



## General Safety & Installation Instructions

This document covers the following Stion Products:

Stion STN, STO, & SZF framed modules

For more information please visit:

[www.stion.com](http://www.stion.com)

Last Revised: 01/28/14

### **Danger of death from electric shock!**



Solar modules generate direct current (DC) electricity as soon as the front face is exposed to light. Individual modules and especially connected systems can be an electrical hazard. Follow the general safety and installation guidelines to avoid safety and electrical hazards.



## 1.0 Introduction:

This document covers safety and installation information for Stion products that conform to ANSI/UL1703, IEC 61646, IEC 61730-1&2, EC directives 2004/108/EC (EMC – Electromagnetic Compatibility), and 2006/95/EC (LVD – Low Voltage Electrical Safety Directive).

Read carefully through these installation instructions before use, installation, operation, or maintenance of any products of Stion Corporation. Failure to do so may result in bodily injury or damage to property. Additionally, failure to do so may void Stion Corporation's Limited Warranties.

### 1.1 Disclaimer of Liability

The use of this General Safety and Installation Guide and the conditions and methods of installation, operation, use and maintenance of the module are beyond Stion control. Therefore, Stion assumes no responsibility and expressly disclaims liability for loss, damage, injury or expense arising out of or in any connected with such installation, operation, use or maintenance of the module. Furthermore, Stion assumes no responsibility for any infringement of patents or other rights of third parties that may result from use of the modules, unless we are automatically liable by law.

No license is granted by implication or otherwise under any patent or patent rights. The information in this Guide is based on Stion knowledge and experience and is believed to be reliable; but such information including product specifications (without limitations) and suggestions do not constitute a warranty, expressed or implied. Stion reserves the right to make changes to the product, specifications or this Guide without prior notice.

Note: This document may be provided in multiple languages. If there is a conflict among versions, the English version dominates.

### 1.2 Module Limited Warranties

Information and instructions provided in this Guide are based on Stion knowledge and believed to be reliable. However, this document and any other product specifications (without limitations) do not constitute a warranty. Information on limited power and workmanship warranties and associated certificates and product registration can be found at [www.stion.com](http://www.stion.com) or by contacting the Company or authorized Stion representative.

### 1.3 ANSI/UL 1703 Listing

The Stion PV Modules which this Guide covers meet or exceed the requirements of ANSI/UL 1703. This standard covers flat-plate modules in standard freestanding, rack, or stand-off installation only, and does not cover products that are integrated into building surfaces or materials.

## 2.0 Safety

Working on a PV system requires specialized knowledge and must therefore be carried out only by appropriately qualified and authorized personnel.

- Keep these instructions!
- Keep children away!

### 2.1 Warning notices



#### **Danger of death from electric shock!**

Solar modules generate electricity as soon as the front face is exposed to light. When modules are connected in series, voltages are additive. When modules are connected in parallel, current is additive. Consequently, a multi-module system can produce high voltages and current.

Although touch protection is provided in the form of the fully insulated cables and connectors, the following points must be observed when handling the solar modules to avoid the risk of fire, arcing and fatal electric shock:

- The installation of modules requires a great degree of skill and should (if DC voltage exceeds 100 V: *must*) only be performed by a qualified licensed professional, including, without limitation, licensed contractors and licensed electricians.
- Installer assumes the risk of all injury that might occur during installation, including, without limitation, the risk of electric shock.
- All installations in the US should be installed in strict compliance with the latest or applicable National Electrical Code (NEC) requirements for the appropriate jurisdiction. Installations in Canada shall be in accordance with CSA C22.1, Safety Standards for Electrical Installations, Canadian Electrical Code, Part I.
- When making or breaking electrical circuits, cover all modules in the array with an opaque material or cloth to prevent light from electrifying the array.
- Do not insert electrically conducting parts into plugs or sockets!
- Do not wear metallic jewelry while performing mechanical or electrical installation.
- Work only under dry conditions, and use only dry tools. Do not handle modules when they are wet unless wearing the appropriate protective equipment.
- Exercise extreme caution when carrying out work on wiring and use the appropriate safety equipment (insulated tools, insulated gloves, etc.)!
- Do not use damaged modules! Do not dismantle modules! Do not remove any part or label fitted by the manufacturer! Do not treat the rear of the laminate with paint, adhesives or mark it using sharp objects!
- Exercise extreme caution when working on the inverter and wiring the system.
- After switching off the inverter, it is essential to wait for the time interval specified by the manufacturer before beginning any further work. This allows the high voltage components time to discharge.
- Be sure to carefully follow the inverter manufacturer's installation instructions.



### **Danger of death from arcing!**

Modules generate direct current (DC) when any amount of light shines on them. When breaking a connected string of modules (e.g. when disconnecting the DC line from the inverter under load), a lethally strong arc can occur:

- Never remove the solar generator from the inverter while it is still connected to the main grid!
- Ensure that the cable connections are in perfect condition (no cracking, soiling or other contamination)!

When disconnecting a connected module under load, follow these directions and all cautions and warnings that appear above. These steps should only be performed by a fully licensed and qualified electrician or contractor:

Step 1: Take all precautions noted above, including reading the inverter manufacturer's manual and specifications and wearing and using insulated gloves and tools.

Step 2: Shade the active module or modules with an opaque material.

Step 3: Disconnect the inverter from both the grid and from the system of modules according to the specifications provided by the inverter manufacturer.

Step 4: Wait the minimum amount of time specified by the inverter manufacturer before disconnecting any PV modules under load.

Step 5: Disconnect or connect PV modules only as absolutely needed.

## **2.2 Unpacking the modules and storage**

Observe the warnings on the packaging!

The utmost care is required when handling the modules. Take care when unpacking, transporting, and storing them. Leave modules in packaging until they are to be installed. A module with broken glass cannot be repaired and must not be used since contact with any module surface or the frame can produce electrical shock. Broken or damaged modules must be handled carefully and disposed of properly. Broken glass can be sharp and cause injury if not handled with the appropriate protective equipment. Carry modules with both hands. Do not use the cables, connectors, or junction box as a handle. Do not stand modules on hard or rough ground. Do not stand modules on their corners. Ensure modules do not bow. Do not place modules on top of each other. Do not subject to load, do not stand on them, do not drop. Do not mark or work on them with sharp objects. Keep all electrical contacts clean and dry. In order to keep a record of your system, we recommend that you make a note of the serial numbers. If it is necessary to store the modules temporarily, always cover the modules and use a dry, ventilated room.

## **2.3 General safety information**

Ensure that the module is used for its intended purpose only. Modules are intended for outdoors, land-based applications only. Modules are not intended for indoor use or application on moving vehicles of any kind. Pay attention to local ordinances, building standards and

accident- prevention regulations during installation. Use only equipment, connectors, wiring and support frames suitable for use in a solar electric system. The safety information for other system components must also be followed.

### 3.0 Electrical Specifications:

Electrical Ratings						
	Pmax	Voc (V)	Isc (A)	Imp (A)	Vmp (V)	Series Fuse Rating (A)
STN-120	120	56.8	3.41	2.93	41.2	6
STN-125	125	57.9	3.43	2.98	42.1	6
STN-130	130	58.3	3.45	3.02	43.0	6
STN-135	135	58.7	3.45	3.05	44.3	6
STN-140	140	59.5	3.45	3.08	45.5	6
STN-145	145	60.9	3.45	3.10	46.8	6
STN-150	150	62.1	3.45	3.13	47.9	6
STO-125-600	125	76.5	2.63	2.30	54.1	6
STO-130-600	130	76.7	2.58	2.28	57.1	6
STO-135-600	135	77.4	2.62	2.32	58.2	6
STO-140-600	140	78.8	2.65	2.34	59.8	6
STO-145-600	145	79.6	2.68	2.38	61.0	6
STO-150-600	150	80.8	2.72	2.39	62.7	6
STO-125	125	76.5	2.63	2.30	54.1	10
STO-130	130	76.7	2.58	2.28	57.1	10
STO-135	135	77.4	2.62	2.32	58.2	10
STO-140	140	78.8	2.65	2.34	59.8	10
STO-145	145	79.6	2.68	2.38	61.0	10
STO-150	150	80.8	2.72	2.39	62.7	10
SZF-130	130	76.7	2.58	2.28	57.1	8
SZF-135	135	77.4	2.62	2.32	58.2	8
SZF-140	140	78.8	2.65	2.34	59.8	8
SZF-145	145	79.6	2.68	2.38	61.0	8
SZF-150	150	80.8	2.72	2.39	62.7	8

All electrical ratings are measured at Standard Test Conditions (STC): 25°C, 1000W/m<sup>2</sup>, AM 1.5G

Maximum System Voltage:

STN = 1000V (IEC), 600V (UL)

STO-600 = 1000V (IEC), 600V (UL)

STO = 1000V (IEC), 1000V (UL)

SZF = 1000V (IEC)

Application Class: A

### 3.1 Fire Class Rating:

These modules are rated to Fire Class C.

## 3.2 Wiring

The module contains factory-installed PV wire cables with factory provided locking MC-4 type connectors and a Diotec FI200-D bypass diode rated for 12A, located inside the junction box. Under no circumstances should the junction box be opened or tampered with. This will void the warranty.

For the wiring, pay attention to:

- **Correct wiring scheme**

In order to decrease voltage caused by indirect lightning strikes, all connecting cables should be as short as possible. Check that the wiring is correct before commissioning the system. If the measured open circuit voltage differs from the specifications, then there is a wiring fault. Match the polarities of cables and terminals when making the connections; failure to do so may result in damage to the module.

- **Correct plug connections**

Make connections only in dry conditions. Ensure connections are secure and tight.

- **Use of suitable materials**

Use special solar cable and suitable connectors only. Ensure that they are in perfect electrical and mechanical condition. Use only single wire cables. Select a suitable conductor diameter to minimize voltage drop.

- **Cable protection**

We recommend securing the cables to the mounting system using UV-resistant cable ties. Protect exposed cables from damage using suitable precautions (e.g. laying them in plastic pipes). Avoid direct exposure to sunlight.

### **ANSI/UL 1703 Information (U.S. and Canada)**

- The solar module electrical characteristics are within +/-10% of the module label indicated values of  $I_{sc}$ ,  $V_{oc}$ , and  $P_{max}$  under Standard Test Conditions (irradiance of 1000 W/m<sup>2</sup>, AM 1.5 spectrum, and a cell temperature of 25°C/77°F), unless otherwise indicated.
- Under normal conditions, a photovoltaic module is likely to experience conditions that produce more current and/or voltage than reported at STC. Accordingly, the values of  $I_{sc}$  and  $V_{oc}$  marked on this module should be multiplied by a factor of 1.25 at 125 mW/cm<sup>2</sup>, AM1.5 spectrum, cell temperature -10C for  $V_{oc}$  and +75C for  $I_{sc}$ , when determining component voltage ratings, conductor capacities, and fuse and control sizes connected to the PV output.
- Refer to section 690-8 of the NEC for an additional multiplying factor of 125% (80% de-rating) which may be applicable.
- Over-current protection shall be in accordance with the requirements of Article 240 of the NEC, or less than 6A according to Stion's max series fuse rating, whichever is lower.
- Conductor recommendations: 8-14 AWG (2.5-10 mm<sup>2</sup>) PV wire (non-conduit)/ THWN-2 (conduit), 90°C wet rated, -40°C min. For conduits, do not use PV-wire.
- Cable conduits should be used in locations where the wiring is accessible to children or small animals.
- Modification or tampering of diodes by unqualified personnel is not permitted. Please consult Stion for additional information regarding diode replacement/repair.
- The fire rating of this module is valid only when mounted in the manner specified in the mechanical mounting instructions.
- A slope less than 5 in/ft (127 mm/305mm) is required to maintain the fire class rating.
- The module is considered to be in compliance with UL 1703 only when the module is mounted in the manner specified by the mounting instructions below.
- A module with exposed conductive parts is considered to be in compliance with UL 1703 only when it is electrically grounded in accordance with the instructions presented below and the requirements of the National Electrical Code.
- Where common grounding hardware (nuts, bolts, star washers, split-ring lock washers, flat washers and the like) is used to attach a listed grounding/bonding device, the attachment must be made in conformance with the grounding device manufacturer's instructions.

## 3.3 Grounding

The company installing the PV module is also responsible for the professional grounding. The factory-provided aluminum frame must be grounded. All grounding must be performed to be compliant with the latest National Electrical Code (NEC) regulations that are applicable for the jurisdiction. If the building is already equipped with an exterior lightning protection system, the PV-installation must be integrated in the protection system against direct effects of lightning. Country-specific standards must be adhered to.

A grounding method and components that are compliant with appropriate ANSI/UL standards including UL467, UL1703, UL 1741 must be adhered to in the US and Canada and for use of this module.

The following grounding methods are acceptable to Stion if done in accordance with regional and national safety and electricity standards:

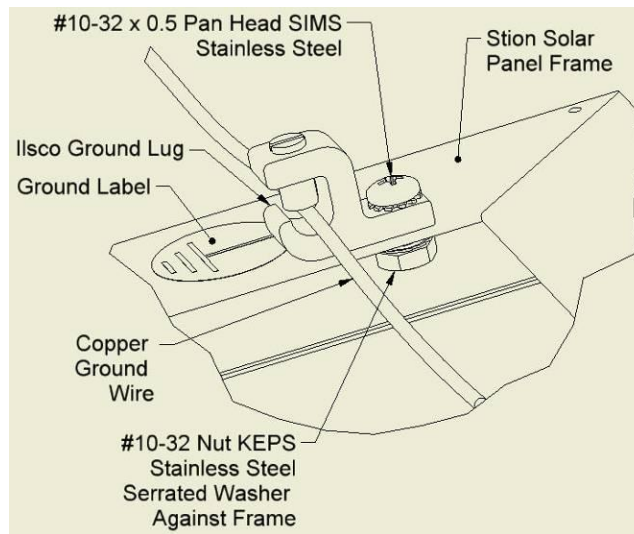
- thread screw
- star washer
- bolt-star washer
- WEEB washers
- module clamps with integrated grounding

**An example of UL or IEC approved grounding:**

The modules can be connected to the grounding holes using a lay-in lug and a bolt with serrated washer and a nut with serrated washer contacting the back of the frame as shown in the diagram. Please note that the nut must have a serrated washer to break through the anodized coating of the frame. The recommended hardware is as follows:

Item	Name/Description	Manufacturer/Distributor	Part Number
Ground Lug	Lay-in Lug	IlSCO	GBL-4DBT
Bolt	#10-32 X 0.5" Pan Head, SIMS, Stainless	McMaster-Carr	95345A566
Nut	#10-32 Nut, KEPS, Stainless	McMaster-Carr	96278A411

Diagram of Grounding Method



We recommend using the components listed above, including a lay-in lug, a bolt, with integral stainless steel serrated washer (SIMS), and a nut, with integral stainless steel serrated washer (KEPS). The serrated washer should be used in order to break through the anodized coating and contact the frame. A torque assembly must be used to ensure contact with the aluminum (torque 35-40 in-lb). A solid copper grounding conductor must be secured with the set screw provided by the lay-in lug manufacturer to prevent galvanic corrosion due to contact by dissimilar metals.

Please also refer to NEC Article 690 for further information on grounding PV systems and specific requirements.

**4.0 Installation**

When installing the modules, please pay attention to:

**4.1 Installation Safety**

Do not carry out installation work when there are strong winds. Follow appropriate safety practices and use required safety equipment to avoid falling hazards. Secure work materials to prevent articles from falling. Create a work zone to avoid accidents with other people. The modules have no on/off switch. Fully cover their front surface with an opaque material during installation.

## 4.2 Maximum Loading

Make sure the support structure adheres to maximum permissible load requirements. The system has been load tested to ANSI/UL 1703 at 45 PSF. Building departments often require a design safety factor of 1.5 or greater for structures. The maximum structural loading listed in this guide does not include an added safety factor. Check with your local building department for code information as prescribed by local ordinances, particularly in regions of high snow accumulations and high wind velocities. Take notice of possible bowing of the modules under high loads. Avoid installing fasteners, cable ties, etc. between the module backside and support structure (i.e. on mounting rails) as any sharp edges can damage the modules.

## 4.3 Fire Safety

The roof construction and installation may affect the fire safety of a building; improper installation may contribute to hazards in the event of fire. For roof application, the modules should be mounted over a fire-resistant covering rated for the application. It may be necessary to use components such as earth ground fault circuit breakers, fuses and circuit breakers. The module is “non-explosion-protected equipment”. Hence it must not be installed in proximity of highly flammable gases and vapors (e.g. filling stations, gas containers, paint spraying equipment). The module must not be installed near open flames or flammable materials. Refer to your local authority for guidelines and requirements for building or structural fire safety.

## 4.4 Suitable Environment

The module is intended for use in temperate climatic conditions where operating temperatures range from -40 to +90°C (-40 to +194°F). The module must not be subjected to concentrated light. It must not be immersed in water or constantly exposed to water spray (e.g. from fountains). There is risk of corrosion with exposure to salt (it is recommended that modules are installed at least 500 m or 1700 ft from the sea) and sulfur (sulfur sources, volcanoes). The module may not be exposed to extremely corrosive chemicals (e.g. emissions from manufacturing plants).

## 4.5 Suitable Design

Make sure the module meets the technical requirements of the system as a whole. Ensure that other system components do not exert damaging mechanical or electrical influences on the modules. When connected in series, modules must all have the same amperage. When connected in parallel, the modules must all have the same voltage. The modules must not be connected together to create a voltage higher than the permitted system voltage. Modules must not be fitted as overhead glazing or vertical glazing (façade). Ensure that the mounting system can also withstand the anticipated wind and snow loads. There are drainage holes at the corners of the module frame to allow water from precipitation to drain. Ensure that these openings are not blocked nor partially blocked by the module installation method.

**Array-Sizing & Performance:** Follow requirements of the NEC and local jurisdictions to evaluate, derate, and size the number of maximum modules per string accordingly so that the added voltage of the specified module model numbers and the quantity of modules do not exceed the maximum system voltage allowed. Be sure to size arrays and strings sizes according to potential changes in temperature during module operation. Lower temperatures can increase voltage and may require fewer modules to be installed in each series string.

- Several modules can be connected in series to form a string of modules; the system voltage is then equal to the sum of the voltage of each module.
- Parallel connection is a function of the Inverter used in the system. Please refer to the Inverter specification to determine the number of modules which can be supported when connected in parallel. Each module or string must be individually fused when connected in parallel (at the series fuse rating).
- Several strings of modules can be connected in parallel; the system current is then equal to the sum of the current of each string of modules.
- The maximum system voltage is 600 volts or 1000 volts depending on the product family rating listed above. However products are rated for use up to 1000V where UL standards do not apply.
- The maximum number of series connected modules depends on system design, the type of inverter used and environmental conditions.

- There is no limitation on the number of modules that can be connected in parallel, the number of modules is determined by system design parameters such as current or power output.

**Angle & Tilt:** To obtain maximum yield from the system, we recommend you determine the best direction and tilt angle for the modules. Conditions for generating electricity are considered ideal when the sun's rays strike the module perpendicular to its surface. To avoid performance drops in series circuits, ensure that all modules have the same orientation and tilt. Stion recommends the modules be mounted in portrait to avoid possible power loss from shade and debris. If landscape mounting is required at the site, Stion recommends regular inspection and cleaning, so as not to shade a larger portion of one cell with buildup or debris. In dry climates with low-tilt angle (<15°), the modules should not be mounted in landscape. Modules should not be mounted in landscape without a regime of regular inspection and cleaning.

**Shading:** Even partial shading will cause a yield reduction. A module is "shade free" when the entire surface is shade free all year round and, even on the most unfavorable days of the year, receives unobstructed sunlight. Even partial shadowing can substantially reduce module and system output.

**Ventilation:** Provide adequate rear ventilation under a module (100mm: 4 in. gap minimum) to avoid the build-up of heat that can reduce performance. Clearance of 7mm: ¼ in or more between modules is required to allow for thermal expansion of the frames.

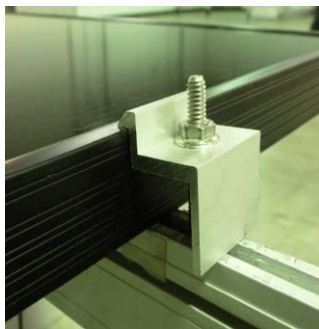
## 4.6 Mounting & Configurations

Modules are only ANSI/UL 1703 listed when the factory provided frame is still intact. Do not tamper with, alter, or remove the frame or create additional mounting holes. Doing so will void the warranty. Each module must be securely fastened at a minimum of 4 points. There are 8 approved, factory-provided mounting holes that are on the long sides of the frame, 10.5 inches (268mm) and 16.0 inches (408mm) from the short edge of the frame. The mounting holes at the middle of the long frame sides are optional to provide additional support. Mounting at these holes does not preclude the need to mount at 4 points designated at the approved mounting holes or the approved mounting zones. The frame has been stress tested by Stion and ANSI/UL 1703 listed for mounting by the long sides only. The module should not be mounted by the short sides of the frame.

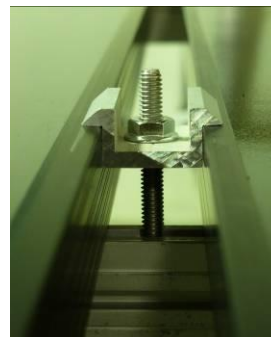
Stion PV modules can be mounted to the substructure by using the following method:

- 1) **Bolting:** The module may be secured to the structure by bolting or screwing through the factory-provided holes in the long sides of the frame. Refer to Stion's module datasheet for exact mounting hole locations. We recommend using four ¼ in. stainless steel bolts/screws with nuts, washers, and lock washers. The bolt/screw should be long enough to enable full engagement with the nut but allow for at least ¼ in. gap between the end of the bolt/screw and the glass surface of the module. Use appropriate corrosion-proof fastening materials.
- 2) **Clamping:** The module may be secured to the structure by clamping. A clamping solution requires a top clamp piece that braces the front of the module frame and a rail or bottom clamp piece that supports or clamps the bottom of the module. The top clamps hold the module securely at four points against rails or bottom clamps. An example of top down end-clamping and mid-clamping is shown in the diagrams below.

**End-Clamping**



**Mid-Clamping**



We recommend using anodized aluminum top and bottom clamps per the minimum requirements below:  
Material: Aluminum

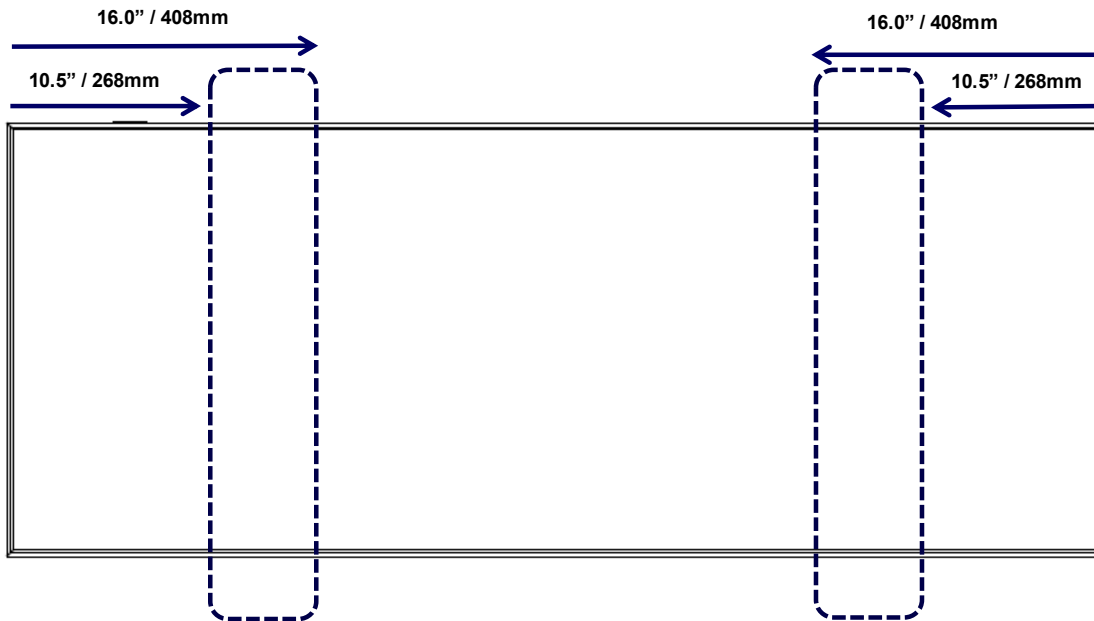


Minimum Length: 38mm (1.5 inch)  
 Minimum Thickness: 3.0mm (1/8 inch)  
 Minimum Catch Width: 5mm (3/16 inch)

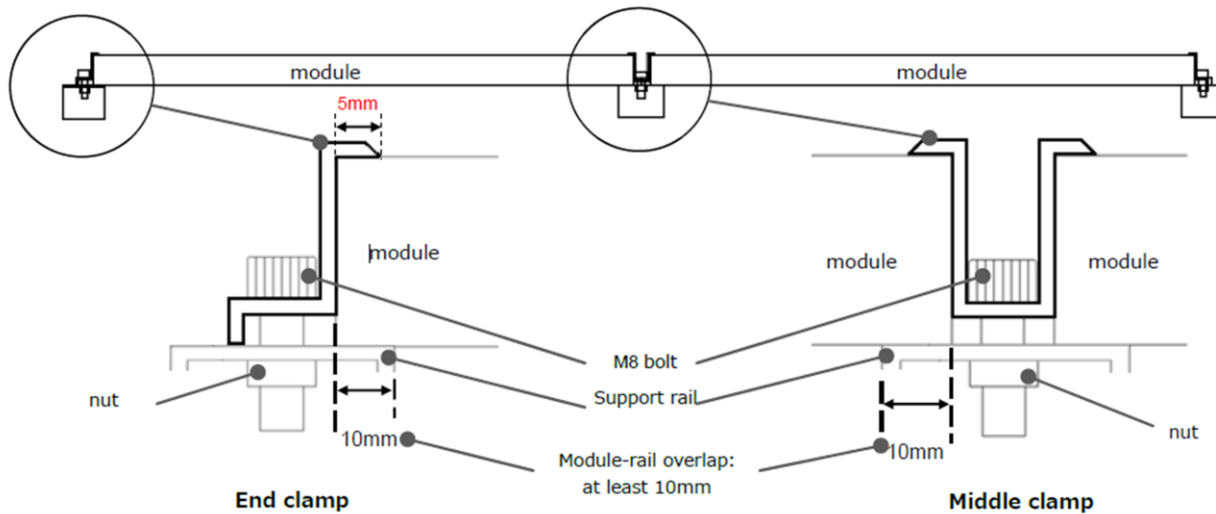
Stion's module should only be clamped on the long sides. The center of the clamps should be located in the mounting zones. The mounting zones are located between 10.5 inches (268mm) and 16.0 inches (408mm) from the short edge of the module and are shown in the diagram below.

Finger tighten flange nuts, center and align the module as needed, and securely tighten the flange nuts (10 ft lbs).

**Mounting Zone Diagram**



The module can be mounted on support rails parallel or perpendicular to the length of the module. If the module is mounted on rails parallel to the long side of the frame it is recommended that the module and support rail overlap 10mm (3/8 inch) or more.



## 4.7 Maintenance and cleaning

PV modules and systems do not require routine maintenance. However, we recommend regular inspection to ensure:

1. All cable connections are secure, tight, clean, and free of corrosion.
2. All mounting points are tight, secure, and free of corrosion.
3. Cable, glass, frame, junction box or external electrical connections are not damaged in any way.
4. The conductivity of module frame to earth ground is sufficient.

Given a sufficient tilt ( $>15^\circ$ ), cleaning of the modules is not typically necessary (rainfall will have a self-cleaning effect). In dry and other unique climates, and in case of heavy soiling, we recommend cleaning the modules using plenty of water (from a hose) without any cleaning agents and using a gentle cleaning implement (a sponge). It is recommended to clean the modules early in the morning or during cloudy weather to prevent damage to the glass from extreme thermal shock of spraying cold water on a hot glass surface. To remove ingrained dirt, the coated glass can be washed with a micro-fiber cloth and ethanol or a conventional glass cleanser. Deposits of foreign material on the frame surface can be cleaned using a wet sponge or cloth and dried in air or by using a clean chamois. Alternatively, a mild detergent or glass cleaner may be used. Always wear rubber gloves for electrical insulation while maintaining, washing or cleaning modules. Dirt must never be scraped or rubbed away when dry, as this may cause micro-scratches. Do not use harsh cleaning materials such as scouring powder, alkali based chemicals, steel wool, scrapers, blades, or other sharp instruments to clean the glass surface of the module. Use of such materials or cleaning without consultation will void the product warranty.

**Stion Corporation**  
**6321 San Ignacio Avenue**  
**San Jose, CA 95119**  
**USA**

**Tel (Customer service): +1-855-736-0659**

**Tel (Technical support): +1-855-736-0658**

**Fax: +1-408-574-0160**