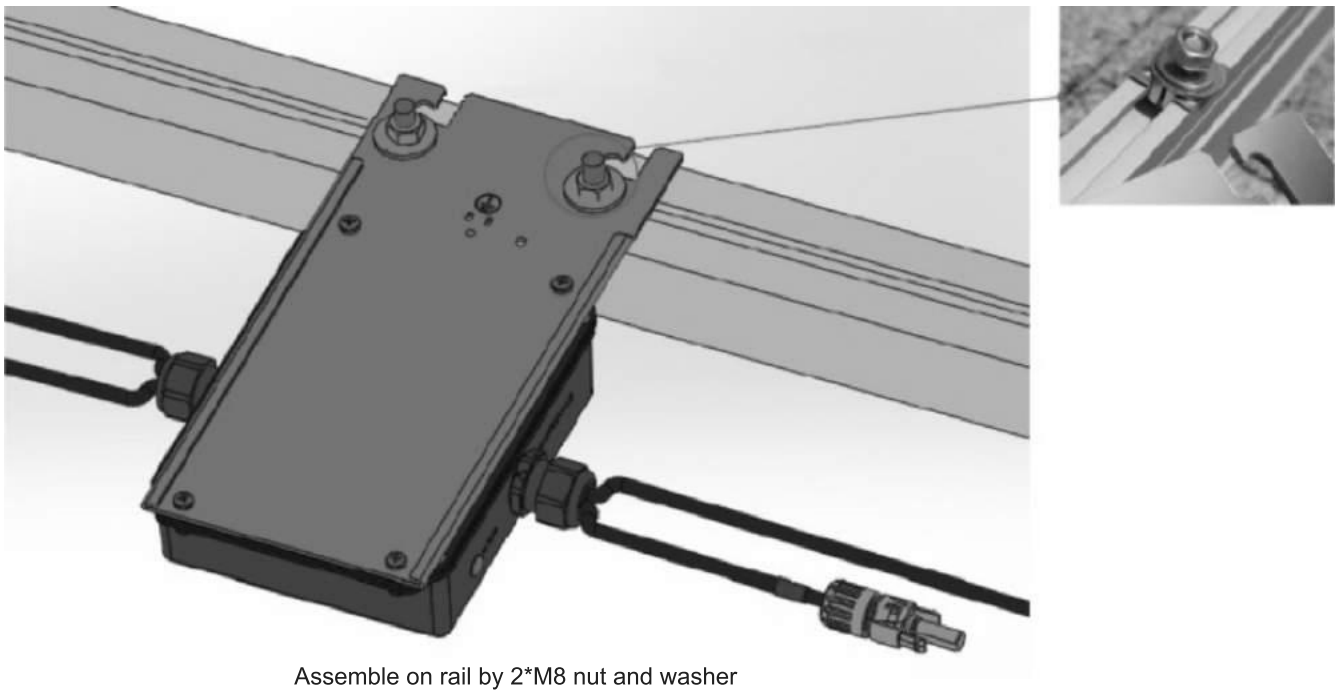
1. **Locate a place on the racking that is close enough to the last module in the string for one lead on the last module to reach the SRSD and within 10 feet of the array for NEC 2014/ CEC2015 or within 1 foot of the array for NEC 2017 (690.12.B.1).**
2. **Mount the bracket to the racking with the SRSD facing the roof and the bracket pointed toward the bottom of the roof.**

- Secure the bracket to the racking rail with two M8 nuts and washers.

3. **Connect the equipment grounding conductor to grounding lug of bracket**

- Insert a 4 to 12 AWG copper wire into the safety grounding lug and tighten the lug set screw to the copper wire to the torque based on the wire size (4-6 AWG at 35 in-lbs and 8-12 AWG at 30 in-lbs). Do not exceed the maximum rated overcurrent protection, 20 A (12 AWG),40 A (10 AWG), 90 A (8 AWG), 150 A (6 AWG), and 200 A (4 AWG). The lug is UL2703 certified.

⚠DANGER Ensure the proper grounding connection of the bracket before making the rest of the connections.



Assemble on rail by 2*M8 nut and washer

Make Connections

Once the device is mounted and grounded, the connections to the PV array and the inverter are made. Ensure that all the mating connectors used in the installation match the connector manufacture and type provided on the SRSD.
The wiring methods in accordance with National Electrical Code, ANSI/NFPA 70 or the Canadian Electrical Code C22.1-15 are to be used

Base Model	Grounding	DC Connector Style
DG-006-F001401	Generic Bracket	MC4 connector

⚠CAUTION The mating connectors used for field wiring must be of the same manufacturer and connector type as those provided with the SRSD.

⚠CAUTION Ensure to correctly identify the input and output.

⚠DANGER Ensure that the DC disconnect switch of the inverter is in the state OFF before starting this procedure.

1. **Locate the connectors labeled INPUT [PV].**

2. **Attach the INPUT [PV] connectors to positive and negative connections of the PV string.**

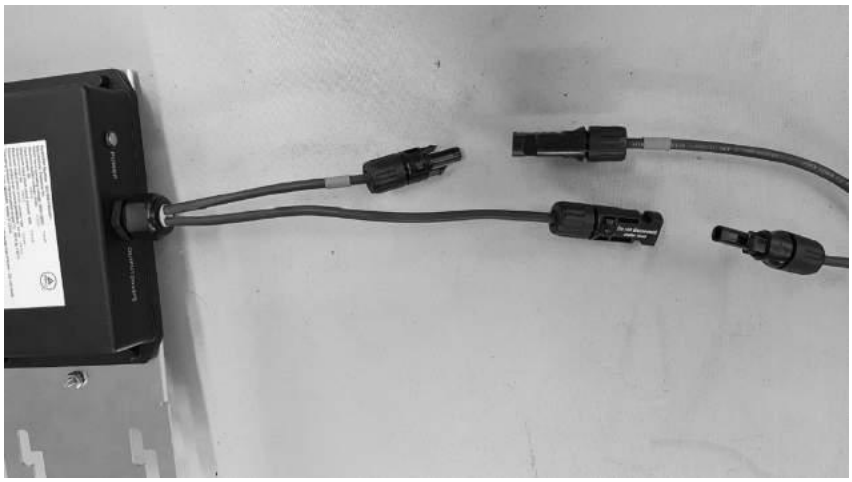
3. Check whether the power light on the opposite side of the device is blinking.

If the power light is...	Current State	Next Step
Blinking	The device is • Receiving the minimum turn-on voltage from the PV array, and • Attempting to discover the inverter	Ready to connect to the inverter
Off	Either • The PV array voltage is lower than the SRSD's turn-on voltage minimum, or • The device is not connected to the PV array correctly	Should verify that the • PV string output voltage is greater than the device turn-on voltage, and • Polarity of the input is correct

4. Locate the connectors labelled OUTPUT [Invert].

5. Attach the OUTPUT [Invert] connectors to the cables from the inverter.

ATTENTION Make sure the cables from the inverter are securely connected in the inverter.



ATTENTION A home run length of greater than 150 feet for any individual home run will negate the safety functionality of the device. A home run refers to the cable between the PV array and the inverter.

Validate Connection to Inverter

Once the device is mounted and connections to the inverter and PV panel array are made, verify the system is working by taking these steps.
The inverter must be commissioned before the SRSD operation can be verified.

1. **Close the AC disconnect switch.**
2. **Close the DC disconnect switch on the inverter.**
3. **Check the inverter display to confirm whether the inverter is receiving power from the PV array.**

【NOTE】 It will take less than a minute for the inverter to receive power from the PV array and enter the inverter's start-up sequence.

If the inverter is...	Then...
Producing power	The SRSD device is operational.
Not producing	System troubleshooting is required to resolve the issue.

Verify that the Power LED is illuminated in a steady state on each SRSD.

Validate Shutdown Functionality of SRSD

Once the connection to the inverter has been verified, the shutdown functionality of the SRSD must be tested. Ensure the inverter is operating before starting this test.

WARNING Failure to test voids the intended function of the device.

1. **Verify that the Power LED on each SRSD is illuminated in a steady state.**
2. **Open the DC disconnect switch on the inverter.**
3. **Verify that the Power LED on each SRSD is in a blinking mode.**

If...	Then...
A Power LED is not blinking	Replace SRSD and retest the system
All Power LEDs are blinking	System works properly

Troubleshoot the System

In the event that an inverter is not producing power use the following steps to help troubleshoot the system. Check the power light on the SRSD device to determine what to troubleshoot.

If the power light on the SRSD is....	Current State	Next Step
on	Has connected the PV array to the inverter	Troubleshoot the inverter unit.
blinking	Is not recognizing that the inverter is connected	Troubleshoot the SRSD device by verifying • The SRSD is electrically connected to the inverter, and • The DC Disconnect is closed If these steps do not resolve the issue, contact the product distributor.
off	Is not powered as it either • Is not connected properly, or • The PV array voltage is lower than the minimum SRSD turn-on voltage	Verify that the PV array voltage at the input to the SRSD.

Service or Removal of the SRSD

The SRSD may need to be removed to reposition or repurpose the unit.

1. **De-energize the system by opening all disconnects in the system, including the DC disconnect of the inverter**
2. **Verify that the SRSD power light is blinking. This ensures the SRSD has de-energized the wires to the inverter**
3. **Detach the OUTPUT [Invert] connectors**
4. **Detach the INPUT [PV] connectors**

   ⚠**CAUTION** Assume that the wires connected to the input side of the SRSD are at the maximum system voltage rating of 600V DC.

5. **Remove the bracket from the rail by removing the safety wire from the bracket lug and the two M8 nuts and washers holding the bracket to the racking rail**
6. **Perform necessary maintenance on the SRSD unit, then re-install it or install a new SRSD unit**